INTRODUCTION

The NIOSH Pocket Guide to Chemical Hazards is intended as a source of general industrial hygiene information for workers, employers, and occupational health professionals. The Pocket Guide presents key information and data in abbreviated tabular form for 677 chemicals or substance groupings (e.g., manganese compounds, tellurium compounds, inorganic tin compounds, etc.) that are found in the work environment. The industrial hygiene information found in the Pocket Guide should help users recognize and control occupational chemical hazards. The chemicals or substances contained in this revision include all substances for which the National Institute for Occupational Safety and Health (NIOSH) has recommended exposure limits (RELs) and those with permissible exposure limits (PELs) as found in the Occupational Safety and Health Administration (OSHA) General Industry Air Contaminants Standard (29 CFR 1910.1000).

Background

In 1974, NIOSH (which is responsible for recommending health and safety standards) joined OSHA (whose jurisdictions include promulgation and enforcement activities) in developing a series of occupational health standards for substances with existing PELs. This joint effort was labeled the Standards Completion Program and involved the cooperative efforts of several contractors and personnel from various divisions within NIOSH and OSHA. The Standards Completion Program developed 380 substance-specific draft standards with supporting documentation that contained technical information and recommendations needed for the
promulgation of new occupational health regulations. The *Pocket Guide* was developed to make the technical information in those draft standards more conveniently available to workers, employers, and occupational health professionals. The *Pocket Guide* is updated periodically to reflect new data regarding the toxicity of various substances and any changes in exposure standards or recommendations.

**Data Collection and Application**

The data were collected from a variety of sources, including NIOSH policy documents such as criteria documents and Current Intelligence Bulletins (CIBs), and recognized references in the fields of industrial hygiene, occupational medicine, toxicology, and analytical chemistry.

**NIOSH RECOMMENDATIONS**

Acting under the authority of the Occupational Safety and Health Act of 1970 (29 USC Chapter 15) and the Federal Mine Safety and Health Act of 1977 (30 USC Chapter 22), NIOSH develops and periodically revises recommended exposure limits (RELS) for hazardous substances or conditions in the workplace. NIOSH also recommends appropriate preventive measures to reduce or eliminate the adverse health and safety effects of these hazards. To formulate these recommendations, NIOSH evaluates all known and available medical, biological, engineering, chemical, trade, and other information relevant to the hazard. These recommendations are then published and transmitted to OSHA and the Mine Safety and Health Administration (MSHA) for use in promulgating legal standards.

NIOSH recommendations are published in a variety of documents. Criteria documents recommend workplace exposure limits and appropriate preventive measures to reduce or eliminate adverse health effects and accidental injuries.

Current Intelligence Bulletins (CIBs) are issued to disseminate new scientific information about occupational hazards. A CIB may draw attention to a formerly unrecognized hazard, report new data on a known hazard, or present information on hazard control.

Alerts, Special Hazard Reviews, Occupational Hazard Assessments, and Technical Guidelines support and complement the other standards development activities of the Institute. Their purpose is to assess the safety and health problems associated with a given agent or hazard (e.g., the potential for injury or for carcinogenic, mutagenic, or teratogenic effects) and to recommend appropriate control and surveillance methods. Although these documents are not intended to supplant the more comprehensive criteria documents, they are prepared to assist OSHA and MSHA in the formulation of regulations.

In addition to these publications, NIOSH periodically presents testimony before various Congressional committees and at OSHA and MSHA rulemaking hearings.

Recommendations made through 1992 are available in a single compendium entitled *NIOSH Recommendations for Occupational Safety and Health: Compendium of Policy Documents and Statements* [DHHS (NIOSH) Publication No. 92-100].

More recent recommendations are available on the NIOSH Web site (http://www.cdc.gov/niosh). Copies of the *Compendium* may be ordered from the NIOSH Publications office (800-356-4674).

**HOW TO USE THIS POCKET GUIDE**

The *Pocket Guide* has been designed to provide chemical-specific data to supplement general industrial hygiene knowledge. To maximize the amount of data provided in this limited space, abbreviations and codes have been used extensively. These abbreviations and codes, which have been designed to permit rapid comprehension by the regular user, are discussed for each column in the following subsections.

The chemical name found in the OSHA General Industry Air Contaminants Standard (29 CFR 1910.1000) is listed in the top left portion of each chemical table.

**Chemical Name**

The chemical name found in the OSHA General Industry Air Contaminants Standard (29 CFR 1910.1000) is listed in the top left portion of each chemical table.
The chemical structure or formula is listed under the chemical name in each chemical table. Carbon-carbon double bonds (-C=C-) have been indicated where applicable.

**CAS Number**

This Chemical Abstracts Service (CAS) registry number is provided in the top right portion of the chemical tables. The CAS number, in the format xxx-xx-x, is unique for each chemical and allows efficient searching on computerized data bases. The CAS number index can be used to find a chemical based on the CAS number.

**RTECS Number**

This section lists the Registry of Toxic Effects of Chemical Substances (RTECS®) number, in the format ABxxxxxx. RTECS® may be useful for obtaining additional toxicologic information on a specific substance.

RTECS® is a compendium of data extracted from the open scientific literature. On December 18, 2001, CDC's Technology Transfer Office, on behalf of NIOSH, successfully completed negotiating a "PHS Trademark Licensing Agreement" for RTECS®. This non-exclusive licensing agreement provides for the transfer and continued development of the "RTECS® database and its trademark" to MDL Information Systems, Inc. (MDL), a wholly owned subsidiary of Elsevier Science, Inc. Under this agreement, MDL will be responsible for updating, licensing, marketing, and distributing RTECS®.

**DOT ID and Guide Number**

This section lists the U.S. Department of Transportation (DOT) Identification numbers and the corresponding Guide numbers. Their format is xxx yyy. The Identification (ID) number (xxxx) indicates that the chemical is regulated by DOT. The Guide number (yyy) refers to actions to be taken to stabilize an emergency situation; this information can be found in the 2004 Emergency Response Guidebook (Office of Hazardous Materials Initiatives and Training [DHM-50], Research and Special Programs Administration, U.S. Department of Transportation, 400 7th Street, S.W., Washington, D.C. 20590-0001; for sale by the U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954). Please note however, that many DOT numbers are not unique for a specific substance.

**Synonyms and Trade Names**

This section of each chemical table contains an alphabetical list of common synonyms and trade names for each chemical. The Chemical Name, Synonym and Trade Name Index can be used to search for chemical pages. This index also includes the primary chemical names for all of the chemicals in the Pocket Guide.

**Conversion Factors**

This section lists factors for the conversion of ppm (parts of vapor or gas per million parts of contaminated air by volume) to mg/m³ (milligrams of vapor or gas per cubic meter of contaminated air) at 25°C and 1 atmosphere for chemicals with exposure limits expressed in ppm.

**Exposure Limits**

The NIOSH recommended exposure limits (RELs) are listed first in this section. For NIOSH RELs, "TWA" indicates a time-weighted average concentration for up to a 10-hour workday during a 40-hour workweek. A short-term exposure limit (STEL) is designated by "ST" preceding the value; unless noted otherwise, the STEL is a 15-minute TWA exposure that should not be exceeded at any time during a workday. A ceiling REL is designated by "C" preceding the value; unless noted otherwise, the ceiling value should not be exceeded at any time. Any substance that NIOSH considers to be a potential occupational carcinogen is designated by the notation "Ca" (see Appendix A, which contains a brief discussion of potential occupational carcinogens).

The OSHA permissible exposure limits (PELs), as found in Tables Z-1, Z-2, and Z-3 of the OSHA General Industry Air Contaminants Standard (29 CFR 1910.1000), that were effective on July 1, 1993* and which are currently enforced by OSHA are listed next.

*In July 1992, the 11th Circuit Court of Appeals in its decision in AFL-CIO v. OSHA, 965 F.2d
TWA concentrations for OSHA PELs must not be exceeded during any 8-hour workshift of a 40-hour workweek. A STEL is designated by "ST" preceding the value and is measured over a 15-minute period unless noted otherwise. OSHA ceiling concentrations (designated by "C" preceding the value) must not be exceeded during any part of the workday; if instantaneous monitoring is not feasible, the ceiling must be assessed as a 15-minute TWA exposure. In addition, there are a number of substances from Table Z-2 (e.g., beryllium, ethylene dibromide) that have ceiling values that must not be exceeded except for specified excursions. For example, a "5-minute maximum peak in any 2 hours" means that a 5-minute exposure above the ceiling value, but never above the maximum peak, is allowed in any 2 hours during an 8-hour workday. Appendix B contains a brief discussion of substances regulated as carcinogens by OSHA.

Concentrations are given in ppm, mg/m³, mppcf (millions of particles per cubic foot of air as determined from counting an impinger sample), or fibers/cm³ (fibers per cubic centimeter). The "[skin]" designation indicates the potential for dermal absorption; skin exposure should be prevented as necessary through the use of good work practices, gloves, coveralls, goggles, and other appropriate equipment. The "(total)" designation indicates that the REL or PEL listed is for "total particulate" versus the "(resp)" designation which refers to the "respirable fraction" of the airborne particulate.

Appendix C contains more detailed discussions of the specific exposure limits for certain low-molecular-weight aldehydes, asbestos, various dyes (benzidine-, o-tolidine-, and o-dianisidine-based), carbon black, chloroethanes, the various chromium compounds (chroic acid and chromates, chromium(II) and chromium(III) compounds, and chromium metal), coal tar pitch volatiles, coke oven emissions, cotton dust, lead, mineral dusts, NIA® Catalyst ESN, trichloroethylene, and tungsten carbide (cemented). Appendix D contains a brief discussion of substances included in the Pocket Guide with no established RELs at this time. Appendix F contains miscellaneous notes regarding the OSHA PEL for benzene and the IDLHs for four chloronaphthalene compounds, and Appendix G lists the OSHA PELs that were vacated on June 30, 1993.

**IDLH - Immediately Dangerous to Life and Health**

This section lists the immediately dangerous to life or health concentrations (IDLHs). For the June 1994 Edition of the Pocket Guide, NIOSH reviewed and in many cases revised the IDLH values. The criteria utilized to determine the adequacy of the original IDLH values were a combination of those used during the Standards Completion Program and a newer methodology developed by NIOSH. These "interim" criteria formed a tiered approach, preferentially using acute human toxicity data, followed by acute animal inhalation toxicity data, and then by acute animal oral toxicity data to determine a preliminary updated IDLH value. When relevant acute toxicity data were insufficient or unavailable, NIOSH also considered using chronic toxicity data or an analogy to a chemically similar substance. NIOSH then compared these preliminary values with the following criteria to determine the updated IDLH value: 10% of lower explosive limit (LEL); acute animal respiratory irritation data (RD₅₀); other short-term exposure guidelines; and the NIOSH Respirator Selection Logic (DHHS [NIOSH] Publication No. 2005-100) The Documentation for Immediately Dangerous to Life or Health Concentrations (NTIS Publication Number PB-94-195047) further describes these criteria and provides information sources for both the original and revised IDLH values. NIOSH currently is assessing the various uses of IDLHs, whether the criteria used to derive the IDLH values are valid, and if other information or criteria should be utilized.

The purpose for establishing an IDLH value in the Standards Completion Program was to determine the airborne concentration from which a worker could escape without injury or irreversible health effects from an IDLH exposure in the event of the failure of respiratory protection equipment. The IDLH was considered a maximum concentration above which only a highly reliable breathing apparatus providing maximum worker protection should be permitted. In determining IDLH values, NIOSH considered the ability of a worker to escape without loss of life or irreversible health effects along with certain transient effects, such as severe eye or respiratory irritation, disorientation, and incoordination, which could prevent escape. As a safety margin, IDLH values are based on effects that might occur as a consequence of a 30-minute exposure. However, the 30-minute period was NOT meant to imply that workers should stay in the work environment any longer than necessary; in fact, EVERY EFFORT SHOULD BE MADE TO EXIT IMMEDIATELY!

NIOSH Respirator Selection Logic defines IDLH exposure conditions as "conditions that pose an immediate threat to life or health, or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health." The purpose of establishing an IDLH exposure concentration is to ensure that the worker can escape from a given...
contaminated environment in the event of failure of the respiratory protection equipment. The NIOSH Respirator Selection Logic uses IDLH values as one of several respirator selection criteria. Under the NIOSH Respirator Selection Logic, the most protective respirators (e.g., a self-contained breathing apparatus equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode) would be selected for firefighting, exposure to carcinogens, entry into oxygen-deficient atmospheres, in emergency situations, during entry into an atmosphere that contains a substance at a concentration greater than 2,000 times the NIOSH REL or OSHA PEL, and for entry into IDLH atmospheres. IDLH values are listed in the Pocket Guide for over 380 substances.

The notation “Ca” appears in the IDLH field for all substances that NIOSH considers potential occupational carcinogens. However, IDLH values that were originally determined in the Standards Completion Program or were subsequently revised are shown in brackets following the “Ca” designations. “10%LEL” indicates that the IDLH was based on 10% of the lower explosive limit for safety considerations even though the relevant toxicological data indicated that irreversible health effects or impairment of escape existed only at higher concentrations. "N.D." indicates that an IDLH value has not been determined for that substance. Appendix F contains an explanation of the "Effective" IDLHs used for four chloronaphthalene compounds.

### Physical Description

This entry provides a brief description of the appearance and odor of each substance. Notations are made as to whether a substance can be shipped as a liquefied compressed gas or whether it has major use as a pesticide.

### Chemical and Physical Properties

The following abbreviations are used for the chemical and physical properties given for each substance. "NA" indicates that a property is not applicable, and a question mark (?) indicates that it is unknown.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>Molecular weight</td>
</tr>
<tr>
<td>BP</td>
<td>Boiling point at 1 atmosphere, °F</td>
</tr>
<tr>
<td>Sol</td>
<td>Solubility in water at 68 °F (unless a different temperature is noted), % by weight (i.e., g/100 ml)</td>
</tr>
<tr>
<td>FLP</td>
<td>Flash point (i.e., the temperature at which the liquid phase gives off enough vapor to flash when exposed to an external ignition source), closed cup (unless annotated &quot;(oc)&quot; for open cup), °F</td>
</tr>
<tr>
<td>IP</td>
<td>Ionization potential, eV (electron volts) [Ionization potentials are given as a guideline for the selection of photoionization detector lamps used in some direct-reading instruments.]</td>
</tr>
<tr>
<td>VP</td>
<td>Vapor pressure at 68 °F (unless a different temperature is noted), mm Hg; “approx” indicates approximately</td>
</tr>
<tr>
<td>MLT</td>
<td>Melting point for solids, °F</td>
</tr>
<tr>
<td>FRZ</td>
<td>Freezing point for liquids and gases, °F</td>
</tr>
<tr>
<td>UEL</td>
<td>Upper explosive (flammable) limit in air, % by volume (at room temperature unless otherwise noted)</td>
</tr>
<tr>
<td>LEL</td>
<td>Lower explosive (flammable) limit in air, % by volume (at room temperature unless otherwise noted)</td>
</tr>
<tr>
<td>MEC</td>
<td>Minimum explosive concentration, g/m³ (when available)</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>Specific gravity at 68 °F (unless a different temperature is noted) referenced to water at 39.2 °F (4 °C)</td>
</tr>
<tr>
<td>RGasD</td>
<td>Relative density of gases referenced to air = 1 (indicates how many times a gas is heavier than air at the same temperature)</td>
</tr>
</tbody>
</table>

When available, the flammability/combustibility of a substance is listed at the bottom of the chemical and physical properties section. The following OSHA criteria (29 CFR 1910.106) were used to classify flammable or combustible liquids:

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>FLP. below 73 °F and BP below 100 °F.</td>
</tr>
<tr>
<td>IB</td>
<td>FLP. below 73 °F and BP at or above 100 °F.</td>
</tr>
<tr>
<td>IC</td>
<td>FLP. at or above 73 °F and below 100 °F.</td>
</tr>
</tbody>
</table>
Class II combustible liquid
F.L.P. at or above 100 °F and below 140 °F.

Class IIIA combustible liquid
F.L.P. at or above 140 °F and below 200 °F.

Class IIIB combustible liquid
F.L.P. at or above 200 °F.

Incompatibilities and Reactivities

This entry lists important hazardous incompatibilities or reactivities for each substance.

Measurement Methods

The section provides a source (NIOSH or OSHA) and the corresponding method number for measurement methods which can be used to determine the exposure for the chemical or substance. Unless otherwise noted, the NIOSH methods are from the 4th edition of the NIOSH Manual of Analytical Methods [DHHS [NIOSH] Publication No. 94-113 and supplements. If a different edition of the NIOSH Manual of Analytical Methods is cited, the appropriate edition and, where applicable, the volume number are noted [e.g., II-4 (2nd edition, volume 4)]. The OSHA methods are from the OSHA Web site ("http://www.osha-slc.gov/dts/sltc/methods").

"None available" means that no method is available from NIOSH or OSHA.

Each method listed is the recommended method for the analysis of the compound of interest. However, the method may not have been fully optimized to meet the specific sampling situation. Note that some methods are only partially evaluated and have been used in very limited sampling situations. Review the details of the method and consult with the laboratory performing the analysis regarding the applicability of the method and the need for further modifications to the method in order to adjust for the particular conditions.

Personal Protection and Sanitation

This section presents a summary of recommended practices for each substance. These recommendations supplement general work practices (e.g., no eating, drinking, or smoking where chemicals are used) and should be followed if additional controls are needed after using all feasible process, equipment, and task controls. Each category is described as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKIN:</td>
<td>Recommends the need for personal protective clothing.</td>
</tr>
<tr>
<td>EYES:</td>
<td>Recommends the need for eye protection.</td>
</tr>
<tr>
<td>WASH SKIN:</td>
<td>Recommends when workers should wash the spilled chemical from the body in addition to normal washing (e.g., before eating).</td>
</tr>
<tr>
<td>REMOVE:</td>
<td>Advises workers when to remove clothing that has accidentally become wet or significantly contaminated.</td>
</tr>
<tr>
<td>CHANGE:</td>
<td>Recommends whether the routine changing of clothing is needed.</td>
</tr>
<tr>
<td>PROVIDE:</td>
<td>Recommends the need for eyewash fountains and/or quick drench facilities.</td>
</tr>
</tbody>
</table>

First Aid

This entry lists emergency procedures for eye and skin contact, inhalation, and ingestion of the toxic substance.

Recommendations for Respirator Selection

This section provides a condensed table of allowable respirators to be used for those substances for which IDLH values have been determined, or for which NIOSH has previously provided respirator recommendations (e.g., in criteria documents or Current Intelligence Bulletins) for certain chemicals. There are, however, 186 chemicals listed in the Pocket Guide for which IDLH values have yet to be determined. Since the IDLH value is a critical component for completing the NIOSH Respirator Selection Logic for a given chemical, the Pocket Guide does not provide respiratory recommendations for those 186 chemicals without IDLH values. As new or revised IDLH values are developed for those and other chemicals, NIOSH will provide appropriate respirator recommendations. Updated information on the Pocket Guide can be found on the NIOSH Web site (http://www.cdc.gov/niosh/pg/np/g.html) and will be incorporated into subsequent editions of the Pocket Guide. [Appendix F contains an explanation of the "Effective" IDLHs used for four chloronaphthalene compounds.]
In 1995, NIOSH developed a new set of regulations in 42 CFR 84 (also referred to as “Part 84”) for testing and certifying non-powered, air-purifying, particulate-filter respirators. The new Part 84 respirators have passed a more demanding certification test than the old respirators (e.g., dust; dust and mist; dust, mist, and fume; spray paint; pesticide) certified under 30 CFR 11 (also referred to as “Part 11”). Recommendations for non-powered, air-purifying particulate respirators have been updated from previous editions of the Pocket Guide to incorporate Part 84 respirators; Part 11 terminology has been removed. For more information concerning the selection of N-, R-, or P-series (Part 84) particulate respirators click here.

In January 1998, OSHA revised its respiratory protection standard (29 CFR 1910.134). Among the provisions in the revised standard is the requirement for an end-of-service-life indicator (ESLI) or a change schedule when air-purifying respirators with chemical cartridges or canisters are used for protection against gases and vapors [29 CFR 1910.134(d)(3)(iii). requirement]. In the Pocket Guide, air-purifying respirators (without ESLIs) for protection against gases and vapors are recommended only for chemicals with adequate warning properties, but now these respirators may be selected regardless of the warning properties. Respirator recommendations in the Pocket Guide have not been revised in this edition to reflect the OSHA requirements for ESLIs or change schedules.

Appendix A lists the NIOSH carcinogen policy. Respirator recommendations for carcinogens in the Pocket Guide have not been revised to reflect this policy; these recommendations will be revised in future editions.

The first line in the entry indicates whether the "NIOSH" or the "OSHA" exposure limit is used on which to base the respirator recommendations. The more protective limit between the NIOSH REL or the OSHA PEL is always used. "NIOSH/OSHA" indicates that the limits are equivalent.

Each subsequent line lists a maximum use concentration (MUC) followed by the classes of respirators, with their Assigned Protection Factors (APFs), that are acceptable for use up to the MUC. Individual respirator classes are separated by diagonal lines (/). More protective respirators may be worn. "Emergency or planned entry into unknown concentrations or entry into IDLH conditions" is followed by the classes of respirators acceptable for these conditions. "Escape" indicates that the respirators are to be used only for escape purposes. For each MUC or condition, this entry lists only those respirators with the required APF and other use restrictions based on the NIOSH Respirator Selection Logic.

In certain cases, the recommended respirators are annotated with the following symbols as additional information:

- Substance reported to cause eye irritation or damage; may require eye protection
- Substance causes eye irritation or damage; eye protection needed
- Only nonoxidizable sorbents allowed (not charcoal)
- End of service life indicator (ESLI) required

All respirators selected must be approved by NIOSH under the provisions of 42 CFR 84. The current listing of NIOSH/MSHA certified respirators can be found in the NIOSH Certified Equipment List, which is available on the NIOSH Web site (http://www.cdc.gov/niosh/npptl/topics/respirators/cel).

A complete respiratory protection program must be implemented and must fulfill all requirements of 29 CFR 1910.134. respiratory protection program must include a written standard operating procedure covering regular training, fit-testing, fit-checking, periodic environmental monitoring, maintenance, medical monitoring, inspection, cleaning, storage and periodic program evaluation. Selection of a specific respirator within a given class of recommended respirators depends on the particular situation; this choice should be made only by a knowledgeable person. REMEMBER: Air-purifying respirators will not protect users against oxygen-deficient atmospheres, and they are not to be used in IDLH conditions. The only respirators recommended for fire fighting are self-contained breathing apparatuses that have full facepieces and are operated in a pressure-demand or other positive-pressure mode. Additional information on the selection and use of respirators can be found in the NIOSH Respirator Selection Logic (DHHS [NIOSH] Publication No. 2005-100) and the NIOSH Guide to Industrial Respiratory Protection (DHHS [NIOSH] Publication No. 87-116).

**Exposure Route, Symptoms, Target Organs**

**Exposure Route**

This section lists the toxicologically important routes of entry for each substance and whether contact with the skin or eyes is potentially hazardous.
Symptoms

This entry lists the potential symptoms of exposure and whether NIOSH considers the substance a potential occupational carcinogen.

Target Organs

This entry lists the organs that are affected by exposure to each substance. For carcinogens, the type(s) of cancer are listed in brackets. Information in this section reflects human data unless otherwise noted.

Selection of N-, R-, or P- Series Particulate Respirators

1. The selection of N-, R-, and P-series filters depends on the presence of oil particles as follows:

   - If no oil particles are present in the work environment, use a filter of any series (i.e., N-, R-, or P-series).
   - If oil particles (e.g., lubricants, cutting fluids, glycerine) are present, use an R- or P-series filter. Note: N-series filters cannot be used if oil particles are present.
   - If oil particles are present and the filter is to be used for more than one work shift, use only a P-series filter.

   **Note:** To help you remember the filter series, use the following guide:

   - N for Not resistant to oil,
   - R for Resistant to oil,
   - P for oil Proof.

2. Selection of filter efficiency (i.e., 95%, 99%, or 99.7%) depends on how much filter leakage can be accepted. Higher filter efficiency means lower filter leakage.

3. The choice of facepiece depends on the level of protection needed - that is, the assigned protection factor (APF) needed.

   **See Recommendations for Respirator Selection for more information.**
## NIOSH Pocket Guide to Chemical Hazards

### INDEX of Primary Chemical Names

<table>
<thead>
<tr>
<th>SEQ</th>
<th>CHEMICAL NAME</th>
<th>CAS No.</th>
<th>RTECS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001*</td>
<td>Acetaldehyde</td>
<td>75-07-0</td>
<td>AB1925000</td>
</tr>
<tr>
<td>0002*</td>
<td>Acetic acid</td>
<td>64-19-7</td>
<td>AF1225000</td>
</tr>
<tr>
<td>0003*</td>
<td>Acetic anhydride</td>
<td>108-24-7</td>
<td>AK1925000</td>
</tr>
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<td>0004*</td>
<td>Acetone</td>
<td>67-64-1</td>
<td>AL3150000</td>
</tr>
<tr>
<td>0005*</td>
<td>Acetone cyanohydrin</td>
<td>75-86-5</td>
<td>OD9275000</td>
</tr>
<tr>
<td>0006*</td>
<td>Acetonitrile</td>
<td>75-05-8</td>
<td>AL7700000</td>
</tr>
<tr>
<td>0007*</td>
<td>2-Acetylaminofluorene</td>
<td>53-96-3</td>
<td>AB9450000</td>
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<td>0008*</td>
<td>Acetylene</td>
<td>74-86-2</td>
<td>AO9600000</td>
</tr>
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<td>0009*</td>
<td>Acetylene tetrabromide</td>
<td>79-27-6</td>
<td>KI8225000</td>
</tr>
<tr>
<td>0010*</td>
<td>Acetysalicylic acid</td>
<td>50-78-2</td>
<td>VO0700000</td>
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<td>0011*</td>
<td>Acrolein</td>
<td>107-02-8</td>
<td>AS1050000</td>
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<td>0012*</td>
<td>Acrylamide</td>
<td>79-06-1</td>
<td>AS3325000</td>
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<td>0013*</td>
<td>Acrylic acid</td>
<td>79-10-7</td>
<td>AS4375000</td>
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<td>Acrylonitrile</td>
<td>107-13-1</td>
<td>AT5250000</td>
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<td>0015*</td>
<td>Adiponitrile</td>
<td>111-69-3</td>
<td>AV2625000</td>
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<td>0016*</td>
<td>Aldrin</td>
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<td>IO2100000</td>
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<td>Allyl alcohol</td>
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<td>BA5075000</td>
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<td>Allyl chloride</td>
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<td>UC7350000</td>
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<td>Allyl glycidyl ether</td>
<td>106-92-3</td>
<td>RR0875000</td>
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<td>0020*</td>
<td>Allyl propyl disulfide</td>
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<td>JO0350000</td>
</tr>
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0468* | Octachloronaphthalene | 2234-13-1 | QK0250000 
0469* | 1-Octadecanethiol | 2885-00-9 | 
0470* | Octane | 111-65-9 | RG8400000 
0471* | 1-Octanethiol | 111-88-6 | 
0472* | Oil mist (mineral) | 8012-95-1 | PY8030000 
0473* | Osmium tetroxide | 20816-12-0 | RN1140000 
0474* | Oxalic acid | 144-62-7 | RO2450000 
0475* | Oxygen difluoride | 7783-41-7 | RS2100000 
0476* | Ozone | 10028-15-6 | RS8225000 

### A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

### P

### SEQ | CHEMICAL NAME | CAS No. | RTECS No. 
---|---|---|---
0477* | Paraffin wax fume | 8002-74-2 | RV0350000 
0478* | Paraquat (Paraquat dichloride) | 1910-42-5 | DW2275000 
0479* | Parathion | 56-38-2 | TF4550000 
0480* | Particulates not otherwise regulated | | 
0481* | Pentaborane | 19624-22-7 | RY8925000 
0482* | Pentachloroethane | 76-01-7 | KI6300000 
0483* | Pentachloronaphthalene | 1321-64-8 | QK0300000 
0484* | Pentachlorophenol | 87-86-5 | SM6300000 
0485* | Pentaerythritol | 115-77-5 | RZ2490000 
0486* | n-Pentane | 109-66-0 | RZ9450000 
0487* | 1-Pentanethiol | 110-66-7 | SA3150000 
0488* | 2-Pentanone | 107-87-9 | SA7875000 
0489* | Perchloromethyl mercaptan | 594-42-3 | PB0370000 
0490* | Perchloryl fluoride | 7616-94-6 | SD1925000 
0491* | Perlite | 93763-70-3 | SD5254000 
0492* | Petroleum distillates (naphtha) | 8002-05-9 | SE7449000 
0493* | Phenol | 108-95-2 | SJ3325000 
0494* | Phenothiazine | 92-84-2 | SN5075000 
0495* | p-Phenylenediamine | 106-50-3 | SS8050000 
0497* | Phenyl ether-biphenyl mixture (vapor) | 8004-13-5 | DV1500000 
0496* | Phenyl ether (vapor) | 101-84-8 | KN8970000 
0498* | Phenyl glycidyl ether | 122-60-1 | TZ3675000 
0499* | Phenylhydrazine | 100-63-0 | MV8925000
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APPENDIX A - NIOSH Potential Occupational Carcinogens

New Policy

For the past 20 plus years, NIOSH has subscribed to a carcinogen policy that was published in 1976 by Edward J. Fairchild, II, Associate Director for Cincinnati Operations, which called for "no detectable exposure levels for proven carcinogenic substances" (Annals of the New York Academy of Sciences, 271:200-207, 1976). This was in response to a generic OSHA rulemaking on carcinogens. Because of advances in science and in approaches to risk assessment and risk management, NIOSH has adopted a more inclusive policy. NIOSH recommended exposure limits (RELs) will be based on risk evaluations using human or animal health effects data, and on an assessment of what levels can be feasibly achieved by engineering controls and measured by analytical techniques. To the extent feasible, NIOSH will project not only a no-effect exposure, but also exposure levels at which there may be residual risks. This policy applies to all workplace hazards, including carcinogens, and is responsive to Section 20(a)(3) of the Occupational Safety and Health Act of 1970, which charges NIOSH to "...describe exposure levels that are safe for various periods of employment, including but not limited to the exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience."

The effect of this new policy will be the development, whenever possible, of quantitative RELs that are based on human and/or animal data, as well as on the consideration of technological feasibility for controlling workplace exposures to the REL. Under the old policy, RELs for most carcinogens were non-quantitative values labeled "lowest feasible concentration (LFC)." [Note: There are a few exceptions to LFC RELs for carcinogens (e.g., RELs for asbestos, formaldehyde, benzene, and ethylene oxide are quantitative values based primarily on analytical limits of detection or technological feasibility). Also, in 1989, NIOSH adopted several quantitative RELs for carcinogens from OSHA's permissible exposure limit (PEL) update.]

Under the new policy, NIOSH will also recommend the complete range of respirators (as determined by the NIOSH Respirator Decision Logic) for carcinogens with quantitative RELs. In this way, respirators will be consistently recommended regardless of whether a substance is a carcinogen or a non-carcinogen.

Old Policy

In the past, NIOSH identified numerous substances that should be treated as potential occupational carcinogens even though OSHA might not have identified them as such. In determining their carcinogenicity, NIOSH used the OSHA classification outlined in 29 CFR 1990.103, which states in part:

Potential occupational carcinogen means any substance, or combination or mixture of substances, which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance which is metabolized into one or more potential occupational carcinogens by mammals.
When thresholds for carcinogens that would protect 100% of the population had not been identified, NIOSH usually recommended that occupational exposures to carcinogens be limited to the lowest feasible concentration. To ensure maximum protection from carcinogens through the use of respiratory protection, NIOSH also recommended that only the most reliable and protective respirators be used. These respirators include (1) a self-contained breathing apparatus (SCBA) that has a full facepiece and is operated in a positive-pressure mode, or (2) a supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in a pressure-demand or other positive-pressure mode.

Recommendations to be Revised

The RELs and respirator recommendations for carcinogens listed in this edition of the *Pocket Guide* still reflect the old policy. Changes in the RELs and respirator recommendations that reflect the new policy will be included in future editions.

APPENDIX B - Thirteen OSHA-Regulated Carcinogens

Without establishing PELs, OSHA promulgated standards in 1974 to regulate the industrial use of 13 chemicals identified as potential occupational carcinogens.

- 2-Acetylaminofluorene
- 4-Aminodiphenyl
- Benzidine
- bis-Chloromethyl ether
- 3,3′-Dichlorobenzidine
- 4-Dimethylaminoazobenzene
- Ethyleneimine
- Methyl chloromethyl ether
- alpha-Naphthylamine
- beta-Naphthylamine
- 4-Nitrophenyl
- N-Nitrosodimethylamine
- beta-Propiolactone

Exposure to these 13 chemicals is to be controlled through the required use of engineering controls, work practices, and personal protective equipment, including respirators. See 29 CFR 1910.1003-1910.1016 for specific details of these requirements.

Respirator selections in the Pocket Guide are based on NIOSH policy, which considers the 13 chemicals to be potential occupational carcinogens.

APPENDIX C

Supplementary Exposure Limits

**Aldehydes (Low-Molecular-Weight)**

Exposure to acetaldehyde has produced nasal tumors in rats and laryngeal tumors in hamsters, and exposure to malonaldehyde has produced thyroid gland and pancreatic islet cell tumors in rats. NIOSH therefore recommends that acetaldehyde and malonaldehyde be considered potential occupational carcinogens in conformance with the OSHA carcinogen policy.

Testing has not been completed to determine the carcinogenicity of acrolein, butyraldehyde (CAS#: 123-72-8), crotonaldehyde, glutaraldehyde, glyoxal (CAS#: 107-22-2), paraformaldehyde (CAS#: 30525-89-4), propionaldehyde (CAS#: 624-67-9), propionaldehyde (CAS#: 123-38-6), and n-valeraldehyde, nine related low-molecular-weight-aldehydes.
However, the limited studies to date indicate that these substances have chemical reactivity and mutagenicity similar to acetaldehyde and malonaldehyde. Therefore, NIOSH recommends that careful consideration should be given to reducing exposures to these nine related aldehydes.

Further information can be found in the "NIOSH Current Intelligence Bulletin 55: Carcinogenicity of Acetaldehyde and Malonaldehyde, and Mutagenicity of Related Low-Molecular-Weight Aldehydes" [DHHS (NIOSH) Publication No. 91-112.]

**Asbestos**

NIOSH considers asbestos to be a potential occupational carcinogen and recommends that exposures be reduced to the lowest feasible concentration. For asbestos fibers >5 micrometers in length, NIOSH recommends a REL of 100,000 fibers per cubic meter of air (100,000 fibers/m^3), which is equal to 0.1 fiber per cubic centimeter of air (0.1 fiber/cm^3), as determined by a 400-liter air sample collected over 100 minutes in accordance with NIOSH Analytical Method #7400. Airborne asbestos fibers are defined as those particles having (1) an aspect ratio of 3 to 1 or greater and (2) the mineralogic characteristics (that is, the crystal structure and elemental composition) of the asbestos minerals and their nonasbestiform analogs. The asbestos minerals are defined as chrysotile, crocidolite, amosite (cumingtonite-grunerite), anthophyllite, tremolite, and actinolite. In addition, airborne cleavage fragments from the nonasbestiform habits of the serpentine minerals antigorite and lizardite, and the amphibole minerals contained in the series cummingtonite-grunerite, tremolite-ferroactinolite, and glaucophane-riebeckite should also be counted as fibers provided they meet the criteria for a fiber when viewed microscopically.

As found in 29 CFR 1910.1001, the OSHA PEL for asbestos fibers (i.e., actinolite asbestos, amosite, anthophyllite asbestos, chrysotile, crocidolite, and tremolite asbestos) is an 8-hour TWA airborne concentration of 0.1 fiber (longer than 5 micrometers and having a length-to-diameter ratio of at least 3 to 1) per cubic centimeter of air (0.1 fiber/cm^3), as determined by the membrane filter method at approximately 400X magnification with phase contrast illumination. No worker should be exposed in excess of 1 fiber/cm^3 (excursion limit) as averaged over a sampling period of 30 minutes.

**Benzidine-, o-Tolidine, and o-Dianisidine-based Dyes**

In December 1980, OSHA and NIOSH jointly published the Health Hazard Alert: Benzidine-, o-Tolidine-, and o-Dianisidine-based Dyes.

In this Alert, OSHA and NIOSH concluded that benzidine and benzidine-based dyes were potential occupational carcinogens and recommended that worker exposure be reduced to the lowest feasible level.

OSHA and NIOSH further concluded that o-tolidine and o-dianisidine (and dyes based on them) may present a cancer risk to workers and should be handled with caution and exposure minimized.

**Carbon Black**

NIOSH considers "Carbon Black" to be the material consisting of more than 80% elemental carbon, in the form of near-spherical colloidal particles and coalesced particle aggregates of colloidal size, that is obtained by the partial combustion or thermal decomposition of hydrocarbons. The NIOSH REL (10-hour TWA) for carbon black is 3.5 mg/m^3. Polycyclic aromatic hydrocarbons (PAHs), particulate polycyclic organic material (PPOM), and polynuclear aromatic hydrocarbons (PNAs) are terms frequently used to describe various petroleum-based substances that NIOSH considers to be potential occupational carcinogens. Since some of these aromatic hydrocarbons may be formed during the manufacture of carbon black (and become adsorbed on the carbon black), the NIOSH REL (10-hour TWA) for carbon black in the presence of PAHs is 0.1 mg PAHs/m^3 (measured as the cyclohexane-extractable fraction). The OSHA PEL (8-hour TWA) for carbon black is 3.5 mg/m^3.

**Chloroethanes**

NIOSH considers ethylene dichloride; hexachloroethane; 1,1,2,2-tetrachloroethane; and 1,1,2-trichloroethane; to be potential occupational carcinogens.

Additionally, NIOSH recommends that the other five chloroethane compounds:

- 1,1-Dichloroethane
- Ethyl chloride
- Methyl chloroform
be treated in the workplace with caution because of their structural similarity to the four chloroethanes shown to be carcinogenic in animals.

**Chromic Acid and Chromates (as CrO₃), Chromium(II) and Chromium(III) Compounds (as Cr), and Chromium Metal (as Cr)**

The NIOSH REL (10-hour TWA) is 0.001 mg Cr(VI)/m³ for all hexavalent chromium [Cr(VI)] compounds. NIOSH considers all Cr(VI) compounds (including chromic acid, tert-butyl chromate, zinc chromate, and chromyl chloride) to be potential occupational carcinogens.

The NIOSH REL (8-hour TWA) is 0.5 mg Cr/m³ for chromium metal and chromium(II) and chromium(III) compounds.

The OSHA PEL is 0.1 mg CrO₃/m³ (ceiling) for chromic acid and chromates (including tert-butyl chromate with a "skin" designation and zinc chromate); 0.5 mg Cr/m³ (8-hour TWA) for chromium(II) and chromium(III) compounds; and 1 mg Cr/m³ (8-hour TWA) for chromium metal and insoluble salts.

**Coal Tar Pitch Volatiles**

NIOSH considers coal tar products (i.e., coal tar, coal tar pitch, or creosote) to be potential occupational carcinogens; the NIOSH REL (10-hour TWA) for coal tar products is 0.1 mg/m³ (cyclohexane-extractable fraction).

The OSHA PEL (8-hour TWA) for coal tar pitch volatiles is 0.2 mg/m³ (benzene-soluble fraction). OSHA defines "coal tar pitch volatiles" in 29 CFR 1910.1002 as the fused polycyclic hydrocarbons that volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter and includes substances such as anthracene, benzo(a)pyrene (BaP), phenanthrene, acridine, chrysene, pyrene, etc.

**Coke Oven Emissions**

The production of coke by the carbonization of bituminous coal leads to the release of chemically-complex emissions from coke ovens that include both gases and particulate matter of varying chemical composition.

The emissions include coal tar pitch volatiles (e.g., particulate polycyclic organic matter [PPOM], polycyclic aromatic hydrocarbons [PAHs], and polynuclear aromatic hydrocarbons [PNAs]), aromatic compounds (e.g., benzene and beta-naphthylamine), trace metals (e.g., arsenic, beryllium, cadmium, chromium, lead, and nickel), and gases (e.g., nitric oxides and sulfur dioxide).

**Cotton Dust (raw)**

NIOSH recommends reducing exposures to cotton dust to the lowest feasible concentration to reduce the prevalence and severity of byssinosis; the REL is <0.200 mg/m³ (as lint-free cotton dust).

As found in OSHA Table Z-1 (29 CFR 1910.1000), the PEL for cotton dust (raw) is 1 mg/m³ for the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and garnetting.

PELs for other sectors (as found in 29 CFR 1910.1043) are 0.200 mg/m³ for yarn manufacturing and cotton washing operations, 0.500 mg/m³ for textile mill waste house operations or for dust from "lower grade washed cotton" used during yarn manufacturing, and 0.750 mg/m³ for textile slashing and weaving operations.

The OSHA standard in 29 CFR 1910.1043 does not apply to cotton harvesting, ginning, or the handling and processing of woven or knitted materials and washed cotton.

All PELs for cotton dust are mean concentrations of lint-free, respirable cotton dust collected by the vertical elutriator or an equivalent method and averaged over an 8-hour period.

**Lead**
NIOSH considers "Lead" to mean metallic lead, lead oxides, and lead salts (including organic salts such as lead soaps but excluding lead arsenate).

The NIOSH REL for lead (8-hour TWA) is 0.050 mg/m³; air concentrations should be maintained so that worker blood lead remains less than 0.060 mg Pb/100 g of whole blood.

OSHA considers "Lead" to mean metallic lead, all inorganic lead compounds (lead oxides and lead salts), and a class of organic compounds called soaps; all other lead compounds are excluded from this definition.

The OSHA PEL (8-hour TWA) is 0.050 mg/m³; other OSHA requirements can be found in 29 CFR 1910.1025. The OSHA PEL (8-hour TWA) for lead in "non-ferrous foundries with less than 20 employees" is 0.075 mg/m³.

Mineral Dusts

The OSHA PELs for "mineral dusts" listed below are from Table Z-3 of 29 CFR 1910.1000. The OSHA PEL (8-hour TWA) for crystalline silica (as respirable quartz) is either 250 mppcf divided by the value "%SiO₂ + 5" or 10 mg/m³ divided by the value "%SiO₂ + 2." The OSHA PEL (8-hour TWA) for crystalline silica (as total quartz) is 30 mg/m³ divided by the value "%SiO₂ + 2." The OSHA PELs (8-hour TWAs) for cristobalite and tridymite are « the values calculated above using the count or mass formulae for quartz.

The OSHA PEL (8-hour TWA) for amorphous silica (including diatomaceous earth) is either 80 mg/m³ divided by the value "%SiO₂," or 20 mppcf.

The OSHA PELs (8-hour TWAs) for talc (not containing asbestos), mica, and soapstone are 20 mppcf. The OSHA PEL (8-hour TWA) for portland cement is 50 mppcf. The OSHA PEL (8-hour TWA) for graphite (natural) is 15 mppcf. The PELs for talc (not containing asbestos), mica, soapstone, and portland cement are applicable if the material contains less than 1% crystalline silica.

The OSHA PEL (8-hour TWA) for coal dust (as the respirable fraction) containing less than 5% SiO₂ is 2.4 mg/m³ divided by the value "%SiO₂ + 2." The OSHA PEL (8-hour TWA) for coal dust (as the respirable fraction) containing greater than or equal to 5% SiO₂ is 10 mg/m³ divided by the value "%SiO₂ + 2."

NIAX® Catalyst ESN

In May 1978, OSHA and NIOSH jointly published the Current Intelligence Bulletin (CIB) 26: NIAX® Catalyst ESN.

In this CIB, OSHA and NIOSH recommended that occupational exposure to NIAX® Catalyst ESN, its components, dimethylaminopropionitrile and bis(2-(dimethylamino)ethyl)ether, as well as formulations containing either component, be minimized.

Exposures should be limited to as few workers as possible, while minimizing workplace exposure concentrations with effective work practices and engineering controls.

Exposed workers should be carefully monitored for potential disorders of the nervous and genitourinary system. Although substitution is a possible control measure, alternatives to NIAX® Catalyst ESN or its components should be carefully evaluated with regard to possible adverse health effects.

Trichloroethylene

NIOSH considers trichloroethylene (TCE) to be a potential occupational carcinogen and recommends a REL of 2 ppm (as a 60-minute ceiling) during the usage of TCE as an anesthetic agent and 25 ppm (as a 10-hour TWA) during all other exposures.

Tungsten Carbide (Cemented)

"Cemented tungsten carbide" or "hard metal" refers to a mixture of tungsten carbide, cobalt, and sometimes metal oxides or carbides and other metals (including nickel).

When the cobalt (Co) content exceeds 2%, its contribution to the potential hazard is judged to exceed that of tungsten carbide.

Therefore, the NIOSH REL (10-hour TWA) for cemented tungsten carbide containing >2% Co is 0.05 mg Co/m³; the applicable OSHA PEL is 0.1 mg Co/m³ (8-hour TWA). Nickel (Ni) may sometimes be used as a binder...
rather than cobalt.

NIOSH considers cemented tungsten carbide containing nickel to be a potential occupational carcinogen and recommends a REL of 0.015 mg Ni/m$^3$ (10-hour TWA).

The OSHA PEL for Insoluble Nickel (i.e., a 1 mg Ni/m$^3$ 8-hour TWA) applies to mixtures of tungsten carbide and nickel.

APPENDIX D - Substances with No Established RELs

After reviewing available published literature, NIOSH provided comments to OSHA on August 1, 1988, regarding the "Proposed Rule on Air Contaminants" (29 CFR 1910, Docket No. H-020).

In these comments, NIOSH questioned whether the PELs proposed (and listed below) for the following substances included in the Pocket Guide were adequate to protect workers from recognized health hazards:

- Acetylene tetrabromide [TWA 1 ppm]
- Chlorobenzene [TWA 75 ppm]
- Coal dust (<5% SiO$_2$) [TWA 2 mg/m$^3$ (as the respirable dust fraction)]
- Coal dust (> or = 5% SiO$_2$) [TWA 0.1 mg/m$^3$ (as the respirable quartz fraction)]
- Ethyl bromide [TWA 200 ppm; STEL 250 ppm]
- Ethylene glycol [Ceiling 50 ppm]
- Ethyl ether [TWA 400 ppm; STEL 500 ppm]
- Fenthion [TWA 0.2 mg/m$^3$ (skin)]
- Furfural [TWA 2 ppm (skin)]
- 2-Isopropoxyethanol [TWA 25 ppm]
- Isopropyl acetate [TWA 250 ppm; STEL 310 ppm]
- Isopropylamine [TWA 5 ppm; STEL 10 ppm]
- Manganese tetroxide (as Mn) [TWA 1 mg/m$^3$]
- Molybdenum (soluble compounds as Mo) [TWA 5 mg/m$^3$]
- Nitromethane [TWA 100 ppm]
- m-Toluidine [TWA 2 ppm (skin)]
- Triethylamine [TWA 10 ppm; STEL 15 ppm]

At that time, NIOSH also conducted a limited evaluation of the literature and concluded that the documentation cited by OSHA was inadequate to support the proposed PEL (as an 8-hour TWA) of 10 mg/m$^3$ for alpha-alumina, benomyl, emery, glycerine (mist), graphite (synthetic), magnesium oxide fume, molybdenum (insoluble compounds as Mo), particulates not otherwise regulated, picloram, and rouge.

APPENDIX E - OSHA Respirator Requirements for Selected Chemicals

Revisions to the OSHA Respiratory Protection Standard (29 CFR 1910.134) became effective on April 8, 1998. Incorporated within the preamble of this ruling were changes to OSHA regulations for several chemicals or substances, which are listed as subheadings in blue text throughout this appendix. These subheadings, which are also the titles of the affected standards within 29 CFR 1910 and 29 CFR 1926, are followed by the standard number(s) in parentheses and the OSHA respirator requirements. Fit testing is required by OSHA for all tight-fitting air-purifying respirators. Please consult 29 CFR 1910.134 for the full content of the changes that apply. For all of the chemicals listed in this appendix, any respirators that are permitted at higher environmental concentrations can be used at lower concentrations.

13 Carcinogens (4-Nitrobiphenyl, etc.) (1910.1003)
Employees engaged in handling operations involving the carcinogens listed below must be provided with, and required to wear and use, a half-mask filter-type respirator for dusts, mists, and fumes. A respirator affording higher levels of protection than this respirator may be substituted.

<table>
<thead>
<tr>
<th>Carcinogen</th>
<th>Carcinogen</th>
<th>Carcinogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Acetylaminofluorene</td>
<td>4-Dimethylaminoazobenezene</td>
<td>beta-Naphthylamine</td>
</tr>
<tr>
<td>4-Aminodiphenyl</td>
<td>Ethyleneimine</td>
<td>4-Nitro biphenyl</td>
</tr>
<tr>
<td>Benzidine</td>
<td>Methyl chloromethyl ether</td>
<td>N-Nitrosodimethylamine</td>
</tr>
<tr>
<td>bis-Chloromethyl ether</td>
<td>alpha-Naphthylamine</td>
<td>beta-Propiolactone</td>
</tr>
<tr>
<td>3,3’-Dichlorobenzidine (and its salts)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Acrylonitrile (1910.1045)**

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Respirator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 20 ppm (parts per million)</td>
<td>(1) Chemical cartridge respirator with organic vapor cartridge(s) and half-mask facepiece; or (2) Supplied-air respirator with half-mask facepiece.</td>
</tr>
<tr>
<td>&lt; or = 100 ppm or maximum use concentration of cartridges or canisters, whichever is lower</td>
<td>(1) Full-facepiece respirator with (A) organic vapor cartridges, (B) organic vapor gas mask, chin-style, or (C) organic vapor gas mask canister, front- or back-mounted; (2) Supplied-air respirator with full facepiece; or (3) Self-contained breathing apparatus with full facepiece.</td>
</tr>
<tr>
<td>&lt; or = 4,000 ppm</td>
<td>Supplied-air respirator operated in positive-pressure mode with full facepiece, helmet, suit, or hood.</td>
</tr>
<tr>
<td>&gt; 4,000 ppm or unknown concentration</td>
<td>(1) Supplied-air and auxiliary self-contained breathing apparatus with full facepiece in positive-pressure mode; or (2) Self-contained breathing apparatus with full facepiece in positive-pressure mode.</td>
</tr>
<tr>
<td>Firefighting</td>
<td>Self-contained breathing apparatus with full facepiece in positive-pressure mode.</td>
</tr>
<tr>
<td>Escape</td>
<td>(1) Any organic vapor respirator; or (2) Any self-contained breathing apparatus.</td>
</tr>
</tbody>
</table>

**Arsenic, inorganic (1910.1018)**

**Requirements for Respiratory Protection for Inorganic Arsenic Particulate**

*Except for Those With Significant Vapor Pressure*

<table>
<thead>
<tr>
<th>Airborne Concentration (as As) or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 100 µg/m³ (micrograms per cubic meter)</td>
<td>(1) Half-mask air-purifying respirator equipped with high-efficiency filter*; or (2) Any half-mask supplied air respirator.</td>
</tr>
<tr>
<td>Airborne Concentration (as As) or Condition of Use</td>
<td>Required Respirator</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>&lt; or = 500 µg/m³</td>
<td>(1) Full facepiece air-purifying respirator equipped with high-efficiency filter*; (2) Any full-facepiece supplied-air respirator; or (3) Any full-facepiece self-contained breathing apparatus.</td>
</tr>
<tr>
<td>&lt; or = 10,000 µg/m³</td>
<td>(1) Powered air-purifying respirators in all inlet face coverings with high-efficiency filters*; or (2) Half-mask supplied-air respirators operated in positive-pressure mode.</td>
</tr>
<tr>
<td>&lt; or = 20,000 µg/m³</td>
<td>Supplied-air respirator with full facepiece, hood, or helmet or suit, operated in positive-pressure mode.</td>
</tr>
<tr>
<td>&gt; 20,000 µg/m³, unknown concentrations, or firefighting</td>
<td>Any full-facepiece self-contained breathing apparatus operated in positive-pressure mode.</td>
</tr>
</tbody>
</table>

* A high-efficiency filter means a filter that is at least 99.97% efficient against mono-dispersed particles of 0.3 µm (micrometers) in diameter or higher.

**Requirements for Respiratory Protection for Inorganic Arsenicals With Significant Vapor Pressure**

<table>
<thead>
<tr>
<th>Airborne Concentration (as As) or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 100 µg/m³ (micrograms per cubic meter)</td>
<td>(1) Half-mask* air-purifying respirator equipped with high-efficiency filter** and acid gas cartridge; or (2) Any half-mask* supplied-air respirator.</td>
</tr>
<tr>
<td>&lt; or = 500 µg/m³</td>
<td>(1) Front- or back-mounted gas mask equipped with high-efficiency filter** and acid gas canister; (2) Any full-facepiece supplied-air respirator; or (3) Any full-facepiece self-contained breathing apparatus.</td>
</tr>
<tr>
<td>&lt; or = 10,000 µg/m³</td>
<td>Half-mask* supplied-air respirator operated in positive-pressure mode.</td>
</tr>
<tr>
<td>&lt; or = 20,000 µg/m³</td>
<td>Supplied-air respirator with full facepiece, hood, or helmet or suit, operated in positive-pressure mode.</td>
</tr>
<tr>
<td>&gt; 20,000 µg/m³, unknown concentrations, or firefighting</td>
<td>Any full-facepiece self-contained breathing apparatus operated in positive-pressure mode.</td>
</tr>
</tbody>
</table>

* Half-mask respirators shall not be used for protection against arsenic trichloride, as it is rapidly absorbed through the skin.

** A high-efficiency filter means a filter that is at least 99.97% efficient against mono-dispersed particles of 0.3 µm (micrometers) in diameter or higher.

**Asbestos (1910.1001 & 1926.1101)**

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 1 f/cm³ (fibers per cubic centimeter) (10 X PEL)</td>
<td>Half-mask air-purifying respirator other than a disposable respirator, equipped with high-efficiency filters*.</td>
</tr>
<tr>
<td>&lt; or = 5 f/cm³ (50 X PEL)</td>
<td>Full-facepiece air-purifying respirator equipped with high-efficiency filters*.</td>
</tr>
<tr>
<td>&lt; or = 10 f/cm³ (100 X PEL)</td>
<td>Any powered air-purifying respirator equipped with high-efficiency filters* or any supplied-air respirator operated in continuous-flow mode.</td>
</tr>
</tbody>
</table>
< or = 100 f/cm³ (1,000 X PEL)  Full-facepiece supplied air respirator operated in pressure-demand mode.

> 100 f/cm³ (1,000 X PEL), or unknown concentrations  Full-facepiece supplied-air respirator operated in pressure-demand mode, equipped with an auxiliary positive-pressure self-contained breathing apparatus.

* A high-efficiency filter means a filter that is at least 99.97% efficient against mono-dispersed particles of 0.3 µm (micrometers) in diameter or higher.

### Benzene (1910.1028)

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 10 ppm (parts per million)</td>
<td>Half-mask air-purifying respirator with organic vapor cartridge.</td>
</tr>
<tr>
<td>&lt; or = 50 ppm</td>
<td>(1) Full-facepiece respirator with organic vapor cartridges; or (2) Full-facepiece gas mask with chin-style canisters*.</td>
</tr>
<tr>
<td>&lt; or = 100 ppm</td>
<td>Full-facepiece powered air-purifying respirator with organic vapor canister*.</td>
</tr>
<tr>
<td>&lt; or = 1,000 ppm</td>
<td>Supplied-air respirator with full facepiece in positive-pressure mode.</td>
</tr>
<tr>
<td>&gt; 1,000 ppm or unknown concentration</td>
<td>(1) Self-contained breathing apparatus with full facepiece in positive-pressure mode; or (2) Full-facepiece positive-pressure supplied-air respirator with auxiliary self-contained air supply.</td>
</tr>
<tr>
<td>Escape</td>
<td>(1) Any organic vapor gas mask; or (2) Any self-contained breathing apparatus with full facepiece.</td>
</tr>
<tr>
<td>Firefighting</td>
<td>Full-facepiece self-contained breathing apparatus in positive-pressure mode.</td>
</tr>
</tbody>
</table>

* Canisters must have a minimum service life of four (4) hours when tested at 150 ppm benzene, at a flow rate of 64 liters per minute (LPM), 25°C, and 85% relative humidity for non-powered air-purifying respirators. The flow rate shall be 115 LPM and 170 LPM, respectively, for tight-fitting and loose-fitting powered air-purifying respirators.

### 1,3-Butadiene (1910.1051)

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 5 ppm (parts per million)</td>
<td>Air-purifying half-mask or full-facepiece respirator equipped with approved butadiene or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 4 hours.</td>
</tr>
<tr>
<td>&lt; or = 10 ppm</td>
<td>Air-purifying half-mask or full-facepiece respirator equipped with approved butadiene or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 3 hours.</td>
</tr>
</tbody>
</table>
< or = 25 ppm

(1) Air-purifying half-mask or full-facepiece respirator equipped with approved butadiene or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 2 hours;

(2) Any powered air-purifying respirator equipped with approved butadiene or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every [1] hour; or

(3) Continuous-flow supplied-air respirator equipped with a hood or helmet.

< or = 50 ppm

(1) Air-purifying full-facepiece respirator equipped with approved butadiene or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every [1] hour; or

(2) Powered air-purifying respirator (PAPR) equipped with a tight-fitting facepiece and approved butadiene or organic vapor cartridges. PAPR cartridges shall be replaced every [1] hour.

< or = 1,000 ppm

Supplied-air respirator equipped with a half-mask or full facepiece and operated in a pressure-demand or other positive-pressure mode.

> 1,000 ppm, unknown concentration, or firefighting

(1) Self-contained breathing apparatus equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode; or

(2) Any supplied-air respirator equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

Escape from IDLH conditions (IDLH is 2,000 ppm)

(1) Any positive-pressure self-contained breathing apparatus with an appropriate service life; or

(2) Any air-purifying full-facepiece respirator equipped with a front- or back-mounted butadiene or organic vapor canister.

### Cadmium (1910.1027 & 1926.1127)

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 50 µg/m³ (micrograms per cubic meter)</td>
<td>Half-mask, air-purifying respirator equipped with a high-efficiency filter*.</td>
</tr>
<tr>
<td>&lt; or = 125 µg/m³</td>
<td>(1) Powered air-purifying respirator with a loose-fitting hood or helmet equipped with a high-efficiency filter*; or (2) Supplied-air respirator with a loose-fitting hood or helmet facepiece operated in continuous-flow mode.</td>
</tr>
<tr>
<td>&lt; or = 250 µg/m³</td>
<td>(1) Full-facepiece air-purifying respirator equipped with a high-efficiency filter*; (2) Powered air-purifying respirator with a tight-fitting half-mask equipped with a high-efficiency filter*; or (3) Supplied-air respirator with a tight-fitting half-mask operated in continuous-flow mode.</td>
</tr>
<tr>
<td>&lt; or = 1,250 µg/m³</td>
<td>(1) Powered air-purifying respirator with a tight-fitting full facepiece equipped with a high-efficiency filter*; or (2) Supplied-air respirator with a tight-fitting full facepiece operated in continuous-flow mode.</td>
</tr>
<tr>
<td>&lt; or = 5,000 µg/m³</td>
<td>Supplied-air respirator with half-mask or full facepiece operated in pressure-demand or other positive-pressure mode.</td>
</tr>
</tbody>
</table>
> 5,000 µg/m³ or unknown concentration

(1) Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive-pressure mode; or (2) Supplied-air respirator with a full facepiece operated in pressure-demand or other positive-pressure mode and equipped with an auxiliary escape-type self-contained breathing apparatus operated in pressure-demand mode.

Firefighting

Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive-pressure mode.

**Note:** Quantitative fit testing is required for all tight-fitting air-purifying respirators where airborne concentration of cadmium exceeds 10 times the TWA PEL (10 X 5 µg/m³ = 50 µg/m³). A full-facepiece respirator is required when eye irritation is expected.

* A high-efficiency filter means a filter that is at least 99.97% efficient against mono-dispersed particles of 0.3 µm (micrometers) in diameter or higher.

**Coke oven emissions (1910.1029)**

<table>
<thead>
<tr>
<th>Airborne Concentration</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 1500 µg/m³ (micrograms per cubic meter)</td>
<td>(1) Any particulate filter respirator for dust and mist except single-use respirator; or (2) Any particulate filter respirator or combination chemical cartridge and particulate filter respirator for coke oven emissions.</td>
</tr>
<tr>
<td>Any concentrations</td>
<td>(1) Type C supplied-air respirator operated in pressure-demand or continuous-flow mode; (2) Powered air-purifying particulate filter respirator for dust and mist; or (3) Powered air-purifying particulate filter respirator or combination chemical cartridge and particulate filter respirator for coke oven emissions.</td>
</tr>
</tbody>
</table>

**Cotton dust (1910.1043)**

<table>
<thead>
<tr>
<th>Airborne Concentration</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 5 X PEL</td>
<td>Disposable respirator* with a particulate filter.</td>
</tr>
<tr>
<td>&lt; or = 10 X PEL</td>
<td>Quarter- or half-mask respirator, other than a disposable respirator, equipped with particulate filters.</td>
</tr>
<tr>
<td>&lt; or = 100 X PEL</td>
<td>Full-facepiece respirator equipped with high-efficiency particulate filters**.</td>
</tr>
<tr>
<td>&gt; 100 X PEL</td>
<td>Powered air-purifying respirator equipped with high-efficiency particulate filters.</td>
</tr>
</tbody>
</table>

* A disposable respirator means the filter element is an inseparable part of the respirator. ** A high-efficiency filter means a filter that is at least 99.97% efficient against mono-dispersed particles of 0.3 µm (micrometers) in diameter or higher.

**Notes:** Self-contained breathing apparatus are not required but are permitted respirators.

Supplied-air respirators are not required but are permitted under the following conditions:

Cotton dust concentration not greater than 10X the PEL: Any supplied air respirator; not greater than 100X the PEL: Any supplied-air respirator with full facepiece, helmet, or hood; greater than 100X the PEL: Supplied-air respirator operated in positive-pressure mode.

**1,2-Dibromo-3-chloropropane (1910.1044)**
<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 10 ppb (parts per billion)</td>
<td>(1) Any supplied-air respirator; or (2) any self-contained breathing apparatus.</td>
</tr>
<tr>
<td>&lt; or = 50 ppb</td>
<td>(1) Any supplied-air respirator with full facepiece, helmet, or hood; or (2) any self-contained breathing apparatus with full facepiece.</td>
</tr>
<tr>
<td>&lt; or = 1,000 ppb</td>
<td>Type C supplied-air respirator operated in pressure-demand or other positive-pressure or continuous-flow mode.</td>
</tr>
<tr>
<td>&lt; or = 2,000 ppb</td>
<td>Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive-pressure mode, or with full facepiece, helmet, or hood operated in continuous-flow mode.</td>
</tr>
<tr>
<td>&gt; 2,000 ppb or entry and escape from unknown concentrations</td>
<td>(1) A combination respirator which includes a Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or positive-pressure mode; or (2) Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive-pressure mode.</td>
</tr>
<tr>
<td>Firefighting</td>
<td>Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive-pressure mode.</td>
</tr>
</tbody>
</table>

**Ethylene oxide (1910.1047)**

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 50 ppm (parts per million)</td>
<td>Full-facepiece respirator with ethylene oxide approved canister, front- or back-mounted.</td>
</tr>
<tr>
<td>&lt; or = 2,000 ppm</td>
<td>(1) Positive-pressure supplied-air respirator equipped with full facepiece, hood, or helmet; or (2) Continuous-flow supplied-air respirator (positive-pressure) equipped with hood, helmet, or suit.</td>
</tr>
<tr>
<td>&gt; 2,000 ppm or unknown concentrations</td>
<td>(1) Positive-pressure self-contained breathing apparatus equipped with full facepiece; or (2) Positive-pressure full-facepiece supplied-air respirator equipped with an auxiliary positive-pressure self-contained breathing apparatus.</td>
</tr>
<tr>
<td>Firefighting</td>
<td>Positive-pressure self-contained breathing apparatus equipped with full facepiece.</td>
</tr>
<tr>
<td>Escape</td>
<td>Any respirator described above.</td>
</tr>
</tbody>
</table>

**Formaldehyde (1910.1048)**

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 7.5 ppm (parts per million) (10 X PEL)</td>
<td>Full-facepiece respirator with cartridges or canisters specifically approved for protection against formaldehyde*.</td>
</tr>
<tr>
<td>Airborne Concentration or Condition of Use</td>
<td>Required Respirator</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>&lt; or = 0.5 mg/m³ (milligrams per cubic meter) (10 X PEL)</td>
<td>Half-mask* air-purifying respirator equipped with high-efficiency filters**.</td>
</tr>
<tr>
<td>&lt; or = 2.5 mg/m³ (50 X PEL)</td>
<td>Full-facepiece air-purifying respirator with high-efficiency filters**.</td>
</tr>
<tr>
<td>&lt; or = 50 mg/m³ (1000 X PEL)</td>
<td>(1) Any powered air-purifying respirator with high-efficiency filters**; or (2) Half-mask* supplied-air respirator operated in positive-pressure mode.</td>
</tr>
<tr>
<td>&lt; or = 100 mg/m³ (2000 X PEL)</td>
<td>Supplied-air respirators with full facepiece, hood, helmet, or suit, operated in positive-pressure mode.</td>
</tr>
<tr>
<td>&gt; 100 mg/m³, unknown concentration, or firefighting</td>
<td>Full-facepiece, self-contained breathing apparatus operated in positive-pressure mode.</td>
</tr>
</tbody>
</table>

* Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

** A high-efficiency filter means a filter that is at least 99.97% efficient against mono-dispersed particles of 0.3 µm (micrometers) in diameter or higher.
<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 1.25 mg/m³</td>
<td>(1) Loose-fitting hood or helmet powered air-purifying respirator with high-efficiency filters**; or (2) Hood or helmet supplied-air respirator operated in a continuous-flow mode (e.g., Type CE abrasive blasting respirators operated in a continuous-flow mode).</td>
</tr>
<tr>
<td>&lt; or = 2.5 mg/m³</td>
<td>(1) Full-facepiece air-purifying respirator with high-efficiency filters**; (2) Tight-fitting powered air-purifying respirator with high-efficiency filters**; (3) Full-facepiece supplied-air respirator operated in demand mode; (4) Half-mask* or full-facepiece supplied-air respirator operated in a continuous-flow mode; or (5) Full-facepiece self-contained breathing apparatus operated in demand mode.</td>
</tr>
<tr>
<td>&lt; or = 50 mg/m³</td>
<td>Half-mask* supplied-air respirator operated in pressure-demand or other positive-pressure mode.</td>
</tr>
<tr>
<td>&lt; or = 100 mg/m³</td>
<td>Full-facepiece supplied-air respirator operated in pressure-demand or other positive-pressure mode (e.g., Type CE abrasive blasting respirators operated in a continuous-flow mode).</td>
</tr>
<tr>
<td>&gt; 100 mg/m³, unknown concentration, or firefighting</td>
<td>Full-facepiece self-contained breathing apparatus in pressure-demand or other positive-pressure mode.</td>
</tr>
</tbody>
</table>

* Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

** A high-efficiency filter means a filter that is at least 99.97% efficient against mono-dispersed particles of 0.3 µm (micrometers) in diameter or higher.

### Methylene chloride (1910.1052)

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 625 ppm (parts per million) (25 X PEL)</td>
<td>Continuous-flow supplied-air respirator, hood or helmet.</td>
</tr>
<tr>
<td>&lt; or = 1250 ppm (50 X PEL)</td>
<td>(1) Full-facepiece supplied-air respirator operated in negative-pressure (demand) mode; or (2) Full-facepiece self-contained breathing apparatus operated in negative-pressure (demand) mode.</td>
</tr>
<tr>
<td>&lt; or = 5,000 ppm (200 X PEL)</td>
<td>(1) Continuous-flow supplied-air respirator, full-facepiece; (2) Pressure-demand supplied-air respirator, full-facepiece; or (3) Positive-pressure full-facepiece self-contained breathing apparatus.</td>
</tr>
<tr>
<td>&gt; 5,000 ppm or unknown concentration</td>
<td>(1) Positive-pressure full-facepiece self-contained breathing apparatus; or (2) Full-facepiece pressure-demand supplied-air respirator with an auxiliary self-contained air supply.</td>
</tr>
<tr>
<td>Firefighting</td>
<td>Positive-pressure full-facepiece self-contained breathing apparatus.</td>
</tr>
<tr>
<td>Emergency escape</td>
<td>(1) Any continuous-flow or pressure-demand self-contained breathing apparatus; or (2) Gas mask with organic vapor canister.</td>
</tr>
</tbody>
</table>

4,4’-Methylenedianiline (1910.1050 & 1926.60)
### Vinyl Chloride (1910.1017)

<table>
<thead>
<tr>
<th>Airborne Concentration or Condition of Use</th>
<th>Required Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; or = 10 ppm (parts per million)</td>
<td>(1) Combination Type C supplied-air respirator, demand type, with half facepiece, and auxiliary self-contained air supply; (2) Type C supplied-air respirator, demand type, with half facepiece; or (3) Any chemical cartridge respirator with an organic vapor cartridge which provides a service life of at least 1 hour for concentrations of vinyl chloride up to 10 ppm.</td>
</tr>
<tr>
<td>&lt; or = 25 ppm</td>
<td>(1) Powered air-purifying respirator with hood, helmet, full or half facepiece, and a canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm; or (2) Gas mask with front- or back-mounted canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm.</td>
</tr>
<tr>
<td>&lt; or = 100 ppm</td>
<td>(1) Combination Type C supplied-air respirator, demand type, with full facepiece, and auxiliary self-contained air supply; or (2) Open-circuit self-contained breathing apparatus with full facepiece, in demand mode; or (3) Type C supplied-air respirator, demand type, with full facepiece.</td>
</tr>
<tr>
<td>&lt; or = 1,000 ppm</td>
<td>Type C supplied-air respirator, continuous-flow type, with full or half facepiece, helmet, or hood.</td>
</tr>
<tr>
<td>&lt; or = 3,600 ppm</td>
<td>(1) Combination Type C supplied-air respirator, pressure demand type, with full or half facepiece, and auxiliary self-contained air supply; or (2) Combination type continuous-flow supplied-air respirator with full or half facepiece and auxiliary self-contained air supply.</td>
</tr>
<tr>
<td>&gt; 3,600 ppm or unknown concentration</td>
<td>Open-circuit self-contained breathing apparatus, pressure-demand type, with full facepiece.</td>
</tr>
</tbody>
</table>
APPENDIX F: Miscellaneous Notes

Benzene

The final OSHA Benzene standard in 1910.1028 applies to all occupational exposures to benzene except some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sales of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply (i.e., an 8-hour TWA of 10 ppm, an acceptable ceiling of 25 ppm, and 50 ppm for a maximum duration of 10 minutes as an acceptable maximum peak above the acceptable ceiling).

OctachloronaphthalenePentachloronaphthaleneTetrachloronaphthaleneTrichloronaphthalene

Trichloronaphthalene

IDLH values for these four chloronaphthalene compounds are unknown. The Documentation for Immediately Dangerous to Life or Health Concentrations identified "Effective" IDLH values, based on analogy with other chloronaphthalenes and the then-effective NIOSH Respirator Decision Logic (DHHS [NIOSH] Publication No. 87-108; http://www.cdc.gov/niosh/docs/87-108). These values for respirator recommendations were determined by multiplying the NIOSH REL or OSHA PEL by an assigned protection factor of 10. This assigned protection factor was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for these four chemicals. Listed below are the "Effective" IDLH values that were determined using 10 times the REL or PEL for each chemical. For more information please consult the IDLH Documentation.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>NIOSH REL/OSHA PEL</th>
<th>&quot;Effective&quot; IDLH (10 X REL/PEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octachloronaphthalene</td>
<td>TWA 0.1 mg/m³ *</td>
<td>1 mg/m³</td>
</tr>
<tr>
<td>Pentachloronaphthalene</td>
<td>TWA 0.5 mg/m³</td>
<td>5 mg/m³</td>
</tr>
<tr>
<td>Tetrachloronaphthalene</td>
<td>TWA 5 mg/m³</td>
<td>50 mg/m³</td>
</tr>
<tr>
<td>Trichloronaphthalene</td>
<td>TWA 2 mg/m³</td>
<td>20 mg/m³</td>
</tr>
</tbody>
</table>

* NIOSH also recommends a STEL of 0.3 mg/m³ for octachloronaphthalene; the TWA of 0.1 mg/m³ was used to calculate the "Effective" IDLH of 1 mg/m³.

APPENDIX G: 1989 Air Contaminants Update Project - Exposure Limits NOT in Effect

<table>
<thead>
<tr>
<th>Chemical</th>
<th>NIOSH REL/OSHA PEL</th>
<th>Exposure Limits NOT in Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>TWA 100 ppm (180 mg/m³) ST 150 ppm (270 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Acetic anhydride</td>
<td>C 5 ppm (20 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Acetone</td>
<td>TWA 750 ppm (1800 mg/m³) ST 1000 ppm (2400 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>TWA 40 ppm (70 mg/m³) ST 60 ppm (105 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Acetylsalicyclic acid</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Acrolein</td>
<td>TWA 0.1 ppm (0.25 mg/m³) ST 0.3 ppm (0.8 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Acrylamide</td>
<td>TWA 0.03 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Acrylic acid</td>
<td>TWA 10 ppm (30 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Allyl alcohol</td>
<td>TWA 2 ppm (5 mg/m³) ST 4 ppm (10 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Allyl chloride</td>
<td>TWA 1 ppm (3 mg/m³) ST 2 ppm (6 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Substance</td>
<td>TWA</td>
<td>ST</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-----------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Allyl glycidyl ether</td>
<td>5 ppm (22 mg/m³)</td>
<td>10 ppm (44 mg/m³)</td>
</tr>
<tr>
<td>Allyl propyl disulfide</td>
<td>2 ppm (12 mg/m³)</td>
<td>3 ppm (18 mg/m³)</td>
</tr>
<tr>
<td>alpha-Alumina</td>
<td>10 mg/m³ (total)</td>
<td>5 mg/m³ (resp)</td>
</tr>
<tr>
<td>Aluminum (pyro powders &amp; welding fumes, as Al)</td>
<td>5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Aluminum (soluble salts &amp; alkyls, as Al)</td>
<td>2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Amitrole</td>
<td>0.2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Ammonia</td>
<td>35 ppm (27 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Ammonium chloride fume</td>
<td>10 mg/m³</td>
<td>20 mg/m³</td>
</tr>
<tr>
<td>Ammonium sulfamate</td>
<td>10 mg/m³ (total)</td>
<td>5 mg/m³ (resp)</td>
</tr>
<tr>
<td>Aniline (and homologs)</td>
<td>2 ppm (8 mg/m³)</td>
<td>[skin]</td>
</tr>
<tr>
<td>Atrazine</td>
<td>5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Barium sulfate</td>
<td>10 mg/m³ (total)</td>
<td>5 mg/m³ (resp)</td>
</tr>
<tr>
<td>Benomyl</td>
<td>10 mg/m³</td>
<td>5 mg/m³ (resp)</td>
</tr>
<tr>
<td>Benzenethiol</td>
<td>0.5 ppm (2 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Bismuth telluride (doped with selenium sulfide, as Bi₂Te₃)</td>
<td>5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Borates, tetra, sodium salts (Anhydrous)</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Borates, tetra, sodium salts (Decahydrate)</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Borates, tetra, sodium salts (Pentahydrate)</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Boron oxide</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Boron tribromide</td>
<td>1 ppm (10 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Bromacil</td>
<td>1 ppm (10 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Bromine</td>
<td>0.1 ppm (0.7 mg/m³)</td>
<td>0.3 ppm (2 mg/m³)</td>
</tr>
<tr>
<td>Bromine pentfluoride</td>
<td>0.1 ppm (0.7 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>n-Butane</td>
<td>800 ppm (1900 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>2-Butanone</td>
<td>200 ppm (590 mg/m³)</td>
<td>300 ppm (885 mg/m³)</td>
</tr>
<tr>
<td>2-Butoxyethanol</td>
<td>25 ppm (120 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>n-Butyl acetate</td>
<td>150 ppm (710 mg/m³)</td>
<td>200 ppm (950 mg/m³)</td>
</tr>
<tr>
<td>Butyl acrylate</td>
<td>10 ppm (55 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>n-Butyl alcohol</td>
<td>50 ppm (150 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>sec-Butyl alcohol</td>
<td>100 ppm (305 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>tert-Butyl alcohol</td>
<td>100 ppm (300 mg/m³)</td>
<td>150 ppm (450 mg/m³)</td>
</tr>
<tr>
<td>n-Butyl glycidyl ether</td>
<td>25 ppm (135 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>n-Butyl lactate</td>
<td>5 ppm (25 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chemical Name</td>
<td>TWA/ST Concentration</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>n-Butyl mercaptan</td>
<td>0.5 ppm (1.5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>o-sec-Butylphenol</td>
<td>5 ppm (30 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>p-tert-Butyltoluene</td>
<td>10 ppm (60 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Calcium cyanamide</td>
<td>0.5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Caprolactam Dust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TWA</td>
<td>1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>3 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Vapor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TWA</td>
<td>5 ppm (20 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>10 ppm (40 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Captafol</td>
<td>0.1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Captan</td>
<td>5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Carbofuran</td>
<td>0.1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>10,000 ppm (18,000 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>4 ppm (12 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>35 ppm (40 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Carbon tetrabromide</td>
<td>0.1 ppm (1.4 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>2 ppm (12.6 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Carbonyl fluoride</td>
<td>2 ppm (5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Catechol</td>
<td>5 ppm (20 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Cesium hydroxide</td>
<td>2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Chlorinated camphene</td>
<td>0.5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>0.5 ppm (1.5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chlorine dioxide</td>
<td>0.1 ppm (0.3 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chloroacetyl chloride</td>
<td>0.05 ppm (0.2 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chlorobenzylidene malononitrile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorodifluoromethane</td>
<td>1000 ppm (3500 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chloroform</td>
<td>2 ppm (9.78 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>1-Chloro-1-nitropropane</td>
<td>2 ppm (10 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chloropentafluoroethane</td>
<td>1000 ppm (6320 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>beta-Chloroprene</td>
<td>10 ppm (35 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chlorostyrene</td>
<td>50 ppm (285 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chlorotoluene</td>
<td>50 ppm (250 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>0.2 mg/m³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[skin]</td>
<td></td>
</tr>
<tr>
<td>Chemical</td>
<td>TWA Concentration (mg/m³) &lt;br&gt; (&lt;condition&gt;)</td>
<td>ST Concentration (mg/m³) &lt;br&gt; (&lt;condition&gt;)</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Coal dust</td>
<td>TWA 2 mg/m³ (&lt;5% SiO₂) (resp dust)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 0.1 mg/m³ (&gt; or = 5% SiO₂) (resp quartz)</td>
<td></td>
</tr>
<tr>
<td>Cobalt metal dust &amp; fume, as Co)</td>
<td>TWA 0.05 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cobalt carbonyl (as Co)</td>
<td>TWA 0.1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cobalt hydrocarbonyl (as Co)</td>
<td>TWA 0.1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Crag® herbicide</td>
<td>TWA 10 mg/m³ (total)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Crufomate</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cyanamide</td>
<td>TWA 2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cyanogen</td>
<td>TWA 10 ppm (20 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Cyanogen chloride</td>
<td>C 0.3 ppm (0.6 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Cyclohexanol</td>
<td>TWA 50 ppm (200 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Cyclohexanone</td>
<td>TWA 25 ppm (100 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Cyclohexylamine</td>
<td>TWA 10 ppm (40 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Cyclonite</td>
<td>TWA 1.5 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Cyclopentane</td>
<td>TWA 600 ppm (1720 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Cyhexatin</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Decaborane</td>
<td>TWA 0.3 mg/m³ (0.05 ppm)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 0.9 mg/m³ (0.15 ppm) [skin]</td>
<td></td>
</tr>
<tr>
<td>Diazinon</td>
<td>TWA 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>2-N-Dibutylaminoethanol</td>
<td>TWA 2 ppm (14 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Dibutyl phosphate</td>
<td>TWA 1 ppm (5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 2 ppm (10 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Dichloroacetylene</td>
<td>C 0.1 ppm (0.4 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>p-Dichlorobenzene</td>
<td>TWA 75 ppm (450 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 110 ppm (675 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>1,3-Dichloro-5,5-dimethyldantoin</td>
<td>TWA 0.2 mg/m³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 0.4 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Dichloroethyl ether</td>
<td>TWA 5 ppm (30 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 10 ppm (60 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Dichloromonofluoromethane</td>
<td>TWA 10 ppm (20 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>1,1-Dichloro-1-nitroethane</td>
<td>TWA 2 ppm (10 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>1,3-Dichloropropene</td>
<td>TWA 1 ppm (5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[skin]</td>
<td></td>
</tr>
<tr>
<td>2,2-Dichloropropionic acid</td>
<td>TWA 1 ppm (6 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Dicrotophos</td>
<td>TWA 0.25 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Dicyclopentadiene</td>
<td>TWA 5 ppm (30 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Dicyclopentadienyl iron</td>
<td>TWA 10 mg/m³ (total)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Diethanolamine</td>
<td>TWA 3 ppm (15 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Diethylamine</td>
<td>TWA 10 ppm (30 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 25 ppm (75 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Diethylenetriamine</td>
<td>TWA 1 ppm (4 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Diethyl ketone</td>
<td>TWA 200 ppm (705 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chemical Name</td>
<td>TWA Values</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Diethyl phthalate</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Diglycidyl ether</td>
<td>TWA 0.1 ppm (0.5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Diisobutyl ketone</td>
<td>TWA 25 ppm (150 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>N,N-Dimethylaniline</td>
<td>TWA 5 ppm (25 mg/m³) ST 10 ppm (50 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Dimethyl-1,2-dibromo-2,2-dichlorethyl phosphate</td>
<td>TWA 3 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Dimethyl sulfate</td>
<td>TWA 0.1 ppm (0.5 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Dinitolmide</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Di-sec octyl phthalate</td>
<td>TWA 5 mg/m³ ST 10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Dioxane</td>
<td>TWA 25 ppm (90 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Dioxathion</td>
<td>TWA 0.2 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Diphenylamine</td>
<td>TWA 10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Dipropylene glycol methyl ether</td>
<td>TWA 100 ppm (600 mg/m³) ST 150 ppm (900 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Dipropyl ketone</td>
<td>TWA 50 ppm (235 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Diquat (Diquat dibromide)</td>
<td>TWA 0.5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Disulfiram</td>
<td>TWA 2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Disulfoton</td>
<td>TWA 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>2,6-Di-tert-butyl-p-cresol</td>
<td>TWA 10 mg/m³</td>
<td></td>
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<tr>
<td>Diuron</td>
<td>TWA 10 mg/m³</td>
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<tr>
<td>Divinyl benzene</td>
<td>TWA 10 ppm (50 mg/m³)</td>
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</tr>
<tr>
<td>Emery</td>
<td>TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Endosulfan</td>
<td>TWA 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Epichlorohydrin</td>
<td>TWA 2 ppm (8 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Ethanolamine</td>
<td>TWA 3 ppm (8 mg/m³) ST 6 ppm (15 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Ethion</td>
<td>TWA 0.4 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Ethyl acrylate</td>
<td>TWA 5 ppm (20 mg/m³) ST 25 ppm (100 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Ethyl benzene</td>
<td>TWA 100 ppm (435 mg/m³) ST 125 ppm (545 mg/m³)</td>
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<tr>
<td>Ethyl bromide</td>
<td>TWA 200 ppm (890 mg/m³) ST 250 ppm (1110 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Ethylene chlorohydrin</td>
<td>C 1 ppm (3 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Ethylene dichloride</td>
<td>TWA 1 ppm (4 mg/m³) ST 2 ppm (8 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Ethylene glycol</td>
<td>C 50 ppm (125 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Ethylene glycol dinitrate</td>
<td>ST 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Ethyl ether</td>
<td>TWA 400 ppm (1200 mg/m³) ST 500 ppm (1500 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Ethylidene norbornene</td>
<td>C 5 ppm (25 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Ethyl mercaptan</td>
<td>TWA 0.5 ppm (1 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Substance</td>
<td>TWA</td>
<td>ST</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Ethyl silicate</td>
<td>TWA 10 ppm (85 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Fenamiphos</td>
<td>TWA 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Fensulfothion</td>
<td>TWA 0.1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Fenthion</td>
<td>TWA 0.2 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Ferbam</td>
<td>TWA 10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Ferrovanadium dust</td>
<td>TWA 1 mg/m³</td>
<td>ST 3 mg/m³</td>
</tr>
<tr>
<td>Fluorotrichloromethane</td>
<td>C 1000 ppm (5600 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Fonofos</td>
<td>TWA 20 ppm (30 mg/m³)</td>
<td>ST 30 ppm (45 mg/m³)</td>
</tr>
<tr>
<td>Furfural</td>
<td>TWA 2 ppm (8 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Furfuryl alcohol</td>
<td>TWA 10 ppm (40 mg/m³)</td>
<td>ST 15 ppm (60 mg/m³) [skin]</td>
</tr>
<tr>
<td>Gasoline</td>
<td>TWA 300 ppm (900 mg/m³)</td>
<td>ST 500 ppm (1500 mg/m³)</td>
</tr>
<tr>
<td>Germanium tetrahydride</td>
<td>TWA 0.2 ppm (0.6 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Glutaraldehyde</td>
<td>C 0.2 ppm (0.8 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Glycerin (mist)</td>
<td>TWA 10 mg/m³ (total)</td>
<td>TWA 5 mg/m³ (resp)</td>
</tr>
<tr>
<td>Glycidol</td>
<td>TWA 25 ppm (75 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Graphite (natural)</td>
<td>TWA 2.5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Graphite (synthetic)</td>
<td>TWA 10 mg/m³ (total)</td>
<td>TWA 5 mg/m³ (resp)</td>
</tr>
<tr>
<td>n-Heptane</td>
<td>TWA 400 ppm (1600 mg/m³)</td>
<td>ST 500 ppm (2000 mg/m³)</td>
</tr>
<tr>
<td>Hexachlorobutadiene</td>
<td>TWA 0.02 ppm (0.24 mg/m³)</td>
<td></td>
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<tr>
<td>Hexachlorocyclopentadiene</td>
<td>TWA 0.01 ppm (0.1 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Hexafluoroacetone</td>
<td>TWA 0.1 ppm (0.7 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>n-Hexane</td>
<td>TWA 50 ppm (180 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Hexane isomers (except n-Hexane)</td>
<td>TWA 500 ppm (1800 mg/m³)</td>
<td>ST 1000 ppm (3600 mg/m³)</td>
</tr>
<tr>
<td>2-Hexanone</td>
<td>TWA 5 ppm (20 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Hexone</td>
<td>TWA 50 ppm (205 mg/m³)</td>
<td>ST 75 ppm (300 mg/m³)</td>
</tr>
<tr>
<td>Hexylene glycol</td>
<td>C 25 ppm (125 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Hydrazine</td>
<td>TWA 0.1 ppm (0.1 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Hydrogenated terphenyls</td>
<td>TWA 0.5 ppm (5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Hydrogen bromide</td>
<td>C 3 ppm (10 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Hydrogen cyanide</td>
<td>ST 4.7 ppm (5 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Hydrogen fluoride (as F)</td>
<td>TWA 3 ppm</td>
<td>ST 6 ppm</td>
</tr>
<tr>
<td>Chemical</td>
<td>TWA ppm (mg/m³)</td>
<td>ST ppm (mg/m³)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>10 (14)</td>
<td>15 (21)</td>
</tr>
<tr>
<td>2-Hydroxypropyl acrylate</td>
<td>0.5 (3) [skin]</td>
<td></td>
</tr>
<tr>
<td>Indene</td>
<td>10 (45)</td>
<td></td>
</tr>
<tr>
<td>Indium</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Iodoform</td>
<td>0.6 (10)</td>
<td></td>
</tr>
<tr>
<td>Iron pentacarbonyl (as Fe)</td>
<td>0.1 (0.8)</td>
<td>0.2 (1.6)</td>
</tr>
<tr>
<td>Iron salts (soluble, as Fe)</td>
<td>1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Isoamyl alcohol (primary &amp; secondary)</td>
<td>100 (360)</td>
<td>125 (450)</td>
</tr>
<tr>
<td>Isobutane</td>
<td>800 (1900)</td>
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<tr>
<td>Isobutyl alcohol</td>
<td>50 (150)</td>
<td></td>
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<tr>
<td>Isooctyl alcohol</td>
<td>50 (270) [skin]</td>
<td></td>
</tr>
<tr>
<td>Isophorone</td>
<td>4 (23)</td>
<td></td>
</tr>
<tr>
<td>Isophorone diisocyanate</td>
<td>0.005 (0.02) [skin]</td>
<td></td>
</tr>
<tr>
<td>2-Isopropoxyethanol</td>
<td>25 (105)</td>
<td></td>
</tr>
<tr>
<td>Isopropyl acetate</td>
<td>250 (950)</td>
<td>310 (1185)</td>
</tr>
<tr>
<td>Isopropyl alcohol</td>
<td>400 (980)</td>
<td>500 (1225)</td>
</tr>
<tr>
<td>Isopropylamine</td>
<td>5 (12)</td>
<td>10 (24)</td>
</tr>
<tr>
<td>N-Isopropylaniline</td>
<td>2 (10) [skin]</td>
<td></td>
</tr>
<tr>
<td>Isopropyl glycidyl ether</td>
<td>50 (240)</td>
<td>75 (360)</td>
</tr>
<tr>
<td>Kaolin</td>
<td>10 (total)</td>
<td>5 (resp)</td>
</tr>
<tr>
<td>Ketene</td>
<td>0.5 (0.9)</td>
<td>1.5 (3)</td>
</tr>
<tr>
<td>Magnesium oxide fume</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Malathion</td>
<td>10 [skin]</td>
<td></td>
</tr>
<tr>
<td>Manganese compounds and fume (as Mn)</td>
<td>5 (total)</td>
<td>5 (resp)</td>
</tr>
<tr>
<td></td>
<td>Compounds:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fume:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 1 mg/m³</td>
<td>ST 3 mg/m³</td>
</tr>
<tr>
<td>Manganese cyclopentadienyl tricarbonyl (as Mn)</td>
<td>0.1 [skin]</td>
<td></td>
</tr>
<tr>
<td>Manganese tetroxide (as Mn)</td>
<td>1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mercury compounds, as Hg [except(organo) alkyls]</td>
<td>0.05 [skin]</td>
<td></td>
</tr>
<tr>
<td>Hg Vapor</td>
<td>0.05 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Non-alkyl compounds</td>
<td>0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Mercury (organo) alkyl compounds (as Hg)</td>
<td>0.01 mg/m³</td>
<td>0.03 mg/m³ [skin]</td>
</tr>
<tr>
<td>Substance</td>
<td>TWA</td>
<td>ST</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>-----</td>
<td>-------------</td>
</tr>
<tr>
<td>Mesityl oxide</td>
<td>TWA 15 ppm (60 mg/m³)</td>
<td>ST 25 ppm (100 mg/m³)</td>
</tr>
<tr>
<td>Methacrylic acid</td>
<td>TWA 20 ppm (70 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Methomyl</td>
<td>TWA 2.5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Methoxychlor</td>
<td>TWA 10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>4-Methoxyphenol</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Methyl acetate</td>
<td>TWA 200 ppm (610 mg/m³)</td>
<td>ST 250 ppm (760 mg/m³)</td>
</tr>
<tr>
<td>Methyl acetylene-propadiene mixture</td>
<td>TWA 1000 ppm (1800 mg/m³)</td>
<td>ST 1250 ppm (2250 mg/m³)</td>
</tr>
<tr>
<td>Methylacrylonitrile</td>
<td>TWA 1 ppm (3 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>TWA 200 ppm (260 mg/m³)</td>
<td>ST 250 ppm (325 mg/m³) [skin]</td>
</tr>
<tr>
<td>Methyl bromide</td>
<td>TWA 5 ppm (20 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Methyl chloride</td>
<td>TWA 50 ppm (105 mg/m³)</td>
<td>ST 100 ppm (210 mg/m³)</td>
</tr>
<tr>
<td>Methyl chloroform</td>
<td>TWA 350 ppm (1900 mg/m³)</td>
<td>ST 450 ppm (2450 mg/m³)</td>
</tr>
<tr>
<td>Methyl-2-cyanoacrylate</td>
<td>TWA 2 ppm (8 mg/m³)</td>
<td>ST 4 ppm (16 mg/m³)</td>
</tr>
<tr>
<td>Methylcyclohexane</td>
<td>TWA 400 ppm (1600 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Methylcyclohexanol</td>
<td>TWA 50 ppm (235 mg/m³)</td>
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</tr>
<tr>
<td>o-Methylcyclohexanone</td>
<td>TWA 50 ppm (230 mg/m³)</td>
<td>ST 75 ppm (345 mg/m³) [skin]</td>
</tr>
<tr>
<td>Methyl cyclopentadienyl manganese tricarbonyl (as Mn)</td>
<td>TWA 0.2 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Methyl demeton</td>
<td>TWA 0.5 mg/m³ [skin]</td>
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<tr>
<td>4,4′-Methylenebis(2-chloroaniline)</td>
<td>TWA 0.02 ppm (0.22 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Methylene bis(4-cyclo-hexylisocyanate)</td>
<td>C 0.01 ppm (0.11 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Methyl ethyl ketone peroxide</td>
<td>C 0.7 ppm (5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Methyl formate</td>
<td>TWA 100 ppm (250 mg/m³)</td>
<td>ST 150 ppm (375 mg/m³)</td>
</tr>
<tr>
<td>Methyl iodide</td>
<td>TWA 2 ppm (10 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Methyl isoamyl ketone</td>
<td>TWA 50 ppm (240 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Methyl isobutyl carbinol</td>
<td>TWA 25 ppm (100 mg/m³)</td>
<td>ST 40 ppm (165 mg/m³) [skin]</td>
</tr>
<tr>
<td>Methyl isopropyl ketone</td>
<td>TWA 200 ppm (705 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Methyl mercaptan</td>
<td>TWA 0.5 ppm (1 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Methyl parathion</td>
<td>TWA 0.2 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Methyl silicate</td>
<td>TWA 1 ppm (6 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>alpha-Methyl styrene</td>
<td>TWA 50 ppm (240 mg/m³)</td>
<td>ST 100 ppm (485 mg/m³)</td>
</tr>
<tr>
<td>Metribuzin</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mica</td>
<td>TWA 3 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Molybdenum (insoluble compounds, as Mo)</td>
<td>TWA 10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Substance</td>
<td>TWA</td>
<td>ST</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Monocrotophos</td>
<td>0.25 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Monomethyl aniline</td>
<td>0.5 ppm (2 mg/m³) [skin]</td>
<td></td>
</tr>
</tbody>
</table>
| Morpholine                               | TWA 20 ppm (70 mg/m³)  
                | ST 30 ppm (105 mg/m³) [skin] |         |
| Naphthalene                              | TWA 10 ppm (50 mg/m³)  
                | ST 15 ppm (75 mg/m³) |         |
| Nickel metal & other compounds (as Ni)   | TWA 1 mg/m³ |                |
|   Metal & insoluble compounds            | TWA 0.1 mg/m³ |                |
|   Soluble compounds                      | TRA 0.1 mg/m³ |                |
| Nitric acid                              | TWA 2 ppm (5 mg/m³)  
                | ST 4 ppm (10 mg/m³) |         |
| p-Nitroaniline                           | TWA 3 mg/m³ [skin] |                |
| Nitrogen dioxide                         | ST 1 ppm (1.8 mg/m³) |         |
| Nitroglycerine                           | ST 0.1 mg/m³ [skin] |                |
| 2-Nitropropane                           | TWA 10 ppm (35 mg/m³) |         |
| Nitrotoluene (o-, m-, p-isomers)         | TWA 2 ppm (11 mg/m³) [skin] |         |
| Nonane                                   | TWA 200 ppm (1050 mg/m³) |         |
| Octachloronaphthalene                    | TWA 0.1 mg/m³  
                | ST 0.3 mg/m³ [skin] |         |
| Octane                                   | TWA 300 ppm (1450 mg/m³)  
                | ST 375 ppm (1800 mg/m³) |         |
| Osmium tetroxide (as Os)                 | TWA 0.002 mg/m³ (0.0002 ppm)  
                | ST 0.006 mg/m³ (0.0006 ppm) |         |
| Oxalic acid                              | TWA 1 mg/m³  
                | ST 2 mg/m³ |         |
| Oxygen difluoride                        | C 0.05 ppm (0.1 mg/m³) |         |
| Ozone                                    | TWA 0.1 ppm (0.2 mg/m³)  
                | ST 0.3 ppm (0.6 mg/m³) |         |
| Paraffin wax fume                        | TWA 2 mg/m³ |                |
| Paraquat                                 | TWA 0.1 mg/m³ (resp) [skin] |         |
| Pentaborane                              | TWA 0.005 ppm (0.01 mg/m³)  
                | ST 0.015 ppm (0.03 mg/m³) |         |
| Pentaerythritol                          | TWA 10 mg/m³ (total)  
                | TWA 5 mg/m³ (resp) |         |
| n-Pentane                                | TWA 600 ppm (1800 mg/m³)  
                | ST 750 ppm (2250 mg/m³) |         |
| 2-Pentanone                              | TWA 200 ppm (700 mg/m³)  
                | ST 250 ppm (875 mg/m³) |         |
| Perchloryl fluoride                      | TWA 3 ppm (14 mg/m³)  
                | ST 6 ppm (28 mg/m³) |         |
| Petroleum distillates (naphtha)          | TWA 400 ppm (1600 mg/m³) |         |
| Phenothiazine                            | TWA 5 mg/m³ [skin] |                |
| Phenyl glycidyl ether                    | TWA 1 ppm (6 mg/m³) |                |
| Phenylhydrazine                          | TWA 5 ppm (20 mg/m³)  
<pre><code>            | ST 10 ppm (45 mg/m³) [skin] |         |
</code></pre>
<table>
<thead>
<tr>
<th>Substance</th>
<th>TWA</th>
<th>ST [mg/m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenylphosphine</td>
<td>0.05 ppm</td>
<td>0.25 mg/m³</td>
</tr>
<tr>
<td>Phorate</td>
<td>0.05 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Phosdrin</td>
<td>0.01 ppm</td>
<td>0.3 mg/m³</td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.3 ppm</td>
<td>1 mg/m³</td>
</tr>
<tr>
<td>Phosphine</td>
<td>0.3 ppm</td>
<td></td>
</tr>
<tr>
<td>Phosphine</td>
<td>0.4 ppm</td>
<td></td>
</tr>
<tr>
<td>Phosphoric acid</td>
<td>1 mg/m³</td>
<td>3 mg/m³</td>
</tr>
<tr>
<td>Phosphorus oxychloride</td>
<td>0.1 ppm</td>
<td>0.6 mg/m³</td>
</tr>
<tr>
<td>Phosphorus pentasulfide</td>
<td>1 mg/m³</td>
<td>3 mg/m³</td>
</tr>
<tr>
<td>Phosphorus trichloride</td>
<td>0.2 ppm</td>
<td>1.5 mg/m³</td>
</tr>
<tr>
<td>Phosphorus trichloride</td>
<td>0.5 ppm</td>
<td>3 mg/m³</td>
</tr>
<tr>
<td>Phthalic anhydride</td>
<td>6 mg/m³</td>
<td>(1 ppm)</td>
</tr>
<tr>
<td>m-Phthalodinitrile</td>
<td>5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Picloram</td>
<td>10 mg/m³</td>
<td>(total)</td>
</tr>
<tr>
<td>Piperazine dihydrochloride</td>
<td>5 mg/m³</td>
<td>(total)</td>
</tr>
<tr>
<td>Platinum metal (as Pt)</td>
<td>1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Portland cement</td>
<td>10 mg/m³</td>
<td>(total)</td>
</tr>
<tr>
<td>Potassium hydroxide</td>
<td>2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Propargyl alcohol</td>
<td>1 ppm</td>
<td>(2 mg/m³)</td>
</tr>
<tr>
<td>Propionic acid</td>
<td>10 ppm</td>
<td>(30 mg/m³)</td>
</tr>
<tr>
<td>Propoxur</td>
<td>0.5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>n-Propyl acetate</td>
<td>200 ppm</td>
<td>(840 mg/m³)</td>
</tr>
<tr>
<td>n-Propyl alcohol</td>
<td>200 ppm</td>
<td>(500 mg/m³)</td>
</tr>
<tr>
<td>Propylene dichloride</td>
<td>75 ppm</td>
<td>(350 mg/m³)</td>
</tr>
<tr>
<td>Propylene glycol dinitrate</td>
<td>0.05 ppm</td>
<td>(0.3 mg/m³)</td>
</tr>
<tr>
<td>Propylene glycol monomethyl ether</td>
<td>100 ppm</td>
<td>(360 mg/m³)</td>
</tr>
<tr>
<td>Propylene oxide</td>
<td>20 ppm</td>
<td>(50 mg/m³)</td>
</tr>
<tr>
<td>n-Propyl nitrate</td>
<td>25 ppm</td>
<td>(105 mg/m³)</td>
</tr>
<tr>
<td>Resorcinol</td>
<td>10 ppm</td>
<td>(45 mg/m³)</td>
</tr>
<tr>
<td>Rosin core solder, pyrolysis products (as formaldehyde)</td>
<td>0.1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rouge</td>
<td>10 mg/m³</td>
<td>(total)</td>
</tr>
<tr>
<td>Silica, amorphous</td>
<td>6 mg/m³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.1 mg/m³</td>
<td>(fused)</td>
</tr>
<tr>
<td>Substance</td>
<td>TWA/ST Concentration</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td>Silica, crystalline (as respirable dust)</td>
<td>TWA 0.05 mg/m³ (cristobalite)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 0.05 mg/m³ (tridymite)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 0.1 mg/m³ (quartz)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 0.1 mg/m³ (tripoli)</td>
<td></td>
</tr>
<tr>
<td>Silicon</td>
<td>TWA 10 mg/m³ (total)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Silicon carbide</td>
<td>TWA 10 mg/m³ (total)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Silicon tetrahydride</td>
<td>TWA 5 ppm (7 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Soapstone</td>
<td>TWA 6 mg/m³ (total)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 3 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Sodium azide</td>
<td>C 0.1 ppm (as HN₃) [skin]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C 0.3 mg/m³ (as NaN₃) [skin]</td>
<td></td>
</tr>
<tr>
<td>Sodium bisulfite</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Sodium fluoroacetate</td>
<td>TWA 0.05 mg/m³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 0.15 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>C 2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Sodium metabisulfite</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Stoddard solvent</td>
<td>TWA 525 mg/m³ (100 ppm)</td>
<td></td>
</tr>
<tr>
<td>Styrene</td>
<td>TWA 50 ppm (215 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 100 ppm (425 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Subtilisins</td>
<td>ST 0.00006 mg/m³ [60-minute]</td>
<td></td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>TWA 2 ppm (5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 5 ppm (13 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Sulfur monochloride</td>
<td>C 1 ppm (6 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Sulfur pentafluoride</td>
<td>C 0.01 ppm (0.1 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Sulfur tetrafluoride</td>
<td>C 0.1 ppm (0.4 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Sulfuryl fluoride</td>
<td>TWA 5 ppm (20 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 10 ppm (40 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Sulprofos</td>
<td>TWA 1 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Talc</td>
<td>TWA 2 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Temephos</td>
<td>TWA 10 mg/m³ (total)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Terphenyl (o-, m-, p-isomers)</td>
<td>C 5 mg/m³ (0.5 ppm)</td>
<td></td>
</tr>
<tr>
<td>1,1,2,2-Tetrachloroethane</td>
<td>TWA 1 ppm (7 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Tetrachloroethylene</td>
<td>TWA 25 ppm (170 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Tetrahydrofuran</td>
<td>TWA 200 ppm (590 mg/m³)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST 250 ppm (735 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Tetrasodium pyrophosphate</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>4,4'-Thiobis(6-tert-butyl-m-cresol)</td>
<td>TWA 10 mg/m³ (total)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Thioglycolic acid</td>
<td>TWA 1 ppm (4 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Thionyl chloride</td>
<td>C 1 ppm (5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Tin (organic compounds, as Sn)</td>
<td>TWA 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Tin(II) oxide (as Sn)</td>
<td>TWA 2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Chemical</td>
<td>TWA (mg/m³)</td>
<td>ST (mg/m³)</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------</td>
<td>------------</td>
</tr>
<tr>
<td>Tin(IV) oxide (as Sn)</td>
<td>TWA 2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Titanium dioxide</td>
<td>TWA 10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Toluene</td>
<td>TWA 100 ppm (375 mg/m³)</td>
<td>ST 150 ppm (560 mg/m³)</td>
</tr>
<tr>
<td>Toluene-2,4-diisocyanate</td>
<td>TWA 0.005 ppm (0.04 mg/m³)</td>
<td>ST 0.02 ppm (0.15 mg/m³)</td>
</tr>
<tr>
<td>m-Toluidine</td>
<td>TWA 2 ppm (9 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>p-Toluidine</td>
<td>TWA 2 ppm (9 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Tributyl phosphate</td>
<td>TWA 0.2 ppm (2.5 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Trichloroacetic acid</td>
<td>TWA 1 ppm (7 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>1,2,4-Trichlorobenzene</td>
<td>C 5 ppm (40 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Trichloroethylene</td>
<td>TWA 50 ppm (270 mg/m³)</td>
<td>ST 200 ppm (1080 mg/m³)</td>
</tr>
<tr>
<td>1,2,3-Trichloropropane</td>
<td>TWA 10 ppm (60 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>1,1,2-Trichloro-1,2,2-trifluoroethane</td>
<td>TWA 1000 ppm (7600 mg/m³)</td>
<td>ST 1250 ppm (9500 mg/m³)</td>
</tr>
<tr>
<td>Triethylamine</td>
<td>TWA 10 ppm (40 mg/m³)</td>
<td>ST 15 ppm (60 mg/m³)</td>
</tr>
<tr>
<td>Trimellitic anhydride</td>
<td>TWA 0.005 ppm (0.04 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Trimethylamine</td>
<td>TWA 10 ppm (24 mg/m³)</td>
<td>ST 15 ppm (36 mg/m³)</td>
</tr>
<tr>
<td>1,2,3-Trimethylbenzene</td>
<td>TWA 25 ppm (125 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>1,2,4-Trimethylbenzene</td>
<td>TWA 25 ppm (125 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>TWA 25 ppm (125 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Trimethyl phosphite</td>
<td>TWA 2 ppm (10 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>2,4,6-Trinitrotoluene</td>
<td>TWA 0.5 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Triorthocresyl phosphate</td>
<td>TWA 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Triphenylamine</td>
<td>TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Tungsten (insoluble compounds, as W)</td>
<td>TWA 5 mg/m³</td>
<td>ST 10 mg/m³</td>
</tr>
<tr>
<td>Tungsten (soluble compounds, as W)</td>
<td>TWA 1 mg/m³</td>
<td>ST 3 mg/m³</td>
</tr>
<tr>
<td>Tungsten carbide (cemented)</td>
<td>TWA 5 mg/m³ (as W)</td>
<td>ST 10 mg/m³ (as W)</td>
</tr>
<tr>
<td></td>
<td>TWA 0.05 mg/m³ (as Co)</td>
<td>TWA 1 mg/m³ (as Ni)</td>
</tr>
<tr>
<td>Uranium (insoluble compounds, as U)</td>
<td>TWA 0.2 mg/m³</td>
<td>ST 0.6 mg/m³</td>
</tr>
<tr>
<td>n-Valeraldehyde</td>
<td>TWA 50 ppm (175 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Vanadium dust</td>
<td>TWA 0.05 mg V₂O₅/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>Vanadium fume</td>
<td>C 0.05 mg V₂O₅/m³</td>
<td></td>
</tr>
<tr>
<td>Vinyl acetate</td>
<td>TWA 10 ppm (30 mg/m³)</td>
<td>ST 20 ppm (60 mg/m³)</td>
</tr>
<tr>
<td>Vinyl bromide</td>
<td>TWA 5 ppm (20 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Chemical</td>
<td>TWA Concentration</td>
<td>ST Concentration</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Vinyl cyclohexene dioxide</td>
<td>10 ppm (60 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>Vinylidene chloride</td>
<td>1 ppm (4 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>VM &amp; P Naphtha</td>
<td>1350 mg/m³ (300 ppm)</td>
<td>1800 mg/m³ (400 ppm)</td>
</tr>
<tr>
<td>Welding fumes</td>
<td>5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Wood dust (all wood dusts except Western red cedar)</td>
<td>5 mg/m³</td>
<td>10 mg/m³</td>
</tr>
<tr>
<td>Wood dust (Western red cedar)</td>
<td>2.5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Xylene (α-, m-, p-isomers)</td>
<td>100 ppm (435 mg/m³)</td>
<td>150 ppm (655 mg/m³)</td>
</tr>
<tr>
<td>m-Xylene alpha, alpha'-diamine</td>
<td>C 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>Xylidine</td>
<td>2 ppm (10 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>Zinc chloride fume</td>
<td>1 mg/m³</td>
<td>2 mg/m³</td>
</tr>
<tr>
<td>Zinc oxide</td>
<td>5 mg/m³ (fume)</td>
<td>10 mg/m³ (fume)</td>
</tr>
<tr>
<td></td>
<td>10 mg/m³ (total dust)</td>
<td>5 mg/m³ (resp dust)</td>
</tr>
<tr>
<td>Zinc stearate</td>
<td>10 mg/m³ (total)</td>
<td>5 mg/m³ (resp)</td>
</tr>
<tr>
<td>Zirconium compounds (as Zr)</td>
<td>5 mg/m³</td>
<td>10 mg/m³</td>
</tr>
</tbody>
</table>

**Definitions for Type C and Type CE Respirators**

The definitions below were obtained from the NIOSH Certified Equipment List, which is available on the NIOSH Web site [http://www.cdc.gov/niosh/npptl/topics/respirators/cel](http://www.cdc.gov/niosh/npptl/topics/respirators/cel).

**Type C Respirator:** An airline respirator, for entry into and escape from atmospheres not immediately dangerous to life or health, which consists of a source of respirable breathing air, a hose, a detachable coupling, a control valve, orifice, a demand valve or pressure demand valve, and arrangement for attaching the hose to the wearer and a facepiece, hood, or helmet.

**Type CE Respirator:** A Type C supplied-air respirator equipped with additional devices designed to protect the wearer's head and neck against impact and abrasion from rebounding abrasive material, and with shielding material such as plastic, glass, woven wire, sheet metal, or other suitable material to protect the window(s) of facepieces, hoods, and helmets which do not unduly interfere with the wearer's vision and permit easy access to the external surface of such window(s) for cleaning.
### Acetaldehyde

**CAS** 75-07-0  
**RTECS** AB1925000

**Synonyms & Trade Names**
- Acetic aldehyde
- Ethanal
- Ethyl aldehyde

**DOT ID & Guide**
- 1089 129

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca</th>
<th>See Appendix A See Appendix C (Aldehydes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: TWA 200 ppm (360 mg/m³)</td>
<td></td>
</tr>
</tbody>
</table>

**IDLH** Ca [2000 ppm]  
**Conversion** 1 ppm = 1.80 mg/m³

### Physical Description
- Colorless liquid or gas (above 69°F) with a pungent, fruity odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>44.1</td>
</tr>
<tr>
<td>BP</td>
<td>69°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-190°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Miscible</td>
</tr>
<tr>
<td>IP</td>
<td>10.22 eV</td>
</tr>
<tr>
<td>UEL</td>
<td>60%</td>
</tr>
<tr>
<td>LEL</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

**Class IA Flammable Liquid:** Fl.P. below 73°F and BP below 100°F.

### Incompatibilities & Reactivities
- Strong oxidizers, acids, bases, alcohols, ammonia & amines, phenols, ketones, HCN, H₂S  
  [Note: Prolonged contact with air may cause formation of peroxides that may explode and burst containers; easily undergoes polymerization.]

### Measurement Methods
- NIOSH 2018, 2538, 3507; OSHA 68
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, nose, throat; eye, skin burns; dermatitis; conjunctivitis; cough; central nervous system depression; delayed pulmonary edema; in animals: kidney, reproductive, teratogenic effects; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, respiratory system, kidneys, central nervous system, reproductive system |
| **Cancer Site** | [in animals: nasal cancer] |

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Acetic acid

<table>
<thead>
<tr>
<th>CAS</th>
<th>64-19-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>AF1225000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Acetic acid (aqueous)
- Ethanoic acid
- Glacial acetic acid (pure compound)
- Methanecarboxylic acid [Note: Can be found in concentrations of 5-8% in vinegar.]

### DOT ID & Guide

- 2790 153 (10-80% acid)
- 2789 132 (>80% acid)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 10 ppm (25 mg/m³) ST 15 ppm (37 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 10 ppm (25 mg/m³)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>50 ppm</th>
</tr>
</thead>
</table>

### Physical Description

- Colorless liquid or crystals with a sour, vinegar-like odor. [Note: Pure compound is a solid below 62°F. Often used in an aqueous solution.]

<table>
<thead>
<tr>
<th>MW</th>
<th>60.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>244°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>62°F</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.05</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VP</th>
<th>11 mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP</td>
<td>10.66 eV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fl.P</th>
<th>103°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>UEL(200°F)</td>
<td>19.9%</td>
</tr>
<tr>
<td>LEL</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

- Strong oxidizers (especially chromic acid, sodium peroxide & nitric acid), strong caustics [Note: Corrosive to metals.]

### Measurement Methods

- NIOSH 1603 ; OSHA ID186SG
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: Prevent skin contact (>10%)
- Eyes: Prevent eye contact
- Wash skin: When contaminated (>10%)
- Remove: When wet or contaminated (>10%)
- Change: No recommendation
- Provide: Eyewash (>5%), Quick drench (>50%)

### First Aid

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 50 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, nose, throat; eye, skin burns; skin sensitization; dental erosion; black skin, hyperkeratosis; conjunctivitis, lacrimation (discharge of tears); pharyngeal edema, chronic bronchitis</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, teeth</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Acetic anhydride

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-24-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>AK1925000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Acetic acid anhydride, Acetic oxide, Acetyl oxide, Ethanoic anhydride

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C</th>
<th>5 ppm (20 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>TWA 5 ppm (20 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 200 ppm  
**Conversion** 1 ppm = 4.18 mg/m³

### Physical Description

- Colorless liquid with a strong, pungent, vinegar-like odor.
- **MW**: 102.1
- **BP**: 282°F
- **FRZ**: -99°F
- **Sol**: 12%
- **VP**: 4 mmHg
- **IP**: 10.00 eV
- **Sp.Gr**: 1.08
- **Fl.P**: 120°F
- **UEL**: 10.3%
- **LEL**: 2.7%

**Class II Combustible Liquid**: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

- Water, alcohols, strong oxidizers (especially chromic acid), amines, strong caustics [Note: Corrosive to iron, steel & other metals. Reacts with water to form acetic acid.]

### Measurement Methods

- NIOSH 3506 ; OSHA 82 , 102
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: No recommendation  
- **Provide**: Eyewash, Quick drench

### First Aid

- **Eye**: Irrigate immediately  
- **Skin**: Water flush immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 125 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 200 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Conjunctivitis, lacrimation (discharge of tears), corneal edema, opacity, photophobia (abnormal visual intolerance to light); nasal, pharyngeal irritation; cough, dyspnea (breathing difficulty), bronchitis; skin burns, vesiculation, sensitization dermatitis

**Target Organs** Eyes, skin, respiratory system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Acetone

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>67-64-1</td>
</tr>
<tr>
<td>RTECS</td>
<td>AL3150000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dimethyl ketone
- Ketone propane
- 2-Propanone

### DOT ID & Guide
- DOT ID & Guide: 1090 127

### Exposure Limits
- NIOSH REL: TWA 250 ppm (590 mg/m³)
- OSHA PEL†: TWA 1000 ppm (2400 mg/m³)

### IDLH
- 2500 ppm [10%LEL]

### Conversion
- 1 ppm = 2.38 mg/m³

### Physical Description
- Colorless liquid with a fragrant, mint-like odor.
- MW: 58.1
- BP: 133°F
- FRZ: -140°F
- Sol: Miscible
- VP: 180 mmHg
- IP: 9.69 eV
- Sp.Gr: 0.79
- Fl.P: 0°F
- UEL: 12.8%
- LEL: 2.5%

### Incompatibilities & Reactivities
- Oxidizers, acids

### Measurement Methods
- NIOSH 1300, 2555, 3800; OSHA 69
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH</strong></td>
</tr>
<tr>
<td><strong>Up to 2500 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*</td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

| **Exposure Routes** inhalation, ingestion, skin and/or eye contact |
| **Symptoms** Irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis |
| **Target Organs** Eyes, skin, respiratory system, central nervous system |

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Acetone cyanohydrin

**CAS** 75-86-5

**RTECS** OD9275000

### Synonyms & Trade Names
- Cyanohydrin-2-propanone
- 2-Cyano-2-propanol
- alpha-Hydroxyisobutyronitrile
- 2-Hydroxy-2-methyl-propionitrile
- 2-Methylactonitrile

### DOT ID & Guide
- DOT ID: 1541 155 (stabilized)

### Exposure Limits
- **NIOSH REL:** C 1 ppm (4 mg/m³) [15-minute]
- **OSHA PEL:** none
- **IDLH:** N.D.

### Conversion
1 ppm = 3.48 mg/m³

### Physical Description
- Colorless liquid with a faint odor of bitter almond. [Note: Forms cyanide in the body.]
- MW: 85.1
- BP: 203°F
- FRZ: -4°F
- Sol: Miscible
- VP: 0.8 mmHg
- IP: ?
- Sp.Gr(77°F): 0.93
- Fl.P: 165°F
- UEL: 12.0%
- LEL: 2.2%

**Class IIIA Combustible Liquid:** Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Sulfuric acid, caustics [Note: Slowly decomposes to acetone & HCN at room temperatures; rate is accelerated by an increase in pH, water content, or temperature.]

### Measurement Methods
- NIOSH 2506
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
### Respirator Recommendations NIOSH

**Up to 10 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 25 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 50 ppm:**
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 250 ppm:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, respiratory system; dizziness, lassitude (weakness, exhaustion), headache, confusion, convulsions; liver, kidney injury; pulmonary edema, asphyxia</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system, cardiovascular system, liver, kidneys, gastrointestinal tract</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
<table>
<thead>
<tr>
<th><strong>Acetonitrile</strong></th>
<th><strong>CAS</strong> 75-05-8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CH₃CN</strong></td>
<td><strong>RTECS</strong> AL7700000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong> 1648 127</td>
</tr>
<tr>
<td>Cyanomethane, Ethyl nitrile, Methyl cyanide [Note: Forms cyanide in the body.]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th>NIOSH REL: TWA 20 ppm (34 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: TWA 40 ppm (70 mg/m³)</td>
</tr>
<tr>
<td><strong>IDLH</strong> 500 ppm</td>
<td><strong>Conversion</strong> 1 ppm = 1.68 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Physical Description</strong></th>
<th>Colorless liquid with an aromatic odor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW: 41.1</td>
<td>BP: 179°F</td>
</tr>
<tr>
<td>VP: 73 mmHg</td>
<td>IP: 12.20 eV</td>
</tr>
<tr>
<td>Fl.P(oc): 42°F</td>
<td>UEL: 16.0%</td>
</tr>
<tr>
<td></td>
<td>LEL: 3.0%</td>
</tr>
<tr>
<td>Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Incompatibilities &amp; Reactivities</strong></th>
<th>Strong oxidizers</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Measurement Methods</strong></th>
<th>NIOSH 1606</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>See: NMAM or OSHA Methods</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Personal Protection &amp; Sanitation</strong> (See protection)</th>
<th><strong>First Aid</strong> (See procedures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
<td>Skin: Water flush immediately</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Remove: When wet (flammable)</td>
<td>Swallow: Medical attention</td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Provide: Quick drench</td>
<td></td>
</tr>
</tbody>
</table>
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 200 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
(APF = 10) Any supplied-air respirator

Up to 500 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation nose, throat; asphyxia; nausea, vomiting; chest pain; lassitude (weakness, exhaustion); stupor, convulsions; in animals: liver, kidney damage

Target Organs respiratory system, cardiovascular system, central nervous system, liver, kidneys

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### 2-Acetylamino fluorene

<table>
<thead>
<tr>
<th>CAS 53-96-3</th>
</tr>
</thead>
</table>

#### Synonyms & Trade Names
- AAF, 2-AAF, 2-Acetaminofluorene, N-Acetyl-2-aminofluorene, FAA, 2-FAA, 2-Fluorenylacetamide

#### Exposure Limits
- **NIOSH REL**: Ca See Appendix A
- **OSHA PEL**: [1910.1014] See Appendix B
- **IDLH**: Ca [N.D.]

#### Physical Description
- Tan, crystalline powder.
- **MW**: 223.3
- **BP**: ?
- **MLT**: 381°F
- **Sol**: Insoluble
- **VP**: ?
- **IP**: ?
- **Fl.P**: ?
- **UEL**: ?
- **LEL**: ?

#### Combustible Solid

#### Incompatibilities & Reactivities
- None reported

#### Measurement Methods
- None available
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated/Daily
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

#### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

#### Important additional information about respirator selection

### Respirator Recommendations

- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration**:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

- **Escape**:
  - (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
- Reduced function of liver, kidneys, bladder, pancreas; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Liver, bladder, kidneys, pancreas, skin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors of the liver, bladder, lungs, skin &amp; pancreas]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Acetylene

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>74-86-2</td>
</tr>
<tr>
<td>RTECS</td>
<td>AO9600000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td></td>
</tr>
<tr>
<td>Ethine, Ethyne [Note: A compressed gas used in the welding &amp; cutting of metals.]</td>
<td></td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td></td>
</tr>
<tr>
<td>1001 116</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>LimitType</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>C 2500 ppm (2662 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
<tr>
<td>IDLH</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

**Conversion**

1 ppm = 1.06 mg/m³

### Physical Description

Colorless gas with a faint, ethereal odor. [Note: Commercial grade has a garlic-like odor. Shipped under pressure dissolved in acetone.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>26.0</td>
</tr>
<tr>
<td>BP</td>
<td>Sublimes</td>
</tr>
<tr>
<td>FRZ</td>
<td>-119°F (Sublimes)</td>
</tr>
<tr>
<td>Sol.</td>
<td>2%</td>
</tr>
<tr>
<td>VP</td>
<td>44.2 atm</td>
</tr>
<tr>
<td>IP</td>
<td>11.40 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>0.91</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA (Gas)</td>
</tr>
<tr>
<td>UEL</td>
<td>100%</td>
</tr>
<tr>
<td>LEL</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Zinc; oxygen & other oxidizing agents such as halogens [Note: Forms explosive acetylide compounds with copper, mercury, silver & brasses (containing more than 66% copper).]

### Measurement Methods

NIOSH Acetylene Crit. Doc.

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Frostbite wash

### First Aid (See procedures)

- Eye: Frostbite
- Skin: Frostbite
- Breathing: Fresh air

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, skin and/or eye contact (liquid)

### Symptoms

Headache, dizziness; asphyxia; liquid: frostbite

### Target Organs

central nervous system, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Acetylene tetrabromide

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>79-27-6</td>
</tr>
<tr>
<td>RTECS</td>
<td>KI8225000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Symmetrical tetrabromoethane; TBE; Tetrabromoacetylene; Tetrabromoethane; 1,1,2,2-Tetrabromoethane

### Exposure Limits
- **NIOSH REL**: See Appendix D
- **OSHA PEL**: TWA 1 ppm (14 mg/m³)
- **IDLH**: 8 ppm
- **Conversion**: 1 ppm = 14.14 mg/m³

### Physical Description
- Pale-yellow liquid with a pungent odor similar to camphor or iodoform. [Note: A solid below 32°F.]
- **MW**: 345.7
- **BP**: 474°F (Decomposes)
- **FRZ**: 32°F
- **Sol**: 0.07%
- **VP**: 0.02 mmHg
- **IP**: ?
- **Sp.Gr**: 2.97
- **UEL**: NA
- **LEL**: NA

### Incompatibilities & Reactivities
- Noncombustible Liquid
- Strong caustics; hot iron; reducing metals such as aluminum, magnesium & zinc

### Measurement Methods
- NIOSH 2003
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations
- **OSHA**
  - **Up to 8 ppm**:  
    - (APF = 10) Any supplied-air respirator
    - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - **Emergency or planned entry into unknown concentrations or IDLH conditions**:
    - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
    - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
  - **Escape**:
    - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, nose; anorexia, nausea; headache; abdominal pain; jaundice; leukocytosis (increased blood leukocytes); central nervous system depression</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, respiratory system, liver, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
### NIOSH Pocket Guide to Chemical Hazards

**Acetylsalicylic acid**

<table>
<thead>
<tr>
<th>CAS 50-78-2</th>
</tr>
</thead>
</table>

**CH$_3$COOC$_6$H$_4$COOH**

**RTECS** VO0700000

**Synonyms & Trade Names**

- o-Acetoxybenzoic acid
- 2-Acetoxybenzoic acid
- Aspirin

**DOT ID & Guide**

**Exposure Limits**

- NIOSH REL: TWA 5 mg/m$^3$
- OSHA PEL†: none

**IDLH** N.D.

**Conversion**

**Physical Description**

Odorless, colorless to white, crystal-line powder. [aspirin] [Note: Develops the vinegar-like odor of acetic acid on contact with moisture.]

- MW: 180.2
- BP: 284°F (Decomposes)
- MLT: 275°F
- Sol(77°F): 0.3%
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 1.35
- UEL: NA
- LEL: NA

Combustible Powder; explosion hazard if dispersed in air.

**Incompatibilities & Reactivities**

Solutions of alkali hydroxides or carbonates, strong oxidizers, moisture [Note: Slowly hydrolyzes in moist air to salicylic & acetic acids.]

**Measurement Methods**

NIOSH 0500
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: No recommendation
- Change: Daily
- Provide: Eyewash, Quick drench

**First Aid**

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Respirator Recommendations**

Not available.

**Exposure Routes**

inhalation, ingestion, skin and/or eye contact

**Symptoms**

Irritation eyes, skin, upper respiratory system; increased blood clotting time; nausea, vomiting; liver, kidney injury

**Target Organs**

- Eyes, skin, respiratory system, blood, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Acrolein

- **CAS:** 107-02-8
- **RTECS:** AS1050000
- **Synonyms & Trade Names:** Acraldehyde, Acrylaldehyde, Acrylic aldehyde, Allyl aldehyde, Propenal, 2-Propenal
- **DOT ID & Guide:** 1092 131 P (inhibited)

### Exposure Limits
- NIOSH REL: TWA 0.1 ppm (0.25 mg/m³) ST 0.3 ppm (0.8 mg/m³) See Appendix C (Aldehydes)
- OSHA PEL†: TWA 0.1 ppm (0.25 mg/m³)
- **IDLH:** 2 ppm
- **Conversion:** 1 ppm = 2.29 mg/m³

### Physical Description
Colorless or yellow liquid with a piercing, disagreeable odor.

- **MW:** 56.1
- **BP:** 127°F
- **FRZ:** -126°F
- **Sol:** 40%
- **VP:** 210 mmHg
- **IP:** 10.13 eV
- **Sp.Gr:** 0.84
- **Fl.P:** -15°F
- **UEL:** 31%
- **LEL:** 2.8%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
Oxidizers, acids, alkalis, ammonia, amines [Note: Polymerizes readily unless inhibited--usually with hydroquinone. May form shock-sensitive peroxides over time.]

### Measurement Methods
NIOSH 2501 ; OSHA 52
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; decreased pulmonary function; delayed pulmonary edema; chronic respiratory disease

Target Organs Eyes, skin, respiratory system, heart

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Acrylamide

<table>
<thead>
<tr>
<th>CAS 79-06-1</th>
</tr>
</thead>
</table>

### CAS 79-06-1

<table>
<thead>
<tr>
<th>RTECS AS3325000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

- Acrylamide monomer, Acrylic amide, Propenamide, 2-Propenamide

### DOT ID & Guide

- DOT ID & Guide 2074 153 P

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca TWA 0.03 mg/m³ [skin] See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 0.3 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

### IDLH

- Ca [60 mg/m³]

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>White crystalline, odorless solid.</td>
</tr>
</tbody>
</table>

### MW: 71.1

<table>
<thead>
<tr>
<th>BP: 347-572°F (Decomposes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLT: 184°F</td>
</tr>
<tr>
<td>Sol(86°F): 216%</td>
</tr>
</tbody>
</table>

### VP: 0.007 mmHg

<table>
<thead>
<tr>
<th>IP: 9.50 eV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp.Gr: 1.12</td>
</tr>
</tbody>
</table>

### Fl.P: 280°F

<table>
<thead>
<tr>
<th>UEL: ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEL: ?</td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities

- Strong oxidizers [Note: May polymerize violently upon melting.]

### Measurement Methods

- OSHA 21, PV2004

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

## Important additional information about respirator selection

### Respirator Recommendations NIOSH

- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact
**Symptoms** Irritation eyes, skin; ataxia, numb limbs, paresthesia; muscle weakness; absent deep tendon reflex; hand sweating; lassitude (weakness, exhaustion), drowsiness; reproductive effects; [potential occupational carcinogen]

**Target Organs** Eyes, skin, central nervous system, peripheral nervous system, reproductive system

**Cancer Site** [in animals: tumors of the lungs, testes, thyroid & adrenal glands]

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Acrylic acid

<table>
<thead>
<tr>
<th>CAS</th>
<th>79-10-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂=CHCOOH</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Acroleic acid
- Aqueous acrylic acid (technical grade is 94%)
- Ethylenecarboxylic acid
- Glacial acrylic acid (98% in aqueous solution)
- 2-Propenoic acid

### DOT ID & Guide

- 2218 132 P (inhibited)

### Exposure Limits

- NIOSH REL: TWA 2 ppm (6 mg/m³) [skin]
- OSHA PEL†: none
- IDLH N.D.

### Physical Description

- Colorless liquid or solid (below 55°F) with a distinctive, acrid odor. [Note: Shipped with an inhibitor (e.g., hydroquinone) since it readily polymerizes.]
- MW: 72.1
- BP: 286°F
- FRZ: 55°F
- Sol: Miscible
- VP: 3 mmHg
- IP: ?
- Sp.Gr: 1.05
- Fl.P: 121°F
- UEL: 8.02%
- LEL: 2.4%
- Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

- Oxidizers, amines, alkalis, ammonium hydroxide, chloro-sulfonic acid, oleum, ethylene diamine, ethyleneimine, 2-aminoethanol [Note: Corrosive to many metals.]

### Measurement Methods

- OSHA 28, PV2005
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations

Not available.

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, skin, respiratory system; eye, skin burns; skin sensitization; in animals: lung, liver, kidney injury

### Target Organs

- Eyes, skin, respiratory system

See also: INTRODUCTION
**Acrylonitrile**

<table>
<thead>
<tr>
<th>CAS 107-13-1</th>
<th>RTECS AT5250000</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
- Acrylonitrile monomer, AN, Cyanoethylene, Propenenitrile, 2-Propenenitrile, VCN, Vinyl cyanide

**Exposure Limits**
- NIOSH REL: Ca TWA 1 ppm C 10 ppm [15-minute] [skin] See Appendix A
- OSHA PEL: [1910.1045] TWA 2 ppm C 10 ppm [15-minute] [skin]
- IDLH Ca [85 ppm]
- **Conversion** 1 ppm = 2.17 mg/m³

**Physical Description**
- Colorless to pale-yellow liquid with an unpleasant odor. [Note: Odor can only be detected above the PEL.]

| MW: 53.1 | BP: 171°F | FRZ: -116°F | Sol: 7% |
| VP: 83 mmHg | IP: 10.91 eV | | Sp.Gr: 0.81 |
| Fl.P: 30°F | UEL: 17% | LEL: 3.0% |

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

**Incompatibilities & Reactivities**
- Strong oxidizers, acids & alkalis; bromine; amines [Note: Unless inhibited (usually with methylhydroquinone), may polymerize spontaneously or when heated or in presence of strong alkali. Attacks copper.]

**Measurement Methods**
- NIOSH 1604 ; OSHA 37
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

**First Aid** (See procedures)
- **Eye:** Irrigate immediately
- **Skin:** Water wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** (See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin; asphyxia; headache; sneezing; nausea, vomiting; lassitude (weakness, exhaustion), dizziness; skin vesiculation; scaling dermatitis; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, cardiovascular system, liver, kidneys, central nervous system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[brain tumors, lung &amp; bowel cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Adiponitrile</th>
<th>CAS 111-69-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC(CH₂)₄CN</td>
<td>RTECS AV2625000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

1,4-Dicyanobutane; Hexanedinitrile; Tetramethylene cyanide

**DOT ID & Guide**

2205 153

---

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 4 ppm (18 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL: none</td>
<td></td>
</tr>
</tbody>
</table>

**IDLH N.D.**

**Conversion**

1 ppm = 4.43 mg/m³

---

**Physical Description**

Water-white, practically odorless, oily liquid. [Note: A solid below 34°F. Forms cyanide in the body.]

**MW:** 108.2  
**BP:** 563°F  
**FRZ:** 34°F  
**Sol:** 4.5%  
**VP:** 0.002 mmHg  
**IP:** ?  
**Sp.Gr:** 0.97  
**Class IIIA Combustible Liquid:** Fl.P. at or above 140°F and below 200°F.

---

**Incompatibilities & Reactivities**

Oxidizers (e.g., perchlorates, nitrates), strong acids (e.g., sulfuric acid) [Note: Decomposes above 194°F, forming hydrogen cyanide.]

---

**Measurement Methods**

NIOSH Nitriles Crit. Doc.  
See: NMAM or OSHA Methods

---

**Personal Protection & Sanitation** *(See protection)*

- Skin: Prevent skin contact  
- Eyes: Prevent eye contact  
- Wash skin: When contaminated  
- Remove: When wet or contaminated  
- Change: Daily

---

**First Aid** *(See procedures)*

- Eye: Irrigate immediately  
- Skin: Soap wash immediately  
- Breathing: Respiratory support  
- Swallow: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 40 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 100 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 200 ppm:**
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 250 ppm:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; headache, dizziness, lassitude (weakness, exhaustion), confusion, convulsions; blurred vision; dyspnea (breathing difficulty); abdominal pain, nausea, vomiting

**Target Organs** Eyes, skin, respiratory system, central nervous system, cardiovascular system

See also: INTRODUCTION
## Aldrin

<table>
<thead>
<tr>
<th>CAS</th>
<th>309-00-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>IO2100000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-endoo-1,4-exo-5,8-dimethanonaphthalene; HHDN; Octalene

### DOT ID & Guide
2761 151

### Exposure Limits

| NIOSH REL: Ca TWA 0.25 mg/m³ [skin] See Appendix A |
| OSHA PEL: TWA 0.25 mg/m³ [skin] |

### Physical Description
Colorless to dark-brown crystalline solid with a mild chemical odor. [Note: Formerly used as an insecticide.]

- **MW:** 364.9
- **BP:** Decomposes
- **MLT:** 219°F
- **Sol:** 0.003%
- **VP:** 0.00008 mmHg
- **IP:** ?
- **Sp.Gr.:** 1.60

Noncombustible Solid, but may be dissolved in flammable liquids.

### Incompatibilities & Reactivities
Concentrated mineral acids, active metals, acid catalysts, acid oxidizing agents, phenol

### Measurement Methods

- NIOSH 5502
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

### First Aid

- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort); myoclonic jerks of limbs; clonic, tonic convulsions; coma; hematuria (blood in the urine), azotemia; [potential occupational carcinogen] |
| **Target Organs** | central nervous system, liver, kidneys, skin |
| **Cancer Site** | [in animals: tumors of the lungs, liver, thyroid & adrenal glands] |

See also: INTRODUCTION
### Allyl alcohol

**CAS** 107-18-6  
**RTECS** BA5075000  
**DOT ID & Guide** 1098 131

#### Synonyms & Trade Names
- AA, Allylic alcohol, Propenol, 1-Propen-3-ol, 2-Propenol, Vinyl carbinol

#### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA</td>
<td>2 ppm (5 mg/m³)</td>
</tr>
<tr>
<td></td>
<td>ST 4 ppm (10 mg/m³) [skin]</td>
</tr>
<tr>
<td>OSHA PEL†: TWA</td>
<td>2 ppm (5 mg/m³) [skin]</td>
</tr>
<tr>
<td>IDLH</td>
<td>20 ppm</td>
</tr>
</tbody>
</table>

#### Conversion

1 ppm = 2.38 mg/m³

#### Physical Description

Colorless liquid with a pungent, mustard-like odor.

**MW:** 58.1  
**BP:** 205°F  
**FRZ:** -200°F  
**Sol:** Miscible

**VP:** 17 mmHg  
**IP:** 9.63 eV  
**Sp.Gr:** 0.85

**Fl.P:** 70°F  
**UEL:** 18.0%  
**LEL:** 2.5%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities

Strong oxidizers, acids, carbon tetrachloride [Note: Polymerization may be caused by elevated temperatures, oxidizers, or peroxides.]

#### Measurement Methods

NIOSH 1402, 1405  
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

(See protection)

- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet (flammable)  
- **Change:** No recommendation  
- **Provide:** Quick drench

#### First Aid

(See procedures)

- **Eye:** Irrigate immediately  
- **Skin:** Water flush immediately  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately
### Respirator Recommendations NIOSH/OSHA

**Up to 20 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Eye irritation, tissue damage; irritation upper respiratory system, skin; pulmonary edema

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

**Allyl chloride**

<table>
<thead>
<tr>
<th>CH₂=CHCH₂Cl</th>
<th>CAS 107-05-1</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**

- 3-Chloropropene
- 1-Chloro-2-propene
- 3-Chloropropylene

**DOT ID & Guide**

- DOT ID 1100 131
- RTECS UC7350000

**Exposure Limits**

- NIOSH REL: TWA 1 ppm (3 mg/m³) ST 2 ppm (6 mg/m³)
- OSHA PEL†: TWA 1 ppm (3 mg/m³)
- IDLH 250 ppm

**Conversion**

- 1 ppm = 3.13 mg/m³

**Physical Description**

- Colorless, brown, yellow, or purple liquid with a pungent, unpleasant odor.
- MW: 76.5
- BP: 113°F
- MLT: -210°F
- Sol: 0.4%
- VP: 295 mmHg
- IP: 10.05 eV
- Sp.Gr: 0.94
- Fl.P: -25°F
- UEL: 11.1%
- LEL: 2.9%

**Incompatibilities & Reactivities**

- Strong oxidizers, acids, amines, iron & aluminum chlorides, magnesium, zinc

**Measurement Methods**

- NIOSH 1000 ; OSHA 7
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Quick drench

**First Aid**

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Respirator Selection Recommendations

### NIOSH/OSHA

<table>
<thead>
<tr>
<th>Concentration Range</th>
<th>APF</th>
<th>Respirator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 25 ppm:</strong></td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td><strong>Up to 50 ppm:</strong></td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 250 ppm:</strong></td>
<td>200</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td></td>
<td>10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, mucous membrane; pulmonary edema; in animals: liver, kidney injury

### Target Organs
- Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
### Allyl glycidyl ether

**C₆H₁₀O₂**

**CAS 106-92-3**

**RTECS RR0875000**

**Synonyms & Trade Names**

AGE; 1-Allyloxy-2,3-epoxypropane; Glycidyl allyl ether; [(2-Propenylxoxy)methyl] oxirane

**DOT ID & Guide**

2219 129

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th>NIOSH REL: TWA 5 ppm (22 mg/m³) ST 10 ppm (44 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: C 10 ppm (45 mg/m³)</td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
<td>50 ppm</td>
</tr>
</tbody>
</table>

**Conversion** 1 ppm = 4.67 mg/m³

### Physical Description

Colorless liquid with a pleasant odor.

**MW: 114.2**  **BP: 309°F**  **FRZ: -148°F [forms glass]**  **Sol: 14%**

**VP: 2 mmHg**  **IP: ?**  **Sp.Gr: 0.97**

**Fl.P: 135°F**  **UEL: ?**  **LEL: ?**

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

Strong oxidizers

### Measurement Methods

NIOSH 2545

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: No recommendation

Provide: Eyewash

### First Aid (See procedures )

Eye: Irrigate immediately

Skin: Water flush promptly

Breathing: Respiratory support

Swallow: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 50 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, respiratory system; dermatitis; pulmonary edema; narcosis; possible hematopoietic, reproductive effects

**Target Organs** Eyes, skin, respiratory system, blood, reproductive system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Allyl propyl disulfide

**CAS** 2179-59-1

**H2C=CHCH2S2CH2CH2CH3**

**RTECS** JO0350000

### Synonyms & Trade Names

- 4,5-Dithia-1-octene; Onion oil; 2-Propenyl propyl disulfide; Propyl allyl disulfide

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 2 ppm (12 mg/m³) ST 3 ppm (18 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>TWA 2 ppm (12 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** N.D.

**Conversion** 1 ppm = 6.07 mg/m³

### Physical Description

Pale-yellow liquid with a strong & irritating onion-like odor. [Note: The chief volatile component of onion oil.]

- **MW:** 148.3
- **BP:** ?
- **FRZ:** 5°F
- **Sol:** Insoluble
- **VP:** ?
- **IP:** ?
- **Sp.Gr(59°F):** 0.93
- **UEL:** ?
- **LEL:** ?

### Incompatibilities & Reactivities

- **Combustible Liquid**
- **Oxidizers**

### Measurement Methods

- OSHA PV2086
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** No recommendation
- **Eyes:** Prevent eye contact
- **Wash skin:** No recommendation
- **Remove:** When wet or contaminated
- **Change:** No recommendation

**First Aid**

- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

### Exposure Routes

Inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, nose, respiratory system; lacrimation (discharge of tears)

### Target Organs

Eyes, respiratory system

See also: **INTRODUCTION**
### alpha-Alumina

<table>
<thead>
<tr>
<th>CAS</th>
<th>1344-28-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>BD1200000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
Alumina, Aluminum oxide, Aluminum trioxide [Note: alpha-Alumina is the main component of technical grade alumina. Corundum is natural Al₂O₃. Emery is an impure crystalline variety of Al₂O₃.]

#### Conversion

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Physical Description
White, odorless, crystalline powder.

| MW: 101.9 | BP: 5396°F | MLT: 3632°F | Sol: Insoluble |
| VP: 0 mmHg (approx) | IP: NA |   | Sp.Gr: 4.0 |
| FI.P: NA | UEL: NA | LEL: NA |

Noncombustible solid, but dusts may form explosive mixtures in air.

#### Incompatibilities & Reactivities
Chlorine trifluoride, hot chlorinated rubber, acids, oxidizers [Note: Hydrogen gas may be formed when finely divided iron contacts moisture during crushing & milling operations.]

#### Measurement Methods
NIOSH 0500, 0600; OSHA ID109SG, ID198SG
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
**Skin:** No recommendation
**Eyes:** No recommendation
**Wash skin:** No recommendation
**Remove:** No recommendation
**Change:** No recommendation

#### First Aid
**Eye:** Irrigate immediately
**Skin:** Blot/brush away
**Breathing:** Fresh air
**Swallow:** Medical attention immediately

#### Exposure Routes
Irritation eyes, skin, respiratory system

#### Symptoms
irritation eyes, skin, respiratory system

#### Target Organs
Eyes, skin, respiratory system

See also: **INTRODUCTION**
# Aluminum

**CAS** 7429-90-5  
**RTECS** BD0330000  
**DOT ID & Guide**  
- 1309 170 (powder, coated)  
- 1396 138 (powder, uncoated)  
- 9260 169 (molten)

## Synonyms & Trade Names
Aluminium, Aluminum metal, Aluminum powder, Elemental aluminum

## Exposure Limits
- **NIOSH REL:** TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)  
- **OSHA PEL:** TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)

## Physical Description
- Silvery-white, malleable, ductile, odorless metal.
- **MW:** 27.0  
- **BP:** 4221°F  
- **MLT:** 1220°F  
- **Sol:** Insoluble  
- **VP:** 0 mmHg (approx)  
- **IP:** NA  
- **Sp.Gr:** 2.70  
- **UEL:** NA  
- **LEL:** NA

Combustible Solid, finely divided dust is easily ignited; may cause explosions.

## Incompatibilities & Reactivities
- Strong oxidizers & acids, halogenated hydrocarbons. [Note: Corrodes in contact with acids & other metals. Ignition may occur if powders are mixed with halogens, carbon disulfide, or methyl chloride.]

## Measurement Methods
- NIOSH 7013, 7300, 7301, 7303; OSHA ID121
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** No recommendation  
- **Eyes:** No recommendation  
- **Wash skin:** No recommendation  
- **Remove:** No recommendation  
- **Change:** No recommendation

## First Aid
- **Eye:** Irrigate immediately  
- **Breathing:** Fresh air

## Exposure Routes
- Inhalation, skin and/or eye contact

## Symptoms
- Irritation eyes, skin, respiratory system

## Target Organs
- Eyes, skin, respiratory system

See also: **INTRODUCTION**
### Aluminum (pyro powders and welding fumes, as Al)

| Synonyms & Trade Names |  
|------------------------|---
| Synonyms vary depending upon the specific aluminum compound. |  

| DOT ID & Guide |  
|----------------|---
| 1383 135 (powder, pyrophoric) |  

| Exposure Limits |  
|-----------------|---
| NIOSH REL: TWA 5 mg/m³ |  
| OSHA PEL†: none |  

| IDLH | Conversion |  
| N.D. |  |  

| Physical Description |  
|----------------------|---
| Appearance and odor vary depending upon the specific aluminum compound. |  

| Incompatibilities & Reactivities |  
|---------------------------------|---
| Varies |  

| Measurement Methods |  
|---------------------|---
| NIOSH 7300, 7301, 7303 |  
| See: NMAM or OSHA Methods |  

| Personal Protection & Sanitation |  
|---------------------------------|---
| Skin: No recommendation |  
| Eyes: No recommendation |  
| Wash skin: No recommendation |  
| Remove: No recommendation |  
| Change: No recommendation |  

| First Aid |  
|-----------|---
| Eye: Irrigate immediately |  
| Skin: Water flush immediately |  
| Breathing: Respiratory support |  
| Swallow: Medical attention immediately |  

| Important additional information about respirator selection |  
|-------------------------------------------------------------|---
| Respirator Recommendations | Not available. |  

| Exposure Routes |  
|-----------------|---
| Inhalation, ingestion, skin and/or eye contact |  

| Symptoms |  
|---------|---
| Irritation skin, respiratory system; pulmonary fibrosis |  

| Target Organs |  
|---------------|---
| Skin, respiratory system |  

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

**Aluminum (soluble salts and alkyls, as Al)**

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>3051 135 (Aluminum alkyls)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Synonyms vary depending upon the specific aluminum compound.

### Exposure Limits

| NIOSH REL: TWA 2 mg/m³ |
| OSHA PEL†: none |

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description
Appearance and odor vary depending upon the specific aluminum compound.

Properties vary depending upon the specific aluminum compound.

### Incompatibilities & Reactivities
Varies

### Measurement Methods
NIOSH 7013, 7300, 7301, 7303; OSHA ID121

See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)

**Skin:** Prevent skin contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: Daily

### First Aid
(See procedures)

**Eye:** Irrigate immediately  
**Skin:** Water flush immediately  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation skin, respiratory system; skin burns

### Target Organs
Skin, respiratory system

See also: INTRODUCTION
## 4-Aminodiphenyl

<table>
<thead>
<tr>
<th>Chemical Information</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>92-67-1</td>
</tr>
<tr>
<td>RTECS</td>
<td>DU8925000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 4-Aminobiphenyl
- p-Aminobiphenyl
- p-Aminodiphenyl
- 4-Phenylaniline

### Exposure Limits
- **NIOSH REL:** Ca [See Appendix A]
- **OSHA PEL:** [1910.1011] [See Appendix B]

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Ca [N.D.]</th>
</tr>
</thead>
</table>

### Physical Description
- Colorless crystals with a floral odor. [Note: Turns purple on contact with air.]

<table>
<thead>
<tr>
<th>MW</th>
<th>169.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>576°F</td>
</tr>
<tr>
<td>MLT</td>
<td>127°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Slight</td>
</tr>
<tr>
<td>VP(22°C)</td>
<td>1 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.16</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
- Oxidized by air

### Measurement Methods
- NIOSH P&CAM269 (II-4) ; OSHA 93
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection )
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

### First Aid
(See procedures )
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations
(See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- **(APF = 50)** Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Headache, dizziness; drowsiness, dyspnea (breathing difficulty); ataxia, lassitude (weakness, exhaustion); methemoglobinemia; urinary burning; acute hemorrhagic cystitis; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Bladder, skin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[bladder cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## 2-Aminopyridine

**CAS** 504-29-0  
**RTECS** US1575000

### Exposure Limits

| NIOSH REL | TWA 0.5 ppm (2 mg/m³) |
| OSHA PEL | TWA 0.5 ppm (2 mg/m³) |
| IDLH | 5 ppm |

### Conversion

1 ppm = 3.85 mg/m³

### Physical Description

White powder, leaflets, or crystals with a characteristic odor.

- **MW:** 94.1  
- **BP:** 411°F  
- **MLT:** 137°F  
- **Sol.:** >100%  
- **VP (77°F):** 0.8 mmHg  
- **IP:** 8.00 eV  
- **Sp.Gr.:** ?  
- **Fl.P.:** 154°F  
- **UEL:** ?  
- **LEL:** ?

### Incompatibilities & Reactivities

Combustible Solid  
Strong oxidizers

### Measurement Methods

NIOSH S158 (II-4)  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

See protection

- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet or contaminated  
- **Change:** Daily  
- **Provide:** Quick drench

### First Aid

See procedures

- **Eye:** Irrigate immediately  
- **Skin:** Water flush immediately  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

#### Up to 5 ppm:

- (APF = 10) Any supplied-air respirator*  
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, nose, throat; headache, dizziness; excitement; nausea; high blood pressure; respiratory distress; lassitude (weakness, exhaustion); convulsions; stupor</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>central nervous system, respiratory system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Amitrole

<table>
<thead>
<tr>
<th>CAS</th>
<th>61-82-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>XZ3850000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- Aminotriazole
- 3-Aminotriazole
- 2-Amino-1,3,4-triazole
- 3-Amino-1,2,4-triazole

#### Exposure Limits
- **NIOSH REL**: Ca TWA 0.2 mg/m³  
  See Appendix A
- **OSHA PEL†**: none

#### Physical Description
- Colorless to white, crystalline powder. [herbicide]  
  [Note: Odorless when pure.]
- **MW**: 84.1  
  **BP**: ?  
  **MLT**: 318°F  
  **Sol(77°F)**: 28%
- **VP**: <0.000008 mmHg  
  **IP**: ?  
  **Sp.Gr**: 1.14
- **Fl.P**: NA  
  **UEL**: NA  
  **LEL**: NA

- Noncombustible Solid, but may be dissolved in flammable liquids.

#### Incompatibilities & Reactivities
- Light (decomposes), strong oxidizers  
  [Note: Corrosive to iron, aluminum & copper.]

#### Measurement Methods
- NIOSH 0500 ; OSHA PV2006
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact
- **Wash skin**: Daily  
- **Remove**: When wet or contaminated
- **Change**: Daily  
- **Provide**: Eyewash, Quick drench

#### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

#### Important additional information about respirator selection

#### Respirator Recommendations NIOSH
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
- **Escape**:
  - **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin; dyspnea (breathing difficulty), muscle spasms, ataxia, anorexia, salivation, increased body temperature; lassitude (weakness, exhaustion), skin dryness, depression (thyroid function suppression)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, thyroid</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[in animals: liver, thyroid &amp; pituitary gland tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Ammonia

| NH₃ | CAS 7664-41-7 |

### Synonyms & Trade Names
Anhydrous ammonia, Aqua ammonia, Aqueous ammonia [Note: Often used in an aqueous solution.]

### DOT ID & Guide
- 1005 125 (anhydrous)
- 2672 154 (10-35% solution)
- 2073 125 (>35-50% solution)
- 1005 125 (>50% solution)

### Exposure Limits
- NIOSH REL: TWA 25 ppm (18 mg/m³) ST 35 ppm (27 mg/m³)
- OSHA PEL†: TWA 50 ppm (35 mg/m³)
- IDLH 300 ppm

### Conversion
1 ppm = 0.70 mg/m³

### Physical Description
Colorless gas with a pungent, suffocating odor. [Note: Shipped as a liquefied compressed gas. Easily liquefied under pressure.]

- MW: 17.0
- BP: -28°F
- FRZ: -108°F
- Sol: 34%
- VP: 8.5 atm
- IP: 10.18 eV
- RGasD: 0.60
- Fl.P: NA (Gas)
- UEL: 28%
- LEL: 15%

[Note: Although NH₃ does not meet the DOT definition of a Flammable Gas (for labeling purposes), it should be treated as one.]

### Incompatibilities & Reactivities
Strong oxidizers, acids, halogens, salts of silver & zinc [Note: Corrosive to copper & galvanized surfaces.]

### Measurement Methods
- NIOSH 3800, 6015, 6016; OSHA ID188
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated (solution)
- Remove: When wet or contaminated (solution)
- Change: No recommendation
- Provide: Eyewash (>10%), Quick drench (>10%)

### First Aid (See procedures)
- Eye: Irrigate immediately (solution/liquid)
- Skin: Water flush immediately (solution/liquid)
- Breathing: Respiratory support
- Swallow: Medical attention immediately (solution)
### Respirator Recommendations

**NIOSH**

**Up to 250 ppm:**
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern*
- (APF = 10) Any supplied-air respirator*

**Up to 300 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern*
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)

### Symptoms
- Irritation eyes, nose, throat; dyspnea (breathing difficulty), wheezing, chest pain; pulmonary edema; pink frothy sputum; skin burns, vesiculation; liquid: frostbite

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Ammonium chloride fume

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>12125-02-9</td>
<td>BP4550000</td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Ammonium chloride, Ammonium muriate fume, Sal ammoniac fume

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: TWA</th>
<th>ST 20 mg/m³</th>
</tr>
</thead>
</table>

| OSHA PEL†      | none        |

**IDLH**
N.D.

**Conversion**

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
</table>
Finely divided, odorless, white particulate dispersed in air.

<table>
<thead>
<tr>
<th>MW</th>
<th>BP</th>
<th>MLT</th>
<th>Sol</th>
</tr>
</thead>
<tbody>
<tr>
<td>53.5</td>
<td>Sublimes</td>
<td>662°F (Sublimes)</td>
<td>37%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VP(321°F)</th>
<th>IP</th>
<th>Sp.Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mmHg</td>
<td>NA</td>
<td>1.53</td>
</tr>
</tbody>
</table>

**Noncombustible Solid**

**Incompatibilities & Reactivities**
Alkalis & their carbonates, lead & silver salts, strong oxidizers, ammonium nitrate, potassium chlorate, bromine trifluoride

[Note: Corrodes most metals at high (i.e., fire) temperatures.]

**Measurement Methods**
OSHA ID188
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

**First Aid** *(See procedures)*
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms**
Irritation eyes, skin, respiratory system; cough, dyspnea (breathing difficulty), pulmonary sensitization

**Target Organs**
Eyes, skin, respiratory system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Ammonium sulfamate

<table>
<thead>
<tr>
<th>CAS</th>
<th>7773-06-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH₄OSO₂NH₂</td>
<td></td>
</tr>
<tr>
<td>RTECS</td>
<td>WO6125000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Ammate herbicide
- Ammonium amidosulfonate
- AMS
- Monoammonium salt of sulfamic acid
- Sulfamate

### Exposure Limits

| NIOSH REL: TWA | 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL†     | TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

**IDLH** 1500 mg/m³

### Conversion

- **Physical Description**
  - Colorless to white crystalline, odorless solid. [herbicide]
  - MW: 114.1
  - BP: 320°F (Decomposes)
  - MLT: 268°F
  - Sol: 200%
  - VP: 0 mmHg (approx)
  - IP: ?
  - Sp.Gr: 1.77
  - Fl.P: NA
  - UEL: NA
  - LEL: NA

### Incompatibilities & Reactivities
- Noncombustible Solid
- Acids, hot water [Note: Elevated temperatures cause a highly exothermic reaction with water.]

### Measurement Methods
- NIOSH S348 (II-5)
- See NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: No recommendation
- **Eyes**: No recommendation
- **Wash skin**: No recommendation
- **Remove**: No recommendation
- **Change**: No recommendation

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

---

**Authored in PDF format by Industrial Hygiene Services; www.ihresources.com**
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 50 mg/m³:**
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 100 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

**Up to 250 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 500 mg/m³:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1500 mg/m³:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

#### Exposure Routes
- Inhalation, skin and/or eye contact

#### Symptoms
- Irritation eyes, nose, throat; cough, dyspnea (breathing difficulty)

#### Target Organs
- Eyes, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## n-Amyl acetate

<table>
<thead>
<tr>
<th>CAS</th>
<th>628-63-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>AJ1925000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Amyl acetic ester
- Amyl acetic ether
- 1-Pentanol acetate
- Pentyl ester of acetic acid
- Primary amyl acetate

### Exposure Limits

| NIOSH REL | TWA 100 ppm (525 mg/m³) |
| OSHA PEL | TWA 100 ppm (525 mg/m³) |
| IDLH | 1000 ppm |

### Conversion

1 ppm = 5.33 mg/m³

### Physical Description

- Colorless liquid with a persistent banana-like odor.
- MW: 130.2
- BP: 301°F
- FRZ: -95°F
- Sol: 0.2%
- VP: 4 mmHg
- IP: ?
- Sp.Gr: 0.88
- Fl.P: 77°F
- UEL: 7.5%
- LEL: 1.1%
- Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities

- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods

- NIOSH 1450, 2549; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

### Up to 1000 ppm:
- **(APF = 10)** Any chemical cartridge respirator with organic vapor cartridge(s)*
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor cartridge(s)*
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, nose; dermatitis; possible central nervous system depression, narcosis

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: **INTRODUCTION**
# sec-Amyl acetate

<table>
<thead>
<tr>
<th>CAS</th>
<th>626-38-0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CH₃COO(CH₃)C₃H₇</strong></td>
<td>RTECS AJ2100000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
<tr>
<td>1-Methylbutyl acetate, 2-Pentanol acetate, 2-Pentyl ester of acetic acid</td>
<td>1104 129</td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 125 ppm (650 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 125 ppm (650 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 1000 ppm

**Conversion** 1 ppm = 5.33 mg/m³

## Physical Description

Colorless liquid with a mild odor.

- MW: 130.2
- BP: 249°F
- FRZ: -109°F
- Sol: Slight
- VP: 7 mmHg
- IP: ?
- Sp.Gr: 0.87
- Fl.P: 89°F
- UEL: 7.5%
- LEL: 1%

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

## Incompatibilities & Reactivities

Nitrates; strong oxidizers, alkalis & acids

## Measurement Methods

- NIOSH 1450, 2549
- OSHA 7
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

## First Aid

- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

---

This information is derived from the NIOSH Pocket Guide to Chemical Hazards.
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 1000 ppm:

- **(APF = 10)** Any chemical cartridge respirator with organic vapor cartridge(s)*
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor cartridge(s)*
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- **inhalation**, **ingestion**, **skin and/or eye contact**

### Symptoms

- Irritation **eyes**, **skin**, **nose**; **narcosis**; **dermatitis**; **possible kidney, liver injury**; **possible central nervous system depression**

### Target Organs

- **Eyes**, **skin**, **respiratory system**, **kidneys**, **liver**, **central nervous system**

See also: [INTRODUCTION](#)
Aniline (and homologs)  

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>62-53-3</td>
<td>BW6650000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**  
Aminobenzene, Aniline oil, Benzenamine, Phenylamine

**DOT ID & Guide**  
1547 153

**Exposure Limits**  

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>OSHA PEL†: TWA 5 ppm (19 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca [100 ppm]</td>
<td>Conversion 1 ppm = 3.81 mg/m³</td>
</tr>
</tbody>
</table>

**Physical Description**  
Colorless to brown, oily liquid with an aromatic amine-like odor. [Note: A solid below 21°F.]

<table>
<thead>
<tr>
<th>MW</th>
<th>BP</th>
<th>FRZ</th>
<th>Sol</th>
<th>Sp.Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>93.1</td>
<td>363°F</td>
<td>21°F</td>
<td>4%</td>
<td>1.02</td>
</tr>
</tbody>
</table>

**VP**: 0.6 mmHg  
**IP**: 7.70 eV  
**Fl.P**: 158°F  
**UEL**: 11%  
**LEL**: 1.3%

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

**Incompatibilities & Reactivities**  
Strong oxidizers, strong acids, toluene diisocyanate, alkalis

**Measurement Methods**  
NIOSH 2002, 2017, 8317; OSHA PV2079  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**  
(See protection )  
Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: No recommendation  
Provide: Quick drench

**First Aid**  
(See procedures )  
Eye: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**  
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**  
inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**  
Headache, lassitude (weakness, exhaustion), dizziness; cyanosis; ataxia; dyspnea (breathing difficulty) on effort; tachycardia; irritation eyes; methemoglobinemia; cirrhosis; [potential occupational carcinogen]
**Target Organs** Blood, cardiovascular system, eyes, liver, kidneys, respiratory system

**Cancer Site** [bladder cancer]

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## o-Anisidine

<table>
<thead>
<tr>
<th>CAS</th>
<th>90-04-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>BZ5410000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- ortho-Aminoanisole, 2-Anisidine, o-Methoxyaniline [Note: o-Anisidine has been used as a basis for many dyes.]

### Exposure Limits

| NIOSH REL: | Ca 0.5 mg/m³ [skin] See Appendix A |
| OSHA PEL:  | TWA 0.5 mg/m³ [skin]               |

### IDLH

Ca [50 mg/m³]

### Physical Description
Red or yellow, oily liquid with an amine-like odor. [Note: A solid below 41°F.]

- MW: 123.2
- BP: 437°F
- FRZ: 41°F
- Sol(77°F): 1%
- VP: <0.1 mmHg
- IP: 7.44 eV
- Sp.Gr: 1.10
- Fl.P(oc): 244°F
- UEL: ?
- LEL: ?

Class III B Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities
Strong oxidizers

### Measurement Methods
- NIOSH 2514
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Headache, dizziness; cyanosis; red blood cell Heinz bodies; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Blood, kidneys, liver, cardiovascular system, central nervous system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors of the thyroid gland, bladder &amp; kidneys]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## p-Anisidine

<table>
<thead>
<tr>
<th>CAS</th>
<th>104-94-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>BZ5450000</td>
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<tr>
<td>Synonyms &amp; Trade Names</td>
<td>para-Aminoanisole, 4-Anisidine, p-Methoxyaniline</td>
</tr>
</tbody>
</table>

**DOT ID & Guide**

| 2431 153 |

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 0.5 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 0.5 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

**IDLH**

| 50 mg/m³ |

### Physical Description

Yellow to brown, crystalline solid with an amine-like odor.

<table>
<thead>
<tr>
<th>MW</th>
<th>123.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>475°F</td>
</tr>
<tr>
<td>MLT</td>
<td>135°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Moderate</td>
</tr>
<tr>
<td>VP(77°F)</td>
<td>0.006 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>7.44 eV</td>
</tr>
<tr>
<td>Sp.Gr.</td>
<td>1.07</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>?</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
</tbody>
</table>

### Combustible Solid

### Incompatibilities & Reactivities

Strong oxidizers

### Measurement Methods

NIOSH 2514

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Quick drench

### First Aid

(See procedures)

Eye: Irrigate immediately
皮肤: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 5 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 12.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 25 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 50 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode*

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Headache, dizziness; cyanosis; red blood cell Heinz bodies

Target Organs Blood, kidneys, liver, cardiovascular system, central nervous system

See also: INTRODUCTION
### NIOSH Pocket Guide to Chemical Hazards

**Antimony**

<table>
<thead>
<tr>
<th>CAS 7440-36-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS CC4025000</td>
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</table>

#### Synonyms & Trade Names

Antimony metal, Antimony powder, Stibium

#### DOT ID & Guide

- 1549 157 (inorganic compounds, n.o.s.)
- 2871 170 (powder)
- 3141 157 (inorganic liquid compounds, n.o.s.)

#### Exposure Limits

- **NIOSH REL**: TWA 0.5 mg/m³ [*Note: The REL also applies to other antimony compounds (as Sb).]*
- **OSHA PEL**: TWA 0.5 mg/m³ [*Note: The PEL also applies to other antimony compounds (as Sb).]*

**IDLH**: 50 mg/m³ (as Sb)

#### Conversion

<table>
<thead>
<tr>
<th><strong>Physical Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder.</td>
</tr>
</tbody>
</table>

| MW: 121.8 |
| BP: 2975°F |
| MLT: 1166°F |
| Sol: Insoluble |

| VP: 0 mmHg (approx) |
| IP: NA |
| Sp.Gr: 6.69 |

**Noncombustible Solid in bulk form, but a moderate explosion hazard in the form of dust when exposed to flame.**

#### Incompatibilities & Reactivities

Strong oxidizers, acids, halogenated acids [Note: Stibine is formed when antimony is exposed to nascent (freshly formed) hydrogen.]

#### Measurement Methods

NIOSH 7301, 7303, P&CAM261 (II-4) ; OSHA ID121, ID125G, ID206

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation *(See protection )*

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: Daily |

#### First Aid *(See procedures )*

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |
### Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

**Up to 5 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

**Up to 12.5 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 25 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 50 mg/m³:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly

**Target Organs** Eyes, skin, respiratory system, cardiovascular system

See also: [INTRODUCTION](#)
### NIOSH Pocket Guide to Chemical Hazards

#### ANTU

**C₁₀H₇NHC(NH₂)S**

**CAS 86-88-4**

**RTECS YT9275000**

**Synonyms & Trade Names**

- alpha-Naphthyl thiocarbamide
- 1-Naphthyl thiourea
- alpha-Naphthyl thiourea

**DOT ID & Guide**

- 1651 153

### Exposure Limits

- NIOSH REL: TWA 0.3 mg/m³
- OSHA PEL: TWA 0.3 mg/m³
- IDLH 100 mg/m³

### Physical Description

- White crystalline or gray, odorless powder. [rodenticide]
- MW: 202.3
- BP: Decomposes
- MLT: 388°F
- Sol: 0.06%
- VP: Low
- IP: ?
- Sp.Gr: ?
- Fl.P: NA
- UEL: NA
- LEL: NA

**Noncombustible Solid**

### Incompatibilities & Reactivities

- Strong oxidizers, silver nitrate

### Measurement Methods

- NIOSH S276 (II-5)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: Daily

### First Aid

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Conversion
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 3 mg/m³:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 7.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 15 mg/m³:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 100 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion

Symptoms After ingestion of large doses: vomiting, dyspnea (breathing difficulty), cyanosis, coarse pulmonary rales; liver damage

Target Organs respiratory system, blood, liver

See also: INTRODUCTION
Arsenic (inorganic compounds, as As)  

CAS 7440-38-2 (metal)  
RTECS CG0525000 (metal)

Synonyms & Trade Names  
Arsenic metal: Arsenia  
Other synonyms vary depending upon the specific As compound. [Note: OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite & all inorganic compounds containing arsenic except ARSINE.]

DOT ID & Guide  
1558 152 (metal)  
1562 152 (dust)

Exposure Limits  
NIOSH REL: Ca C 0.002 mg/m³ [15-minute] See Appendix A  
OSHA PEL: [1910.1018] TWA 0.010 mg/m³

IDLH Ca [5 mg/m³ (as As)]

Physical Description  
Metal: Silver-gray or tin-white, brittle, odorless solid.

MW: 74.9  
BP: Sublimes  
MLT: 1135°F (Sublimes)  
Sol: Insoluble

VP: 0 mmHg (approx)  
IP: NA  
Sp.Gr: 5.73 (metal)

Incompatibilities & Reactivities  
Strong oxidizers, bromine azide [Note: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.]

Measurement Methods  
NIOSH 7300, 7301, 7303, 7900, 9102; OSHA ID105  
See: NMAM or OSHA Methods

Personal Protection & Sanitation  
Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated/Daily  
Remove: When wet or contaminated  
Change: Daily  
Provide: Eyewash, Quick drench

First Aid  
Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately

Important additional information about respirator selection

Respirator Recommendations  
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, skin and/or eye contact ingestion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Liver, kidneys, skin, lungs, lymphatic system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung &amp; lymphatic cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
<table>
<thead>
<tr>
<th><strong>Arsenic, organic compounds (as As)</strong></th>
<th><strong>CAS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>RTECS</strong></td>
</tr>
<tr>
<td>Synonyms vary depending upon the specific organic arsenic compound.</td>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
<tr>
<td><strong>Exposure Limits</strong></td>
<td><strong>NIOSH REL:</strong> none</td>
</tr>
<tr>
<td></td>
<td><strong>OSHA PEL:</strong> TWA 0.5 mg/m³</td>
</tr>
<tr>
<td><strong>IDLH</strong> N.D.</td>
<td><strong>Conversion</strong></td>
</tr>
<tr>
<td><strong>Physical Description</strong></td>
<td><strong>Measurement Methods</strong></td>
</tr>
<tr>
<td>Appearance and odor vary depending upon the specific organic arsenic compound.</td>
<td>NIOSH 5022</td>
</tr>
<tr>
<td>Properties vary depending upon the specific organic arsenic compound.</td>
<td>See: NMAM or OSHA Methods</td>
</tr>
<tr>
<td><strong>Incompatibilities &amp; Reactivities</strong></td>
<td><strong>First Aid</strong></td>
</tr>
<tr>
<td>Varies</td>
<td><strong>See procedures</strong></td>
</tr>
<tr>
<td></td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td></td>
<td>Skin: Soap wash immediately</td>
</tr>
<tr>
<td></td>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td></td>
<td>Swallow: Medical attention immediately</td>
</tr>
<tr>
<td><strong>Personal Protection &amp; Sanitation</strong></td>
<td><strong>Important additional information about respirator selection</strong></td>
</tr>
<tr>
<td>(See protection)</td>
<td>Respirator Recommendations Not available.</td>
</tr>
<tr>
<td>Recommendations regarding personal protective clothing vary depending upon the specific compound.</td>
<td>Exposure Routes inhalation, ingestion, skin and/or eye contact</td>
</tr>
<tr>
<td>Recommendations regarding eye protection vary depending upon the specific compound.</td>
<td></td>
</tr>
</tbody>
</table>
### Symptoms
In animals: irritation skin, possible dermatitis; respiratory distress; diarrhea; kidney damage; muscle tremor, convulsions; possible gastrointestinal tract, reproductive effects; possible liver damage

### Target Organs
Skin, respiratory system, kidneys, central nervous system, liver, gastrointestinal tract, reproductive system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Arsine

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>7784-42-1</td>
</tr>
<tr>
<td>RTECS</td>
<td>CG6475000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2188 119</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Arsenic hydride, Arsenic trihydride, Arseniuretted hydrogen, Arsenous hydride, Hydrogen arsenide

### Exposure Limits
- NIOSH REL: Ca C 0.002 mg/m³ [15-minute] See Appendix A
- OSHA PEL: TWA 0.05 ppm (0.2 mg/m³)
- IDLH Ca [3 ppm]

### Conversion
1 ppm = 3.19 mg/m³

### Physical Description
Colorless gas with a mild, garlic-like odor. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>78.0</td>
</tr>
<tr>
<td>BP</td>
<td>-81°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-179°F</td>
</tr>
<tr>
<td>Sol</td>
<td>20%</td>
</tr>
<tr>
<td>VP(70°F)</td>
<td>14.9 atm</td>
</tr>
<tr>
<td>IP</td>
<td>9.89 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>2.69</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA (Gas)</td>
</tr>
<tr>
<td>UEL</td>
<td>78%</td>
</tr>
<tr>
<td>LEL</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
- Strong oxidizers, chlorine, nitric acid [Note: Decomposes above 446°F. There is a high potential for the generation of arsine gas when inorganic arsenic is exposed to nascent (freshly formed) hydrogen.]

### Measurement Methods
NIOSH 6001 ; OSHA ID105
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
**Skin:** Frostbite
**Eyes:** Frostbite
**Wash skin:** No recommendation
**Remove:** When wet (flammable)
**Change:** No recommendation
**Provide:** Frostbite wash

### First Aid
**Eye:** Frostbite
**Skin:** Frostbite
**Breathing:** Respiratory support

### Important additional information about respirator selection
**Respirator Recommendations NIOSH**
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
inhalation, skin and/or eye contact (liquid)
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Headache, malaise (vague feeling of discomfort), lassitude (weakness, exhaustion), dizziness; dyspnea (breathing difficulty); abdominal, back pain; nausea, vomiting; bronze skin; hematuria (blood in the urine); jaundice; peripheral neuropathy; liquid: frostbite; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Blood, kidneys, liver</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>lung &amp; lymphatic cancer</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
Asbestos

Hydrated mineral silicates

Syonyms & Trade Names
Actinolite, Actinolite asbestos, Amosite (cummingtonite-grunerite), Anthophyllite, Anthophyllite asbestos, Chrysotile, Crocidolite (Riebeckite), Tremolite, Tremolite asbestos

DOT ID & Guide
2212 171 (blue, brown)
2590 171 (white)

Exposure Limits
NIOSH REL: Ca See Appendix A See Appendix C
OSHA PEL: [1910.1001] [1926.1101] See Appendix C
IDLH Ca [N.D.]

Conversion

Physical Description
White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite) fibrous, odorless solids.

MW: Varies
BP: Decomposes
MLT: 1112°F (Decomposes)
Sol: Insoluble
VP: 0 mmHg (approx)
IP: NA
Sp.Gr: ?
FIP: NA
UEL: NA
LEL: NA

Incompatibilities & Reactivities
None reported

Measurement Methods
NIOSH 7400, 7402; OSHA ID160, ID191
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: No recommendation
Change: Daily

First Aid (See procedures)
Eye: Irrigate immediately
Breathing: Fresh air

Important additional information about respirator selection
Respirator Recommendations (See Appendix E) NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Asbestosis (chronic exposure): dyspnea (breathing difficulty), interstitial fibrosis, restricted pulmonary function, finger clubbing; irritation eyes; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>respiratory system, eyes</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Asphalt fumes

<table>
<thead>
<tr>
<th>CAS</th>
<th>8052-42-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>CI9900000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1999 130 (asphalt)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Asphalt: Asphaltum, Bitumen (European term), Petroleum asphalt, Petroleum bitumen, Road asphalt, Roofing asphalt

### Exposure Limits
- NIOSH REL: Ca C 5 mg/m³ [15-minute] See Appendix A
- OSHA PEL: none

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Ca [N.D.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description
Fumes generated during the production or application of asphalt (a dark-brown to black cement-like substance manufactured by the vacuum distillation of crude petroleum oil).

Properties vary depending upon the specific asphalt formulation or mixture.

Asphalt: Combustible Solid

### Incompatibilities & Reactivities
None reported [Note: Asphalt becomes molten at about 200°F.]

### Measurement Methods
- NIOSH 5042
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** Daily
**Remove:** No recommendation
**Change:** Daily

**First Aid**
- Eye: Irrigate immediately
- Breathing: Respiratory support

### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, respiratory system; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, respiratory system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: skin tumors]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# Atrazine

**CAS** 1912-24-9  
**RTECS** XY5600000

### Synonyms & Trade Names
2-Chloro-4-ethylamino-6-isopropylamino-s-triazine; 6-Chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine

### DOT ID & Guide
2763 151 (triazine pesticide)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 5 mg/m³</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

### Physical Description
Colorless or white, odorless, crystalline powder. [herbicide]

- MW: 215.7  
- BP: Decomposes  
- MLT: 340°F  
- Sol: 0.003%  
- VP: 0.0000003 mmHg  
- IP: NA  
- Sp.Gr: 1.19  
- Fl.P: NA  
- UEL: NA  
- LEL: NA

Noncombustible Solid, but may be mixed with flammable liquids.

### Incompatibilities & Reactivities
Strong acids, strong bases

### Measurement Methods
NIOSH 5602, 8315  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact  
- Eyes: Prevent eye contact  
- Wash skin: When contaminated  
- Remove: When wet or contaminated  
- Change: Daily  
- Provide: Eyewash, Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately  
- Skin: Soap wash immediately  
- Breathing: Respiratory support  
- Swallow: Medical attention immediately

### Important additional information about respirator selection
Respirator Recommendations: Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin; dermatitis, sensitization skin; dyspnea (breathing difficulty), lassitude (weakness, exhaustion), incoordination, salivation; hypothermia; liver injury

### Target Organs
Eyes, skin, respiratory system, central nervous system, liver

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Azinphos-methyl

<table>
<thead>
<tr>
<th>CAS</th>
<th>86-50-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>TE1925000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>O,O-Dimethyl-S-4-oxo-1,2,3-benzotriazin-3(4H)-ylmethyl phosphorodithioate; Guthion®; Methyl azinphos</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2783 152 (organophosphorus pesticide, solid, toxic)</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 0.2 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 0.2 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

| IDLH      | 10 mg/m³ |

### Physical Description

Colorless crystals or a brown, waxy solid. [insecticide]

- MW: 317.3
- BP: Decomposes
- MLT: 163°F
- Sol: 0.003%
- VP: $8 \times 10^{-9}$ mmHg
- IP: ?
- Sp.Gr: 1.44
- Fl.P: NA
- UEL: NA
- LEL: NA

Noncombustible Solid

### Incompatibilities & Reactivities

Strong oxidizers, acids

### Measurement Methods

NIOSH 5600; OSHA PV2087

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Quick drench

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Symptoms</th>
<th>Target Organs</th>
<th>See also</th>
</tr>
</thead>
<tbody>
<tr>
<td>inhalation, skin absorption, ingestion, skin and/or eye contact</td>
<td>Miosis; ache eyes; blurred vision, lacrimation (discharge of tears), rhinorrhea (discharge of thin mucus); headache; tightness chest, wheezing, laryngeal spasm; salivation; cyanosis; anorexia; nausea, vomiting, diarrhea; sweating; twitching, paralysis, convulsions; low blood pressure, cardiac irregularities</td>
<td>respiratory system, central nervous system, cardiovascular system, blood cholinesterase</td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Barium chloride (as Ba)

<table>
<thead>
<tr>
<th>CAS</th>
<th>CAS 10361-37-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RTECS CQ8750000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Barium dichloride

### DOT ID & Guide
- 1564 154 (barium compound, n.o.s.)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*</th>
<th>TWA 0.5 mg/m³ [Note: The REL also applies to other soluble barium compounds (as Ba) except Barium sulfate.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL*</td>
<td>TWA 0.5 mg/m³ [Note: The PEL also applies to other soluble barium compounds (as Ba) except Barium sulfate.]</td>
</tr>
</tbody>
</table>

### IDLH
- 50 mg/m³ (as Ba)

## Physical Description

- White, odorless solid.

### Conversion

<table>
<thead>
<tr>
<th>MW</th>
<th>BP: 2840°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>208.2</td>
<td>1765°F</td>
</tr>
<tr>
<td>VP</td>
<td>Low</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>3.86</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
- Noncombustible Solid
- Acids, oxidizers

### Measurement Methods

- NIOSH 7056, 7303; OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

| Skin | Prevent skin contact |
| Eyes | Prevent eye contact |
| Wash skin | When contaminated |
| Remove | When wet or contaminated |
| Change | Daily |

### First Aid

| Eye | Irrigate immediately |
| Skin | Water flush immediately |
| Breathing | Respiratory support |
| Swallow | Medical attention immediately |

---

*Note: The REL also applies to other soluble barium compounds (as Ba) except Barium sulfate.*

*Note: The PEL also applies to other soluble barium compounds (as Ba) except Barium sulfate.*
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 5 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

#### Up to 12.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

#### Up to 25 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

#### Up to 50 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)
# Barium nitrate (as Ba)

<table>
<thead>
<tr>
<th>CAS 10022-31-8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ba(NO₃)₂</strong></td>
</tr>
<tr>
<td>RTECS CQ9625000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
Barium dinitrate, Barium(II) nitrate (1:2), Barium salt of nitric acid

## DOT ID & Guide
1446 141

## Exposure Limits
- **NIOSH REL**: TWA 0.5 mg/m³ [*Note: The REL also applies to other soluble barium compounds (as Ba) except Barium sulfate.]*
- **OSHA PEL**: TWA 0.5 mg/m³ [*Note: The PEL also applies to other soluble barium compounds (as Ba) except Barium sulfate.]*

**IDLH**: 50 mg/m³ (as Ba)

## Conversion

## Physical Description
White, odorless solid.

- **MW**: 261.4
- **BP**: Decomposes
- **MLT**: 1094°F
- **Sol**: 9%
- **VP**: Low
- **IP**: ?
- **Sp.Gr**: 3.24
- **UEL**: NA
- **LEL**: NA

Noncombustible Solid, but will accelerate the burning of combustible materials.

## Incompatibilities & Reactivities
Acids, oxidizers, aluminum-magnesium alloys, (barium dioxide + zinc) [Note: Contact with combustible material may cause fire.]

## Measurement Methods
NIOSH 7056; OSHA ID121
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily

## First Aid
(See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Water flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 5 mg/m\(^3\):**

(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

**Up to 12.5 mg/m\(^3\):**

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 25 mg/m\(^3\):**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 50 mg/m\(^3\):**

(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes

**inhalation, ingestion, skin and/or eye contact**

### Symptoms

Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia

### Target Organs

Eyes, skin, respiratory system, heart, central nervous system

See also: [INTRODUCTION](#)
### NIOSH Pocket Guide to Chemical Hazards

**Barium sulfate**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7727-43-7</td>
<td>CR0600000</td>
<td>1564 154 (barium compound, n.o.s.)</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Artificial barite, Barite, Barium salt of sulfuric acid, Barytes (natural)

**Exposure Limits**
- NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)
- OSHA PEL†: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)
- IDLH: N.D.

**Physical Description**
- White or yellowish, odorless powder.
- MW: 233.4
- BP: 2912°F (Decomposes)
- MLT: 2876°F
- Sol(64°F): 0.0002%
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 4.25-4.5

**Incompatibilities & Reactivities**
- Noncombustible Solid
- Phosphorus, aluminum [Note: Aluminum in the presence of heat can cause an explosion.]

**Measurement Methods**
- NIOSH 0500, 0600
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: Daily
- Remove: No recommendation
- Change: No recommendation
- Provide: Eyewash, Quick drench

**First Aid**
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations**
- Not available.

**Exposure Routes**
- Inhalation, skin and/or eye contact

**Symptoms**
- Irritation eyes, nose, upper respiratory system; benign pneumoconiosis (baritosis)

**Target Organs**
- Eyes, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Benomyl

<table>
<thead>
<tr>
<th>CAS</th>
<th>17804-35-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>DD6475000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate

### DOT ID & Guide
- 2757 151 (carbamate pesticide, solid)

### Exposure Limits
- NIOSH REL: See Appendix D
- OSHA PEL†: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)

### Physical Description
- White crystalline solid with a faint, acrid odor. (fungicide) [Note: Decomposes without melting above 572°F.]
- MW: 290.4
- BP: Decomposes
- MLT: >572°F (Decomposes)
- Sol: 0.0004%
- VP: <0.00001 mmHg
- IP: NA
- FI.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Heat, strong acids, strong alkalis

### Measurement Methods
- NIOSH 0500, 0600; OSHA PV2107
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### Important additional information about respirator selection

### Respirator Recommendations
- Not available.

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, upper respiratory system; skin sensitization; possible reproductive, teratogenic effects

### Target Organs
- Eyes, skin, respiratory system, reproductive system

See also: INTRODUCTION
### Benzene

<table>
<thead>
<tr>
<th>CAS</th>
<th>71-43-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>CY1400000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Benzol, Phenyl hydride</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1114 130</td>
</tr>
</tbody>
</table>

#### Exposure Limits

- **NIOSH REL:** Ca TWA 0.1 ppm ST 1 ppm  
  See Appendix A
- **OSHA PEL:** [1910.1028] TWA 1 ppm ST 5 ppm  
  See Appendix F

| IDLH Ca [500 ppm] | Conversion 1 ppm = 3.19 mg/m³ |

#### Physical Description

Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

- MW: 78.1
- BP: 176°F
- FRZ: 42°F
- Sol: 0.07%
- VP: 75 mmHg
- IP: 9.24 eV
- Sp.Gr: 0.88
- Fl.P: 12°F
- UEL: 7.8%
- LEL: 1.2%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities

Strong oxidizers, many fluorides & perchlorates, nitric acid

#### Measurement Methods

NIOSH 1500, 1501, 3700, 3800; OSHA 12, 1005

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

(See protection)

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

#### First Aid

(See procedures)

- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

#### Important additional information about respirator selection

Respirator Recommendations

(See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms

Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, blood, central nervous system, bone marrow</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[leukemia]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION]
## NIOSH Pocket Guide to Chemical Hazards

### Benzenethiol

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-98-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>DC0525000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Mercaptobenzene, Phenyl mercaptan, Thiophenol</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2337 131</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: | 0.1 ppm (0.5 mg/m³) [15-minute] |
| OSHA PEL†: | none |

| IDLH N.D. | Conversion 1 ppm = 4.51 mg/m³ |

### Physical Description

- Water-white liquid with an offensive, garlic-like odor. [Note: A solid below 5°F.]
- MW: 110.2
- BP: 336°F
- FRZ: 5°F
- Sol(77°F): 0.08%
- VP(65°F): 1 mmHg
- IP: 8.33 eV
- Sp.Gr: 1.08
- Fl.P: 132°F
- UEL: ?
- LEL: ?

**Class II Combustible Liquid:** Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

- Strong acids & bases, calcium hypochlorite, alkali metals [Note: Oxidizes on exposure to air.]

### Measurement Methods

- OSHA PV2075
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures )

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 1 ppm:**
- \( \text{APF} = 10 \) Any chemical cartridge respirator with organic vapor cartridge(s)
- \( \text{APF} = 10 \) Any supplied-air respirator

**Up to 2.5 ppm:**
- \( \text{APF} = 25 \) Any supplied-air respirator operated in a continuous-flow mode
- \( \text{APF} = 25 \) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 5 ppm:**
- \( \text{APF} = 50 \) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- \( \text{APF} = 50 \) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- \( \text{APF} = 50 \) Any self-contained breathing apparatus with a full facepiece
- \( \text{APF} = 50 \) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- \( \text{APF} = 10,000 \) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- \( \text{APF} = 10,000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; dermatitis; cyanosis; cough, wheezing, dyspnea (breathing difficulty), pulmonary edema, pneumonitis; headache, dizziness, central nervous system depression; nausea, vomiting; kidney, liver, spleen damage

### Target Organs
- Eyes, skin, respiratory system, central nervous system, kidneys, liver, spleen

See also: [INTRODUCTION](#)
**NIOSH Pocket Guide to Chemical Hazards**

### Benzidine

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>92-87-5</th>
</tr>
</thead>
</table>

**NH₂C₆H₄C₆H₄NH₂**

**Synonyms & Trade Names**

Benzidine-based dyes; 4,4'-Bianiline; 4,4'-Biphenyldiamine; 1,1'-Biphenyl-4,4'-diamine; 4,4'-Diaminobiphenyl; p-Diaminodiphenyl

[Note: Benzidine has been used as a basis for many dyes.]

**DOT ID & Guide**

1885 153

---

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>See Appendix A</th>
<th>See Appendix C</th>
</tr>
</thead>
</table>

| OSHA PEL: [1910.1010] | See Appendix B | See Appendix C |

**IDLH**

Ca [N.D.]

**Conversion**

---

### Physical Description

Grayish-yellow, reddish-gray, or white crystalline powder. [Note: Darkens on exposure to air and light.]

**MW:** 184.3  
**BP:** 752°F  
**MLT:** 239°F  
**Sol:** 0.04\% (54°F)

**VP:** Low  
**IP:** ?  
**UEL:** ?  
**LEL:** ?

**Combustible Solid, but difficult to burn.**

### Incompatibilities & Reactivities

Red fuming nitric acid

---

### Measurement Methods

NIOSH 5509 ; OSHA 65

See: NMAM or OSHA Methods

---

### Personal Protection & Sanitation

[See protection ]

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated/Daily  
**Remove:** When wet or contaminated  
**Change:** Daily  
**Provide:** Eyewash, Quick drench

---

### First Aid

[See procedures ]

**Eye:** Irrigate immediately  
**Skin:** Soap wash immediately  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

---

### Important additional information about respirator selection

**Respirator Recommendations**

(See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here] for information on selection of N, R, or P filters. /Any appropriate escape-type, self-contained breathing apparatus

---

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Hematuria (blood in the urine); secondary anemia from hemolysis; acute cystitis; acute liver disorders; dermatitis; painful, irregular urination; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Bladder, skin, kidneys, liver, blood</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[liver, kidney &amp; bladder cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Benzoyl peroxide

**CAS**: 94-36-0

**RTECS**: DM8575000

**Synonyms & Trade Names**
- Benzoperoxide, Dibenzoyl peroxide

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 5 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: TWA 5 mg/m³</td>
</tr>
</tbody>
</table>

**IDLH**: 1500 mg/m³

<table>
<thead>
<tr>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Physical Description**
- Colorless to white crystals or a granular powder with a faint, benzaldehyde-like odor.
- **MW**: 242.2
- **BP**: Decomposes explosively
- **MLT**: 217°F
- **Sol**: <1%
- **VP**: <1 mmHg
- **IP**: ?
- **Sp.Gr**: 1.33
- **FI.P**: 176°F
- **UEL**: ?
- **LEL**: ?

**Combustible Solid (easily ignited and burns very rapidly).**

**Incompatibilities & Reactivities**
- Combustible substances (wood, paper, etc.), acids, alkalis, alcohols, amines, ethers
  - [Note: Containers may explode when heated. Extremely explosion-sensitive to shock, heat & friction.]

**Measurement Methods**
- NIOSH 5009
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily

**First Aid**

- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 50 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

**Up to 125 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*  
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

**Up to 250 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.  
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*  
- (APF = 50) Any self-contained breathing apparatus with a full facepiece  
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1500 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, mucous membrane; sensitization dermatitis

### Target Organs
- Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# Benzyl chloride

<table>
<thead>
<tr>
<th>CAS</th>
<th>100-44-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>XS8925000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Chloromethylbenzene, alpha-Chlorotoluene

## DOT ID & Guide
- 1738 156

## Exposure Limits
- **NIOSH REL:** C 1 ppm (5 mg/m³) [15-minute]
- **OSHA PEL:** TWA 1 ppm (5 mg/m³)
- **IDLH:** 10 ppm
- **Conversion:** 1 ppm = 5.18 mg/m³

## Physical Description
Colorless to slightly yellow liquid with a pungent, aromatic odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW:</td>
<td>126.6</td>
</tr>
<tr>
<td>BP:</td>
<td>354°F</td>
</tr>
<tr>
<td>FRZ:</td>
<td>-38°F</td>
</tr>
<tr>
<td>Sol:</td>
<td>0.05%</td>
</tr>
<tr>
<td>VP:</td>
<td>1 mmHg</td>
</tr>
<tr>
<td>IP:</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr:</td>
<td>1.10</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>153°F</td>
</tr>
<tr>
<td>UEL:</td>
<td>?</td>
</tr>
<tr>
<td>LEL:</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

## Incompatibilities & Reactivities
- Oxidizers, acids, copper, aluminum, magnesium, iron, zinc, tin [Note: Can polymerize when in contact with all common metals except nickel & lead. Hydrolyzes in H₂O to benzyl alcohol.]

## Measurement Methods
- NIOSH 1003 ; OSHA 7
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

## First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 10 ppm:

- **(APF = 10)** Any chemical cartridge respirator with organic vapor and acid gas cartridge(s)*
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor and acid gas canister
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor and acid gas cartridge(s)*
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor and acid gas canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

| Inhalation, ingestion, skin and/or eye contact |

### Symptoms

- Irritation eyes, skin, nose; lassitude (weakness, exhaustion); irritability; headache; skin eruption; pulmonary edema

### Target Organs

- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
## Beryllium & beryllium compounds (as Be)

<table>
<thead>
<tr>
<th>Be (metal)</th>
<th>CAS 7440-41-7 (metal)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>RTECS DS1750000 (metal)</td>
</tr>
<tr>
<td>Beryllium metal: Beryllium</td>
<td>DOT ID &amp; Guide 1566 154 (compounds)</td>
</tr>
<tr>
<td>Other synonyms vary depending upon the specific beryllium compound.</td>
<td>1567 134 (powder)</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca Not to exceed 0.0005 mg/m³ See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: TWA 0.002 mg/m³ C 0.005 mg/m³ 0.025 mg/m³ [30-minute maximum peak]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca [4 mg/m³ (as Be)]</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description

Metal: A hard, brittle, gray-white solid.

| MW: 9.0 | BP: 4532°F | MLT: 2349°F | Sol: Insoluble |
| VP: 0 mmHg (approx) | IP: NA | |
| Sp.Gr: 1.85 (metal) | |

Metal: Noncombustible. Solid in bulk form, but a slight explosion hazard in the form of a powder or dust.

### Incompatibilities & Reactivities

Acids, caustics, chlorinated hydrocarbons, oxidizers, molten lithium

### Measurement Methods

NIOSH 7102, 7300, 7301, 7303, 9102; OSHA ID125G, ID206

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** Daily
**Remove:** When wet or contaminated
**Change:** Daily
**Provide:** Eyewash

### First Aid

(See procedures)

**Eye:** Irrigate immediately
**Breathing:** Fresh air

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[lung cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>Bismuth telluride, doped with Selenium sulfide (as Bi$_2$Te$_3$)</strong></th>
<th><strong>CAS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>RTECS</strong></td>
</tr>
<tr>
<td>Doped bismuth sesquitelluride, Doped bismuth telluride, Doped bismuth tritelluride, Doped tellurobismuthite [Note: Doped with selenium sulfide. Commercial mix may contain 80% Bi$_2$Te$_3$, 20% stannous telluride, plus some tellurium.]</td>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th><strong>NIOSH REL</strong>: TWA 5 mg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
<td><strong>Conversion</strong></td>
</tr>
<tr>
<td><strong>IDLH</strong> N.D.</td>
<td><strong>Sp.Gr</strong>: ?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Physical Description</strong></th>
<th><strong>Noncombustible Solid</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray, crystalline solid that has been enhanced (doped) with a small amount of selenium sulfide (SeS). [Note: Doping alters the conductivity of a semiconductor.]</td>
<td><strong>Incompatibilities &amp; Reactivities</strong></td>
</tr>
<tr>
<td>Properties are unavailable but should be similar to Bismuth telluride, undoped.</td>
<td>Strong oxidizers, moisture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Measurement Methods</strong></th>
<th><strong>NIOSH 0500 ; OSHA ID121</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>See: NMAM or OSHA Methods</td>
<td><strong>First Aid</strong> (See procedures)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Personal Protection &amp; Sanitation</strong> (See protection)</th>
<th><strong>Eye</strong>: Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
<td>Skin: Soap wash immediately</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
<td>Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
<td><strong>Important additional information about respirator selection</strong></td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td><strong>Respirator Recommendations</strong> Not available.</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
<td><strong>Exposure Routes</strong> inhalation, skin and/or eye contact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th><strong>In animals</strong>: pulmonary lesions (nonfibrotic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritation eyes, skin, upper respiratory system; garlic breath</td>
<td><strong>Target Organs</strong> Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DOT ID &amp; Guide</strong></th>
<th><strong>Conversion</strong></th>
</tr>
</thead>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Bismuth telluride, undoped

<table>
<thead>
<tr>
<th>CAS</th>
<th>1304-82-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>EB31100000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Bismuth sesquitelluride, Bismuth telluride, Bismuth tritelluride, Tellurobismuthite

### Exposure Limits

| NIOSH REL | TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL  | TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

| IDLH       | N.D. |
| Conversion |       |

### Physical Description
- Gray, crystalline solid.
- MW: 800.8
- BP: ?
- MLT: 1063°F
- Sp.Gr: 7.7
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- UEL: NA
- LEL: NA
- Noncombustible Solid

### Incompatibilities & Reactivities
- Strong oxidizers (e.g., bromine, chlorine, or fluorine), moisture, nitric acid (decomposes)

### Measurement Methods
- NIOSH 0500, 0600; OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations
- Not available.

### Exposure Routes
- Inhalation, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, upper respiratory system; garlic breath

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

<table>
<thead>
<tr>
<th>Borates, tetra, sodium salts (Anhydrous)</th>
<th>CAS 1330-43-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na&lt;sub&gt;2&lt;/sub&gt;B&lt;sub&gt;4&lt;/sub&gt;O&lt;sub&gt;7&lt;/sub&gt;</td>
<td>RTECS ED4588000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Anhydrous borax, Borax dehydrated, Disodium salt of boric acid, Disodium tetraborate, Fused borax, Sodium borate (anhydrous), Sodium tetraborate

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 1 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

**Physical Description**
White to gray, odorless powder. [herbicide] [Note: Becomes opaque on exposure to air.]

| MW: 201.2      | BP: 2867°F (Decomposes) |
| VP: 0 mmHg (approx) | IP: NA |
| Fl.P: NA   | UEL: NA |
|             | Sol: 4% |
|             | Sp.Gr: 2.37 |

**Noncombustible Solid**

**Incompatibilities & Reactivities**
Moisture [Note: Forms partial hydrate in moist air.]

**Measurement Methods**
NIOSH 0500 ; OSHA ID125G
See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection )**
Skin: No recommendation
Eyes: No recommendation
Wash skin: Daily
Remove: No recommendation
Change: Daily

**First Aid (See procedures )**
Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**
Respirator Recommendations Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, upper respiratory system; dermatitis; epistaxis (nosebleed); cough, dyspnea (breathing difficulty)

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
# Borates, tetra, sodium salts (Decahydrate)

<table>
<thead>
<tr>
<th>CAS</th>
<th>1303-96-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>RTECS</td>
</tr>
<tr>
<td>RTECS</td>
<td>VZ2275000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Borax, Borax decahydrate, Sodium borate decahydrate, Sodium tetraborate decahydrate</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 5 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.D.</td>
<td></td>
</tr>
</tbody>
</table>

## Physical Description

White, odorless, crystalline solid. [herbicide] [Note: Becomes anhydrous at 608°F.]

<table>
<thead>
<tr>
<th>MW</th>
<th>381.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>608°F</td>
</tr>
<tr>
<td>MLT</td>
<td>167°F</td>
</tr>
<tr>
<td>Sol</td>
<td>6%</td>
</tr>
<tr>
<td>VP</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr.</td>
<td>1.73</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid (an inherent fire retardant).

## Incompatibilities & Reactivities

Zirconium, strong acids, metallic salts

## Measurement Methods

NIOSH 0500 ; OSHA ID125G

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

(See protection )

<table>
<thead>
<tr>
<th>Skin:</th>
<th>No recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes:</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Wash skin:</td>
<td>Daily</td>
</tr>
<tr>
<td>Remove:</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Change:</td>
<td>Daily</td>
</tr>
</tbody>
</table>

## First Aid

(See procedures )

<table>
<thead>
<tr>
<th>Eye:</th>
<th>Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin:</td>
<td>Soap wash</td>
</tr>
<tr>
<td>Breathing:</td>
<td>Respiratory support</td>
</tr>
<tr>
<td>Swallow:</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>

## Important additional information about respirator selection

Respirator Recommendations Not available.

## Exposure Routes

inhalation, ingestion, skin and/or eye contact

## Symptoms

Irritation eyes, skin, upper respiratory system; dermatitis; epistaxis (nosebleed); cough, dyspnea (breathing difficulty)

## Target Organs

Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Borates, tetra, sodium salts (Pentahydrate)

**CAS** 12179-04-3

**Na$_2$B$_4$O$_7$ • 5H$_2$O**

**RTECS** VZ2540000

**Synonyms & Trade Names**
- Borax pentahydrate
- Sodium borate pentahydrate
- Sodium tetraborate pentahydrate

**DOT ID & Guide**

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 1 mg/m$^3$</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.D.</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description

Colorless or white, odorless crystals or free-flowing powder. [herbicide] [Note: Begins to lose water of hydration at 252°F.]

<table>
<thead>
<tr>
<th>MW</th>
<th>BP</th>
<th>MLT</th>
<th>Sol</th>
<th>Sp.Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>291.4</td>
<td>?</td>
<td>392°F</td>
<td>3%</td>
<td>1.82</td>
</tr>
</tbody>
</table>

Noncombustible Solid

### Incompatibilities & Reactivities

None reported [However, see the reactivities & incompatibilities reported for the related substance Borax decahydrate above.]

### Measurement Methods

NIOSH 0500 ; OSHA ID125G

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: Daily
- Remove: No recommendation
- Change: Daily

### First Aid (See procedures )

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, upper respiratory system; dermatitis; epistaxis (nosebleed); cough, dyspnea (breathing difficulty)

### Target Organs

Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Boron oxide

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>1303-86-2</td>
</tr>
<tr>
<td>RTECS</td>
<td>ED7900000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Boric anhydride, Boric oxide, Boron trioxide

### Exposure Limits
- NIOSH REL: TWA 10 mg/m³
- OSHA PEL: TWA 15 mg/m³
- IDLH: 2000 mg/m³

### Physical Description
Colorless, semitransparent lumps or hard, white, odorless crystals.

- MW: 69.6
- BP: 3380°F
- MLT: 842°F
- Sol: 3%
- IP: 13.50 eV
- Sp.Gr: 2.46
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Water [Note: Reacts slowly with water to form boric acid.]

### Measurement Methods
- NIOSH 0500
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Fresh air
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH

**Up to 50 mg/m³**:  
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.*

**Up to 100 mg/m³**:  
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.*  
(APF = 10) Any supplied-air respirator*

**Up to 250 mg/m³**:  
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*  
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

**Up to 500 mg/m³**:  
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.  
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*  
(APF = 50) Any self-contained breathing apparatus with a full facepiece  
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 2000 mg/m³**:  
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions**:  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:  
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; cough; conjunctivitis; skin erythema (skin redness)

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Boron tribromide

<table>
<thead>
<tr>
<th>CAS number</th>
<th>RTECS code</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>10294-33-4</td>
<td>ED74000000</td>
<td>2692 157</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Boron bromide, Tribromoborane

### Exposure Limits
- NIOSH REL: C 1 ppm (10 mg/m³)
- OSHA PEL†: none
- IDLH: N.D.

### Conversion
- 1 ppm = 10.25 mg/m³

### Physical Description
- Colorless, fuming liquid with a sharp, irritating odor.
- MW: 250.5
- BP: 194°F
- FRZ: -51°F
- Sol: Decomposes
- VP(57°F): 40 mmHg
- IP: 9.70 eV
- Sp.Gr(65°F): 2.64
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Moisture, water, heat, potassium, sodium, alcohols
  - [Note: Attacks metals, wood & rubber. Reacts with water to form boric acid and hydrogen bromide.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations
- Not available.

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; eye, skin burns; dyspnea (breathing difficulty), pulmonary edema

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Boron trifluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>7637-07-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>ED2275000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Boron fluoride, Trifluoroborane</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1008 125</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>C 1 ppm (3 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>C 1 ppm (3 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 25 ppm  
**Conversion** 1 ppm = 2.77 mg/m³

### Physical Description

Colorless gas with a pungent, suffocating odor. [Note: Forms dense white fumes in moist air. Shipped as a nonliquefied compressed gas.]

- **MW:** 67.8
- **BP:** -148°F
- **FRZ:** -196°F
- **Sol:** 106% (in cold H₂O)
- **VP:** >50 atm
- **IP:** 15.50 eV
- **RGasD:** 2.38
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

Nonflammable Gas

### Incompatibilities & Reactivities

Alkali metals, calcium oxide [Note: Hydrolyzes in moist air or hot water to form boric acid, hydrogen fluoride & fluoboric acid.]

### Measurement Methods

None available  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** No recommendation  
**Eyes:** No recommendation  
**Wash skin:** No recommendation  
**Remove:** No recommendation  
**Change:** No recommendation  

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Water flush immediately  
**Breathing:** Respiratory support
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 10 ppm:**
- \( \text{APF} = 10 \) Any supplied-air respirator*

**Up to 25 ppm:**
- \( \text{APF} = 25 \) Any supplied-air respirator operated in a continuous-flow mode*
- \( \text{APF} = 50 \) Any self-contained breathing apparatus with a full facepiece
- \( \text{APF} = 50 \) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- \( \text{APF} = 10,000 \) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- \( \text{APF} = 10,000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

---

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, nose, respiratory system; epistaxis (nosebleed); eye, skin burns; in animals: pneumonitis; kidney damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, kidneys</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
### Bromacil

<table>
<thead>
<tr>
<th>CAS</th>
<th>314-40-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>YQ9100000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>5-Bromo-3-sec-butyl-6-methyluracil, 5-Bromo-6-methyl-3-(1-methylpropyl)uracil</td>
</tr>
</tbody>
</table>

#### Exposure Limits

- **NIOSH REL**: TWA 1 ppm (10 mg/m³)
- **OSHA PEL†**: none
- **IDLH**: N.D.

**Conversion**: 1 ppm = 10.68 mg/m³

#### Physical Description

- Odorless, colorless to white, crystalline solid. [herbicide] [Note: Commercially available as a wett able powder or in liquid formulations.]
- MW: 261.2
- BP: Sublimes
- MLT: 317°F (Sublimes)
- Sol(77°F): 0.08%
- VP(212°F): 0.0008 mmHg
- IP: ?
- Sp.Gr: 1.55
- F.L.P: NA
- UEL: NA
- LEL: NA

- Noncombustible Solid, but may be dissolved in flammable liquids.

#### Incompatibilities & Reactivities

- Strong acids (decomposes slowly), oxidizers, heat, sparks, open flames

#### Measurement Methods

- NIOSH 0500
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection )

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

#### First Aid (See procedures )

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations**: Not available.

#### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

#### Symptoms

- Irritation eyes, skin, upper respiratory system; in animals: thyroid injury

#### Target Organs

- Eyes, skin, respiratory system, thyroid

See also: INTRODUCTION
# Bromine

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Br₂</td>
<td>7726-95-6</td>
<td>EF91000000</td>
<td>1744 154</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Molecular bromine

## Exposure Limits
- **NIOSH REL**: TWA 0.1 ppm (0.7 mg/m³) ST 0.3 ppm (2 mg/m³)
- **OSHA PEL†**: TWA 0.1 ppm (0.7 mg/m³)

**IDLH**: 3 ppm

**Conversion**: 1 ppm = 6.54 mg/m³

## Physical Description
- Dark reddish-brown, fuming liquid with suffocating, irritating fumes.

**MW**: 159.8  
**BP**: 139°F  
**FRZ**: 19°F  
**Sol**: 4%

**VP**: 172 mmHg  
**IP**: 10.55 eV  
**Sp.Gr**: 3.12

**Fire Point**: NA  
**UEL**: NA  
**LEL**: NA

Noncombustible Liquid, but accelerates the burning of combustibles.

## Incompatibilities & Reactivities
- Combustible organics (sawdust, wood, cotton, straw, etc.), aluminum, readily oxidizable materials, ammonia, hydrogen, acetylene, phosphorus, potassium, sodium [Note: Corrodes iron, steel, stainless steel & copper.]

## Measurement Methods
- NIOSH 6011 ; OSHA ID108
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation *(See protection)*

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash, Quick drench

## First Aid *(See procedures)*

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2.5 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern

Up to 3 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Dizziness, headache; lacrimation (discharge of tears), epistaxis (nosebleed); cough, feeling of oppression, pulmonary edema, pneumonitis; abdominal pain, diarrhea; measles-like eruptions; eye, skin burns

Target Organs respiratory system, eyes, central nervous system, skin

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>Bromine pentafluoride</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BrF₅</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td></td>
</tr>
<tr>
<td>Bromine fluoride</td>
<td></td>
</tr>
<tr>
<td><strong>CAS</strong></td>
<td>7789-30-2</td>
</tr>
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<td><strong>RTECS</strong></td>
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<td><strong>DOT ID &amp; Guide</strong></td>
<td>1745 144</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 0.1 ppm (0.7 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL†: none</td>
<td></td>
</tr>
<tr>
<td>IDLH</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

**Conversion** 1 ppm = 7.15 mg/m³

**Physical Description**
Colorless to pale-yellow, fuming liquid with a pungent odor. [Note: A colorless gas above 105°F. Shipped as a compressed gas.]

| MW | 174.9 |
| BP | 105°F |
| FRZ | -77°F |
| Sol | Reacts violently |
| VP | 328 mmHg |
| IP | ? |
| Sp.Gr | 2.48 |

Noncombustible Liquid, but a very powerful oxidizer.

**Incompatibilities & Reactivities**
Acids, halogens, arsenic, selenium, sulfur, glass, organic materials, water [Note: Reacts with all elements except inert gases, nitrogen & oxygen.]

**Measurement Methods**
None available
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

**First Aid** (See procedures)
Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**
Respirator Recommendations Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; corneal necrosis; skin burns; cough, dyspnea (breathing difficulty), pulmonary edema; liver, kidney injury

**Target Organs** Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
## Bromoform

**CAS** 75-25-2

**RTECS** PB5600000

### Synonyms & Trade Names
- Methyl tribromide
- Tribromomethane

### DOT ID & Guide
- 2515 159

### Exposure Limits
- **NIOSH REL:** TWA 0.5 ppm (5 mg/m³) [skin]
- **OSHA PEL:** TWA 0.5 ppm (5 mg/m³) [skin]

**IDLH:** 850 ppm

### Conversion
1 ppm = 10.34 mg/m³

### Physical Description
- Colorless to yellow liquid with a chloroform-like odor. [Note: A solid below 47°F.]
- **MW:** 252.8
- **BP:** 301°F
- **FRZ:** 47°F
- **Sol:** 0.1%
- **VP:** 5 mmHg
- **IP:** 10.48 eV
- **Sp.Gr:** 2.89
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

### Incompatibilities & Reactivities
- Noncombustible Liquid
- Lithium, sodium, potassium, calcium, aluminum, zinc, magnesium, strong caustics, acetone [Note: Gradually decomposes, acquiring yellow color; air & light accelerate decomposition.]

### Measurement Methods
- NIOSH 1003 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

---

**NIOSH Pocket Guide to Chemical Hazards**

[Image of NIOSH logo]
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 850 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

---

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; central nervous system depression; liver, kidney damage

### Target Organs
- Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: [INTRODUCTION](#)
**1,3-Butadiene**

<table>
<thead>
<tr>
<th>Chemical Structure</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂=CHCH=CH₂</td>
<td>106-99-0</td>
<td>EI9275000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

Biethylene, Bivinyl, Butadiene, Divinyl, Erythrene, Vinylethylene

**DOT ID & Guide**

1010 116 P (inhibited)

**Exposure Limits**

- **NIOSH REL:** Ca See Appendix A
- **OSHA PEL:** \[1910.1051\] TWA 1 ppm ST 5 ppm
- **IDLH:** Ca [2000 ppm] [10%LEL]

**Conversion**

1 ppm = 2.21 mg/m³

**Physical Description**

Colorless gas with a mild aromatic or gasoline-like odor. [Note: A liquid below 24°F. Shipped as a liquefied compressed gas.]

- **MW:** 54.1
- **BP:** 24°F
- **FRZ:** -164°F
- **Sol:** Insoluble
- **VP:** 2.4 atm
- **IP:** 9.07 eV
- **RGasD:** 1.88
- **Sp.Gr:** 0.65 (Liquid at 24°F)

**Flammable Gas**

**Incompatibilities & Reactivities**

Phenol, chlorine dioxide, copper, crotonaldehyde [Note: May contain inhibitors (such as tributylcatechol) to prevent self-polymerization. May form explosive peroxides upon exposure to air.]

**Measurement Methods**

NIOSH 1024 ; OSHA 56
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)

<table>
<thead>
<tr>
<th>Skin</th>
<th>Frostbite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>Frostbite</td>
</tr>
</tbody>
</table>

| Wash skin: | No recommendation |
| Remove: | When wet (flammable) |
| Change: | No recommendation |
| Provide: | Frostbite wash |

**First Aid** (See procedures)

| Eye | Frostbite |
| Skin | Frostbite |

| Breathing: | Respiratory support |

**Important additional information about respirator selection**

**Respirator Recommendations** (See Appendix E) NIOSH

- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

- **Escape:**
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, nose, throat; drowsiness, dizziness; liquid: frostbite; teratogenic, reproductive effects; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, respiratory system, central nervous system, reproductive system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[hematopoietic cancer]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## n-Butane

**CAS** 106-97-8  
**RTECS** EJ4200000  
**DOT ID & Guide**  
1011 115  
1075 115

### Synonyms & Trade Names
normal-Butane, Butyl hydride, Diethyl, Methyl ethyl methane [Note: Also see specific listing for Isobutane.]

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 800 ppm (1900 mg/m³)</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH</td>
<td>N.D.</td>
<td>Conversion 1 ppm = 2.38 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

Colorless gas with a gasoline-like or natural gas odor. [Note: Shipped as a liquefied compressed gas. A liquid below 31°F.]

- **MW:** 58.1  
- **BP:** 31°F  
- **FRZ:** -217°F  
- **Sol:** Slight

- **VP:** 2.05 atm  
- **IP:** 10.63 eV  
- **RGasD:** 2.11  
- **Sp.Gr:** 0.6 (Liquid at 31°F)

### Incompatibilities & Reactivities

Strong oxidizers (e.g., nitrates & perchlorates), chlorine, fluorine, (nickel carbonyl + oxygen)

### Measurement Methods

OSHA 56  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

**Skin:** Frostbite  
**Eyes:** Frostbite  
**Wash skin:** No recommendation  
**Remove:** When wet (flammable)  
**Change:** No recommendation  
**Provide:** Frostbite wash

### First Aid

(See procedures)

**Eye:** Frostbite  
**Skin:** Frostbite  
**Breathing:** Respiratory support

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, skin and/or eye contact (liquid)

### Symptoms

Drowsiness, narcosis, asphyxia; liquid: frostbite

### Target Organs

central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2-Butanone

<table>
<thead>
<tr>
<th>CAS</th>
<th>78-93-3</th>
</tr>
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<tbody>
<tr>
<td><strong>CH₃COCH₂CH₃</strong></td>
<td></td>
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<tr>
<td><strong>RTECS</strong></td>
<td>EL6475000</td>
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<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>Ethyl methyl ketone, MEK, Methyl acetone, Methyl ethyl ketone</td>
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<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1193 127</td>
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### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA</th>
<th>200 ppm (590 mg/m³)</th>
<th>ST</th>
<th>300 ppm (885 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>TWA 200 ppm (590 mg/m³)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IDLH</td>
<td>3000 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Conversion**

1 ppm = 2.95 mg/m³

### Physical Description

Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor.

<table>
<thead>
<tr>
<th>MW</th>
<th>72.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>175°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-123°F</td>
</tr>
<tr>
<td>Sol</td>
<td>28%</td>
</tr>
<tr>
<td>VP</td>
<td>78 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>9.54 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.81</td>
</tr>
<tr>
<td>Fl.P</td>
<td>16°F</td>
</tr>
<tr>
<td>UEL(200°F)</td>
<td>11.4%</td>
</tr>
<tr>
<td>LEL(200°F)</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Strong oxidizers, amines, ammonia, inorganic acids, caustics, isocyanates, pyridines

### Measurement Methods

NIOSH 2500, 2555, 3800; OSHA 16, 84, 1004

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**(See protection)**

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash

### First Aid

**(See procedures)**

- Eye: Irrigate immediately
- Skin: Water wash immediately
- Breathing: Fresh air
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 3000 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes inhalation, ingestion, skin and/or eye contact

### Symptoms Irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis

### Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2-Butoxyethanol

**CAS** 111-76-2

**RTECS** KJ8575000

### Synonyms & Trade Names
- Butyl Cellosolve®, Butyl oxitol, Dowanol® EB, EGBE, Ektasolve EB®, Ethylene glycol monobutyl ether, Jeffersol EB

### DOT ID & Guide
- DOT ID & Guide 2369 152

### Exposure Limits
- NIOSH REL: TWA 5 ppm (24 mg/m³) [skin]
- OSHA PEL†: TWA 50 ppm (240 mg/m³) [skin]
- IDLH 700 ppm

### Conversion
- 1 ppm = 4.83 mg/m³

### Physical Description
- Colorless liquid with a mild, ether-like odor.
- MW: 118.2
- BP: 339°F
- FRZ: -107°F
- Sol: Miscible
- VP: 0.8 mmHg
- IP: 10.00 eV
- Sp.Gr: 0.90
- Fl.P: 143°F
- UEL(275°F): 12.7%
- LEL(200°F): 1.1%

### Incompatibilities & Reactivities
- Strong oxidizers, strong caustics

### Measurement Methods
- NIOSH 1403 ; OSHA 83
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Respirator Recommendations NIOSH

**Up to 50 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 125 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

**Up to 250 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 700 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat; hemolysis, hematuria (blood in the urine); central nervous system depression, headache; vomiting

### Target Organs
- Eyes, skin, respiratory system, central nervous system, hematopoietic system, blood, kidneys, liver, lymphoid system

See also: [INTRODUCTION](#)
## 2-Butoxyethanol acetate

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₄H₉O(CH₂)₂OCOCH₃</td>
<td>112-07-2</td>
<td>KJ8925000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 2-Butoxyethyl acetate
- Butyl Cellosolve® acetate
- Butyl glycol acetate
- EGBEA
- Ektasolve EB® acetate
- Ethylene glycol monobutyl ether acetate

### Exposure Limits
- NIOSH REL: TWA 5 ppm (33 mg/m³)
- OSHA PEL: none

### IDLH
- N.D.

### Conversion
- 1 ppm = 6.55 mg/m³

### Physical Description
- Colorless liquid with a pleasant, sweet, fruity odor.
- MW: 160.2
- BP: 378°F
- FRZ: -82°F
- Sol: 1.5%
- VP: 0.3 mmHg
- IP: ?
- Sp.Gr: 0.94
- Fl.P: 160°F
- UEL(275°F): 8.54%
- LEL(200°F): 0.88%

### Incompatibilities & Reactivities
- Oxidizers

### Measurement Methods
- OSHA 83
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH</strong></td>
</tr>
<tr>
<td><strong>Up to 50 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 125 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*</td>
</tr>
<tr>
<td><strong>Up to 250 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 700 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
<tr>
<td><strong>Exposure Routes</strong></td>
</tr>
<tr>
<td>Inhalation, skin absorption, ingestion, skin and/or eye contact</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
</tr>
<tr>
<td>Irritation eyes, skin, nose, throat; hemolysis, hematuria (blood in the urine); central nervous system depression, headache; vomiting</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
</tr>
<tr>
<td>Eyes, skin, respiratory system, central nervous system, hematopoietic system, blood, kidneys, liver, lymphoid system</td>
</tr>
<tr>
<td>See also: INTRODUCTION</td>
</tr>
</tbody>
</table>
### n-Butyl acetate

**CAS** 123-86-4

**CH₃COO(CH₂)₃CH₃**

**RTECS** AF7350000

**Synonyms & Trade Names**
- Butyl acetate, n-Butyl ester of acetic acid, Butyl ethanoate

**DOT ID & Guide**
- 1123 129

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 150 ppm (710 mg/m³) ST 200 ppm (950 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IDLH</strong></td>
<td>1700 ppm [10%LEL]</td>
</tr>
</tbody>
</table>

**Conversion**
- 1 ppm = 4.75 mg/m³

### Physical Description
- Colorless liquid with a fruity odor.
- **MW**: 116.2
- **BP**: 258°F
- **FRZ**: -107°F
- **Sol**: 1%
- **VP**: 10 mmHg
- **IP**: 10.00 eV
- **Sp.Gr**: 0.88
- **FL.P**: 72°F
- **UEL**: 7.6%
- **LEL**: 1.7%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods
- NIOSH 1450 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

**First Aid**
- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 1500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*

Up to 1700 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, upper respiratory system; headache, drowsiness, narcosis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## sec-Butyl acetate

<table>
<thead>
<tr>
<th>CAS 105-46-4</th>
</tr>
</thead>
</table>

| CH₃COOCH(CH₃)CH₂CH₃ | RTECS AF7380000 |

### Synonyms & Trade Names
- sec-Butyl ester of acetic acid
- 1-Methylpropyl acetate

### DOT ID & Guide
- 1123 129

### Exposure Limits
- NIOSH REL: TWA 200 ppm (950 mg/m³)
- OSHA PEL: TWA 200 ppm (950 mg/m³)
- IDLH 1700 ppm [10%LEL]
- **Conversion** 1 ppm = 4.75 mg/m³

### Physical Description
- Colorless liquid with a pleasant, fruity odor.
- MW: 116.2
- BP: 234°F
- FRZ: -100°F
- Sol: 0.8%
- VP: 10 mmHg
- IP: 9.91 eV
- Sp.Gr: 0.86
- Fl.P: 62°F
- UEL: 9.8%
- LEL: 1.7%

**Class IB Flammable Liquid:** Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods
- NIOSH 1450 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- (See procedures )
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 1700 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes; headache; drowsiness; dryness upper respiratory system, skin; narcosis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
### tert-Butyl acetate

<table>
<thead>
<tr>
<th>CAS</th>
<th>540-88-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>AF7400000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- tert-Butyl ester of acetic acid

### DOT ID & Guide
- 1123 129

### Exposure Limits
| NIOSH REL: TWA | 200 ppm (950 mg/m³) |
| OSHA PEL: TWA | 200 ppm (950 mg/m³) |

- IDLH: 1500 ppm [10%LEL]

### Conversion
- 1 ppm = 4.75 mg/m³

### Physical Description
- Colorless liquid with a fruity odor.
- MW: 116.2
- BP: 208°F
- FRZ: ?
- Sol: Insoluble
- VP: ?
- IP: ?
- Sp.Gr: 0.87
- Fl.P: 72°F
- UEL: ?
- LEL: 1.5%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods
- NIOSH 1450 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- (See procedures)
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Respirator Recommendations NIOSH/OSHA

**Up to 1500 ppm:**

- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions.**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Itch, inflammation eyes; irritation upper respiratory tract; headache; narcosis; dermatitis</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Respiratory system, eyes, skin, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
Butyl acrylate

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 10 ppm (55 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td>Conversion 1 ppm = 5.24 mg/m³</td>
</tr>
</tbody>
</table>

Physical Description
Clear, colorless liquid with a strong, fruity odor. [Note: Highly reactive; may contain an inhibitor to prevent spontaneous polymerization.]

| MW: 128.2             | BP: 293°F                      |
| VP: 4 mmHg            | IP: ?                          |
| Fl.P: 103°F           | UEL: 9.9%                      |
| Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

Incompatibilities & Reactivities
Strong acids & alkalis, amines, halogens, hydrogen compounds, oxidizers, heat, flame, sunlight [Note: Polymerizes readily on heating.]

Measurement Methods
OSHA PV2011
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Important additional information about respirator selection
Respirator Recommendations Not available.

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, upper respiratory system; sensitization dermatitis; dyspnea (breathing difficulty)

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

**n-Butyl alcohol**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>71-36-3</td>
<td>EO1400000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- 1-Butanol, n-Butanol, Butyl alcohol, 1-Hydroxybutane, n-Propyl carbinol

**DOT ID & Guide**
- 1120 129

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>C 50 ppm (150 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>TWA 100 ppm (300 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH**
- 1400 ppm [10%LEL]

**Conversion**
- 1 ppm = 3.03 mg/m³

## Physical Description

- Colorless liquid with a strong, characteristic, mildly alcoholic odor.
- MW: 74.1
- BP: 243°F
- FRZ: -129°F
- Sol: 9%
- VP: 6 mmHg
- IP: 10.04 eV
- Sp.Gr: 0.81
- Fl.P: 84°F
- UEL: 11.2%
- LEL: 1.4%

**Class IC Flammable Liquid**: Fl.P. at or above 73°F and below 100°F.

## Incompatibilities & Reactivities

- Strong oxidizers, strong mineral acids, alkali metals, halogens

## Measurement Methods

- NIOSH 1405, 1450; OSHA 7
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

## First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 1250 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 1400 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose, throat; headache, dizziness, drowsiness; corneal inflammation, blurred vision, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light); dermatitis; possible auditory nerve damage, hearing loss; central nervous system depression

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: **INTRODUCTION**
## sec-Butyl alcohol

### CAS

<table>
<thead>
<tr>
<th>CH₃CH(OH)CH₂CH₃</th>
<th>RTECS EO1750000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

- 2-Butanol
- Butylene hydrate
- 2-Hydroxybutane
- Methyl ethyl carbinol

### DOT ID & Guide

| 1120 129 |

### Exposure Limits

- **NIOSH REL:** TWA 100 ppm (305 mg/m³) ST 150 ppm (455 mg/m³)
- **OSHA PEL†:** TWA 150 ppm (450 mg/m³)

### IDLH

- 2000 ppm

### Conversion

- 1 ppm = 3.03 mg/m³

### Physical Description

- Colorless liquid with a strong, pleasant odor.
- **MW:** 74.1
- **BP:** 211°F
- **FRZ:** -175°F
- **Sol:** 16%
- **VP:** 12 mmHg
- **IP:** 10.10 eV
- **Sp.Gr:** 0.81
- **FL.P:** 75°F
- **UEL(212°F):** 9.8%
- **LEL(212°F):** 1.7%

### Incompatibilities & Reactivities

- Strong oxidizers, organic peroxides, perchloric & permonosulfuric acids

### Measurement Methods

- NIOSH 1405, 1450; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid (See procedures)

- **Eye:** Irrigate immediately
- **Skin:** Water flush promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 1000 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*

Up to 2000 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; narcosis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## tert-Butyl alcohol

<table>
<thead>
<tr>
<th>CAS</th>
<th>CAS 75-65-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RTECS EO1925000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>2-Methyl-2-propanol, Trimethyl carbinol</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>DOT ID &amp; Guide 1120 129</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: TWA 100 ppm (300 mg/m³) ST 150 ppm (450 mg/m³) |
| OSHA PEL*†: TWA 100 ppm (300 mg/m³) |
| IDLH 1600 ppm |

### Conversion

1 ppm = 3.03 mg/m³

### Physical Description

Colorless solid or liquid (above 77°F) with a camphor-like odor. [Note: Often used in aqueous solutions.]

| MW: 74.1 | BP: 180°F |
| VP(77°F): 42 mmHg | IP: 9.70 eV |
| Fl.P: 52°F | UEL: 8.0% |
| Fl.P: 52°F | LEL: 2.4% |

Combustible Solid Class IB Flammable Liquid

### Incompatibilities & Reactivities

Strong mineral acids, strong hydrochloric acid, oxidizers

### Measurement Methods

NIOSH 1450 ; OSHA 7

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

Wash skin: When contaminated

Remove: When wet (flammable)

Change: No recommendation

### First Aid (See procedures )

**Eye:** Irrigate immediately

**Skin:** Water flush promptly

Breathing: Respiratory support

Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 1600 ppm:**

- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode.
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s).
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister.
- (APF = 50) Any self-contained breathing apparatus with a full facepiece.
- (APF = 50) Any supplied-air respirator with a full facepiece.

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister.
- Any appropriate escape-type, self-contained breathing apparatus.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; drowsiness, narcosis

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## n-Butylamine

<table>
<thead>
<tr>
<th>CAS</th>
<th>109-73-9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CH₃CH₂CH₂CH₂NH₂</strong></td>
<td>RTECS EO2975000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
1-Aminobutane, Butylamine

### DOT ID & Guide
1125 132

### Exposure Limits
- NIOSH REL: C 5 ppm (15 mg/m³) [skin]
- OSHA PEL: C 5 ppm (15 mg/m³) [skin]

### IDLH
300 ppm

### Conversion
1 ppm = 2.99 mg/m³

### Physical Description
Colorless liquid with a fishy, ammonia-like odor.

- MW: 73.2
- BP: 172°F
- FRZ: -58°F
- Sol: Miscible
- VP: 82 mmHg
- IP: 8.71 eV
- Sp.Gr: 0.74
- Fl.P: 10°F
- UEL: 9.8%
- LEL: 1.7%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
Strong oxidizers, strong acids [Note: May corrode some metals in presence of water.]

### Measurement Methods
- NIOSH 2012
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Respirator Recommendations NIOSH/OSHA**

**Up to 50 ppm:**
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern*
- (APF = 10) Any supplied-air respirator*

**Up to 125 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern*

**Up to 250 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 300 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/*Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, nose, throat; headache; skin flush, burns</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## tert-Butyl chromate

### CAS
1189-85-1

### RTECS
GB2900000

### Synonyms & Trade Names
- Di-tert-Butyl ester of chromic acid

### DOT ID & Guide

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca TWA 0.001 mg Cr(VI)/m³</th>
<th>See Appendix A</th>
<th>See Appendix C</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: C 0.1 mg CrO₃/m³ [skin]</td>
<td>See Appendix C</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca [15 mg/m³ {as Cr(VI)}]</th>
</tr>
</thead>
</table>

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid. [Note: Solidifies at 32-23°F.]</td>
</tr>
</tbody>
</table>

| MW: 230.3 | BP: ? | FRZ: 32-23°F |
| FI.P: ?   | UEL: ? | LEL: ?       |

### Incompatibilities & Reactivities
- Reducing agents, moisture, acids, alcohols, hydrazine, combustible materials

### Measurement Methods
- NIOSH 7604 ; OSHA ID103 , ID215
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin: Prevent skin contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated/Daily</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: No recommendation</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

### First Aid

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; eye, skin burns; drowsiness, muscle weakness; skin ulcers; lung changes; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, central nervous system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## n-Butyl glycidyl ether

<table>
<thead>
<tr>
<th>CAS</th>
<th>2426-08-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>TX4200000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>BGE; 1,2-Epoxy-3-butoxypropane</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>C 5.6 ppm (30 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>TWA 50 ppm (270 mg/m³)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>250 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion</td>
<td>1 ppm = 5.33 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

- Colorless liquid with an irritating odor.
- MW: 130.2
- BP: 327°F
- FRZ: ?
- Sol: 2%
- VP(77°F): 3 mmHg
- IP: ?
- Sp.Gr: 0.91
- Fl.P: 130°F
- UEL: ?
- LEL: ?

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

- Strong oxidizers, strong caustics

### Measurement Methods

- NIOSH 1616; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

### First Aid

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 56 ppm:**
- \( \text{APF} = 10 \) Any chemical cartridge respirator with organic vapor cartridge(s)*
- \( \text{APF} = 10 \) Any supplied-air respirator*

**Up to 140 ppm:**
- \( \text{APF} = 25 \) Any supplied-air respirator operated in a continuous-flow mode*
- \( \text{APF} = 25 \) Any powered, air-purifying respirator with organic vapor cartridge(s)*

**Up to 250 ppm:**
- \( \text{APF} = 50 \) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- \( \text{APF} = 50 \) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
- \( \text{APF} = 50 \) Any self-contained breathing apparatus with a full facepiece
- \( \text{APF} = 50 \) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- \( \text{APF} = 10,000 \) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- \( \text{APF} = 10,000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

---

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, nose; skin sensitization; narcosis; possible hematopoietic effects; central nervous system depression</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system, blood</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## n-Butyl lactate

<table>
<thead>
<tr>
<th>CAS 138-22-7</th>
<th>RTECS OD4025000</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃CH(OH)COOC₄H₉</td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Butyl ester of 2-hydroxypropanoic acid, Butyl ester of lactic acid, Butyl lactate

**DOT ID & Guide**
1993 128 (combustible liquid, n.o.s.)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 5 ppm (25 mg/m³)</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH N.D.</td>
<td>Conversion 1 ppm = 5.98 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description
Clear, colorless to white liquid with a mild, transient odor.

- **MW**: 146.2
- **BP**: 370°F
- **FRZ**: -45°F
- **Sol**: Slight
- **VP**: 0.4 mmHg
- **IP**: ?
- **Sp.Gr**: 0.98
- **UFL**: ?
- **UEL**: ?
- **LEL**: 1.15%

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
Strong acids & bases, strong oxidizers, heat, sparks, open flames

### Measurement Methods
None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
**Skin**: Prevent skin contact
**Eyes**: Prevent eye contact
**Wash skin**: When contaminated
**Remove**: When wet or contaminated
**Change**: No recommendation
**Provide**: Eyewash, Quick drench

### First Aid
**Eye**: Irrigate immediately
**Skin**: Soap wash immediately
**Breathing**: Respiratory support
**Swallow**: Medical attention immediately

### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, nose, throat; drowsiness, headache, central nervous system depression; nausea, vomiting

### Target Organs
Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

### n-Butyl mercaptan

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>CAS</td>
<td>109-79-5</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>CH₃CH₂CH₂CH₂SH</td>
</tr>
<tr>
<td>RTECS</td>
<td>EK6300000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Butanethiol, 1-Butanethiol, n-Butanethiol, 1-Mercaptobutane</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2347 130</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>C 0.5 ppm (1.8 mg/m³) [15-minute]</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>TWA 10 ppm (35 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>500 ppm</td>
</tr>
</tbody>
</table>

#### Physical Description

Colorless liquid with a strong, garlic-, cabbage-, or skunk-like odor.

- MW: 90.2
- BP: 209°F
- FRZ: -176°F
- Sol: 0.06%
- VP: 35 mmHg
- IP: 9.15 eV
- Sp.Gr: 0.83
- Fl.P: 35°F
- UEL: ?
- LEL: ?

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities

Strong oxidizers (such as dry bleaches), acids

#### Measurement Methods

NIOSH 2525, 2542

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

#### First Aid

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 500 ppm:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode*

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

#### Symptoms

- Irritation eyes, skin; muscle weakness, malaise (vague feeling of discomfort), sweating, nausea, vomiting, headache, confusion; in animals: narcosis, incoordination, lassitude (weakness, exhaustion); cyanosis, pulmonary irritation; liver, kidney damage

#### Target Organs

- Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## o-sec-Butylphenol

<table>
<thead>
<tr>
<th>CAS</th>
<th>89-72-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂CH₂CH(CH₃)C₆H₄OH</td>
<td>RTECS SJ8920000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 2-sec-Butylphenol, 2-(1-Methylpropyl)phenol

### Exposure Limits
- NIOSH REL: TWA 5 ppm (30 mg/m³) [skin]
- OSHA PEL†: none

| IDLH N.D. | Conversion 1 ppm = 6.14 mg/m³ |

### Physical Description
- Colorless liquid or solid (below 61°F).
- MW: 150.2
- BP: 227°F
- FRZ: 61°F
- Sol: Insoluble
- VP: Low
- IP: ?
- Sp.Gr: 0.89
- Fl.P: 225°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities
- None reported

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- (See protection)
  - Skin: Prevent skin contact
  - Eyes: Prevent eye contact
  - Wash skin: When contaminated
  - Remove: When wet or contaminated
  - Change: No recommendation
  - Provide: Eyewash, Quick drench

### First Aid
- (See procedures)
  - Eye: Irrigate immediately
  - Skin: Soap flush immediately
  - Breathing: Respiratory support
  - Swallow: Medical attention immediately

### Important additional information about respirator selection
- Respirator Recommendations Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; skin burns

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## p-tert-Butyltoluene

<table>
<thead>
<tr>
<th>(CH₃)₃CC₆H₄CH₃</th>
<th>CAS 98-51-1</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
4-tert-Butyltoluene, 1-Methyl-4-tert-butylbenzene

**DOT ID & Guide**
2667 152

**Exposure Limits**
- NIOSH REL: TWA 10 ppm (60 mg/m³) ST 20 ppm (120 mg/m³)
- OSHA PEL†: TWA 10 ppm (60 mg/m³)

**IDLH** 100 ppm

**Conversion** 1 ppm = 6.07 mg/m³

### Physical Description
Colorless liquid with a distinct aromatic odor, somewhat like gasoline.

- **MW**: 148.3
- **BP**: 379°F
- **FRZ**: -62°F
- **Sol**: Insoluble
- **VP(77°F)**: 0.7 mmHg
- **IP**: 8.28 eV
- **Sp.Gr**: 0.86
- **FI.P**: 155°F
- **UEL**: ?
- **LEL**: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- **Oxidizers**

### Measurement Methods
- NIOSH 1501 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation

### First Aid
(See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 100 ppm:**
- \( \text{APF} = 25 \) Any supplied-air respirator operated in a continuous-flow mode
- \( \text{APF} = 25 \) Any powered, air-purifying respirator with organic vapor cartridge(s)
- \( \text{APF} = 50 \) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- \( \text{APF} = 50 \) Any self-contained breathing apparatus with a full facepiece
- \( \text{APF} = 50 \) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- \( \text{APF} = 10,000 \) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- \( \text{APF} = 10,000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormalities cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury

**Target Organs** Eyes, skin, respiratory system, cardiovascular system, central nervous system, bone marrow, liver, kidneys

See also: INTRODUCTION
## n-Butyronitrile

**CAS**: 109-74-0  
**RTECS**: ET8750000

### Synonyms & Trade Names
- Butanenitrile
- Butyronitrile
- 1-Cyanopropane
- Propyl cyanide
- n-Propyl cyanide

### DOT ID & Guide
- **DOT ID**: 2411 131

### Exposure Limits
- **NIOSH REL**: TWA 8 ppm (22 mg/m³)  
- **OSHA PEL**: none

### Conversion
- 1 ppm = 2.83 mg/m³

### Physical Description
- Colorless liquid with a sharp, suffocating odor. [Note: Forms cyanide in the body.]
- **MW**: 69.1
- **BP**: 244°F
- **FRZ**: -170°F
- **Sol (77°F)**: 3%
- **IP**: 11.67 eV
- **Sp.Gr**: 0.81
- **VP**: 14 mmHg
- **UEL**: ?
- **LEL**: 1.65%

### Incompatibilities & Reactivities
- Strong oxidizers & reducing agents, strong acids & bases

### Measurement Methods
- NIOSH 1606 (adapt)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet (flammable)  
- **Change**: No recommendation  
- **Provide**: Quick drench

### First Aid
- **Eye**: Irrigate immediately  
- **Skin**: Soap wash immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 80 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 200 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 400 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1000 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; headache, dizziness, lassitude (weakness, exhaustion), confusion, convulsions; dyspnea (breathing difficulty); abdominal pain, nausea, vomiting

**Target Organs** Eyes, skin, respiratory system, central nervous system, cardiovascular system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Cadmium dust (as Cd)

<table>
<thead>
<tr>
<th>CAS</th>
<th>7440-43-9 (metal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>EU9800000 (metal)</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2570 154 (cadmium compound)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Cadmium metal: Cadmium
Other synonyms vary depending upon the specific cadmium compound.

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*: Ca</th>
<th>See Appendix A</th>
<th>[*Note: The REL applies to all Cadmium compounds (as Cd).]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL*: [1910.1027]</td>
<td>TWA 0.005 mg/m³</td>
<td>[*Note: The PEL applies to all Cadmium compounds (as Cd).]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca [9 mg/m³ (as Cd)]</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description

Metal: Silver-white, blue-tinged lustrous, odorless solid.

- **MW:** 112.4
- **BP:** 1409°F
- **MLT:** 610°F
- **Sol:** Insoluble
- **IP:** NA
- **FI.P:** NA
- **UEL:** NA
- **LEL:** NA

Metal: Noncombustible Solid in bulk form, but will burn in powder form.

### Incompatibilities & Reactivities
Strong oxidizers; elemental sulfur, selenium & tellurium

### Measurement Methods

NIOSH 7048 , 7300 , 7301 , 7303 , 9102 ; OSHA ID121 , ID125G , ID189 , ID206

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** Daily
- **Remove:** No recommendation
- **Change:** Daily

**First Aid (See procedures)**

- **Eye:** Irrigate immediately
- **Skin:** Soap wash
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

Respirator Recommendations (See Appendix E) NIOSH

- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

- **Escape:**
  - (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, ingestion
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>respiratory system, kidneys, prostate, blood</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[prostatic &amp; lung cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
## NIOSH Pocket Guide to Chemical Hazards

### Cadmium fume (as Cd)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAS</strong></td>
<td>1306-19-0 (CdO)</td>
</tr>
<tr>
<td><strong>RTECS</strong></td>
<td>EV1930000 (CdO)</td>
</tr>
</tbody>
</table>
| **Synonyms & Trade Names** | CdO: Cadmium monoxide, Cadmium oxide fume  
Cd: Cadmium |
| **DOT ID & Guide** | |

### Exposure Limits

<table>
<thead>
<tr>
<th>Limit Type</th>
<th>Value</th>
</tr>
</thead>
</table>
| NIOSH REL* | Ca See Appendix A  
[*Note: The REL applies to all Cadmium compounds (as Cd).]* |
| OSHA PEL* | [1910.1027] TWA 0.005 mg/m³  
[*Note: The PEL applies to all Cadmium compounds (as Cd).]* |
| **IDLH** | Ca [9 mg/m³ (as Cd)] |

### Physical Description

- Odorless, yellow-brown, finely divided particulate dispersed in air.  
  [Note: See listing for Cadmium dust for properties of Cd.]
- **MW**: 128.4
- **BP**: Decomposes
- **MLT**: 2599°F
- **Sol**: Insoluble
- **VP**: 0 mmHg (approx)
- **IP**: NA
- **Sp.Gr**: 8.15 (crystalline form)/6.95 (amorphous form)
- **Fl.P**: NA
- **UEL**: NA
- **LEL**: NA

### Incompatibilities & Reactivities

Not applicable

### Measurement Methods

NIOSH 7048, 7300, 7301, 7303; OSHA ID121, ID125G, ID189, ID206  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

**Skin**: No recommendation

**Eyes**: No recommendation

**Wash skin**: Daily

**Remove**: No recommendation

**Change**: Daily

### First Aid

(See procedures)

**Breathing**: Respiratory support

### Important additional information about respirator selection

**Respirator Recommendations** (See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; emphysema, proteinuria, anosmia (loss of the sense of smell), mild anemia; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>respiratory system, kidneys, blood</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[prostatic &amp; lung cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Calcium arsenate (as As)

**CAS** 7778-44-1

**RTECS** CG0830000

**DOT ID & Guide** 1573 151

### Synonyms & Trade Names

Calcium salt (2:3) of arsenic acid, Cucumber dust, Tricalcium arsenate, Tricalcium ortho-arsenate [Note: Also see specific listing for Arsenic (inorganic compounds, as As).]

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca C 0.002 mg/m³ [15-minute] See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: [1910.1018] TWA 0.010 mg/m³</td>
</tr>
<tr>
<td>IDLH Ca</td>
<td>Ca [5 mg/m³ (as As)]</td>
</tr>
</tbody>
</table>

### Physical Description

Colorless to white, odorless solid. [insecticide/herbicide]

**MW:** 398.1  
**BP:** Decomposes  
**MLT:** ?  
**Sol(77°F):** 0.01%

**VP:** 0 mmHg (approx)  
**IP:** NA  
**Sp.Gr:** 3.62

### Incompatibilities & Reactivities

None reported [Note: Produces toxic fumes of arsenic when heated to decomposition.]

### Measurement Methods

NIOSH 7900 ; OSHA ID105  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact  
Skin: Prevent skin contact  
Wash skin: When contaminated/Daily  
Remove: When wet or contaminated  
Change: Daily  
Provide: Eyewash, Quick drench

**Eyes:** Prevent eye contact  
Eye: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Soap wash promptly  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Lassitude (weakness, exhaustion); gastrointestinal disturbance; peripheral neuropathy; skin hyperpigmentation, palmar planter hyperkeratoses; dermatitis; [potential occupational carcinogen]; in animals: liver damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, respiratory system, liver, skin, central nervous system, lymphatic system</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[lymphatic &amp; lung cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# Calcium carbonate

<table>
<thead>
<tr>
<th>CAS</th>
<th>1317-65-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>EV9580000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
Calcium salt of carbonic acid [Note: Occurs in nature as as limestone, chalk, marble, dolomite, aragonite, calcite & oyster shells.]

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
</tbody>
</table>

## Physical Description
White, odorless powder or colorless crystals.

<table>
<thead>
<tr>
<th>MW</th>
<th>100.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>Decomposes</td>
</tr>
<tr>
<td>MLT</td>
<td>1517-2442°F (Decomposes)</td>
</tr>
<tr>
<td>Sol</td>
<td>0.001%</td>
</tr>
<tr>
<td>VP</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr.</td>
<td>2.7-2.95</td>
</tr>
<tr>
<td>FI.P.</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities
Acids, alum, ammonium salts, mercury & hydrogen, fluorine, magnesium

## Measurement Methods
NIOSH 7020 , 7303 ; OSHA ID121
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin</th>
<th>No recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Wash skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Remove</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Change</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

## First Aid

<table>
<thead>
<tr>
<th>Eye</th>
<th>Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Soap wash</td>
</tr>
<tr>
<td>Breathing</td>
<td>Fresh air</td>
</tr>
</tbody>
</table>

## Important additional information about respirator selection

### Respirator Recommendations
Not available.

### Exposure Routes
Inhalation, skin and/or eye contact

### Symptoms
Irritation eyes, skin, respiratory system; cough

### Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Calcium cyanamide

<table>
<thead>
<tr>
<th>CAS 156-62-7</th>
<th>RTECS GS6000000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

Calcium carbimide, Cyanamide, Lime nitrogen, Nitrogen lime [Note: Cyanamide is also a synonym for Hydrogen cyanamide, NH$_2$CN.]

### DOT ID & Guide

1403 138 (with >0.1% calcium carbide)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.5 mg/m$^3$</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
</table>

### Physical Description

Colorless, gray, or black crystals or powder. [fertilizer] [Note: Commercial grades may contain calcium carbide.]

<table>
<thead>
<tr>
<th>MW: 80.1</th>
<th>BP: Sublimes</th>
<th>MLT: 2444°F</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>VP: 0 mmHg (approx)</th>
<th>IP: NA</th>
<th>UEL: NA</th>
<th>LEL: NA</th>
</tr>
</thead>
</table>

Noncombustible Solid, but a fire risk if it contains calcium carbide.

### Incompatibilities & Reactivities

Water [Note: May polymerize in water or alkaline solutions to dicyanamide. Decomposes in water to form acetylene & ammonia.]

### Measurement Methods

NIOSH 0500

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin: Prevent skin contact</th>
<th>Eye: Prevent eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash skin: When contaminated</td>
<td>Wash skin: When contaminated</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: Daily</td>
<td>Change: Daily</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
<td>Provide: Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Eye: Irrigate immediately</th>
<th>Skin: Soap flush immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing: Respiratory support</td>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; headache, dizziness, rapid breathing, low blood pressure, nausea, vomiting; skin burns, sensitization; cough; Antabuse-like effects

**Target Organs** Eyes, skin, respiratory system, vasomotor system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Calcium hydroxide

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS 1305-62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>Ca(OH)₂</td>
</tr>
<tr>
<td>RTECS</td>
<td>EW2800000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Calcium hydrate, Caustic lime, Hydrated lime, Slaked lime

### Exposure Limits

- **NIOSH REL**: TWA 5 mg/m³
- **OSHA PEL**: TWA 15 mg/m³ (total) 5 mg/m³ (resp)
- **IDLH**: N.D.

### Physical Description

- **Physical State**: White, odorless powder. [Note: Readily absorbs CO₂ from the air to form calcium carbonate.]
- **MW**: 74.1
- **BP**: Decomposes
- **MLT**: 1076°F (Decomposes) (Loses H₂O)
- **VP**: 0 mmHg (approx)
- **IP**: NA
- **FI.P**: NA
- **UEL**: NA
- **LEL**: NA

- **Noncombustible Solid**

### Incompatibilities & Reactivities

- Maleic anhydride, phosphorus, nitroethane, nitromethane, nitroparaffins, nitropropane [Note: Attacks some metals.]

### Measurement Methods

- NIOSH 7020 ; OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated/Daily
- **Remove** When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations**: Not available.

### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, skin, upper respiratory system; eye, skin burns; skin vesiculation; cough, bronchitis, pneumonitis

### Target Organs

- Eyes, skin, respiratory system

See also: **INTRODUCTION**
<table>
<thead>
<tr>
<th>Calcium oxide</th>
<th>CAS 1305-78-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaO</td>
<td>RTECS EW3100000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide 1910 157</td>
</tr>
<tr>
<td>Burned lime, Burnt lime, Lime, Pebble lime, Quick lime, Unslaked lime</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits
- NIOSH REL: TWA 2 mg/m³
- OSHA PEL: TWA 5 mg/m³
- IDLH: 25 mg/m³

### Physical Description
White or gray, odorless lumps or granular powder.

| MW: 56.1 | BP: 5162°F | MLT: 4662°F | Sol: Reacts |
| VP: 0 mmHg (approx) | IP: NA | | Sp.Gr: 3.34 |
| Fl.P: NA | UEL: NA | LEL: NA |

Noncombustible Solid, but will support combustion by liberation of oxygen.

### Incompatibilities & Reactivities
Water (liberates heat), fluorine, ethanol [Note: Reacts with water to form calcium hydroxide.]

### Measurement Methods
- NIOSH 7020, 7303; OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 10 mg/m³:**
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

**Up to 20 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

**Up to 25 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, upper respiratory tract; ulcer, perforation nasal septum; pneumonitis; dermatitis

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
# Calcium silicate

<table>
<thead>
<tr>
<th>CAS</th>
<th>1344-95-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>VV9150000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Calcium hydrosilicate
- Calcium metasilicate
- Calcium monosilicate
- Calcium salt of silicic acid
- Wollastonite (mineral)

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
</tbody>
</table>

## Physical Description
- White or cream-colored, free-flowing powder. [Note: The commercial product is prepared from diatomaceous earth & lime.]
- MW: 116.2
- BP: ?
- MLT: 2804°F
- Sol: 0.01%
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 2.9
- Fl.P: NA
- UEL: NA
- LEL: NA

## Noncombustible Solid

## Incompatibilities & Reactivities
- None reported [Note: After prolonged contact with water, solution reverts to soluble calcium salts & amorphous silica.]

## Measurement Methods
- NIOSH 7020 ; OSHA ID121
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

## First Aid
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Fresh air

## Exposure Routes
- Inhalation, skin and/or eye contact

## Symptoms
- Irritation eyes, skin, upper respiratory system

## Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION

## Important additional information about respirator selection

## Respirator Recommendations
- Not available.
# NIOSH Pocket Guide to Chemical Hazards

## Calcium sulfate

<table>
<thead>
<tr>
<th>CAS 7778-18-9</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

Anhydrous calcium sulfate, Anhydrous gypsum, Anhydrous sulfate of lime, Calcium salt of sulfuric acid [Note: Gypsum is the dihydrate form & Plaster of Paris is the hemihydrate form.]

### Exposure Limits

| NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

### Physical Description

Odorless, white powder or colorless, crystalline solid. [Note: May have blue, gray, or reddish tinge.]

| MW: 136.1 | BP: Decomposes | MLT: 2840°F (Decomposes) | Sol: 0.3% |
| VP: 0 mmHg (approx) | IP: NA |  | Sp.Gr: 2.96 |
| Fl.P: NA | UEL: NA |  | LEL: NA |

Noncombustible Solid

### Incompatibilities & Reactivities

Diazomethane, aluminum, phosphorus, water [Note: Hygroscopic (i.e., absorbs moisture from the air). Reacts with water to form Gypsum & Plaster of Paris.]

### Measurement Methods

NIOSH 0500 , 0600

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection )

| Skin: No recommendation |
| Eyes: No recommendation |
| Wash skin: No recommendation |
| Remove: No recommendation |
| Change: No recommendation |

### First Aid

(See procedures )

| Eye: Irrigate immediately |
| Skin: Soap wash |
| Breathing: Fresh air |

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes

inhalation, skin and/or eye contact

### Symptoms

Irritation eyes, skin, upper respiratory system; conjunctivitis; rhinitis, epistaxis (nosebleed)

### Target Organs

Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Camphor (synthetic)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>76-22-2</td>
<td>EX1225000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 2-Camphonone
- Gum camphor
- Laurel camphor
- Synthetic camphor

### DOT ID & Guide
- 2717 133

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 2 mg/m³</td>
<td>TWA 2 mg/m³</td>
</tr>
</tbody>
</table>

### IDLH
- 200 mg/m³

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorless or white crystals with a penetrating, aromatic odor.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MW</th>
<th>BP</th>
<th>Sol.</th>
<th>MLT</th>
<th>Sp.Gr.</th>
<th>Fl.P</th>
<th>UEL</th>
<th>LEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>152.3</td>
<td>399°F</td>
<td>Insoluble</td>
<td>345°F</td>
<td>0.99</td>
<td>150°F</td>
<td>3.5%</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
- Strong oxidizers (especially chromic anhydride & potassium permanganate)

### Measurement Methods
- NIOSH 1301, 2553; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 50 mg/m³:**
- \( \text{APF} = 25 \) Any supplied-air respirator operated in a continuous-flow mode.
- \( \text{APF} = 25 \) Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.

**Up to 100 mg/m³:**
- \( \text{APF} = 50 \) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- \( \text{APF} = 50 \) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter.
- \( \text{APF} = 50 \) Any self-contained breathing apparatus with a full facepiece.
- \( \text{APF} = 50 \) Any supplied-air respirator with a full facepiece.

**Up to 200 mg/m³:**
- \( \text{APF} = 2000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- \( \text{APF} = 10,000 \) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
- \( \text{APF} = 10,000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.

**Escape:**
- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here.

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, mucous membrane; nausea, vomiting, diarrhea; headache, dizziness, excitement, epileptiform convulsions</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Caprolactam

<table>
<thead>
<tr>
<th>CAS</th>
<th>105-60-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>CM3675000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Aminocaproic lactam, epsilon-Caprolactam, Hexahydro-2H-azepin-2-one, 2-Oxohexamethyleneimine</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Dust: TWA 1 mg/m³ ST 3 mg/m³ Vapor: TWA 0.22 ppm (1 mg/m³) ST 0.66 ppm (3 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
<tr>
<td>IDLH</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 4.63 mg/m³

### Physical Description

White, crystalline solid or flakes with an unpleasant odor. [Note: Significant vapor concentrations would be expected only at elevated temperatures.]

<table>
<thead>
<tr>
<th>MW</th>
<th>113.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>515°F</td>
</tr>
<tr>
<td>VP</td>
<td>0.00000008 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Fl.P</td>
<td>282°F</td>
</tr>
<tr>
<td>UEL</td>
<td>8.0%</td>
</tr>
<tr>
<td>LEL</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Combustible Solid

Strong oxidizers, (acetic acid + dinitrogen trioxide)

### Measurement Methods

OSHA PV2012

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily

### First Aid (See procedures )

- **Eye**: Irrigate immediately
- **Skin**: Water wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations**: Not available.

### Exposure Routes

Inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation skin, eyes, respiratory system; epistaxis (nosebleed); dermatitis, skin sensitization; asthma; irritability, confusion, dizziness, headache; abdominal cramps, diarrhea, nausea, vomiting; liver, kidney injury

### Target Organs

Eyes, skin, respiratory system, central nervous system, cardiovascular system, liver, kidneys

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

**Captafol**

<table>
<thead>
<tr>
<th>CAS 2425-06-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₁₀H₉Cl₁₄NO₂S</td>
</tr>
<tr>
<td>RTECS GW4900000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

Captafol; Difolatan®; N-((1,1,2,2-Tetrachloroethyl)thio)-4-cyclohexene-1,2-dicarboximide

**Exposure Limits**

| NIOSH REL: Ca TWA 0.1 mg/m³ [skin] See Appendix A |
| OSHA PEL†: none |

<table>
<thead>
<tr>
<th>IDLH Ca [N.D.]</th>
<th>Conversion</th>
</tr>
</thead>
</table>

**Physical Description**

White, crystalline solid with a slight, characteristic pungent odor. [fungicide] [Note: Available commercially as a wettable powder or in liquid form.]

| MW: 349.1 | BP: Decomposes |
| VP: 0.000008 mmHg | IP: NA |
| Fi.P: NA | UEL: NA |

Noncombustible Solid, but may be dissolved in flammable liquids.

**Incompatibilities & Reactivities**

Acids, acid vapors, strong oxidizers

**Measurement Methods**

NIOSH 0500

See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

(See protection)

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated/Daily
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

**First Aid**

(See procedures)

Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**

inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, respiratory system; dermatitis, skin sensitization; conjunctivitis; bronchitis, wheezing; diarrhea, vomiting; liver, kidney injury; high blood pressure; in animals: teratogenic effects; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system, liver, kidneys, cardiovascular system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors at many sites]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Captan

**CAS** 133-06-2  
**RTECS** GW5075000  
**Synonyms & Trade Names** Captane; N-Trichloromethylmercapto-4-cyclohexene-1,2-dicarboximide

#### Exposure Limits
- **NIOSH REL**: Ca TWA 5 mg/m³ [See Appendix A]  
- **OSHA PEL†**: none

#### IDLH
- Ca [N.D.]

#### Conversion
- **Sol (77°F)**: 0.0003%
- **Sp.Gr.**: 1.74

#### Physical Description
- Odorless, white, crystalline powder. [fungicide]  
- Note: Commercial product is a yellow powder with a pungent odor.
- **MW**: 300.6  
- **BP**: Decomposes  
- **MLT**: 352°F (Decomposes)  
- **Sol (77°F)**: 0.0003%
- **IP**: NA
- **UEL**: ?
- **LEL**: ?
- Combustible Solid; may be dissolved in flammable liquids.

#### Incompatibilities & Reactivities
- Strong alkaline materials (e.g., hydrated lime)  
- Note: Corrosive to metals.

#### Measurement Methods
- NIOSH 5601, 9202, 9205  
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation  
**Skin**: Prevent skin contact  
**Eyes**: Prevent eye contact  
**Wash skin**: When contaminated/Daily  
**Remove**: When wet or contaminated  
**Change**: Daily  
**Provide**: Eyewash, Quick drench

#### First Aid  
**Eye**: Irrigate immediately  
**Skin**: Soap wash immediately  
**Breathing**: Respiratory support  
**Swallow**: Medical attention immediately

#### Important additional information about respirator selection

#### Respirator Recommendations NIOSH
**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
- Irritation eyes, skin, upper respiratory system; blurred vision; dermatitis, skin sensitization; dyspnea (breathing difficulty); diarrhea, vomiting; [potential occupational carcinogenic]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, gastrointestinal tract, liver, kidneys</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: duodenal tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Carbaryl

<table>
<thead>
<tr>
<th>CAS</th>
<th>63-25-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃NHCOOC₁₀H₇</td>
<td></td>
</tr>
<tr>
<td>RTECS</td>
<td>FC5950000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>alpha-Naphthyl N-methyl-carbamate; 1-Naphthyl N-Methyl-carbamate; Sevin®</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2757 151</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 5 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 5 mg/m³</td>
</tr>
<tr>
<td>IDLH</td>
<td>100 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

- White or gray, odorless solid. [pesticide]
- MW: 201.2
- BP: Decomposes
- MLT: 293°F
- Sol: 0.01%
- VP(77°F): <0.00004 mmHg
- IP: ?
- Sp.Gr: 1.23
- Fl.P: NA
- UEL: NA
- LEL: NA

Noncombustible Solid, but may be dissolved in flammable liquids.

### Incompatibilities & Reactivities

Strong oxidizers, strongly alkaline pesticides

### Measurement Methods

- NIOSH 5006, 5601; OSHA 63
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 50 mg/m³:
(APF = 10) Any supplied-air respirator*

Up to 100 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Miosis, blurred vision, tear; rhinorrhea (discharge of thin mucus), salivation; sweating; abdominal cramps, nausea, vomiting, diarrhea; tremor; cyanosis; convulsions; irritation skin; possible reproductive effects

Target Organs respiratory system, central nervous system, cardiovascular system, skin, blood cholinesterase, reproductive system

See also: INTRODUCTION
## Carbofuran

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS Number</th>
<th>RTECS Code</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₁₂H₁₅NO₃</td>
<td>1563-66-2</td>
<td>FB94500000</td>
<td>2757 151</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 2,3-Dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate
- Furacarb®
- Furadan®

### Exposure Limits
- NIOSH REL: TWA 0.1 mg/m³
- OSHA PEL†: none
- IDLH: N.D.

### Physical Description
- Odorless, white or grayish, crystalline solid. [insecticide] [Note: May be dissolved in a liquid carrier.]
- MW: 221.3
- BP: ?
- MLT: 304°F
- Sol(77°F): 0.07%
- VP(77°F): 0.000003 mmHg
- IP: NA
- Sp.Gr: 1.18
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Alkaline substances, acid, strong oxidizers (e.g., perchlorates, peroxides, chlorates, nitrates, permanganates)

### Measurement Methods
- NIOSH 5006, 5601; OSHA 63
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap flush immediately
- Breathing: Fresh air
- Swallow: Medical attention immediately

### Important additional information about respirator selection
- Respirator Recommendations: Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Miosis, blurred vision; sweating, salivation, abdominal cramps, diarrhea, headache, nausea, vomiting;
- Lassitude (weakness, exhaustion), muscle twitching, incoordination, convulsions

### Target Organs
- Central nervous system, peripheral nervous system, blood cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Carbon black

**CAS** 1333-86-4

**RTECS** FF5800000

### Synonyms & Trade Names

- Acetylene black
- Channel black
- Furnace black
- Lamp black
- Thermal black

### Physical Description

- Black, odorless solid.
- MW: 12.0
- BP: Sublimes
- MLT: Sublimes
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 1.8-2.1
- Fl.P: NA
- UEL: NA
- LEL: NA

Combustible Solid that may contain flammable hydrocarbons.

### Incompatibilities & Reactivities

Strong oxidizers such as chlorates, bromates & nitrates

### Measurement Methods

- NIOSH 5000 ; OSHA ID196
- See: NMAM or OSHA Methods

### Exposure Limits

- NIOSH REL: TWA 3.5 mg/m³ Ca TWA 0.1 mg PAHs/m³ [Carbon black in presence of polycyclic aromatic hydrocarbons (PAHs)] See Appendix A See Appendix C
- OSHA PEL: TWA 3.5 mg/m³

### IDLH

1750 mg/m³

### Conversion

### Personal Protection & Sanitation (See protection )

- **Skin:** No recommendation
- **Eyes:** Prevent eye contact
- **Wash skin:** Daily
- **Remove:** No recommendation
- **Change:** No recommendation

### First Aid (See procedures )

- **Eye:** Irrigate promptly
- **Breathing:** Fresh air
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 17.5 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 35 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 87.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 175 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 1750 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here in presence of polycyclic aromatic hydrocarbons:

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin and/or eye contact

Symptoms Cough; irritation eyes; in presence of polycyclic aromatic hydrocarbons: [potential occupational carcinogen]

Target Organs respiratory system, eyes

Cancer Site [lymphatic cancer (in presence of PAHs)]

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Carbon dioxide

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>124-38-9</td>
<td>FF6400000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Carbonic acid gas, Dry ice [Note: Normal constituent of air (about 300 ppm)].

### DOT ID & Guide
- 1013 120
- 1845 120 (dry ice)
- 2187 120 (liquid)

## Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 5000 ppm (9000 mg/m³) ST 30,000 ppm (54,000 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>TWA 5000 ppm (9000 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>40,000 ppm</td>
</tr>
</tbody>
</table>

### Conversion
- 1 ppm = 1.80 mg/m³

## Physical Description
- Colorless, odorless gas. [Note: Shipped as a liquefied compressed gas. Solid form is utilized as dry ice.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>44.0</td>
</tr>
<tr>
<td>BP</td>
<td>Sublimes</td>
</tr>
<tr>
<td>MLT</td>
<td>-109°F (Sublimes)</td>
</tr>
<tr>
<td>Sol</td>
<td>0.2%</td>
</tr>
<tr>
<td>VP</td>
<td>56.5 atm</td>
</tr>
<tr>
<td>IP</td>
<td>13.77 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>1.53</td>
</tr>
<tr>
<td>FL.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Nonflammable Gas

## Incompatibilities & Reactivities
- Dusts of various metals, such as magnesium, zirconium, titanium, aluminum, chromium & manganese are ignitable and explosive when suspended in carbon dioxide. Forms carbonic acid in water.

## Measurement Methods
- NIOSH 6603; OSHA ID172
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** Frostbite
- **Eyes:** Frostbite
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation
- **Provide:** Frostbite wash

## First Aid
- **Eye:** Frostbite
- **Skin:** Frostbite
- **Breathing:** Respiratory support

### Important additional information about respirator selection

#### Respirator Recommendations
- **NIOSH/OSHA**
  - **Up to 40,000 ppm:**
    - (APF = 10) Any supplied-air respirator
    - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - **Emergency or planned entry into unknown concentrations or IDLH conditions:**
    - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
    - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
- **Escape:** Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin and/or eye contact (liquid/solid)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Headache, dizziness, restlessness, paresthesia; dyspnea (breathing difficulty); sweating, malaise (vague feeling of discomfort); increased heart rate, cardiac output, blood pressure; coma; asphyxia; convulsions; frostbite (liquid, dry ice)</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>respiratory system, cardiovascular system</td>
</tr>
<tr>
<td><strong>See also:</strong></td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Carbon disulfide

<table>
<thead>
<tr>
<th>CAS</th>
<th>75-15-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>FF6650000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Carbon bisulfide

###DOT ID & Guide
- 1131 131

###Exposure Limits

| NIOSH REL | TWA 1 ppm (3 mg/m³) ST 10 ppm (30 mg/m³) [skin] |
| OSHA PEL† | TWA 20 ppm C 30 ppm 100 ppm (30-minute maximum peak) |

###IDLH
- 500 ppm

####Conversion
- 1 ppm = 3.11 mg/m³

###Physical Description
- Colorless to faint-yellow liquid with a sweet ether-like odor. [Note: Reagent grades are foul smelling.]
- MW: 76.1
- BP: 116°F
- FRZ: -169°F
- Sol: 0.3%
- VP: 297 mmHg
- IP: 10.08 eV
- Sp.Gr: 1.26
- Fl.P: -22°F
- UEL: 50.0%
- LEL: 1.3%

###Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

###Incompatibilities & Reactivities
- Strong oxidizers; chemically-active metals such as sodium, potassium & zinc; azides; rust; halogens; amines [Note: Vapors may be ignited by contact with ordinary light bulb.]

###Measurement Methods
- NIOSH 1600, 3800
- See: NMAM or OSHA Methods

###Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

###First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
# Important additional information about respirator selection

## Respirator Recommendations

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| **Up to 10 ppm:** | (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)  
(APF = 10) Any supplied-air respirator |
| **Up to 25 ppm:** | (APF = 25) Any supplied-air respirator operated in a continuous-flow mode  
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s) |
| **Up to 50 ppm:** | (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister  
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)  
(APF = 50) Any self-contained breathing apparatus with a full facepiece  
(APF = 50) Any supplied-air respirator with a full facepiece |
| **Up to 500 ppm:** | (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode |

### Emergency or planned entry into unknown concentrations or IDLH conditions:

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| (APF = 10,000) | Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus |

## Exposure Routes

| Route | Inhalation, skin absorption, ingestion, skin and/or eye contact |

## Symptoms

| Symptom | Dizziness, headache, poor sleep, lassitude (weakness, exhaustion), anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects |

## Target Organs

| Organ | Central nervous system, peripheral nervous system, cardiovascular system, eyes, kidneys, liver, skin, reproductive system |

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

**Carbon monoxide**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>630-08-0</td>
</tr>
<tr>
<td>RTECS</td>
<td>FG35000000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1016 119 9202 168 (cryogenic liquid)</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Carbon oxide, Flue gas, Monoxide

**Exposure Limits**
- NIOSH REL: TWA 35 ppm (40 mg/m³) C 200 ppm (229 mg/m³)
- OSHA PEL†: TWA 50 ppm (55 mg/m³)

**IDLH** 1200 ppm

**Conversion** 1 ppm = 1.15 mg/m³

**Physical Description**
Colorless, odorless gas. [Note: Shipped as a nonliquefied or liquefied compressed gas.]

- MW: 28.0
- BP: -313°F
- MLT: -337°F
- Sol: 2%
- VP: >35 atm
- IP: 14.01 eV
- RGasD: 0.97
- Fl.P: NA (Gas)
- UEL: 74%
- LEL: 12.5%

**Incompatibilities & Reactivities**
Strong oxidizers, bromine trifluoride, chlorine trifluoride, lithium

**Measurement Methods**
NIOSH 6604 ; OSHA ID209 , ID210
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** ([See protection](#))
- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Frostbite wash

**First Aid** ([See procedures](#))
- Eye: Frostbite
- Skin: Frostbite
- Breathing: Respiratory support
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 350 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 875 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 1200 ppm:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern†
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern†/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin and/or eye contact (liquid)

**Symptoms** Headache, tachypnea, nausea, lassitude (weakness, exhaustion), dizziness, confusion, hallucinations; cyanosis; depressed S-T segment of electrocardiogram, angina, syncope

**Target Organs** cardiovascular system, lungs, blood, central nervous system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

<table>
<thead>
<tr>
<th>Carbon tetrabromide</th>
<th>CAS 558-13-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBr₄</td>
<td>RTECS FG4725000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide 2516 151</td>
</tr>
<tr>
<td>Carbon bromide, Methane tetrabromide, Tetrabromomethane</td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits
- NIOSH REL: TWA 0.1 ppm (1.4 mg/m³) ST 0.3 ppm (4 mg/m³)
- OSHA PEL†: none

### IDLH
- N.D.

### Conversion
- 1 ppm = 13.57 mg/m³

## Physical Description
- Colorless to yellow-brown crystals with a slight odor.
- MW: 331.7
- BP: 374°F
- MLT: 194°F
- Sol: 0.02%
- VP(205°F): 40 mmHg
- IP: 10.31 eV
- Sp.Gr: 3.42
- Fl.P: NA
- UEL: NA
- LEL: NA

## Incompatibilities & Reactivities
- Noncombustible Solid
- Strong oxidizers, hexacyclohexylidilead, lithium

## Measurement Methods
- None available
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)
- Skin: No recommendation
- Eyes: Prevent eye contact
- Wash skin: Daily
- Remove: No recommendation
- Change: Daily
- Provide: Eyewash

## First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

## Important additional information about respirator selection
Respirator Recommendations Not available.

## Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

## Symptoms
- Irritation eyes, skin, respiratory system; lacrimation (discharge of tears); lung, liver, kidney injury; in animals: corneal damage

## Target Organs
- Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Carbon tetrachloride

<table>
<thead>
<tr>
<th>CAS 56-23-5</th>
<th>RTECS FG4900000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Carbon chloride; Carbon tet; Freon® 10; Halon® 104; Tetrachloromethane

### DOT ID & Guide
1846 151

### Exposure Limits

- **NIOSH REL:** Ca ST 2 ppm (12.6 mg/m³) [60-minute] See Appendix A
- **OSHA PEL†:** TWA 10 ppm C 25 ppm 200 ppm (5-minute maximum peak in any 4 hours)

### IDLH Ca [200 ppm]

### Conversion

1 ppm = 6.29 mg/m³

### Physical Description

Colorless liquid with a characteristic ether-like odor.

- **MW:** 153.8
- **BP:** 170°F
- **FRZ:** -9°F
- **Sol:** 0.05%
- **VP:** 91 mmHg
- **IP:** 11.47 eV
- **Sp.Gr:** 1.59
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

### Incompatibilities & Reactivities
Chemically-active metals such as sodium, potassium & magnesium; fluorine; aluminum [Note: Forms highly toxic phosgene gas when exposed to flames or welding arcs.]

### Measurement Methods
NIOSH 1003 ; OSHA 7
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

### First Aid (See procedures )

- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations NIOSH

- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>central nervous system, eyes, lungs, liver, kidneys, skin</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver cancer]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION]
# NIOSH Pocket Guide to Chemical Hazards

## Carbonyl fluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>353-50-4</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Carbon difluoride oxide, Carbon fluoride oxide, Carbon oxyfluoride, Carbonyl difluoride, Fluoroformyl fluoride, Fluorophosgene

### Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

**Conversion** 1 ppm = 2.70 mg/m³

### Physical Description

Colorless gas with a pungent and very irritating odor. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>MW</th>
<th>66.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP</td>
<td>55.4 atm</td>
</tr>
<tr>
<td>FI.P</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Nonflammable Gas**

### Incompatibilities & Reactivities

Heat, moisture, hexafluoroisopropyl-ideneamino-lithium [Note: Reacts with water to form hydrogen fluoride & carbon dioxide.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin**: Frostbite

**Eyes**: Frostbite

Wash skin: No recommendation

Remove: No recommendation

Change: No recommendation

Provide: Frostbite wash

### First Aid

**Eye**: Frostbite

**Skin**: Frostbite

**Breathing**: Respiratory support

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, skin and/or eye contact

### Symptoms

Irritation eyes, skin, mucous membrane, respiratory system; eye, skin burns; lacrimation (discharge of tears); cough, pulmonary edema, dyspnea (breathing difficulty); chronic exposure: gastrointestinal pain, muscle fibrosis, skeletal fluorosis; liquid: frostbite

### Target Organs

Eyes, skin, respiratory system, bone

---

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Catechol

<table>
<thead>
<tr>
<th>CAS</th>
<th>120-80-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>UX1050000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
1,2-Benzenediol; o-Benzenediol; 1,2-Dihydroxybenzene; o-Dihydroxybenzene; 2-Hydroxyphenol; Pyrocatechol

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 5 ppm (20 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

| IDLH N.D.       | Conversion 1 ppm = 4.50 mg/m³         |

### Physical Description

Colorless, crystalline solid with a faint odor. [Note: Discolors to brown in air & light.]

- **MW:** 110.1
- **BP:** 474°F
- **MLT:** 221°F
- **Sol:** 44%
- **VP(244°F):** 10 mmHg
- **IP:** ?
- **Sp.Gr:** 1.34
- **FI.P:** 261°F
- **UEL:** ?
- **LEL:** 1.4%

### Incompatibilities & Reactivities

Combustible Solid

Strong oxidizers, nitric acid

### Measurement Methods

OSHA PV2014

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: Daily

Provide: Eyewash

### First Aid

**Eye:** Irrigate immediately

**Skin:** Water wash immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system; skin sensitization, dermatitis; lacrimation (discharge of tears), burns; convulsions, increased blood pressure, kidney injury

### Target Organs

Eyes, skin, respiratory system, central nervous system, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Cellulose

<table>
<thead>
<tr>
<th>CAS 9004-34-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS FJ5691460</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Hydroxycellulose
- Pyrocellulose

### Exposure Limits
- **NIOSH REL:** TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)
- **OSHA PEL:** TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)
- **IDLH:** N.D.

### Physical Description
- Odorless, white substance. [Note: The principal fiber cell wall material of vegetable tissues (wood, cotton, flax, grass, etc.).]
- **MW:** 160,000-560,000
- **BP:** Decomposes
- **MLT:** 500-518°F (Decomposes)
- **Sol:** Insoluble
- **VP:** 0 mmHg (approx)
- **IP:** NA
- **FI.P:** NA
- **UEL:** NA
- **Sp.Gr:** 1.27-1.61

### Combustible Solid

### Incompatibilities & Reactivities
- Water, bromine pentafluoride, sodium nitrate, fluorine, strong oxidizers

### Measurement Methods
- NIOSH 0500, 0600, 7404
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

### First Aid (See procedures)
- **Eye:** Irrigate immediately
- **Skin:** Soap wash
- **Breathing:** Fresh air

### Important additional information about respirator selection

### Respirator Recommendations
- Not available.

### Exposure Routes
- Inhalation, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, mucous membrane

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Cesium hydroxide

**CAS** 21351-79-1  
**RTECS** FK9800000

### Synonyms & Trade Names

- Cesium hydrate, Cesium hydroxide dimer

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 2 mg/m³</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH N.D.</td>
<td>Conversion</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description

- Colorless or yellowish, crystalline solid. [Note: Hygroscopic (i.e., absorbs moisture from the air).]
- MW: 149.9  
- BP: ?  
- MLT: 522°F  
- Sol(59°F): 395%  
- VP: 0 mmHg (approx)  
- IP: NA  
- Sp.Gr: 3.68  
- F.I.P: NA  
- UEL: NA  
- LEL: NA

### Incompatibilities & Reactivities

- Water, acids, CO₂, metals (e.g., Al, Pb, Sn, Zn), oxygen [Note: CsOH is a strong base, causing the generation of considerable heat in contact with water or moisture.]

### Measurement Methods

- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: Daily  
- **Provide**: Eyewash, Quick drench

### First Aid

- **Eye**: Irrigate immediately  
- **Skin**: Water flush immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, upper respiratory system; eye, skin burns

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
### Chlordane

<table>
<thead>
<tr>
<th>CAS</th>
<th>57-74-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>PB9800000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- Chlordan; Chlordano; 1,2,4,5,6,7,8,8-Octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane

#### DOT ID & Guide
- 2762 131

#### Exposure Limits
- **NIOSH REL:** Ca TWA 0.5 mg/m³ [skin] See Appendix A
- **OSHA PEL:** TWA 0.5 mg/m³ [skin]

#### IDLH
- Ca [100 mg/m³]

#### Conversion

##### Physical Description
Amber-colored, viscous liquid with a pungent, chlorine-like odor. [insecticide]

- **MW:** 409.8
- **BP:** Decomposes
- **FRZ:** 217-228°F
- **Sol:** 0.0001%
- **VP:** 0.00001 mmHg
- **IP:** ?
- **Sp.Gr(77°F):** 1.6
- **FL.P:** NA
- **UEL:** NA
- **LEL:** NA

Noncombustible Liquid, but may be utilized in flammable solutions.

#### Incompatibilities & Reactivities
- Strong oxidizers, alkaline reagents

#### Measurement Methods
- NIOSH 5510 ; OSHA 67
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **(See protection )**
  - **Skin:** Prevent skin contact
  - **Eyes:** Prevent eye contact
  - **Wash skin:** When contaminated
  - **Remove:** When wet or contaminated
  - **Change:** Daily
  - **Provide:** Eyewash, Quick drench

#### First Aid
- **(See procedures )**
  - **Eye:** Irrigate immediately
  - **Skin:** Soap wash immediately
  - **Breathing:** Respiratory support
  - **Swallow:** Medical attention immediately

#### Important additional information about respirator selection

##### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here] for information on selection of N, R, or P filters.

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria; in animals: lung, liver, kidney damage; [potential occupational carcinogen] |
| **Target Organs** | central nervous system, eyes, lungs, liver, kidneys |
| **Cancer Site** | [in animals: liver cancer] |

See also: INTRODUCTION
# Chlorinated camphene

**CAS**: 8001-35-2  
**RTECS**: XW5250000

## Synonyms & Trade Names
- Chlorocamphene
- Octachlorocamphene
- Polychlorocamphene
- Toxaphene

## DOT ID & Guide
- **ID**: 2761 151

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca [skin]</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 0.5 mg/m³ [skin]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca [200 mg/m³]</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Physical Description
Amber, waxy solid with a mild, piney, chlorine- and camphor-like odor. [insecticide]

| MW: 413.8 | Decomposes |
| VP(77°F): 0.4 mmHg | ? |
| Fl.P: NA | UEL: NA |

Noncombustible Solid, but may be dissolved in flammable liquids.

## Incompatibilities & Reactivities
- Strong oxidizers  
  [Note: Slightly corrosive to metals under moist conditions.]

## Measurement Methods
- NIOSH 5039  
  See: NMAM or OSHA Methods

## Personal Protection & Sanitation  
(See protection )
- **Skin**: Prevent skin contact  
  - Wash skin: When contaminated/Daily  
  - Remove: When wet or contaminated  
  - Change: Daily  
  - Provide: Eyewash, Quick drench

## First Aid  
(See procedures )
- **Eye**: Irrigate immediately  
- **Skin**: Soap wash promptly  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately

## Important additional information about respirator selection

### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.  
  Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Nausea, confusion, agitation, tremor, convulsions, unconsciousness; dry, red skin; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>central nervous system, skin</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
**Chlorinated diphenyl oxide**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
Synonyms depend on the degree of chlorination of diphenyl oxide \([\text{C}_6\text{H}_5\text{O}]\), ranging from monochlorodiphenyl oxide \([\text{C}_6\text{H}_4\text{Cl}\text{O}(\text{C}_6\text{H}_5)]\) to decachlorodiphenyl oxide \([\text{C}_6\text{Cl}_5\text{O}(\text{C}_6\text{Cl}_5)]\).

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.5 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 0.5 mg/m³</td>
</tr>
</tbody>
</table>

**IDLH 5 mg/m³**

**Physical Description**
Appearance and odor vary depending upon the specific compound.
Properties vary depending upon the specific compound.

**Incompatibilities & Reactivities**
Strong oxidizers

**Measurement Methods**
NIOSH 5025
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily

**First Aid** *(See procedures)*
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 5 mg/m³:**
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor and acid gas canister having an N100, R100, or P100 filter. [Click here](#)

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Acne-form dermatitis, liver damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Skin, liver</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Chlorine

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7782-50-5</td>
<td>FO2100000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Molecular chlorine

### DOT ID & Guide
- 1017 124

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>C 0.5 ppm (1.45 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>C 1 ppm (3 mg/m³)</td>
</tr>
</tbody>
</table>

### IDLH
- 10 ppm

### Conversion
- 1 ppm = 2.90 mg/m³

### Physical Description
- Greenish-yellow gas with a pungent, irritating odor. [Note: Shipped as a liquefied compressed gas.]

### MW: 70.9
### BP: -29°F
### FRZ: -150°F
### Sol: 0.7%
### VP: 6.8 atm
### IP: 11.48 eV
### RGasD: 2.47
### Fl.P: NA
### UEL: NA
### LEL: NA

Nonflammable Gas, but a strong oxidizer.

### Incompatibilities & Reactivities
- Reacts explosively or forms explosive compounds with many common substances such as acetylene, ether, turpentine, ammonia, fuel gas, hydrogen & finely divided metals.

### Measurement Methods
- NIOSH 6011 ; OSHA ID101 , ID126SGX
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation
- Provide: Frostbite wash

### First Aid (See procedures)
- Eye: Frostbite
- Skin: Frostbite
- Breathing: Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 5 ppm:
(APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern*
(APF = 10) Any supplied-air respirator*

Up to 10 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern*
(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin and/or eye contact

Symptoms Burning of eyes, nose, mouth; lacrimation (discharge of tears), rhinorrhea (discharge of thin mucus); cough, choking, substernal (occurring beneath the sternum) pain; nausea, vomiting; headache, dizziness; syncope; pulmonary edema; pneumonitis; hypoxemia (reduced oxygen in the blood); dermatitis; liquid: frostbite

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
# Chlorine dioxide

| **CAS** | 10049-04-4 |
| **RTECS** | FO3000000 |
| **DOT ID & Guide** | 9191143 (hydrate, frozen) |

## Synonyms & Trade Names
Chlorine oxide, Chlorine peroxide

## Exposure Limits
- **NIOSH REL:** TWA 0.1 ppm (0.3 mg/m³) ST 0.3 ppm (0.9 mg/m³)
- **OSHA PEL†:** TWA 0.1 ppm (0.3 mg/m³)
- **IDLH:** 5 ppm

## Conversion
1 ppm = 2.76 mg/m³

## Physical Description
Yellow to red gas or a red-brown liquid (below 52°F) with an unpleasant odor similar to chlorine and nitric acid.

| MW: 67.5 | BP: 52°F | FRZ: -74°F | Sol(77°F): 0.3% |
| VP: >1 atm | IP: 10.36 eV | RGasD: 2.33 | Sp.Gr: 1.6 (Liquid at 32°F) |

Flammable Gas/Combustible Liquid

## Incompatibilities & Reactivities
Organic materials, heat, phosphorus, potassium hydroxide, sulfur, mercury, carbon monoxide [Note: Unstable in light. A powerful oxidizer.]

## Measurement Methods
OSHA ID126SGX, ID202
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)
- **Skin:** Prevent skin contact (liquid)
- **Eyes:** Prevent eye contact (liquid)
- **Wash skin:** When contaminated (liquid)
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Eyewash (liquid), Quick drench (liquid)

## First Aid
(See procedures)
- **Eye:** Irrigate immediately (liquid)
- **Skin:** Soap wash immediately (liquid)
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately (liquid)
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 1 ppm:
(APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern
(APF = 10) Any supplied-air respirator

Up to 2.5 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern

Up to 5 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion (liquid), skin and/or eye contact

Symptoms Irritation eyes, nose, throat; cough, wheezing, bronchitis, pulmonary edema; chronic bronchitis

Target Organs Eyes, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Chlorine trifluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7790-91-2</td>
<td>FO2800000</td>
<td>1749 124</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Chlorine fluoride, Chlorotrifluoride

### Exposure Limits
- **NIOSH REL:** C 0.1 ppm (0.4 mg/m³)
- **OSHA PEL:** C 0.1 ppm (0.4 mg/m³)

**IDLH:** 20 ppm  
**Conversion:** 1 ppm = 3.78 mg/m³

### Physical Description
- Colorless gas or a greenish-yellow liquid (below 53°F) with a somewhat sweet, suffocating odor. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>MW: 92.5</th>
<th>BP: 53°F</th>
<th>FRZ: -105°F</th>
<th>Sol: Reacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 1.4 atm</td>
<td>IP: 13.00 eV</td>
<td>RGasD: 3.21</td>
<td>Sp.Gr: 1.77 (Liquid at 53°F)</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
<td>LEL: NA</td>
<td></td>
</tr>
</tbody>
</table>

Nonflammable Gas Noncombustible Liquid, but contact with organic materials may result in SPONTANEOUS ignition.

### Incompatibilities & Reactivities
- Oxidizers, water, acids, combustible materials, sand, glass, metals (corrosive) [Note: Reacts with water to form chlorine & hydrofluoric acid.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated (liquid)
- **Remove:** When wet or contaminated (liquid)
- **Change:** No recommendation
- **Provide:** Eyewash (liquid), Quick drench (liquid)

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately (liquid)
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 2.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 5 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 20 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

---

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, ingestion (liquid), skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Eye, skin burns (liquid or high vapor concentration); respiratory irritation; in animals: lacrimation (discharge of tears), corneal ulcer; pulmonary edema</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, eyes, respiratory system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# Chloroacetaldehyde

**CAS**: 107-20-0  
**RTECS**: AB2450000

### Synonyms & Trade Names
- Chloroacetaldehyde (40% aqueous solution)
- 2-Chloroacetaldehyde
- 2-Chloroethanal

### DOT ID & Guide
- DOT ID: 2232
- Guide: 153

### Exposure Limits
- NIOSH REL: C 1 ppm (3 mg/m³)
- OSHA PEL: C 1 ppm (3 mg/m³)

**IDLH**: 45 ppm  
**Conversion**: 1 ppm = 3.21 mg/m³

### Physical Description
- Colorless liquid with an acrid, penetrating odor. [Note: Typically found as a 40% aqueous solution.]
- **MW**: 78.5  
- **BP**: 186°F  
- **FRZ**: -3°F (40% solution)  
- **Sol**: Miscible
- **VP**: 100 mmHg  
- **IP**: 10.61 eV  
- **Sp.Gr**: 1.19 (40% solution)
- **Fl.P**: 190°F (40% solution)  
- **UEL**: ?  
- **LEL**: ?

- **Class IIIA Combustible Liquid**: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Oxidizers, acids

### Measurement Methods
- NIOSH 2015  
- OSHA 76
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash, Quick drench

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
## Important additional information about respirator selection

<table>
<thead>
<tr>
<th>Respirator Recommendations NIOSH/OSHA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 10 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*</td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator*</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 25 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 45 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
<td></td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
<td></td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation skin, eyes, mucous membrane; skin burns; eye damage; pulmonary edema; skin, respiratory system sensitization</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
**alpha-Chloroacetophenone**

<table>
<thead>
<tr>
<th>CAS</th>
<th>532-27-4</th>
</tr>
</thead>
</table>

**C₆H₅COCH₂Cl**

<table>
<thead>
<tr>
<th>RTECS</th>
<th>AM6300000</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**

2-Chloroacetophenone; Chloromethyl phenyl ketone; Mace®; Phenacyl chloride; Phenyl chloromethyl ketone; Tear gas

**DOT ID & Guide**

1697 153

---

**Exposure Limits**

NIOSH REL: TWA 0.3 mg/m³ (0.05 ppm)

OSHA PEL: TWA 0.3 mg/m³ (0.05 ppm)

IDLH 15 mg/m³

**Conversion**

1 ppm = 6.32 mg/m³

---

**Physical Description**

Colorless to gray crystalline solid with a sharp, irritating odor.

| MW: 154.6 | BP: 472°F | MLT: 134°F | Sol: Insoluble |
| VP: 0.005 mmHg | IP: 9.44 eV | Sp.Gr: 1.32 |
| Fl.P: 244°F | UEL: ? | LEL: ? |

**Incompatibilities & Reactivities**

Combustible Solid

Water, steam, strong oxidizers [Note: Slowly corrodes metals.]

**Measurement Methods**

NIOSH P&CAM291 (II-5)

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash

**First Aid** (See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 3 mg/m³:

(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

#### Up to 7.5 mg/m³:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode


#### Up to 15 mg/m³:

(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system; pulmonary edema

### Target Organs

Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# Chloroacetyl chloride

**CAS** 79-04-9  
**RTECS** AO6475000

## Synonyms & Trade Names
Chloroacetic acid chloride, Chloroacetic chloride, Monochloroacetyl chloride

## Exposure Limits
- **NIOSH REL**: TWA 0.05 ppm (0.2 mg/m³)  
- **OSHA PEL†**: none  
- **IDLH**: N.D.  
- **Conversion**: 1 ppm = 4.62 mg/m³

## Physical Description
Colorless to yellowish liquid with a strong, pungent odor.

- **MW**: 112.9  
- **BP**: 223°F  
- **FRZ**: -7°F  
- **Sol**: Decomposes
- **VP**: 19 mmHg  
- **IP**: 10.30 eV  
- **Sp.Gr.**: 1.42  
- **Fl.P**: NA  
- **UEL**: NA  
- **LEL**: NA

Noncombustible Liquid

## Incompatibilities & Reactivities
Water, alcohols, bases, metals (corrosive), amines [Note: Decomposes in water to form chloroacetic acid & hydrogen chloride gas.]

## Measurement Methods
None available  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: No recommendation  
- **Provide**: Eyewash, Quick drench

## First Aid
- **Eye**: Irrigate immediately  
- **Skin**: Water flush immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately

## Important additional information about respirator selection
**Respirator Recommendations** Not available.

## Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms
Irritation eyes, skin, respiratory system; eye, skin burns; cough, wheezing, dyspnea (breathing difficulty); lacrimation (discharge of tears)

## Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
## Chlorobenzene

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-90-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>CZ0175000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Benzene chloride, Chlorobenzol, MCB, Monochlorobenzene, Phenyl chloride</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1134 130</td>
</tr>
</tbody>
</table>

### Exposure Limits
- NIOSH REL: See Appendix D
- OSHA PEL: TWA 75 ppm (350 mg/m³)
- IDLH 1000 ppm
- Conversion 1 ppm = 4.61 mg/m³

### Physical Description
- Colorless liquid with an almond-like odor.
- MW: 112.6
- BP: 270°F
- FRZ: -50°F
- Sol: 0.05%
- VP: 9 mmHg
- IP: 9.07 eV
- Sp.Gr: 1.11
- Fl.P: 82°F
- UEL: 9.6%
- LEL: 1.3%

### Incompatibilities & Reactivities
- Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.
- Strong oxidizers

### Measurement Methods
- NIOSH 1003 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

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 Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
## Important additional information about respirator selection

**Respirator Recommendations OSHA**

**Up to 1000 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
c- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** Inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury

**Target Organs** Eyes, skin, respiratory system, central nervous system, liver

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## o-Chlorobenzylidene malononitrile

<table>
<thead>
<tr>
<th>CAS</th>
<th>2698-41-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>OO3675000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- 2-Chlorobenzalmalonitrile, CS, OCBM

**DOT ID & Guide**
- 2810 153

### Exposure Limits

- NIOSH REL: C 0.05 ppm (0.4 mg/m³) [skin]
- OSHA PEL†: TWA 0.05 ppm (0.4 mg/m³)

**IDLH** 2 mg/m³

**Conversion**
- 1 ppm = 7.71 mg/m³

### Physical Description
White crystalline solid with a pepper-like odor.

- MW: 188.6
- BP: 590-599°F
- MLT: 203-205°F
- Sol: Insoluble

- VP: 0.00003 mmHg
- IP: ?
- Sp.Gr: ?

**Combustible Solid**

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH P&CAM304 (II-5)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Pain, burn eyes, lacrimation (discharge of tears), conjunctivitis; erythema (skin redness) eyelids, blepharospasm; irritation throat, cough, chest tightness; headache; erythema (skin redness), skin vesiculation

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Chlorobromomethane

<table>
<thead>
<tr>
<th>CAS</th>
<th>74-97-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>PA5250000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Bromochloromethane; CB; CBM; Fluorocarbon 1011; Halon® 1011; Methyl chlorobromide

### Exposure Limits
- **NIOSH REL:** TWA 200 ppm (1050 mg/m³)
- **OSHA PEL:** TWA 200 ppm (1050 mg/m³)

**IDLH:** 2000 ppm

### Conversion
1 ppm = 5.29 mg/m³

### Physical Description
Colorless to pale-yellow liquid with a chloroform-like odor. [Note: May be used as a fire extinguishing agent.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>129.4</td>
</tr>
<tr>
<td>BP</td>
<td>155°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-124°F</td>
</tr>
<tr>
<td>IP</td>
<td>10.77 eV</td>
</tr>
<tr>
<td>Sp.Gr.</td>
<td>1.93</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Liquid

### Incompatibilities & Reactivities
Chemically-active metals such as calcium, powdered aluminum, zinc & magnesium

### Measurement Methods
- NIOSH 1003
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation *(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

### First Aid *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2000 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, throat; confusion, dizziness, central nervous system depression; pulmonary edema

Target Organs Eyes, skin, respiratory system, liver, kidneys, central nervous system

See also: INTRODUCTION
## Chlorodifluoromethane

**CAS** 75-45-6  
**RTECS** PA6390000

### Synonyms & Trade Names
- Difluorochloromethane; Fluorocarbon-22; Freon® 22; Genetron® 22; Monochlorodifluoromethane; Refrigerant 22

### Exposure Limits
- **NIOSH REL**: TWA 1000 ppm (3500 mg/m³) ST 1250 ppm (4375 mg/m³)
- **OSHA PEL†**: none
- **IDLH**: N.D.

### Conversion
- 1 ppm = 3.54 mg/m³

### Physical Description
- Colorless gas with a faint, sweetish odor. [Note: Shipped as a liquefied compressed gas.]
- **MW**: 86.5  
- **BP**: -41°F  
- **FRZ**: -231°F  
- **Sol(77°F)**: 0.3%
- **VP**: 9.4 atm  
- **IP**: 12.45 eV  
- **RGasD**: 3.11
- **FI.P**: NA  
- **UEL**: NA  
- **LEL**: NA

### Incompatibilities & Reactivities
- Alkalis, alkaline earth metals (e.g., powdered aluminum, sodium, potassium, zinc)

### Measurement Methods
- NIOSH 1018  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Frostbite  
- **Eyes**: Frostbite  
- Wash skin: No recommendation  
- Remove: No recommendation  
- Change: No recommendation  
- Provide: Frostbite wash

### First Aid
- **Eye**: Frostbite  
- **Skin**: Frostbite  
- **Breathing**: Respiratory support

### Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

### Exposure Routes
- Inhalation, skin and/or eye contact (liquid)

### Symptoms
- Irritation respiratory system; confusion, drowsiness, ringing in ears; heart palpitations, cardiac arrhythmias; asphyxia; liver, kidney, spleen injury; liquid: frostbite

### Target Organs
- Respiratory system, cardiovascular system, central nervous system, liver, kidneys, spleen

See also: **INTRODUCTION**
## Chlorodiphenyl (42% chlorine)

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₆H₄ClC₆H₃Cl₂ (approx)</td>
<td>53469-21-9</td>
<td>TQ13560000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Aroclor® 1242, PCB, Polychlorinated biphenyl

### Exposure Limits
- **NIOSH REL**: Ca TWA 0.001 mg/m³ [See Appendix A [Note: The REL also applies to other PCBs.]]
- **OSHA PEL**: TWA 1 mg/m³ (skin)

### Physical Description
- Colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.
- MW: 258 (approx)
- BP: 617-691°F
- FRZ: -2°F
- Sol: Insoluble
- VP: 0.001 mmHg
- IP: ?
- Sp.Gr(77°F): 1.39
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans & chlorinated dibenzo-p-dioxins.

### Measurement Methods
- NIOSH 5503 ; PV2089
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes; chloracne; liver damage; reproductive effects; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, eyes, liver, reproductive system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors of the pituitary gland &amp; liver, leukemia]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
### Chlorodiphenyl (54% chlorine)

**CAS** 11097-69-1

**RTECS** TQ1360000

### Synonyms & Trade Names
- Aroclor® 1254, PCB, Polychlorinated biphenyl

### DOT ID & Guide
- 2315 171

### Exposure Limits
<table>
<thead>
<tr>
<th>IDLH Ca [5 mg/m³]</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description
- Colorless to pale-yellow, viscous liquid or solid (below 50°F) with a mild, hydrocarbon odor.
- MW: 326 (approx)
- BP: 689-734°F
- FRZ: 50°F
- Sol: Insoluble
- VP: 0.00006 mmHg
- IP: ?
- Sp.Gr(77°F): 1.38
- Fl.P: NA
- UEL: NA
- LEL: NA

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzo-furans, and chlorinated dibenzo-p-dioxins.

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH 5503 ; OSHA PV2088
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, eyes, liver, reproductive system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors of the pituitary gland &amp; liver, leukemia]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
#### Chloroform

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>67-66-3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td>FS9100000</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1888 151</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Methane trichloride, Trichloromethane

**Exposure Limits**
- NIOSH REL: Ca ST 2 ppm (9.78 mg/m³) [60-minute] See Appendix A
- OSHA PEL†: C 50 ppm (240 mg/m³)

**ID LH Ca [500 ppm]**

**Conversion**

1 ppm = 4.88 mg/m³

**Physical Description**
- Colorless liquid with a pleasant odor.
- MW: 119.4
- BP: 143°F
- FRZ: -82°F
- Sol(77°F): 0.5%
- VP: 160 mmHg
- IP: 11.42 eV
- Sp.Gr: 1.48
- Fl.P: NA
- UEL: NA
- LEL: NA

**Noncombustible Liquid**

**Incompatibilities & Reactivities**
- Strong caustics; chemically-active metals such as aluminum or magnesium powder, sodium & potassium; strong oxidizers

[Note: When heated to decomposition, forms phosgene gas.]

**Measurement Methods**
- NIOSH 1003
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

**First Aid** (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Liver, kidneys, heart, eyes, skin, central nervous system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver &amp; kidney cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: [1910.1008] See Appendix B</td>
</tr>
<tr>
<td>IDLH Ca [N.D.]</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description

Colorless liquid with a suffocating odor.

- MW: 115.0
- BP: 223°F
- FRZ: -43°F
- Sol: Reacts
- VP (72°F): 30 mmHg
- IP: ?
- Sp.Gr: 1.32
- FI.P: <66°F
- UEL: ?
- LEL: ?

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Acids, water [Note: Reacts with water to form hydrochloric acid & formaldehyde.]

### Measurement Methods

- OSHA 10
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet (flammable)
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations (See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin, mucous membrane, respiratory system; pulmonary congestion, edema; corneal damage, necrosis; decreased pulmonary function, cough, dyspnea (breathing difficulty), wheezing; blood-stained sputum, bronchial secretions; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[lung cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## Chloromethyl methyl ether

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS 107-30-2</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- Chlorodimethyl ether
- Chloromethoxymethane
- CMME
- Dimethylchloroether
- Methylchloromethyl ether

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limit</th>
<th>NIOSH REL: Ca See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>[1910.1006] See Appendix B</td>
</tr>
<tr>
<td>IDLH Ca [N.D.]</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description
- Colorless liquid with an irritating odor.

### MW: 80.5
- BP: 138°F
- FRZ: -154°F
- Sol: Reacts
- VP(70°F): 192 mmHg
- IP: 10.25 eV
- Sp.Gr: 1.06
- Fl.P(oc): 32°F
- UEL: ?
- LEL: ?

### Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Water [Note: Reacts with water to form hydrochloric acid & formaldehyde.]

### Measurement Methods
- NIOSH P&CAM220 (II-1) ; OSHA 10
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet (flammable)
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations (See Appendix E) NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, skin, mucous membrane; pulmonary edema, pulmonary congestion, pneumonitis; skin burns, necrosis; cough, wheezing, pulmonary congestion; blood stained-sputum; weight loss; bronchial secretions; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, respiratory system |
| **Cancer Site** | [in animals: skin & lung cancer] |

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 1-Chloro-1-nitropropane

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>600-25-9</td>
<td>TX5075000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Korax®
- Lanstan®

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 2 ppm (10 mg/m³)</td>
<td>TWA 20 ppm (100 mg/m³)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 ppm</td>
<td>1 ppm = 5.06 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

- Colorless liquid with an unpleasant odor. [fungicide]
- MW: 123.6
- BP: 289°F
- FRZ: ?
- Sol: 0.5%
- VP(77°F): 6 mmHg
- IP: 9.90 eV
- Sp.Gr: 1.21
- Fl.P(oc): 144°F
- UEL: ?
- LEL: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities

- Strong oxidizers, acids

### Measurement Methods

- NIOSH S211 (II-5)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin</th>
<th>Eyes</th>
<th>Wash skin</th>
<th>Remove</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevent skin contact</td>
<td>Prevent eye contact</td>
<td>When contaminated</td>
<td>When wet or contaminated</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Eye</th>
<th>Skin</th>
<th>Breathing</th>
<th>Swallow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigate immediately</td>
<td>Soap wash</td>
<td>Respiratory support</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>
## Important additional information about respirator selection

### Respirator Recommendations NIOSH

#### Up to 20 ppm:
- (APF = 10) Any supplied-air respirator*

#### Up to 50 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

#### Up to 100 ppm:
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>In animals: irritation eyes; pulmonary edema; liver, kidney, heart damage</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>respiratory system, liver, kidneys, cardiovascular system, eyes</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# Chloropentfluoroethane

**CAS** 76-15-3  
**RTECS** KH7877500  
**DOT ID & Guide** 1020 126

## Synonyms & Trade Names
Fluorocarbon-115; Freon® 115; Genetron® 115; Halocarbon 115; Monochloropentfluoroethane

## Exposure Limits
- NIOSH REL: TWA 1000 ppm (6320 mg/m³)  
- OSHA PEL†: none  
- IDLH: N.D.  
- Conversion: 1 ppm = 6.32 mg/m³

## Physical Description
Colorless gas with a slight, ethereal odor. [Note: Shipped as a liquefied compressed gas.]

- **MW:** 154.5  
- **BP:** -38°F  
- **FRZ:** -223°F  
- **Sol(77°F):** 0.006%  
- **VP(70°F):** 7.9 atm  
- **IP:** 12.96 eV  
- **RGasD:** 5.55  
- **Fl.P:** NA  
- **UEL:** NA  
- **LEL:** NA

Nonflammable Gas

## Incompatibilities & Reactivities
Alkalis, alkaline earth metals (e.g., aluminum powder, sodium, potassium, zinc)

## Measurement Methods
None available  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** Frostbite  
- **Eyes:** Frostbite  
- **Wash skin:** No recommendation  
- **Remove:** No recommendation  
- **Change:** No recommendation  
- **Provide:** Frostbite wash

## First Aid
- **Eye:** Frostbite  
- **Skin:** Frostbite  
- **Breathing:** Respiratory support

## Important additional information about respirator selection
**Respirator Recommendations:** Not available.

## Exposure Routes
inhalation, skin and/or eye contact (liquid)

## Symptoms
Dyspnea (breathing difficulty); dizziness, incoordination, narcosis; nausea, vomiting; heart palpitations, cardiac arrhythmias, asphyxia; liquid: frostbite, dermatitis

## Target Organs
Skin, central nervous system, cardiovascular system

See also: INTRODUCTION
## Chloropicrin

<table>
<thead>
<tr>
<th>CAS 76-06-2</th>
<th>RTECS PB6300000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Nitrochloroform, Nitrotrichloromethane, Trichloronitromethane

### Exposure Limits
- **NIOSH REL:** TWA 0.1 ppm (0.7 mg/m³)
- **OSHA PEL:** TWA 0.1 ppm (0.7 mg/m³)

### Physical Description
Colorless to faint-yellow, oily liquid with an intensely irritating odor. [pesticide]

- **MW:** 164.4
- **BP:** 234°F
- **FRZ:** -93°F
- **Sol:** 0.2%
- **VP:** 18 mmHg
- **IP:** ?
- **Sp.Gr:** 1.66
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

### Incompatibilities & Reactivities
- Strong oxidizers [Note: The material may explode when heated under confinement.]

### Measurement Methods
None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

### First Aid (See procedures )
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Conversion
1 ppm = 6.72 mg/m³
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 2 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

#### Symptoms
- Irritation eyes, skin, respiratory system; lacrimation (discharge of tears); cough, pulmonary edema; nausea, vomiting

#### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
**beta-Chloroprene**

| **CAS** | 126-99-8 |
| **RTECS** | E19625000 |
| **Synonyms & Trade Names** | 2-Chloro-1,3-butadiene; Chlorobutadiene; Chloroprene |
| **DOT ID & Guide** | 1991 131 P (inhibited) |

**Exposure Limits**

| **NIOSH REL** | Ca C 1 ppm (3.6 mg/m³) [15-minute] See Appendix A |
| **OSHA PEL†** | TWA 25 ppm (90 mg/m³) [skin] |

| **IDLH** | Ca [300 ppm] |

**Conversion** 1 ppm = 3.62 mg/m³

**Physical Description**

Colorless liquid with a pungent, ether-like odor.

| **MW** | 88.5 |
| **BP** | 139°F |
| **FRZ** | -153°F |
| **Sol** | Slight |
| **VP** | 188 mmHg |
| **IP** | 8.79 eV |
| **Sp.Gr** | 0.96 |
| **UEL** | 11.3% |
| **LEL** | 1.9% |

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

**Incompatibilities & Reactivities**

Peroxides & other oxidizers [Note: Polymerizes at room temperature unless inhibited with antioxidants.]

**Measurement Methods**

NIOSH 1002 ; OSHA 112
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

**First Aid** (See procedures)

Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; anxiety, irritability; dermatitis, alopecia; reproductive effects; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, reproductive system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung &amp; skin cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

<table>
<thead>
<tr>
<th>o-Chlorostyrene</th>
<th>CAS 2039-87-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIC₆H₄CH=CH₂</td>
<td>RTECS WL4160000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide</td>
</tr>
<tr>
<td>2-Chlorostyrene, ortho-Chlorostyrene, 1-Chloro-2-ethenylbenzene</td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 50 ppm (285 mg/m³) ST 75 ppm (428 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
</tr>
<tr>
<td>IDLH N.D.</td>
</tr>
</tbody>
</table>

## Conversion

1 ppm = 5.67 mg/m³

## Physical Description

Colorless liquid.

| MW: 138.6 | BP: 372°F | FRZ: -82°F | Sol: Insoluble |
| VP(77°F): 0.96 mmHg | IP: ? | Sp.Gr: 1.10 |

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

## Incompatibilities & Reactivities

None reported

## Measurement Methods

None available

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

See protection

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |

## First Aid

See procedures

| Eye: Irrigate immediately |
| Skin: Soap wash |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

## Important additional information about respirator selection

Respirator Recommendations: Not available.

## Exposure Routes

inhalation, ingestion, skin and/or eye contact

## Symptoms

In animals: irritation eyes, skin; hematuria (blood in the urine), proteinuria, acidosis; enlarged liver, jaundice

## Target Organs

Eyes, skin, liver, kidneys, central nervous system, peripheral nervous system

See also: INTRODUCTION
o-Chlorotoluene

**CAS** 95-49-8

**RTECS** XS9000000

**Synonyms & Trade Names**
1-Chloro-2-methylbenzene, 2-Chloro-1-methylbenzene, 2-Chlorotoluene, o-Tolyl chloride

**DOT ID & Guide**
2238 129

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA</th>
<th>50 ppm (250 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: ST</td>
<td>75 ppm (375 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

**IDLH** N.D.

**Conversion** 1 ppm = 5.18 mg/m³

### Physical Description

Colorless liquid with an aromatic odor.

- MW: 126.6
- BP: 320°F
- FRZ: -31°F
- Sol(77°F): 0.009%
- VP(77°F): 4 mmHg
- IP: 8.83 eV
- Sp.Gr: 1.08
- Fl.P: 96°F
- UEL: ?
- LEL: ?

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities

Acids, alkalis, oxidizers, reducing materials, water

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection )

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash

### First Aid

(See procedures )

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, mucous membrane; dermatitis; drowsiness, incoordination, anesthesia; cough; liver, kidney injury

### Target Organs

Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2-Chloro-6-trichloromethyl pyridine

<table>
<thead>
<tr>
<th>CAS</th>
<th>1929-82-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>US7525000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>2-Chloro-6-(trichloro-methyl)pyridine; Nitrapyrin; N-serve®; 2,2,2,6-Tetrachloro-2-picoline</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 10 mg/m³ (total) ST 20 mg/m³ (total) TWA 5 mg/m³ (resp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

### Physical Description

Colorless or white, crystalline solid with a mild, sweet odor.

- **MW**: 230.9
- **BP**: ?
- **MLT**: 145°F
- **Sol**: Insoluble
- **VP (73°F)**: 0.003 mmHg
- **IP**: ?
- **Sp.Gr**: ?
- **UEL**: ?
- **LEL**: ?

**Combustible Solid [Explosive]**

### Incompatibilities & Reactivities

Aluminum, magnesium [Note: Emits oxides of nitrogen and chloride ion when heated to decomposition.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily

### First Aid

(See procedures)

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes

Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

No adverse effects noted in ingestion studies with animals.

### Target Organs

Eyes, skin

See also: INTRODUCTION
Chlorpyrifos

<table>
<thead>
<tr>
<th>CAS</th>
<th>2921-88-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₉H₁₁Cl₃NO₃PS</td>
<td>RTECS TF6300000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Chlorpyrifos-ethyl; O,O-Diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate; Dursban®

**DOT ID & Guide**
2783 152

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.2 mg/m³ ST 0.6 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

**IDLH N.D.**

**Physical Description**
Colorless to white, crystalline solid with a mild, mercaptan-like odor. [pesticide] [Note: Commercial formulations may be combined with combustible liquids.]

| MW: 350.6  |
| BP: 320°F (Decomposes) |
| MLT: 108°F  |
| Sol: 0.0002% |
| VP: 0.00002 mmHg |
| IP: ?  |
| UEL: ?  |
| LEL: ?  |

**Combustible Solid**

**Incompatibilities & Reactivities**
Strong acids, caustics, amines [Note: Corrosive to copper & brass.]

**Measurement Methods**
NIOSH 5600 ; OSHA 62
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily

**First Aid** *(See procedures)*
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**
**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Wheezing, laryngeal spasms, salivation; bluish lips, skin; miosis, blurred vision; nausea, vomiting, abdominal cramps, diarrhea

**Target Organs** respiratory system, central nervous system, peripheral nervous system, plasma cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Chromic acid and chromates

<table>
<thead>
<tr>
<th>CAS</th>
<th>1333-82-0 (CrO₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>GB66500000 (CrO₃)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Chromic acid (CrO₃): Chromic anhydride, Chromic oxide, Chromium(VI) oxide (1:3), Chromium trioxide
- Synonyms of chromates (i.e., chromium(VI) compounds) such as zinc chromate vary depending upon the specific compound.

### Exposure Limits

- **NIOSH REL (as Cr):** Ca TWA 0.001 mg/m³  
  - See Appendix A  
  - See Appendix C
- **OSHA PEL (as CrO₃):** C 0.1 mg/m³  
  - See Appendix C

**IDLH Ca [15 mg/m³ (as Cr(VI))]**

## Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrO₃: Dark-red, odorless flakes or powder. [Note: Often used in an aqueous solution (H₂CrO₄).]</td>
</tr>
</tbody>
</table>

- **MW:** 100.0
- **BP:** 482°F (Decomposes)
- **MLT:** 387°F (Decomposes)
- **Sol:** 63%

- **VP:** Very low
- **IP:** NA
- **Sp.Gr:** 2.70 (CrO₃)
- **UEL:** NA
- **LEL:** NA

**CrO₃:** Noncombustible Solid, but will accelerate the burning of combustible materials.

### Incompatibilities & Reactivities
- Combustible, organic, or other readily oxidizable materials (paper, wood, sulfur, aluminum, plastics, etc.); corrosive to metals

### Measurement Methods
- NIOSH 7600, 7604, 7605, 7703, 9101; OSHA ID103, ID215, W4001
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

### First Aid (See procedures)
- **Eye:** Irrigate immediately
- **Skin:** Soap flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation respiratory system; nasal septum perforation; liver, kidney damage; leukocytosis (increased blood leukocytes), leukopenia (reduced blood leukocytes), eosinophilia; eye injury, conjunctivitis; skin ulcer, sensitization dermatitis; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Blood, respiratory system, liver, kidneys, eyes, skin</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung cancer]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Chromium(II) compounds (as Cr)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Synonyms vary depending upon the specific Chromium(II) compound. [Note: Chromium(II) compounds include soluble chromous salts.]

### Exposure Limits
<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.5 mg/m³ [See Appendix C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 0.5 mg/m³ [See Appendix C]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH 250 mg/m³ [as Cr(II)]</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description
Appearance and odor vary depending upon the specific compound.

Properties vary depending upon the specific compound.

### Incompatibilities & Reactivities
Varies

### Measurement Methods
NIOSH 7024, 7300, 7301, 7303, 9102; OSHA ID121, ID125G
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated
**Remove:** When wet or contaminated
**Change:** No recommendation

### First Aid
**Eye:** Irrigate immediately
**Skin:** Water flush promptly
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

---

**NIOSH Pocket Guide to Chemical Hazards**

The National Institute for Occupational Safety and Health

**The CDC**

Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2.5 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.*

Up to 5 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 12.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

Up to 25 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 250 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes; sensitization dermatitis

Target Organs Eyes, skin

See also: INTRODUCTION
## Chromium(III) compounds (as Cr)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Synonyms vary depending upon the specific Chromium(III) compound. [Note: Chromium (III) compounds include soluble chromic salts.]

### Exposure Limits
- **NIOSH REL:** TWA 0.5 mg/m³ See Appendix C
- **OSHA PEL:** TWA 0.5 mg/m³ See Appendix C

- **IDLH** 25 mg/m³ [as Cr(III)]

### Conversion

### Physical Description
Appearance and odor vary depending upon the specific compound.

Properties vary depending upon the specific compound.

### Incompatibilities & Reactivities
Varies

### Measurement Methods
NIOSH 7024, 7300, 7301, 7303, 9102; OSHA ID121, ID125G
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid
(See procedures)
- **Eye:** Irrigate immediately
- **Skin:** Water flush promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 2.5 mg/m³:
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.*

#### Up to 5 mg/m³:
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

#### Up to 12.5 mg/m³:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

#### Up to 25 mg/m³:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes; sensitization dermatitis

### Target Organs
- Eyes, skin

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Chromium metal

<table>
<thead>
<tr>
<th>CAS</th>
<th>7440-47-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>GB4200000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Chrome, Chromium

### Exposure Limits
- NIOSH REL: TWA 0.5 mg/m³ [See Appendix C]
- OSHA PEL*: TWA 1 mg/m³ [See Appendix C] [*Note: The PEL also applies to insoluble chromium salts.]
- IDLH 250 mg/m³ (as Cr)

### Conversion

### Physical Description
Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.

<table>
<thead>
<tr>
<th>MW: 52.0</th>
<th>VP: 0 mmHg (approx)</th>
<th>FI. P: NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP: 4788°F</td>
<td>IP: NA</td>
<td>UEL: NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid in bulk form, but finely divided dust burns rapidly if heated in a flame.

### Incompatibilities & Reactivities
- Strong oxidizers (such as hydrogen peroxide), alkalis

### Measurement Methods
- NIOSH 7024, 7300, 7301, 7303, 9102; OSHA ID121, ID125G
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 2.5 mg/m³:**
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.*

**Up to 5 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

**Up to 12.5 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

**Up to 25 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 250 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; lung fibrosis (histologic)

**Target Organs** Eyes, skin, respiratory system

*See also: INTRODUCTION*
## Chromyl chloride

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>14977-61-8</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

Chlorochromic anhydride, Chromic oxychloride, Chromium chloride oxide, Chromium dichloride dioxide, Chromium dioxide dichloride, Chromium dioxychloride, Chromium oxychloride, Dichlorodioxochromium

### DOT ID & Guide

DOT ID & Guide: 1758 137

### Exposure Limits

<table>
<thead>
<tr>
<th><strong>NIOSH REL:</strong> Ca 0.001 mg Cr(VI)/m³</th>
<th>See Appendix A See Appendix C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL:</strong> none</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description

Deep-red liquid with a musty, burning, acrid odor. [Note: Fumes in moist air.]

<table>
<thead>
<tr>
<th><strong>MW:</strong> 154.9</th>
<th><strong>BP:</strong> 243°F</th>
<th><strong>FRZ:</strong> -142°F</th>
<th><strong>Sol:</strong> Reacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VP:</strong> 20 mmHg</td>
<td><strong>IP:</strong> 12.60 eV</td>
<td></td>
<td><strong>Sp.Gr(77°F):</strong> 1.91</td>
</tr>
<tr>
<td><strong>Fl.P:</strong> NA</td>
<td><strong>UEL:</strong> NA</td>
<td><strong>LEL:</strong> NA</td>
<td></td>
</tr>
</tbody>
</table>

Noncombustible Liquid, but a powerful oxidizer.

### Incompatibilities & Reactivities

Water, combustible substances, halides, phosphorus, turpentine [Note: Reacts violently in water; forms chromic acid, chromic chloride, hydrochloric acid & chlorine. Corrodes common metals.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

| **Skin:** Prevent skin contact |
| **Eyes:** Prevent eye contact |
| **Wash skin:** When contaminated |
| **Remove:** When wet or contaminated |
| **Change:** No recommendation |
| **Provide:** Eyewash, Quick drench |

### First Aid (See procedures)

| **Eye:** Irrigate immediately |
| **Skin:** Water flush immediately |
| **Breathing:** Respiratory support |
| **Swallow:** Medical attention immediately |

### Important additional information about respirator selection

### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

Inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Irritation to eyes, skin, upper respiratory system; eye, skin burns; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, respiratory system |
| **Cancer Site** | [lung cancer] |

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Clopidol</th>
<th>CAS 2971-90-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>C&lt;sub&gt;7&lt;/sub&gt;H&lt;sub&gt;7&lt;/sub&gt;Cl&lt;sub&gt;2&lt;/sub&gt;NO</td>
<td>RTECS UU7711500</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>DOT ID &amp; Guide</td>
</tr>
<tr>
<td>Coyden®; 3,5-Dichloro-2,6-dimethyl-4-pyridinol</td>
<td></td>
</tr>
</tbody>
</table>

| **Exposure Limits** | | **Conversion** |
|---------------------|-----------------|
| NIOSH REL: TWA 10 mg/m<sup>3</sup> (total) ST 20 mg/m<sup>3</sup> (total) TWA 5 mg/m<sup>3</sup> (resp) | | |
| OSHA PEL: TWA 15 mg/m<sup>3</sup> (total) TWA 5 mg/m<sup>3</sup> (resp) | | |
| IDLH N.D. | | |

<table>
<thead>
<tr>
<th><strong>Physical Description</strong></th>
<th>White to light-brown, crystalline solid.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW: 192.1</td>
<td>BP: ?</td>
</tr>
<tr>
<td>VP: ?</td>
<td>IP: ?</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid, but dust may explode in cloud form.

<table>
<thead>
<tr>
<th><strong>Incompatibilities &amp; Reactivities</strong></th>
<th>None reported</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Measurement Methods</strong></th>
<th>NIOSH 0500 , 0600</th>
</tr>
</thead>
<tbody>
<tr>
<td>See: NMAM or OSHA Methods</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Personal Protection &amp; Sanitation</strong> (See protection )</th>
<th>First Aid (See procedures )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: No recommendation</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Eyes: No recommendation</td>
<td>Skin: Soap wash</td>
</tr>
<tr>
<td>Wash skin: No recommendation</td>
<td>Breathing: Fresh air</td>
</tr>
<tr>
<td>Remove: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
</tbody>
</table>

Important additional information about respirator selection

Respirator Recommendations Not available.

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin and/or eye contact</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, nose, throat; cough</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system</th>
</tr>
</thead>
</table>

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Coal dust</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>RTECS GF8281000</td>
</tr>
<tr>
<td>Anthracite coal dust, Bituminous coal dust, Lignite coal dust</td>
<td>DOT ID &amp; Guide 1361 133</td>
</tr>
<tr>
<td><strong>Exposure Limits</strong></td>
<td>NIOSH REL: See Appendix D</td>
</tr>
<tr>
<td>OSHA PEL†: TWA 2.4 mg/m³ (&lt;5% SiO₂) TWA 10 mg/m³/(%SiO₂ + 2) (&gt;5% SiO₂)</td>
<td></td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td>Conversion</td>
</tr>
<tr>
<td><strong>Physical Description</strong></td>
<td></td>
</tr>
<tr>
<td>Dark-brown to black solid dispersed in air.</td>
<td></td>
</tr>
<tr>
<td>Properties vary depending upon the specific coal type.</td>
<td></td>
</tr>
<tr>
<td>Combustible Solid; slightly explosive when exposed to flame.</td>
<td></td>
</tr>
<tr>
<td><strong>Incompatibilities &amp; Reactivities</strong></td>
<td></td>
</tr>
<tr>
<td>None reported</td>
<td></td>
</tr>
<tr>
<td><strong>Measurement Methods</strong></td>
<td></td>
</tr>
<tr>
<td>NIOSH 0600 , 7500</td>
<td></td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
<td></td>
</tr>
<tr>
<td><strong>Personal Protection &amp; Sanitation</strong> (See protection)</td>
<td><strong>First Aid</strong> (See procedures)</td>
</tr>
<tr>
<td>Skin: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Eyes: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Wash skin: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Remove: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Breathing: Fresh air</td>
<td></td>
</tr>
<tr>
<td><strong>Important additional information about respirator selection</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Respirator Recommendations</strong> Not available.</td>
<td></td>
</tr>
<tr>
<td><strong>Exposure Routes</strong> inhalation</td>
<td></td>
</tr>
<tr>
<td><strong>Symptoms</strong> Chronic bronchitis, decreased pulmonary function, emphysema</td>
<td></td>
</tr>
<tr>
<td><strong>Target Organs</strong> respiratory system</td>
<td></td>
</tr>
<tr>
<td>See also: INTRODUCTION</td>
<td></td>
</tr>
</tbody>
</table>
**NIOSH Pocket Guide to Chemical Hazards**

<table>
<thead>
<tr>
<th>Coal tar pitch volatiles</th>
<th>CAS 65996-93-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>RTECS GF8655000</td>
</tr>
<tr>
<td>Synonyms vary depending upon the specific compound (e.g., pyrene, phenanthrene, acridine, chrysene, anthracene &amp; benzo(a)pyrene). [Note: NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products.]</td>
<td>DOT ID &amp; Guide 2713 153 (acridine)</td>
</tr>
</tbody>
</table>

**Exposure Limits**

| NIOSH REL: Ca TWA 0.1 mg/m³ (cyclohexane-extractable fraction) | See Appendix A See Appendix C |
| OSHA PEL: TWA 0.2 mg/m³ (benzene-soluble fraction) [1910.1002] | See Appendix C |

**IDLH Ca [80 mg/m³]**

**Conversion**

**Physical Description**
Black or dark-brown amorphous residue.

Properties vary depending upon the specific compound.

**Combustible Solids**

**Incompatibilities & Reactivities**
Strong oxidizers

**Measurement Methods**
OSHA 58
See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection )**
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: No recommendation
Change: Daily

**First Aid (See procedures )**
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus.
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Dermatitis, bronchitis, [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>respiratory system, skin, bladder, kidneys</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung, kidney &amp; skin cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Cobalt carbonyl (as Co)

<table>
<thead>
<tr>
<th>CAS 10210-68-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS GG0300000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- di-mu-Carbonylhexacarbonyldicobalt, Cobalt octacarbonyl, Cobalt tetracarbonyl dimer, Dicobalt carbonyl, Dicobalt Octacarbonyl, Octacarbonyldicobalt

### Exposure Limits
- NIOSH REL: TWA 0.1 mg/m³
- OSHA PEL: none
- IDLH N.D.

### Physical Description
Orange to dark-brown, crystalline solid. [Note: The pure substance is white.]

- MW: 341.9
- BP: 126°F (Decomposes)
- MLT: 124°F
- Sol: Insoluble
- VP: 0.7 mmHg
- IP: ?
- Sp.Gr: 1.87

Noncombustible Solid, but flammable carbon monoxide is emitted during decomposition.

### Incompatibilities & Reactivities
Air [Note: Decomposes on exposure to air or heat; stable in atmosphere of hydrogen & carbon monoxide.]

### Measurement Methods
None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
Respirator Recommendations Not available.

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, mucous membrane; cough, decreased pulmonary function, wheezing, dyspnea (breathing difficulty); in animals: liver, kidney injury, pulmonary edema

### Target Organs
- Eyes
- skin
- respiratory system
- blood
- central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Cobalt hydrocarbonyl (as Co)

<table>
<thead>
<tr>
<th>CAS</th>
<th>16842-03-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>GG09000000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Hydrocobalt tetracarbonyl
- Tetracarbonylhydridocobalt
- Tetracarbonylhydrocobalt

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>TWA 0.1 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
</tbody>
</table>

### IDLH

N.D.

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas with an offensive odor.</td>
</tr>
</tbody>
</table>

| MW: 172.0 | BP: ? | FRZ: -15°F | Sol: 0.05% |
| VP: >1 atm | IP: ? | RGasD: 5.93 |
| Fl.P: NA (Gas) | UEL: ? | LEL: ? |

### Incompatibilities & Reactivities

Air [Note: Unstable gas that decomposes rapidly in air at room temperature to cobalt carbonyl & hydrogen.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support

### Important additional information about respirator selection

Respirator Recommendations

Not available.

### Exposure Routes

inhalation, skin and/or eye contact

### Symptoms

In animals: irritation respiratory system; dyspnea (breathing difficulty), cough, decreased pulmonary function, pulmonary edema

### Target Organs

Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Cobalt metal dust and fume (as Co)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7440-48-4</td>
<td>GF8750000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Cobalt metal dust
- Cobalt metal fume

### Exposure Limits
- NIOSH REL: TWA 0.05 mg/m³
- OSHA PEL†: TWA 0.1 mg/m³
- IDLH: 20 mg/m³ (as Co)

### Physical Description
- Odorless, silver-gray to black solid.
- MW: 58.9
- BP: 5612°F
- MLT: 2719°F
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 8.92
- Fl.P: NA
- UEL: NA
- LEL: NA

Noncombustible Solid in bulk form, but finely divided dust will burn at high temperatures.

### Incompatibilities & Reactivities
- Strong oxidizers, ammonium nitrate

### Measurement Methods
- NIOSH 7027, 7300, 7301, 7303, 9102; OSHA ID121, ID125G, ID213
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: No recommendation
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 0.25 mg/m³:**
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 0.5 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

**Up to 1.25 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
Any powered air-purifying respirator with a high-efficiency particulate filter.*

Up to 2.5 mg/m³:
- Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- Any self-contained breathing apparatus with a full facepiece
- Any supplied-air respirator with a full facepiece

Up to 20 mg/m³:
- Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

**Exposure Routes**
- Inhalation, ingestion, skin and/or eye contact

**Symptoms**
- Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; respiratory hypersensitivity, asthma

**Target Organs**
- Skin, respiratory system

See also: [INTRODUCTION](#)
Coke oven emissions

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>Synonyms vary depending upon the specific constituent.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca TWA 0.2 mg/m³ (benzene-soluble fraction) See Appendix A See Appendix C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: [1910.1029] TWA 0.150 mg/m³ (benzene-soluble fraction)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Ca [N.D.]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions released during the carbonization of bituminous coal for the production of coke. [Note: See Appendix C for more information.]</td>
</tr>
</tbody>
</table>

Properties vary depending upon the constituent.

<table>
<thead>
<tr>
<th>Incompatibilities &amp; Reactivities</th>
</tr>
</thead>
<tbody>
<tr>
<td>None reported</td>
</tr>
</tbody>
</table>

Measurement Methods

OSHA 58
See: NMAM or OSHA Methods

<table>
<thead>
<tr>
<th>Personal Protection &amp; Sanitation (See protection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: Daily</td>
</tr>
<tr>
<td>Remove: No recommendation</td>
</tr>
<tr>
<td>Change: Daily</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First Aid (See procedures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
</tbody>
</table>

Important additional information about respirator selection

Respirator Recommendations (See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(AF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(AF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(AF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters. /Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, respiratory system; cough, dyspnea (breathing difficulty), wheezing; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Skin, respiratory system, urinary system</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[skin, lung, kidney &amp; bladder cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# Copper (dusts and mists, as Cu)

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL*: TWA 1 mg/m³ [*Note: The REL also applies to other copper compounds (as Cu) except Copper fume.]</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL*: TWA 1 mg/m³ [*Note: The PEL also applies to other copper compounds (as Cu) except copper fume.]</td>
<td></td>
</tr>
<tr>
<td>IDLH 100 mg/m³ (as Cu)</td>
<td></td>
</tr>
</tbody>
</table>

## Physical Description
Reddish, lustrous, malleable, odorless solid.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>63.5</td>
</tr>
<tr>
<td>BP</td>
<td>4703°F</td>
</tr>
<tr>
<td>MLT</td>
<td>1981°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>8.94</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid in bulk form, but powdered form may ignite.

## Incompatibilities & Reactivities
Oxidizers, alkalis, sodium azide, acetylene

## Measurement Methods
NIOSH 7029, 7300, 7301, 7303, 9102; OSHA ID121, ID125G

See: NMAM or OSHA Methods

## Personal Protection & Sanitation *(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

## First Aid *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 5 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.*

Up to 10 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 25 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

Up to 50 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 100 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, respiratory system; cough, dyspnea (breathing difficulty), wheezing; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, liver, kidneys (increase(d) risk with Wilson's disease)

See also: INTRODUCTION
## Copper fume (as Cu)

### CAS
1317-38-0 (CuO)

### RTECS
GL7900000 (CuO)

### DOT ID & Guide

### Synonyms & Trade Names
- CuO: Black copper oxide fume, Copper monoxide fume, Copper(II) oxide fume, Cupric oxide fume
- Cu: Copper fume [Note: Also see specific listing for Copper (dusts and mists).]

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 0.1 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: TWA 0.1 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>100 mg/m³ (as Cu)</th>
</tr>
</thead>
</table>

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finely divided black particulate dispersed in air. [Note: Exposure may occur in copper &amp; brass plants and during the welding of copper alloys.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MW</th>
<th>79.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>Decomposes</td>
</tr>
<tr>
<td>VP</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sol</th>
<th>Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp.Gr</td>
<td>6.4 (CuO)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incompatibilities &amp; Reactivities</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuO: Acetylene, zirconium [Note: See Copper (dusts and mists) for properties of Copper metal.]</td>
</tr>
</tbody>
</table>

### Measurement Methods

NIOSH 7029, 7300, 7301, 7303; OSHA ID121, ID125G, ID206

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid

- Breathing: Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 1 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 2.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 5 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 100 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Irritation eyes, upper respiratory system; metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough, lassitude (weakness, exhaustion); metallic or sweet taste; discoloration skin, hair

Target Organs Eyes, skin, respiratory system (increase(d) risk with Wilson's disease)

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>Cotton dust (raw)</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>CAS</strong></td>
</tr>
<tr>
<td>Raw cotton dust</td>
<td></td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td><strong>RTECS</strong></td>
</tr>
<tr>
<td>1365 133 (cotton)</td>
<td>GN2275000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th><strong>Conversion</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA &lt;0.200 mg/m³</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL: [Z-1-A &amp; 1910.1043] TWA 1 mg/m³ (waste processing during waste recycling [sorting, blending, cleaning &amp; willowing] &amp; garnetting) TWA 0.200 mg/m³ (textile yarn manufacturing) TWA 0.750 mg/m³ (textile slashing &amp; weaving) TWA 0.500 mg/m³ (all other operations)</td>
<td>See Appendix C</td>
</tr>
<tr>
<td>IDLH 100 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Physical Description</strong></th>
<th><strong>Combustible Solid</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorless, odorless solid.</td>
<td></td>
</tr>
<tr>
<td>MW: ?</td>
<td>BP: Decomposes</td>
</tr>
<tr>
<td>VP: 0 mmHg (approx)</td>
<td>IP: NA</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Incompatibilities &amp; Reactivities</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong oxidizers</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Measurement Methods</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA [1910.1043]</td>
<td></td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Personal Protection &amp; Sanitation</strong></th>
<th><strong>First Aid</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: No recommendation</td>
<td>Breathing: Fresh air</td>
</tr>
<tr>
<td>Eyes: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Wash skin: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Remove: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
<tr>
<td>(See protection )</td>
<td>(See procedures )</td>
</tr>
</tbody>
</table>
## Important additional information about respirator selection

### Respirator Recommendations (See Appendix E) NIOSH

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Respirator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 1 mg/m³:</strong></td>
<td><strong>(APF = 5)</strong></td>
<td>Any quarter-mask respirator. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 2 mg/m³:</strong></td>
<td><strong>(APF = 10)</strong></td>
<td>Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 5 mg/m³:</strong></td>
<td><strong>(APF = 10)</strong></td>
<td>Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 10 mg/m³:</strong></td>
<td><strong>(APF = 25)</strong></td>
<td>Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td><strong>Up to 100 mg/m³:</strong></td>
<td><strong>(APF = 1000)</strong></td>
<td>Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode</td>
</tr>
</tbody>
</table>

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- **(APF = 50)** Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

### Exposure Routes

**inhalation**

### Symptoms

- Byssinosis: chest tightness, cough, wheezing, dyspnea (breathing difficulty); decreased forced expiratory volume; bronchitis; malaise (vague feeling of discomfort); fever, chills, upper respiratory symptoms after initial exposure

### Target Organs

- Cardiovascular system, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Crag® herbicide

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS Number</th>
<th>RTECS Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₆H₃Cl₂OCH₂CH₂OSO₃Na</td>
<td>136-78-7</td>
<td>KK4900000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Crag® herbicide No. 1
- 2-(2,4-Dichlorophenoxy)ethyl sodium sulfate
- Sesone

### Exposure Limits

- **NIOSH REL**: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)
- **OSHA PEL†**: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)

### IDLH

- 500 mg/m³

### Physical Description

- Colorless to white crystalline, odorless solid

### Conversion

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>309.1</td>
</tr>
<tr>
<td>BP</td>
<td>Decomposes</td>
</tr>
<tr>
<td>MLT</td>
<td>473°F (Decomposes)</td>
</tr>
<tr>
<td>Sol(77°F)</td>
<td>26%</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.70</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

- Strong oxidizers, acids

### Measurement Methods

- NIOSH S356 (II-5)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Water wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Respirator Selection

**Respirator Recommendations**

**NIOSH**

**Up to 50 mg/m³:**
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 100 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

**Up to 250 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 500 mg/m³:**
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** irritation of eyes, skin; liver, kidney damage; in animals: central nervous system effects, convulsions

**Target Organs** eyes, skin, central nervous system, liver, kidneys

See also: [INTRODUCTION](#)
m-Cresol

CH₃C₆H₄OH

Synonyms & Trade Names
meta-Cresol, 3-Cresol, m-Cresylic acid, 1-Hydroxy-3-methylbenzene, 3-Hydroxytoluene, 3-Methyl phenol

CAS 108-39-4

RTECS GO6125000

DOT ID & Guide 2076 153

Exposure Limits
NIOSH REL: TWA 2.3 ppm (10 mg/m³)
OSHA PEL: TWA 5 ppm (22 mg/m³) [skin]
IDLH 250 ppm

Conversion 1 ppm = 4.43 mg/m³

Physical Description
Colorless to yellowish liquid with a sweet, tarry odor. [Note: A solid below 54°F.]

MW: 108.2
BP: 397°F
FRZ: 54°F
Sol: 2%

VP(77°F): 0.14 mmHg
IP: 8.98 eV
Sp.Gr: 1.03

Fl.P: 187°F
UEL: ?
LEL(300°F): 1.1%

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

Incompatibilities & Reactivities
Strong oxidizers, acids

Measurement Methods
NIOSH 2546 ; OSHA 32
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection )
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

First Aid (See procedures )
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 23 ppm:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 57.5 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 115 ppm:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 250 ppm:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; central nervous system effects: confusion, depression, respiratory failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys, pancreas, cardiovascular system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## o-Cresol

<table>
<thead>
<tr>
<th>CH₃C₆H₄OH</th>
<th>CAS 95-48-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS GO6300000</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- ortho-Cresol, 2-Cresol, o-Cresylic acid, 1-Hydroxy-2-methylbenzene, 2-Hydroxytoluene, 2-Methyl phenol

### DOT ID & Guide
- DOT ID & Guide 2076 153

### Exposure Limits
- NIOSH REL: TWA 2.3 ppm (10 mg/m³)
- OSHA PEL: TWA 5 ppm (22 mg/m³) [skin]
- IDLH 250 ppm

### Conversion
- 1 ppm = 4.43 mg/m³

### Physical Description
- White crystals with a sweet, tarry odor. [Note: A liquid above 88°F.]
- MW: 108.2
- BP: 376°F
- MLT: 88°F
- Sol: 2%
- VP(77°F): 0.29 mmHg
- IP: 8.93 eV
- Sp.Gr: 1.05
- Fl.P: 178°F
- UEL: ?
- LEL(300°F): 1.4%

### Incompatibilities & Reactivities
- Combustible Solid Class IIIA
- Combustible Liquid
- Strong oxidizers, acids

### Measurement Methods
- NIOSH 2546 ; OSHA 32
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 23 ppm:**
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

**Up to 57.5 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 115 ppm:**
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 250 ppm:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

### Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms Irritation eyes, skin, mucous membrane; central nervous system effects: confusion, depression, respiratory failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage

### Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys, pancreas, cardiovascular system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## p-Cresol

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS Number</th>
<th>RTECS Code</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃C₆H₄OH</td>
<td>106-44-5</td>
<td>GO6475000</td>
<td>2076 153</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- para-Cresol
- 4-Cresol
- p-Cresylic acid
- 1-Hydroxy-4-methylbenzene
- 4-Hydroxytoluene
- 4-Methyl phenol

### Exposure Limits
- NIOSH REL: TWA 2.3 ppm (10 mg/m³)
- OSHA PEL: TWA 5 ppm (22 mg/m³) [skin]

### IDLH
- 250 ppm

### Physical Description
- Crystalline solid with a sweet, tarry odor. [Note: A liquid above 95°F.]

#### Physical Properties
- MW: 108.2
- BP: 396°F
- MLT: 95°F
- Sol: 2%
- VP(77°F): 0.11 mmHg
- IP: 8.97 eV
- Sp.Gr: 1.04
- Fl.P: 187°F
- UEL: ?
- LEL(300°F): 1.1%

### Combustible Solid Class IIIA

### Combustible Liquid

### Incompatibilities & Reactivities
- Strong oxidizers, acids

### Measurement Methods
- NIOSH 2546 ; OSHA 32
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation *(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH

**Up to 23 ppm:**

- (APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

**Up to 57.5 ppm:**

- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 115 ppm:**

- (APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 250 ppm:**

- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes

**inhalation, skin absorption, ingestion, skin and/or eye contact**

### Symptoms

Irritation eyes, skin, mucous membrane; central nervous system effects: confusion, depression, respiratory failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage

### Target Organs

Eyes, skin, respiratory system, central nervous system, liver, kidneys, pancreas, cardiovascular system

See also: [INTRODUCTION](#)
## NIOSH Pocket Guide to Chemical Hazards

### Crotonaldehyde

<table>
<thead>
<tr>
<th>CAS</th>
<th>4170-30-3</th>
</tr>
</thead>
</table>

### Chemical Formula

\[ \text{CH}_3\text{CH}=\text{CHCHO} \]

### Synonyms & Trade Names

2-Butenal, beta-Methyl acrolein, Propylene aldehyde

### DOT ID & Guide

1143 131 P (inhibited)

### Exposure Limits

- NIOSH REL: TWA 2 ppm (6 mg/m\(^3\)) See Appendix C (Aldehydes)
- OSHA PEL: TWA 2 ppm (6 mg/m\(^3\))

### IDLH

50 ppm

### Conversion

1 ppm = 2.87 mg/m\(^3\)

### Physical Description

Water-white liquid with a suffocating odor. [Note: Turns pale-yellow on contact with air.]

- MW: 70.1
- BP: 219°F
- FRZ: -101°F
- Sol: 18%
- VP: 19 mmHg
- IP: 9.73 eV
- Sp.Gr: 0.87
- Fl.P: 45°F
- UEL: 15.5%
- LEL: 2.1%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Caustics, ammonia, strong oxidizers, nitric acid, amines [Note: Polymerization may occur at elevated temperatures, such as in fire conditions.]

### Measurement Methods

- NIOSH 3516 ; OSHA 81
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

<table>
<thead>
<tr>
<th><strong>Respirator Recommendations</strong></th>
<th><strong>NIOSH/OSHA</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 20 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10)</td>
<td>Any chemical cartridge respirator with organic vapor cartridge(s)*</td>
</tr>
<tr>
<td>(APF = 10)</td>
<td>Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 50 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 25)</td>
<td>Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>(APF = 25)</td>
<td>Any powered, air-purifying respirator with organic vapor cartridge(s)*</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000)</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000)</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, respiratory system; in animals: dyspnea (breathing difficulty), pulmonary edema, irritation skin</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## NIOSH Pocket Guide to Chemical Hazards

### Crufomate

<table>
<thead>
<tr>
<th>CAS 299-86-5</th>
<th>RTECS TB3850000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- 4-t-Butyl-2-chlorophenylmethyl methylphosphoramidate; Dowco® 132; Ruelene®

### Exposure Limits
- NIOSH REL: TWA 5 mg/m^3 ST 20 mg/m^3
- OSHA PEL: none

### Physical Description
- White, crystalline solid in pure form. [pesticide] [Note: Commercial product is a yellow oil.]

<table>
<thead>
<tr>
<th>MW: 291.7</th>
<th>BP: Decomposes</th>
<th>MLT: 140°F</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(243°F): 0.01 mmHg</td>
<td>IP: ?</td>
<td>Sp.Gr: 1.16</td>
<td></td>
</tr>
</tbody>
</table>

### Combustible Solid

### Incompatibilities & Reactivities
- Strongly alkaline & strongly acidic media [Note: Unstable over long periods in aqueous preparations or above 140°F.]

### Measurement Methods
- NIOSH 0500; OSHA PV2015
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### Important additional information about respirator selection

### Respirator Recommendations
- Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; wheezing, dyspnea (breathing difficulty); blurred vision, lacrimation (discharge of tears); sweating; abdominal cramps, diarrhea, nausea, anorexia

### Target Organs
- Eyes, skin, respiratory system, blood cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Cumene

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>98-82-8</td>
<td>GR8575000</td>
<td>1918 130</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Cumol, Isopropyl benzene, 2-Phenyl propane

### Exposure Limits
- NIOSH REL: TWA 50 ppm (245 mg/m³) [skin]
- OSHA PEL: TWA 50 ppm (245 mg/m³) [skin]

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>900 ppm [10%LEL]</td>
<td>1 ppm = 4.92 mg/m³</td>
</tr>
</tbody>
</table>

**Physical Description**
Colorless liquid with a sharp, penetrating, aromatic odor.

- MW: 120.2
- BP: 306°F
- FRZ: -141°F
- Sol: Insoluble
- VP: 8 mmHg
- IP: 8.75 eV
- Sp.Gr: 0.86
- Fl.P: 96°F
- UEL: 6.5%
- LEL: 0.9%

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities
Oxidizers, nitric acid, sulfur acid [Note: Forms cumene hydroperoxide upon long exposure to air.]

### Measurement Methods
- NIOSH 1501
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
(See procedures)

- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 500 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 900 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms
- Irritation eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma

## Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# Cyanamide

| **CAS** | 420-04-2 |
| **RTECS** | GS5950000 |

## Synonyms & Trade Names
- Amidocyanogen, Carbimide, Carbodiimide, Cyanogen nitride, Hydrogen cyanamide [Note: Cyanamide is also a synonym for Calcium cyanamide.]

## Exposure Limits
- NIOSH REL: TWA 2 mg/m³
- OSHA PEL†: none
- IDLH N.D.

## Physical Description
- Crystalline solid.
- MW: 42.1
- BP: 500°F (Decomposes)
- MLT: 113°F
- Sol(59°F): 78%
- VP: ?
- IP: 10.65 eV
- Sp.Gr: 1.28
- Fl.P: 286°F
- UEL: ?
- LEL: ?

## Incompatibilities & Reactivities
- Combustible Solid
- Above 104°F: Moisture, acids, or alkalis; 1,2-phenylene diamine salts [Note: Polymerization may occur on evaporation of aqueous solutions.]

## Measurement Methods
- NIOSH 0500
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

## First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

## Important additional information about respirator selection
- Respirator Recommendations: Not available.

## Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms
- Irritation eyes, skin, respiratory system; eye, skin burns; miosis, salivation, lacrimation (discharge of tears), twitching; Antabuse-like effects

## Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
## Cyanogen

### CAS

**CAS** 460-19-5

### NCCN

**RTECS** GT1925000

### Synonyms & Trade Names

Carbon nitride, Dicyan, Dicyanogen, Ethanedinitrile, Oxalonitrile

### DOT ID & Guide

**DOT ID & Guide** 1026 119

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA</th>
<th>10 ppm (20 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
</tbody>
</table>

### IDLH

**IDLH** N.D.

#### Conversion

1 ppm = 2.13 mg/m³

### Physical Description

Colorless gas with a pungent, almond-like odor. [Note: Shipped as a liquefied compressed gas. Forms cyanide in the body.]

- **MW:** 52.0
- **BP:** -6°F
- **FRZ:** -18°F
- **Sol:** 1%
- **VP(70°F):** 5.1 atm
- **IP:** 13.57 eV
- **RGasD:** 1.82
- **Sp.Gr:** 0.95 (Liquid at -6°F)
- **UEL:** 32%
- **LEL:** 6.6%

### Incompatibilities & Reactivities

Acids, water, strong oxidizers (e.g., dichlorine oxide, fluorine) [Note: Slowly hydrolyzed in water to form hydrogen cyanide, oxalic acid, or ammonia.]

### Measurement Methods

- **OSHA PV2104**
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

#### Skin

- Frostbite

#### Eyes

- Prevent eye contact/Frostbite

#### Wash skin

- No recommendation

#### Remove

- When wet (flammable)

#### Change

- No recommendation

#### Provide

- Frostbite wash

### First Aid

#### Eye

- Frostbite

#### Skin

- Frostbite

#### Breathing

- Respiratory support

### Important additional information about respirator selection

### Respirator Recommendations

Not available.

### Exposure Routes

- Inhalation, skin and/or eye contact

### Symptoms

Irritation eyes, nose, upper respiratory system; lacrimation (discharge of tears); cherry red lips, tachypnea, hyperemia, bradycardia; headache, convulsions; dizziness, loss of appetite, weight loss; liquid: frostbite

### Target Organs

Eyes, respiratory system, central nervous system, cardiovascular system

See also: INTRODUCTION
# Cyanogen chloride

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>506-77-4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td>GT2275000</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1589 125 (inhibited)</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Chlorcyan
- Chlorine cyanide
- Chlorocyanide
- Chlorocyanogen

## Exposure Limits
- **NIOSH REL**: 0.3 ppm (0.6 mg/m³)
- **OSHA PEL†**: none

## Physical Description
Colorless gas or liquid (below 55°F) with an irritating odor. [Note: Shipped as a liquefied gas. A solid below 20°F. Forms cyanide in the body.]

- **MW**: 61.5
- **BP**: 55°F
- **FRZ**: 20°F
- **Sol**: 7%
- **VP**: 1010 mmHg
- **IP**: 12.49 eV
- **RGasD**: 2.16
- **Sp.Gr**: 1.22 (Liquid at 32°F)
- **Fl.P**: NA
- **UEL**: NA
- **LEL**: NA

## Incompatibilities & Reactivities
- Water, acids, alkalis, ammonia, alcohols
  [Note: Can react very slowly with water to form hydrogen cyanide. May be stabilized to prevent polymerization.]

## Measurement Methods
None available

See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)
- **Skin**: Prevent skin contact (liquid)
- **Eyes**: Prevent eye contact (liquid)
- **Wash skin**: When contaminated (liquid)
- **Remove**: When wet or contaminated (liquid)
- **Change**: No recommendation
- **Provide**: Eyewash (liquid), Quick drench (liquid)

## First Aid
(See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Water wash immediately (liquid)
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately (liquid)

## Exposure Routes
- Inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact (liquid)

## Symptoms
- Irritation eyes, upper respiratory system; cough, delayed pulmonary edema; lassitude (weakness, exhaustion), headache, dizziness, confusion, nausea, vomiting; irregular heartbeat; irritation skin (liquid)

## Target Organs
- Eyes, skin, respiratory system, central nervous system, cardiovascular system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Cyclohexane

<table>
<thead>
<tr>
<th>CAS</th>
<th>110-82-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>GU63000000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Benzene hexahydride
- Hexahydrobenzene
- Hexamethylene
- Hexanaphthene

### DOT ID & Guide
- DOT ID: 1145 128

### Exposure Limits
- NIOSH REL: TWA 300 ppm (1050 mg/m³)
- OSHA PEL: TWA 300 ppm (1050 mg/m³)

### IDLH
- 1300 ppm [10%LEL]

### Conversion
- 1 ppm = 3.44 mg/m³

### Physical Description
- Colorless liquid with a sweet, chloroform-like odor. [Note: A solid below 44°F.]

### MW
- 84.2

### BP
- 177°F

### FRZ
- 44°F

### Sol
- Insoluble

### VP
- 78 mmHg

### IP
- 9.88 eV

### Sp.Gr
- 0.78

### UEL
- 8%

### LEL
- 1.3%

### Incompatibilities & Reactivities
- Oxidizers

### Measurement Methods
- NIOSH 1500 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 1300 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
Cyclohexanethiol

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclohexylmercaptan, Cyclohexylthiol</td>
<td>GV7525000</td>
<td>3054 129</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: C 0.5 ppm (2.4 mg/m³) [15-minute]</td>
<td>1 ppm = 4.75 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorless liquid with a strong, offensive odor.</td>
</tr>
</tbody>
</table>

| VP: 10 mmHg | IP: ? | |
| Fl.P: 110°F | UEL: ? | LEL: ? |

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

<table>
<thead>
<tr>
<th>Incompatibilities &amp; Reactivities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidizers, reducing agents, strong acids, alkali metals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>None available</td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
</tr>
</tbody>
</table>

| Personal Protection & Sanitation (See protection) |
| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

| First Aid (See procedures) |
| Eye: Irrigate immediately |
| Skin: Soap flush immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 5 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
(APF = 10) Any supplied-air respirator

Up to 12.5 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

Up to 25 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, respiratory system; headache, dizziness, lassitude (weakness, exhaustion), nausea, vomiting, convulsions; cough, wheezing, laryngitis, dyspnea (breathing difficulty)

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Cyclohexanol

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-93-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>GV7875000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names

- Anol
- Cyclohexyl alcohol
- Hexahydrophenol
- Hexalin
- Hydralin
- Hydroxycyclohexane

#### DOT ID & Guide

- 1993 128 (combustible liquid, n.o.s.)

### Exposure Limits

| NIOSH REL | TWA 50 ppm (200 mg/m³) [skin] |
| OSHA PEL† | TWA 50 ppm (200 mg/m³) |

#### IDLH

- 400 ppm

#### Conversion

- 1 ppm = 4.10 mg/m³

### Physical Description

- Sticky solid or colorless to light-yellow liquid (above 77°F) with a camphor-like odor.

| MW | 100.2 |
| BP | 322°F |
| MLT | 77°F |
| Sol | 4% |
| VP | 1 mmHg |
| IP | 10.00 eV |
| Sp.Gr | 0.96 |
| Fl.P | 154°F |
| UEL | ? |
| LEL | ? |

**Class IIIA Combustible Liquid:** Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities

- Strong oxidizers (such as hydrogen peroxide & nitric acid)

### Measurement Methods

- NIOSH 1402, 1405; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated

**Remove:** When wet or contaminated

**Change:** Daily

### First Aid

**Eye:** Irrigate immediately

**Skin:** Water wash promptly

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

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**Note:** Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 400 ppm:**

- **(APF = 10)** Any chemical cartridge respirator with organic vapor cartridge(s)*
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor cartridge(s)*
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat; narcosis

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Cyclohexanone

**CAS** 108-94-1

**C₆H₁₀O**

**RTECS** GW1050000

**Synonyms & Trade Names**
Anone, Cyclohexyl ketone, Pimelic ketone

**DOT ID & Guide**
1915 127

### Exposure Limits

<table>
<thead>
<tr>
<th><strong>NIOSH REL</strong></th>
<th>TWA 25 ppm (100 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>TWA 50 ppm (200 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 700 ppm

**Conversion** 1 ppm = 4.02 mg/m³

### Physical Description

Water-white to pale-yellow liquid with a peppermint- or acetone-like odor.

- **MW:** 98.2
- **BP:** 312°F
- **FRZ:** -49°F
- **Sol:** 15%
- **VP:** 5 mmHg
- **IP:** 9.14 eV
- **Sp.Gr:** 0.95
- **Fl.P:** 146°F
- **UEL:** 9.4%
- **LEL(212°F):** 1.1%

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities

Oxidizers, nitric acid

### Measurement Methods

NIOSH 1300, 2555; OSHA 1

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid

(See procedures)

- **Eye:** Irrigate immediately
- **Skin:** Water flush promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
## Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 625 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 700 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

---

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, mucous membrane; headache; narcosis, coma; dermatitis; in animals: liver, kidney damage

**Target Organs** Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
### Cyclohexene

**CAS** 110-83-8  
**RTECS** GW2500000

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene tetrahydride, Tetrahydrobenzene</td>
<td>2256 130</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 300 ppm (1015 mg/m³)</td>
<td>1 ppm = 3.36 mg/m³</td>
</tr>
<tr>
<td>OSHA PEL: TWA 300 ppm (1015 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>IDLH 2000 ppm</td>
<td></td>
</tr>
</tbody>
</table>

**Physical Description**

Colorless liquid with a sweet odor.

- **MW:** 82.2  
- **BP:** 181°F  
- **FRZ:** -154°F  
- **Sol:** Insoluble
- **VP:** 67 mmHg  
- **IP:** 8.95 eV  
- **Sp.Gr:** 0.81
- **Fl.P:** 11°F  
- **UEL:** ?  
- **LEL:** ?

**Class IB Flammable Liquid:** Fl.P. below 73°F and BP at or above 100°F.

**Incompatibilities & Reactivities**

Strong oxidizers [Note: Forms explosive peroxides with oxygen upon storage.]

**Measurement Methods**

NIOSH 1500 ; OSHA 7  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet (flammable)  
- **Change:** No recommendation

**First Aid** *(See procedures)*

- **Eye:** Irrigate immediately  
- **Skin:** Soap wash promptly  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 2000 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; drowsiness

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Cyclohexylamine

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-91-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>GX0700000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2357 132</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Aminocyclohexane
- Aminohexahydrobenzene
- Hexahydroaniline
- Hexahydrobenzenamine

### Exposure Limits
- NIOSH REL: TWA 10 ppm (40 mg/m³)
- OSHA PEL†: none
- IDLH: N.D.
- Conversion: 1 ppm = 4.06 mg/m³

### Physical Description
- Colorless or yellow liquid with a strong, fishy, amine-like odor.
- MW: 99.2
- BP: 274°F
- FRZ: 0°F
- Sol: Miscible
- VP: 11 mmHg
- IP: 8.37 eV
- Sp.Gr: 0.87
- Fl.P: 88°F
- UEL: 9.4%
- LEL: 1.5%
- Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities
- Oxidizers, organic compounds, acid anhydrides, acid chlorides, acids, lead
- [Note: Corrosive to copper, aluminum, zinc & galvanized steel.]

### Measurement Methods
- NIOSH 2010 ; OSHA PV2016
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
- Respirator Recommendations: Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation: eyes, skin, mucous membrane, respiratory system
- Eye: Skin burns; skin sensitization; cough, pulmonary edema; drowsiness, dizziness; diarrhea, nausea, vomiting

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: [INTRODUCTION](#)
## Cyclonite

<table>
<thead>
<tr>
<th>Physical Description</th>
<th>Physical Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>White, crystalline powder. [Note: A powerful high explosive.]</td>
<td>MW: 222.2</td>
</tr>
<tr>
<td>VP(230°F): 0.0004 mmHg</td>
<td>BP: ?</td>
</tr>
<tr>
<td>Fl.P: Explodes</td>
<td>MLT: 401°F</td>
</tr>
<tr>
<td></td>
<td>Sol: Insoluble</td>
</tr>
<tr>
<td></td>
<td>Sp.Gr: 1.82</td>
</tr>
<tr>
<td></td>
<td>UEL: ?</td>
</tr>
<tr>
<td></td>
<td>LEL: ?</td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities

Strong oxidizers, combustible materials, heat [Note: Detonates on contact with mercury fulminate.]

## Measurement Methods

NIOSH 0500

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated/Daily

**Remove:** When wet or contaminated

**Change:** Daily

**Provide:** Eyewash, Quick drench

## First Aid

**Eye:** Irrigate immediately

**Skin:** Soap flush immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

## Important additional information about respirator selection

**Respirator Recommendations** Not available.

## Exposure Routes

Inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms

Irritation eyes, skin; headache, irritability, lassitude (weakness, exhaustion), tremor, nausea, dizziness, vomiting, insomnia, convulsions

## Target Organs

Eyes, skin, central nervous system

See also: INTRODUCTION
## Cyclopentadiene

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>542-92-7</td>
<td>GY1000000</td>
<td>1,3-Cyclopentadiene</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

- **NIOSH REL**: TWA 75 ppm (200 mg/m³)
- **OSHA PEL**: TWA 75 ppm (200 mg/m³)

**IDLH**: 750 ppm

### Conversion

1 ppm = 2.70 mg/m³

### Physical Description

Colorless liquid with an irritating, terpene-like odor.

- **MW**: 66.1
- **BP**: 107°F
- **FRZ**: -121°F
- **Sol**: Insoluble
- **VP**: 400 mmHg
- **IP**: 8.56 eV
- **Sp.Gr**: 0.80
- **Fl.P(oc)**: 77°F
- **UEL**: ?
- **LEL**: ?

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities

Strong oxidizers, fuming nitric acid, sulfuric acid [Note: Polymerizes to dicyclopentadiene upon standing.]

### Measurement Methods

- NIOSH 2523
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid

(See procedures)

- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Respirator Recommendations NIOSH/OSHA**

**Up to 750 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose

**Target Organs** Eyes, respiratory system

See also: INTRODUCTION
## Cyclopentane

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>287-92-3</td>
</tr>
<tr>
<td>RTECS</td>
<td>GY2390000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>Pentamethylene</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1146 128</td>
</tr>
<tr>
<td><strong>Exposure Limits</strong></td>
<td></td>
</tr>
<tr>
<td>NIOSH REL:</td>
<td>TWA 600 ppm (1720 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td>Conversion 1 ppm = 2.87 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description
- Colorless liquid with a mild, sweet odor.
- MW: 70.2
- BP: 121°F
- FRZ: -137°F
- Sol: Insoluble
- VP(88°F): 400 mmHg
- IP: 10.52 eV
- Fl.P: -35°F
- UEL: 8.7%
- LEL: 1.1%
- Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Strong oxidizers (e.g., chlorine, bromine, fluorine)

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: Daily
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat; dizziness, euphoria, incoordination, nausea, vomiting, stupor; dry, cracking skin

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Cyhexatin

<table>
<thead>
<tr>
<th>CAS 13121-70-5</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

- TCHH, Tricyclohexylhydroxystannane, Tricyclohexylhydroxytin, Tricyclohexylstannium hydroxide, Tricyclohexyltin hydroxide

### DOT ID & Guide

- RTECS WH8750000

### Physical Description

- Colorless to white, nearly odorless, crystalline powder. [insecticide]
- MW: 385.2
- BP: 442°F (Decomposes)
- MLT: 383°F
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: ?
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities

- Strong oxidizers, ultraviolet light

### Measurement Methods

- NIOSH 5504
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: Prevent skin contact
- Eyes: No recommendation
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations OSHA

**Up to 3.2 mg/m³:**
- (APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

**Up to 8 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 16 mg/m³:**
- (APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.

Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter

Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

Any self-contained breathing apparatus with a full facepiece

Any supplied-air respirator with a full facepiece

**Up to 80 mg/m³:**

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, respiratory system; headache, dizziness; sore throat, cough; abdominal pain, vomiting; skin burns, pruritus; in animals: liver, kidney damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, liver, kidneys</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2,4-D

<table>
<thead>
<tr>
<th>CAS</th>
<th>94-75-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl₂C₆H₃OCH₂COOH</td>
<td>RTECS AG6825000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Dichlorophenoxyacetic acid; 2,4-Dichlorophenoxyacetic acid

### DOT ID & Guide

2765 152

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 10 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 10 mg/m³</td>
</tr>
</tbody>
</table>

### IDLH

100 mg/m³

### Conversion

### Physical Description

White to yellow, crystalline, odorless powder. [herbicide]

<table>
<thead>
<tr>
<th>MW: 221.0</th>
<th>BP: Decomposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(320°F): 0.4 mmHg</td>
<td>IP: ?</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid, but may be dissolved in flammable liquids.

### Incompatibilities & Reactivities

Strong oxidizers

### Measurement Methods

NIOSH 5001

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection )

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid

(See procedures )

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH/OSHA

**Up to 100 mg/m³:**
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator
(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Lassitude (weakness, exhaustion), stupor, hyporeflexia, muscle twitching; convulsions; dermatitis; in animals: liver, kidney injury</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Skin, central nervous system, liver, kidneys</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
### NIOSH Pocket Guide to Chemical Hazards

**DDT**  
\[(C_6H_4Cl)_2CHCl_3\]  
CAS 50-29-3  
RTECS KJ3325000  
DOT ID & Guide 2761 151

#### Synonyms & Trade Names
- p,p’-DDT; Dichlorodiphenyltrichloroethane; 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane

#### Exposure Limits
- **NIOSH REL:** Ca TWA 0.5 mg/m³  
  See Appendix A  
- **OSHA PEL:** TWA 1 mg/m³ [skin]

#### IDLH **Ca [500 mg/m³]**

#### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
</table>
| Colorless crystals or off-white powder with a slight, aromatic odor. [pesticide]  
| MW: 354.5  
| BP: 230°F (Decomposes)  
| VP: 0.0000002 mmHg  
| Li.P: 162-171°F  
| Sol: Insoluble  
| Sp.Gr: 0.99  
| UEL: ?  
| LEL: ?  
| Combustible Solid  

#### Incompatibilities & Reactivities
- Strong oxidizers, alkalis

#### Measurement Methods
- NIOSH S274 (II-3)  
  See: NMAM or OSHA Methods

#### Personal Protection & Sanitation  
(See protection)
- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated/Daily  
- **Remove:** When wet or contaminated  
- **Change:** Daily  
- **Provide:** Eyewash, Quick drench

#### First Aid  
(See procedures)
- **Eye:** Irrigate immediately  
- **Skin:** Soap wash promptly  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, central nervous system, kidneys, liver, peripheral nervous system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver, lung &amp; lymphatic tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Decaborane

<table>
<thead>
<tr>
<th>CAS</th>
<th>17702-41-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>HD1400000</td>
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<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Decaboron tetradecahydride</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1868 134</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA</th>
<th>0.3 mg/m³ (0.05 ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA</td>
<td>0.3 mg/m³ (0.05 ppm)</td>
</tr>
</tbody>
</table>

**IDLH** 15 mg/m³  
**Conversion** 1 ppm = 5.00 mg/m³

### Physical Description

Colorless to white crystalline solid with an intense, bitter, chocolate-like odor.  

- **MW**: 122.2  
- **BP**: 415°F  
- **MLT**: 211°F  
- **Sol**: Slight  
- **VP**: 0.2 mmHg  
- **IP**: 9.88 eV  
- **FLP**: 176°F  
- **UEL**: ?  
- **LEL**: ?

**Combustible Solid**

### Incompatibilities & Reactivities

Oxidizers, water, halogenated compounds (especially carbon tetrachloride) [Note: May ignite SPONTANEOUSLY on exposure to air. Decomposes slowly in hot water.]

### Measurement Methods

None available  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin**: Prevent skin contact  
**Eyes**: Prevent eye contact  
**Wash skin**: When contaminated/Daily  
**Remove**: When wet or contaminated  
**Change**: Daily  
**Provide**: Eyewash, Quick drench

### First Aid

**Eye**: Irrigate immediately  
**Skin**: Soap wash immediately  
**Breathing**: Respiratory support  
**Swallow**: Medical attention immediately

---

*Authored in PDF format by Industrial Hygiene Services; www.ihresources.com*
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 3 mg/m³:**
- (APF = 10) Any supplied-air respirator

**Up to 7.5 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 15 mg/m³:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Dizziness, headache, nausea, drowsiness; incoordination, localized muscle spasm, tremor, convulsions; lassitude (weakness, exhaustion); in animals: dyspnea (breathing difficulty); lassitude (weakness, exhaustion); liver, kidney damage</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Central nervous system, liver, kidneys</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
1-Decanethiol

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>Decylmercaptan, n-Decylmercaptan, 1-Mercaptodecane</th>
</tr>
</thead>
</table>

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>C 0.5 ppm (3.6 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
</tbody>
</table>

**IDLH** N.D.  

**Conversion** 1 ppm = 7.13 mg/m³

**Physical Description**

Colorless liquid with a strong odor.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: ?</td>
<td>IP: ?</td>
<td></td>
<td>Sp.Gr: 0.84</td>
</tr>
<tr>
<td>Fl.P: 209°F</td>
<td>UEL: ?</td>
<td>LEL: ?</td>
<td></td>
</tr>
</tbody>
</table>

Class IIIA Combustible Liquid: Fl.P. at or above 200°F.

**Incompatibilities & Reactivities**

Oxidizers, strong acids & bases, alkali metals, nitric acid

**Measurement Methods**

None available

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

**First Aid** *(See procedures)*

Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 5 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
(APF = 10) Any supplied-air respirator

Up to 12.5 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

Up to 25 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, respiratory system; confusion, dizziness, headache, drowsiness, nausea, vomiting, lassitude (weakness, exhaustion), convulsions

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Demeton

**CAS** 8065-48-3  
**RTECS** TF3150000  
**Synonyms & Trade Names**  
O-O-Diethyl-O(and S)-2-(ethylthio)ethyl phosphorothioate mixture; Systox®

## Exposure Limits

| NIOSH REL: | TWA 0.1 mg/m³ [skin] |
| OSHA PEL: | TWA 0.1 mg/m³ [skin] |

| IDLH | 10 mg/m³ |

## Conversion

| MW: | 258.3 |
| BP: | Decomposes |
| FRZ: | <-13°F |
| Sol: | 0.01% |
| VP: | 0.0003 mmHg |
| IP: | ? |
| Sp.Gr: | 1.12 |
| Fl.P: | 113°F |
| UEL: | ? |
| LEL: | ? |

**Physical Description**
Amber, oily liquid with a sulfur-like odor. [insecticide]

**Measurement Methods**
NIOSH 5514  
See: NMAM or OSHA Methods

## Incompatibilities & Reactivities

Strong oxidizers, alkalis, water

## Measurement Methods

| NIOSH 5514 |
| See: NMAM or OSHA Methods |

## Personal Protection & Sanitation

(See protection )

| Skin: | Prevent skin contact |
| Eyes: | Prevent eye contact |
| Wash skin: | When contaminated |
| Remove: | When wet or contaminated |
| Change: | Daily |
| Provide: | Eyewash, Quick drench |

## First Aid

(See procedures )

| Eye: | Irrigate immediately |
| Skin: | Soap wash immediately |
| Breathing: | Respiratory support |
| Swallow: | Medical attention immediately |

---
### Respirator Recommendations NIOSH/OSHA

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Recommended Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1 mg/m³</td>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td>Up to 2.5 mg/m³</td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
</tbody>
</table>
| Up to 5 mg/m³ | (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode  
(APF = 50) Any self-contained breathing apparatus with a full facepiece  
(APF = 50) Any supplied-air respirator with a full facepiece |
| Up to 10 mg/m³ | (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode  
Emergency or planned entry into unknown concentrations or IDLH conditions:  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus |
| | Escape:  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here |

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin; miosis, ache eyes, rhinorrhea (discharge of thin mucus), headache; chest tightness, wheezing, laryngeal spasm, salivation, cyanosis; anorexia, nausea, vomiting, abdominal cramps, diarrhea; localized sweating; muscle fasciculation, lassitude (weakness, exhaustion), paralysis; dizziness, confusion, ataxia; convulsions, coma; low blood pressure; cardiac irregularities

### Target Organs
- Eyes, skin, respiratory system, cardiovascular system, central nervous system, blood cholinesterase

See also: [INTRODUCTION](#)
<table>
<thead>
<tr>
<th><strong>Diacetone alcohol</strong></th>
<th><strong>CAS</strong> 123-42-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CH₃COCH₂C(CH₃)₂OH</strong></td>
<td><strong>RTECS</strong> SA9100000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong> 1148 129</td>
</tr>
<tr>
<td>Diacetone, 4-Hydroxy-4-methyl-2-pentanone, 2-Methyl-2-pentanol-4-one</td>
<td></td>
</tr>
</tbody>
</table>

**Exposure Limits**

- NIOSH REL: TWA 50 ppm (240 mg/m³)
- OSHA PEL: TWA 50 ppm (240 mg/m³)
- IDLH 1800 ppm [10%LEL]

**Conversion**

1 ppm = 4.75 mg/m³

**Physical Description**

- Colorless liquid with a faint, minty odor.
- MW: 116.2
- BP: 334°F
- FRZ: -47°F
- Sol: Miscible
- VP: 1 mmHg
- IP: ?
- Sp.Gr: 0.94
- Fl.P: 125°F
- UEL: 6.9%
- LEL: 1.8%
- Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

**Incompatibilities & Reactivities**

- Strong oxidizers, strong alkalis

**Measurement Methods**

- NIOSH 1402, 1405; OSHA 7
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

**First Aid** *(See procedures)*

- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 1250 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

Up to 1800 ppm:
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; corneal damage; in animals: narcosis, liver damage

Target Organs Eyes, skin, respiratory system, central nervous system, liver

See also: INTRODUCTION
2,4-Diaminoanisole (and its salts)  
(NH₂)₂C₆H₃OCH₃  
CAS 615-05-4  
RTECS BZ8580500  

Synonyms & Trade Names  
1,3-Diamino-4-methoxybenzene; 4-Methoxy-1,3-benzene-diamine; 4-Methoxy-m-phenylene-diamine  
Synonyms of salts vary depending upon the specific compound.

**Exposure Limits**  
NIOSH REL: Ca Minimize occupational exposure (especially skin exposures)  
OSHA PEL: none

**Physical Description**  
Colorless solid (needles). [Note: The primary use (including its salts such as 2,4-diaminoanisole sulfate) is a component of hair & fur dye formulations.]


**Combustible Solid**

**Incompatibilities & Reactivities**  
Strong oxidizers

**Measurement Methods**  
None available  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection )  
Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated/Daily  
Remove: When wet or contaminated  
Change: Daily  
Provide: Eyewash, Quick drench

**First Aid** (See procedures )  
Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH  
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus  

**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>In animals: irritation skin; thyroid, liver changes; teratogenic effects; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, thyroid, liver, reproductive system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: thyroid, liver, skin &amp; lymphatic system tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### o-Dianisidine

(NH₂C₆H₃OCH₃)₂

**CAS** 119-90-4  
**RTECS** DD0875000

### Synonyms & Trade Names
- Dianisidine
- 3,3'-Dianisidine
- 3,3'-Dimethoxybenzidine

### Exposure Limits
- **NIOSH REL:** Ca See Appendix A See Appendix C
- **OSHA PEL:** See Appendix C
- **IDLH** Ca [N.D.]

### Physical Description
Colorless crystals that turn a violet color on standing. [Note: Used as a basis for many dyes.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>244.3</td>
</tr>
<tr>
<td>BP</td>
<td>?</td>
</tr>
<tr>
<td>VP</td>
<td>?</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>403°F</td>
</tr>
<tr>
<td>MLT</td>
<td>279°F</td>
</tr>
<tr>
<td>Sol.</td>
<td>Insoluble</td>
</tr>
<tr>
<td>Sp.Gr.</td>
<td>?</td>
</tr>
</tbody>
</table>

### Combustible Solid

### Incompatibilities & Reactivities

**Oxidizers**

### Measurement Methods
- NIOSH 5013 ; OSHA 71
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. **Click here** for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation skin; in animals: kidney, liver damage; thyroid, spleen changes; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Skin, kidneys, liver, thyroid, liver</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: bladder, liver, stomach &amp; mammary gland tumors]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
## Diazinon®

**CAS** 333-41-5

**RTECS** TF3325000

### Synonyms & Trade Names
- Basudin®
- Diazide®
- O,O-Diethyl-O-2-isopropyl-4-methyl-6-pyrimidinyl-phosphorothioate
- Spectracide®

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 0.1 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL†: none</td>
<td></td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description
- Colorless liquid with a faint ester-like odor. [insecticide] [Note: Technical grade is pale to dark brown.]
- MW: 304.4
- BP: Decomposes
- FRZ: ?
- Sol: 0.004%
- VP: 0.0001 mmHg
- IP: ?
- Sp.Gr: 1.12
- Fl.P: 180°F
- UEL: ?
- LEL: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Strong acids & alkalis, copper-containing compounds [Note: Hydrolyzes slowly in water & dilute acid.]

### Measurement Methods
- NIOSH 5600 ; OSHA 62
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures )

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

- **Respirator Recommendations** Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes; miosis, blurred vision; dizziness, confusion, lassitude (weakness, exhaustion), convulsions; dyspnea (breathing difficulty); salivation, abdominal cramps, nausea, vomiting

### Target Organs
- Eyes, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
### Diazomethane

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS Number</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂N₂</td>
<td>334-88-3</td>
<td>PA7000000</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Azimethylene, Azomethylene, Diazirine

### Exposure Limits
- **NIOSH REL:** TWA 0.2 ppm (0.4 mg/m³)
- **OSHA PEL:** TWA 0.2 ppm (0.4 mg/m³)

**IDLH:** 2 ppm

**Conversion:** 1 ppm = 1.72 mg/m³

### Physical Description
Yellow gas with a musty odor. [Note: Shipped as a liquefied compressed gas.]

- **MW:** 42.1
- **BP:** -9°F
- **FRZ:** -229°F
- **Sol:** Reacts
- **IP:** 9.00 eV
- **RGasD:** 1.45
- **Fl.P:** NA (Gas)
- **UEL:** ?
- **LEL:** ?

**Flammable Gas [EXPLOSIVE!]**

### Incompatibilities & Reactivities
- Alkali metals, water, drying agents such as calcium arsenate [Note: May explode violently on heating, exposure to sunlight, or contact with rough edges such as ground glass.]

### Measurement Methods
NIOSH 2515
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin:** Frostbite
- **Eyes:** Frostbite
- **Wash skin:** No recommendation
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Frostbite wash

### First Aid (See procedures)
- **Eye:** Frostbite
- **Skin:** Frostbite
- **Breathing:** Respiratory support

### Respirator Recommendations (NIOSH/OSHA)
**Up to 2 ppm:**
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes; cough, shortness breath; headache, lassitude (weakness, exhaustion); flush skin, fever; chest pain, pulmonary edema, pneumonitis; asthma; liquid: frostbite</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, respiratory system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## Diborane

**Chemical Identity**

- **CAS**: 19287-45-7
- **RTECS**: HQ9275000
- **Synonyms & Trade Names**: Boroethane, Boron hydride, Diboron hexahydride
- **DOT ID & Guide**: 1911 119

### Exposure Limits

- **NIOSH REL**: TWA 0.1 ppm (0.1 mg/m³)
- **OSHA PEL**: TWA 0.1 ppm (0.1 mg/m³)
- **IDLH**: 15 ppm
- **Conversion**: 1 ppm = 1.13 mg/m³

### Physical Description

- Colorless gas with a repulsive, sweet odor. [Note: Usually shipped in pressurized cylinders diluted with hydrogen, argon, nitrogen, or helium.]
- **MW**: 27.7
- **BP**: -135°F
- **FRZ**: -265°F
- **Sol**: Reacts
- **VP(62°F)**: 39.5 atm
- **IP**: 11.38 eV
- **RGasD**: 0.97
- **Fl.P**: NA (Gas)
- **UEL**: 88%
- **LEL**: 0.8%

### Incompatibilities & Reactivities

- Water, halogenated compounds, aluminum, lithium, oxidized surfaces, acids [Note: Will ignite spontaneously in moist air at room temperature. Reacts with water to form hydrogen & boric acid.]

### Measurement Methods

- NIOSH 6006
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid

- Breathing: Respiratory support
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 1 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 2.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 5 ppm:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 15 ppm:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- **inhalation**

### Symptoms
- Chest tightness, precordial pain, shortness breath, nonproductive cough, nausea; headache, dizziness, chills, fever, lassitude (weakness, exhaustion), tremor, muscle fasciculation; in animals: liver, kidney damage; pulmonary edema; hemorrhage

### Target Organs
- respiratory system, central nervous system, liver, kidneys

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## 1,2-Dibromo-3-chloropropane

<table>
<thead>
<tr>
<th>CAS</th>
<th>96-12-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>TX8750000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 1-Chloro-2,3-dibromopropane
- DBCP
- Dibromochloropropane

### DOT ID & Guide
- 2872 159

### Exposure Limits
- NIOSH REL: Ca [See Appendix A]
- OSHA PEL: [1910.1044] TWA 0.001 ppm

### IDLH
- Ca [N.D.]

### Conversion
- 1 ppm = 9.67 mg/m³

### Physical Description
- Dense yellow or amber liquid with a pungent odor at high concentrations. [pesticide] [Note: A solid below 43°F.]
- MW: 236.4
- BP: 384°F
- FRZ: 43°F
- Sol: 0.1%
- VP: 0.8 mmHg
- IP: ?
- Sp.Gr: 2.05
- Fl.P(oc): 170°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities
- Chemically-active metals such as aluminum, magnesium & tin alloys [Note: Corrosive to metals.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin, nose, throat; drowsiness; nausea, vomiting; pulmonary edema; liver, kidney injury; sterility; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system, liver, kidneys, spleen, reproductive system, digestive system</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[in animals: cancer of the nasal cavity, tongue, pharynx, lungs, stomach, adrenal &amp; mammary glands]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2-N-Dibutylaminoethanol

<table>
<thead>
<tr>
<th>CAS</th>
<th>102-81-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KK3850000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dibutylaminoethanol; 2-Dibutylaminoethanol; 2-Di-N-butylaminoethanol; 2-Di-N-butylaminoethyl alcohol; N,N-Dibutylethanolamine

### DOT ID & Guide
- 2873 153

### Exposure Limits
- NIOSH REL: TWA 2 ppm (14 mg/m³) [skin]
- OSHA PEL†: none

### Conversion
- 1 ppm = 7.09 mg/m³

### Physical Description
- Colorless liquid with a faint, amine-like odor.
- MW: 173.3
- BP: 446°F
- FRZ: ?
- Sol: 0.4%
- VP: 0.1 mmHg
- IP: ?
- Sp.Gr: 0.86
- Fi.P: 195°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities
- Oxidizers

### Measurement Methods
- NIOSH 2007
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

#### Skin:
- Prevent skin contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

#### Eyes:
- Prevent eye contact

### First Aid

#### Eye:
- Irrigate immediately

#### Skin:
- Soap flush immediately

#### Breathing:
- Respiratory support

#### Swallow:
- Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations
- Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

#### In animals:
- Irritation eyes, skin, nose; dermatitis; skin, corneal necrosis; weight loss

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
# 2,6-Di-tert-butyl-p-cresol

**CAS** 128-37-0

**RTECS** GO7875000

**Synonyms & Trade Names**
BHT; Butylated hydroxytoluene; Dibutylated hydroxytoluene; 4-Methyl-2,6-di-tert-butyl phenol

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 10 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description
White to pale-yellow, crystalline solid with a slight, phenolic odor. [food preservative]

<table>
<thead>
<tr>
<th>MW: 220.4</th>
<th>BP: 509°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0.01 mmHg</td>
<td>IP: ?</td>
</tr>
<tr>
<td>Fl.P: 261°F</td>
<td>UEL: ?</td>
</tr>
</tbody>
</table>

**Class IIIB Combustible Liquid:** Fl.P. at or above 200°F.

### Incompatibilities & Reactivities
Oxidizers

### Measurement Methods
NIOSH P&CAM226 (II-1) ; OSHA PV2108
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily

### First Aid (See procedures )
Eye: Irrigate immediately
Skin: Soap wash
Breathing: Fresh air
Swallow: Medical attention immediately

### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin; in animals: decreased growth rate, increased liver weight

### Target Organs
Eyes, skin

See also: INTRODUCTION
## Dibutyl phosphate

(C₄H₉O)₂(OH)PO

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dibutyl acid o-phosphate, Di-n-butyl hydrogen phosphate, Dibutyl phosphoric acid</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits
- **NIOSH REL:** TWA 1 ppm (5 mg/m³) ST 2 ppm (10 mg/m³)
- **OSHA PEL†:** TWA 1 ppm (5 mg/m³)

**IDLH:** 30 ppm

**Conversion:** 1 ppm = 8.60 mg/m³

### Physical Description
- Pale-amber, odorless liquid.
- **MW:** 210.2
- **BP:** 212°F (Decomposes)
- **FRZ:** ?
- **Sol:** Insoluble
- **VP:** 1 mmHg (approx)
- **IP:** ?
- **Sp.Gr.:** 1.06
- **UEL:** ?
- **LEL:** ?

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- **NIOSH 5017**
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Quick drench

### First Aid (See procedures )
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH/OSHA

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Recommended Respiratory Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 10 ppm:</strong></td>
<td>10</td>
<td>Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 25 ppm:</strong></td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td><strong>Up to 30 ppm:</strong></td>
<td>50</td>
<td>Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Recommended Respiratory Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>(APF = 10,000)</td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000)</td>
<td>10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

**Escape:**

<table>
<thead>
<tr>
<th>APF</th>
<th>Recommended Respiratory Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. <a href="#">Click here</a></td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; headache

**Target Organs** Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Dibutyl phthalate

| CAS 84-74-2 |

### Chemical formula

C$_6$H$_4$(COOC$_4$H$_9$)$_2$

### RTECS

TI0875000

### Synonyms & Trade Names

DBP; Dibutyl-1,2-benzene-dicarboxylate; Di-n-butyl phthalate

### DOT ID & Guide


## Exposure Limits

- **NIOSH REL:** TWA 5 mg/m$^3$
- **OSHA PEL:** TWA 5 mg/m$^3$
- **IDLH:** 4000 mg/m$^3$

### Conversion

1 ppm = 11.57 mg/m$^3$

## Physical Description

Colorless to faint-yellow, oily liquid with a slight, aromatic odor.

- **MW:** 278.3
- **BP:** 644°F
- **FRZ:** -31°F
- **Sol(77°F):** 0.001%
- **VP:** 0.00007 mmHg
- **IP:** ?
- **Sp.Gr:** 1.05
- **Fl.P:** 315°F
- **UEL:** ?
- **LEL(456°F):** 0.5%

### Class

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

## Incompatibilities & Reactivities

Nitrates; strong oxidizers, alkalis & acids; liquid chlorine

## Measurement Methods

- NIOSH 5020 ; OSHA 104
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection )

- **Skin:** No recommendation
- **Eyes:** Prevent eye contact
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

## First Aid (See procedures )

- **Eye:** Irrigate immediately
- **Skin:** Wash regularly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

---

**Note:** Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

**Up to 50 mg/m$^3$:**
(APF = 10) Any air-purifying full-facepiece respirator equipped with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.

**Up to 125 mg/m$^3$:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode.
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 250 mg/m$^3$:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 4000 mg/m$^3$:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, upper respiratory system, stomach

**Target Organs** Eyes, respiratory system, gastrointestinal tract

See also: INTRODUCTION
## Dichloroacetylene

**CAS** 7572-29-4  
**RTECS** AP1080000  
**DOT ID & Guide**

### Synonyms & Trade Names
DCA, Dichloroethyne  
[Note: DCA is a possible decomposition product of trichloroethylene or trichloroethane.]

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca C 0.1 ppm (0.4 mg/m³)</th>
<th>See Appendix A</th>
<th>OSHA PEL†: none</th>
<th>Conversion</th>
<th>1 ppm = 3.88 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH Ca [N.D.]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description
Volatile oil with a disagreeable, sweetish odor.  
[Note: A gas above 90°F. DCA is not produced commercially.]

<table>
<thead>
<tr>
<th>MW: 94.9</th>
<th>BP: 90°F (Explodes)</th>
<th>FRZ: -58 to -87°F</th>
<th>Sol: ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>FI.P: ?</td>
<td>UEL: ?</td>
<td>LEL: ?</td>
<td></td>
</tr>
</tbody>
</table>

### Combustible Liquid

### Incompatibilities & Reactivities
Oxidizers, heat, shock

### Measurement Methods
None available  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin: Prevent skin contact</th>
<th>Eyes: Prevent eye contact</th>
<th>Wash skin: When contaminated</th>
<th>Remove: When wet (flammable)</th>
<th>Change: No recommendation</th>
<th>Provide: Eyewash, Quick drench</th>
</tr>
</thead>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Eye: Irrigate immediately</th>
<th>Skin: Soap flush immediately</th>
<th>Breathing: Respiratory support</th>
<th>Swallow: Medical attention immediately</th>
</tr>
</thead>
</table>

### Important additional information about respirator selection

### Respirator Recommendations

<table>
<thead>
<tr>
<th>At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:</th>
<th>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

### Escape:

| (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus |

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Headache, loss of appetite, nausea, vomiting, intense jaw pain, cranial nerve palsy; in animals: kidney, liver, brain injury; weight loss; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>central nervous system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: kidney tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>o-Dichlorobenzene</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAS</strong></td>
</tr>
<tr>
<td><strong>RTECS</strong></td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
<tr>
<td><strong>Exposure Limits</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
</tr>
<tr>
<td><strong>Conversion</strong></td>
</tr>
<tr>
<td><strong>Physical Description</strong></td>
</tr>
<tr>
<td><strong>MW</strong></td>
</tr>
<tr>
<td><strong>BP</strong></td>
</tr>
<tr>
<td><strong>FRZ</strong></td>
</tr>
<tr>
<td><strong>Sol</strong></td>
</tr>
<tr>
<td><strong>VP</strong></td>
</tr>
<tr>
<td><strong>IP</strong></td>
</tr>
<tr>
<td><strong>Sp.Gr</strong></td>
</tr>
<tr>
<td><strong>Fl.P.</strong></td>
</tr>
<tr>
<td><strong>UEL</strong></td>
</tr>
<tr>
<td><strong>LEL</strong></td>
</tr>
<tr>
<td><strong>Class IIIA Combustible Liquid</strong></td>
</tr>
<tr>
<td><strong>Incompatibilities &amp; Reactivities</strong></td>
</tr>
<tr>
<td><strong>Measurement Methods</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Personal Protection &amp; Sanitation</strong></td>
</tr>
<tr>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: No recommendation</td>
</tr>
</tbody>
</table>
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 200 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, nose; liver, kidney damage; skin blisters

### Target Organs
- Eyes, skin, respiratory system, liver, kidneys

See also: [INTRODUCTION](#)
**NIOSH Pocket Guide to Chemical Hazards**

### p-Dichlorobenzene

**CAS** 106-46-7

**RTECS** CZ4550000

**Synonyms & Trade Names**
- p-DCB; 1,4-Dichlorobenzene; para-Dichlorobenzene; Dichlorocide

**Exposure Limits**

<table>
<thead>
<tr>
<th>Exposure Limit</th>
<th>NIOSH REL: Ca See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: TWA 75 ppm (450 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH Ca [150 ppm]**

**Conversion** 1 ppm = 6.01 mg/m³

**Physical Description**
- Colorless or white crystalline solid with a mothball-like odor. [insecticide]
- MW: 147.0
- BP: 345°F
- MLT: 128°F
- Sol: 0.008%
- VP: 1.3 mmHg
- IP: 8.98 eV
- Sp.Gr: 1.25
- Fl.P: 150°F
- UEL: ?
- LEL: 2.5%

**Incompatibilities & Reactivities**
- Strong oxidizers (such as chlorine or permanganate)

**Measurement Methods**
- NIOSH 1003; OSHA 7
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)

<table>
<thead>
<tr>
<th>Skin</th>
<th>Eyes</th>
<th>Wash skin:</th>
<th>Remove:</th>
<th>Change:</th>
<th>Provide:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevent skin contact</td>
<td>Prevent eye contact</td>
<td>When contaminated/Daily</td>
<td>When wet or contaminated</td>
<td>Daily</td>
<td>Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

**First Aid** (See procedures)

<table>
<thead>
<tr>
<th>Eye</th>
<th>Skin</th>
<th>Breathing</th>
<th>Swallow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigate immediately</td>
<td>Soap wash</td>
<td>Respiratory support</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>

**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**
- Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Liver, respiratory system, eyes, kidneys, skin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver &amp; kidney cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
**3,3'-Dichlorobenzidine (and its salts)**

<table>
<thead>
<tr>
<th>NH₂ClC₆H₃C₆H₃ClNH₂</th>
<th>CAS 91-94-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS DD05250000</td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

4,4'-Diamino-3,3'-dichlorobiphenyl; Dichlorobenzidine base; o,o'-Dichlorobenzidine; 3,3'-Dichlorobiphenyl-4,4'-diamine; 3,3'-Dichloro-4,4'-biphenyldiamine; 3,3'-Dichloro-4,4'-diaminobiphenyl

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: [1910.1007]</td>
<td>See Appendix B</td>
</tr>
</tbody>
</table>

**IDLH** Ca [N.D.]

**Physical Description**

Gray to purple, crystalline solid.

**MW:** 253.1  **BP:** 788°F  **MLT:** 271°F  **Sol(59°F):** 0.07%

**VP:** ?  **IP:** ?  **Sp.Gr:** ?

**Incompatibilities & Reactivities**

None reported

**Measurement Methods**

NIOSH 5509 ; OSHA 65

See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

(See protection )

Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated/Daily  
Remove: When wet or contaminated  
Change: Daily  
Provide: Eyewash, Quick drench

**First Aid**

(See procedures )

Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately

**Important additional information about respirator selection**

Respirator Recommendations

(See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**

inhalation, skin absorption, ingestion, skin and/or eye contact
**Symptoms**  Skin sensitization, dermatitis; headache, dizziness; caustic burns; frequent urination, dysuria; hematuria (blood in the urine); gastrointestinal upset; upper respiratory infection; [potential occupational carcinogen]

**Target Organs**  Bladder, liver, lung, skin, gastrointestinal tract

**Cancer Site**  [in animals: liver & bladder cancer]

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Dichlorodifluoromethane

**CAS** 75-71-8  
**RTECS** PA8200000

### Synonyms & Trade Names
- Difluorodichloromethane
- Fluorocarbon 12
- Freon® 12
- Genetron® 12
- Halon® 122
- Propellant 12
- Refrigerant 12

### DOT ID & Guide
- 1028 126

### Exposure Limits
- **NIOSH REL:** TWA 1000 ppm (4950 mg/m³)
- **OSHA PEL:** TWA 1000 ppm (4950 mg/m³)
- **IDLH:** 15,000 ppm

### Conversion
- 1 ppm = 4.95 mg/m³

### Physical Description
- Colorless gas with an ether-like odor at extremely high concentrations.  
  [Note: Shipped as a liquefied compressed gas.]
- **MW:** 120.9
- **BP:** -22°F
- **FRZ:** -252°F
- **Sol (77°F):** 0.03%
- **VP:** 5.7 atm
- **IP:** 11.75 eV
- **RGasD:** 4.2
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

### Incompatibilities & Reactivities
- Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium

### Measurement Methods
- NIOSH 1018
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Frostbite
- **Eyes:** Frostbite
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation
- **Provide:** Frostbite wash

### First Aid
- **Eye:** Frostbite
- **Skin:** Frostbite
- **Breathing:** Respiratory support
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 10,000 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 15,000 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin and/or eye contact (liquid)

**Symptoms** Dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite

**Target Organs** cardiovascular system, peripheral nervous system

See also: **INTRODUCTION**
1,3-Dichloro-5,5-dimethylhydantoin

<table>
<thead>
<tr>
<th>CAS</th>
<th>CAS 118-52-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RTECS MU0700000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Dactin, DDH, Halane

**Exposure Limits**
- NIOSH REL: TWA 0.2 mg/m³ ST 0.4 mg/m³
- OSHA PEL: TWA 0.2 mg/m³
- IDLH: 5 mg/m³

**Physical Description**
White powder with a chlorine-like odor.

- MW: 197.0
- BP: ?
- MLT: 270°F
- Sol: 0.2%
- VP: ?
- IP: ?
- Sp.Gr: 1.5
- Fl.P: 346°F
- UEL: ?
- LEL: ?

**Combustible Solid**

**Incompatibilities & Reactivities**
Water, strong acids, easily oxidized materials such as ammonia salts & sulfides

**Measurement Methods**
None available
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash

**First Aid** (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH/OSHA</strong></td>
</tr>
<tr>
<td><strong>Up to 2 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 5 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. <a href="#">Click here</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, mucous membrane, respiratory system</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, respiratory system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
1,1-Dichloroethane

$\text{CHCl}_2\text{CH}_3$

**CAS** 75-34-3

**RTECS** KI0175000

**Synonyms & Trade Names**
Asymmetrical dichloroethane; Ethylidene chloride; 1,1-Ethylidene dichloride

**DOT ID & Guide**
2362 130

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 100 ppm (400 mg/m$^3$)</th>
<th>See Appendix C (Chloroethanes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: TWA 100 ppm (400 mg/m$^3$)</td>
<td></td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
<td>3000 ppm</td>
<td></td>
</tr>
</tbody>
</table>

**Conversion**
1 ppm = 4.05 mg/m$^3$

**Physical Description**
Colorless, oily liquid with a chloroform-like odor.

<table>
<thead>
<tr>
<th>MW: 99.0</th>
<th>BP: 135°F</th>
<th>FRZ: -143°F</th>
<th>Sol: 0.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 182 mmHg</td>
<td>IP: 11.06 eV</td>
<td></td>
<td>Sp.Gr: 1.18</td>
</tr>
<tr>
<td>Fl.P: 2°F</td>
<td>UEL: 11.4%</td>
<td>LEL: 5.4%</td>
<td></td>
</tr>
</tbody>
</table>

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

**Incompatibilities & Reactivities**
Strong oxidizers, strong caustics

**Measurement Methods**
NIOSH 1003; OSHA 7
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

**First Aid**
(See procedures)

- Eye: Irrigate immediately
- Skin: Soap flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 1000 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 2500 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 3000 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation skin; central nervous system depression; liver, kidney, lung damage

**Target Organs** Skin, liver, kidneys, lungs, central nervous system

See also: [INTRODUCTION](#)
### 1,2-Dichloroethylene

**CAS** 540-59-0  
**RTECS** KV9360000  
**DOT ID & Guide** 1150 130 P

#### Synonyms & Trade Names
- Acetylene dichloride
- cis-Acetylene dichloride
- trans-Acetylene dichloride
- sym-Dichloroethylene

#### Exposure Limits
- NIOSH REL: TWA 200 ppm (790 mg/m³)
- OSHA PEL: TWA 200 ppm (790 mg/m³)
- IDLH 1000 ppm

#### Conversion
- 1 ppm = 3.97 mg/m³

#### Physical Description
- Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.
- MW: 97.0  
- BP: 118-140°F  
- FRZ: -57 to -115°F  
- Sol: 0.4%
- VP: 180-265 mmHg  
- IP: 9.65 eV  
- Sp.Gr(77°F): 1.27
- Fl.P: 36-39°F  
- UEL: 12.8%  
- LEL: 5.6%

- Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities
- Strong oxidizers, strong alkalis, potassium hydroxide, copper [Note: Usually contains inhibitors to prevent polymerization.]

#### Measurement Methods
- NIOSH 1003 ; OSHA 7
- See: NMAM or OSHA Methods

#### Measurement Methods

#### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

#### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2000 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, respiratory system; central nervous system depression

Target Organs Eyes, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Dichloroethyl ether

<table>
<thead>
<tr>
<th>CAS</th>
<th>111-44-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KN0875000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1916 152</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- bis(2-Chloroethyl)ether
- 2,2'-Dichlorodiethyl ether
- 2,2'-Dichloroethyl ether

### Exposure Limits
- NIOSH REL: Ca TWA 5 ppm (30 mg/m³) ST 10 ppm (60 mg/m³) [skin] See Appendix A
- OSHA PEL†: TWA 15 ppm (90 mg/m³) [skin]

### Conversion
1 ppm = 5.85 mg/m³

### Physical Description
- Colorless liquid with a chlorinated solvent-like odor.
- MW: 143.0
- BP: 352°F
- FRZ: -58°F
- Sol: 1%
- VP: 0.7 mmHg
- IP: ?
- Sp.Gr: 1.22
- Fl.P: 131°F
- UEL: ?
- LEL: 2.7%

### Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities
- Strong oxidizers [Note: Decomposes in presence of moisture to form hydrochloric acid.]

### Measurement Methods
- NIOSH 1004 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH
- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation nose, throat, respiratory system; lacrimation (discharge of tears); cough; nausea, vomiting; in animals: pulmonary edema; liver damage; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, respiratory system, liver</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Dichloromonofluoromethane

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS Number</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHCl₂F</td>
<td>75-43-4</td>
<td>PA8400000</td>
<td>1029 126</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dichlorofluoromethane
- Fluorodichloromethane
- Freon® 21
- Genetron® 21
- Halon® 112
- Refrigerant 21

### Exposure Limits
- NIOSH REL: TWA 10 ppm (40 mg/m³)
- OSHA PEL†: TWA 1000 ppm (4200 mg/m³)
- IDLH: 5000 ppm

### Conversion
1 ppm = 4.21 mg/m³

### Physical Description
- Colorless gas with a slight, ether-like odor. [Note: A liquid below 48°F. Shipped as a liquefied compressed gas.]
- MW: 102.9
- BP: 48°F
- FRZ: -211°F
- VP(70°F): 1.6 atm
- IP: 12.39 eV
- RGasD: 3.57
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium; acid; acid fumes

### Measurement Methods
- NIOSH 2516
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation
- Provide: Frostbite wash

### First Aid
- Eye: Frostbite
- Skin: Frostbite
- Breathing: Respiratory support
## Important additional information about respirator selection

### Respirator Recommendations NIOSH

**Up to 100 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 250 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 500 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 5000 ppm:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin and/or eye contact (liquid)

### Symptoms
- Asphyxia, cardiac arrhythmias, cardiac arrest; liquid: frostbite

### Target Organs
- Respiratory system, cardiovascular system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## 1,1-Dichloro-1-nitroethane

<table>
<thead>
<tr>
<th>CAS</th>
<th>594-72-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KI1050000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Dichloronitroethane</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2650 153</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: TWA | 2 ppm (10 mg/m³) |
| OSHA PEL†: C 10 ppm (60 mg/m³) |

### IDLH

25 ppm

### Conversion

1 ppm = 5.89 mg/m³

### Physical Description

Colorless liquid with an unpleasant odor. [fumigant]

| MW: 143.9 | BP: 255°F |
| VP: 15 mmHg | IP: ? |
| Fl.P: 136°F | UEL: ? |

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

Strong oxidizers [Note: Corrosive to iron in presence of moisture.]

### Measurement Methods

NIOSH 1601 ; OSHA 7

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation

### First Aid

(See procedures)

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Respirator Recommendations NIOSH

**Up to 20 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 25 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- In animals: irritation eyes, skin; liver, heart, kidney damage; pulmonary edema, hemorrhage

### Target Organs
- Eyes, skin, respiratory system, liver, kidneys, cardiovascular system

---

See also: **INTRODUCTION**
# 1,3-Dichloropropene

**CAS** 542-75-6

**RTECS** UC8310000

### Synonyms & Trade Names
- 3-Chloroallyl chloride; DCP; 1,3-Dichloro-1-propene; 1,3-Dichloropropylene; Telone®

### DOT ID & Guide
- DOT ID & Guide 2047 129

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca TWA 1 ppm (5 mg/m³) [skin]</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
<td></td>
</tr>
<tr>
<td>IDLH Ca [N.D.]</td>
<td>Conversion 1 ppm = 4.54 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description
- Colorless to straw-colored liquid with a sharp, sweet, irritating, chloroform-like odor. [insecticide] [Note: Exists as mixture of cis- & trans-isomers.]
- MW: 111.0
- BP: 226°F
- FRZ: -119°F
- Sol: 0.2%
- VP: 28 mmHg
- IP: ?
- Sp.Gr: 1.21
- Fl.P: 77°F
- UEL: 14.5%
- LEL: 5.3%

### Incompatibilities & Reactivities
- Aluminum, magnesium, halogens, oxidizers [Note: Epichlorohydrin may be added as a stabilizer.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated
**Remove:** When wet (flammable)
**Change:** No recommendation
**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately
**Skin:** Soap flush immediately
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, respiratory system; eye, skin burns; lacrimation (discharge of tears); headache, dizziness; in animals; liver, kidney damage; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system, liver, kidneys</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: cancer of the bladder, liver, lung &amp; forestomach]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
### 2,2-Dichloropropionic acid

**CAS** 75-99-0  
**RTECS** UF0690000

### Synonyms & Trade Names
Dalapon; 2,2-Dichloropropanoic acid; alpha,alpha-Dichloropropionic acid

### Exposure Limits

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
<th>1 ppm = 5.85 mg/m³</th>
</tr>
</thead>
</table>

### Physical Description

Colorless liquid with an acrid odor. [herbicide] [Note: A white to tan powder below 46°F. The sodium salt, a white powder, is often used.]

- **MW:** 143.0  
- **BP:** 374°F  
- **FRZ:** 46°F  
- **Sol:** 50%

### Incompatibilities & Reactivities

Metals [Note: Very corrosive to aluminum & copper alloys. Reacts slowly in water to form hydrochloric & pyruvic acids.]

### Measurement Methods

- **OSHA PV2017**
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet or contaminated  
- **Change:** No recommendation  
- **Provide:** Eyewash, Quick drench

### First Aid (See procedures)

- **Eye:** Irrigate immediately  
- **Skin:** Water wash immediately  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

- inhalation, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, skin, upper respiratory system; skin burns; lassitude (weakness, exhaustion), loss of appetite, diarrhea, vomiting, slowing of pulse; central nervous system depression

### Target Organs

- Eyes, skin, respiratory system, gastrointestinal tract, central nervous system

See also: INTRODUCTION
**Dichlorotetrafluoroethane**  
CAS 76-14-2

**CClF₂CClF₂**  
RTECS KI1101000

### Synonyms & Trade Names
1,2-Dichlorotetrafluoroethane; Freon® 114; Genetron® 114; Halon® 242; Refrigerant 114

### DOT ID & Guide
1958 126

### Exposure Limits
<table>
<thead>
<tr>
<th>NIOSH REL: TWA 1000 ppm (7000 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 1000 ppm (7000 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 15,000 ppm  
**Conversion** 1 ppm = 6.99 mg/m³

### Physical Description
Colorless gas with a faint, ether-like odor at high concentrations. [Note: A liquid below 38°F. Shipped as a liquefied compressed gas.]

| MW: 170.9 | BP: 38°F | FRZ: -137°F | Sol: 0.01% |
| VP(70°F): 1.9 atm | IP: 12.20 eV | RGasD: 5.93 |
| FL.P: NA | UEL: NA | LEL: NA |

Nonflammable Gas

### Incompatibilities & Reactivities
Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium; acids; acid fumes

### Measurement Methods
NIOSH 1018  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation *(See protection)*
- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation
- Provide: Frostbite wash

### First Aid *(See procedures)*
- Eye: Frostbite
- Skin: Frostbite
- Breathing: Respiratory support
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 10,000 ppm:
- (APF = 10) Any supplied-air respirator

#### Up to 15,000 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

---

### Exposure Routes

- Inhalation, skin and/or eye contact (liquid)

### Symptoms

- Irritation respiratory system; asphyxia; cardiac arrhythmias, cardiac arrest; liquid: frostbite

### Target Organs

- Respiratory system, cardiovascular system

See also: [INTRODUCTION](#)
# Dichlorvos

**CAS** 62-73-7

**RTECS** TC0350000

## Synonyms & Trade Names
DDVP; 2,2-Dichlorovinyl dimethyl phosphate

## DOT ID & Guide
2783 152

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL</th>
<th>IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 1 mg/m³ [skin]</td>
<td>TWA 1 mg/m³ [skin]</td>
<td>100 mg/m³</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 9.04 mg/m³

## Physical Description

Colorless to amber liquid with a mild, chemical odor. [Note: Insecticide that may be absorbed on a dry carrier.]

<table>
<thead>
<tr>
<th>MW</th>
<th>BP</th>
<th>FRZ</th>
<th>Sol</th>
<th>Sp.Gr(77°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>221.0</td>
<td>Decomposes</td>
<td>?</td>
<td>0.5%</td>
<td>1.42</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Strong acids, strong alkalis [Note: Corrosive to iron & mild steel.]

### Measurement Methods

NIOSH P&CAM295 (II-5) ; OSHA 62

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

### First Aid

Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 10 mg/m³:**
- (APF = 10) Any supplied-air respirator

**Up to 25 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 50 mg/m³:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 100 mg/m³:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

---

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; miosis, ache eyes; rhinorrhea (discharge of thin mucus); headache; chest tightness, wheezing, laryngeal spasm, salivation; cyanosis; anorexia, nausea, vomiting, diarrhea; sweating; muscle fasciculation, paralysis, dizziness, ataxia; convulsions; low blood pressure, cardiac irregularities

**Target Organs** Eyes, skin, respiratory system, cardiovascular system, central nervous system, blood cholinesterase

See also: [INTRODUCTION](#)
Dicrotophos

CAS 141-66-2

C₈H₁₆NO₅P

RTECS TC3850000

Synonyms & Trade Names

Bidrin®; Carbicron®; 2-Dimethyl-cis-2-dimethylcarbamoyl-1-methylvinylphosphate

DOT ID & Guide

Exposure Limits

NIOSH REL: TWA 0.25 mg/m³ [skin]

OSHA PEL†: none

IDLH N.D.

Conversion 1 ppm = 9.70 mg/m³

Physical Description

Yellow-brown liquid with a mild, ester odor. [insecticide]


VP: 0.0001 mmHg IP: ? Sp.Gr(59°F): 1.22

Fl.P: >200°F UEL: ? LEL: ?

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

Incompatibilities & Reactivities

Metals [Note: Corrosive to cast iron, mild steel, brass & stainless steel.]

Measurement Methods

NIOSH 5600
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection )

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Quick drench

First Aid (See procedures )

Eye: Irrigate immediately
Skin: Water wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Important additional information about respirator selection

Respirator Recommendations Not available.

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Headache, nausea, dizziness, anxiety, restlessness, muscle twitching, lassitude (weakness, exhaustion), tremor, incoordination, vomiting, abdominal cramps, diarrhea; salivation, sweating, lacrimation (discharge of tears), rhinitis; anorexia, malaise (vague feeling of discomfort)

Target Organs central nervous system, blood cholinesterase

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Dicyclopentadiene</th>
<th>CAS 77-73-6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C_{10}H_{12}</strong></td>
<td>RTECS PC1050000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>DOT ID &amp; Guide 2048 130</td>
</tr>
<tr>
<td>Bicyclopentadiene; DCPD; 1,3-Dicyclopentadiene dimer; 3a,4,7,7a-Tetrahydro-4,7-methanoindene [Note: Exists in two stereoisomeric forms.]</td>
<td></td>
</tr>
</tbody>
</table>

**Exposure Limits**
- NIOSH REL: TWA 5 ppm (30 mg/m³)
- OSHA PEL†: none
- IDLH N.D.

**Conversion** 1 ppm = 5.41 mg/m³

**Physical Description**
- Colorless, crystalline solid with a disagreeable, camphor-like odor. [Note: A liquid above 90°F.]
- MW: 132.2
- BP: 342°F
- FRZ: 90°F
- Sol: 0.02%
- VP: 1.4 mmHg
- IP: ?
- Sp.Gr: 0.98 (Liquid at 95°F)
- Fl.P(oc): 90°F
- UEL: 6.3%
- LEL: 0.8%

**Incompatibilities & Reactivities**
- Oxidizers [Note: Depolymerizes at boiling point and forms two molecules of cyclopentadiene. Must be inhibited and maintained under an inert atmosphere to prevent polymerization.]

**Measurement Methods**
- OSHA PV2098
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

**First Aid** *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**
**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; incoordination, headache; sneezing, cough; skin blisters; in animals: kidney, lung damage

**Target Organs** Eyes, skin, respiratory system, central nervous system, kidneys

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

**Dicyclopentadienyl iron**

(C\textsubscript{5}H\textsubscript{5})\textsubscript{2}Fe

**Synonyms & Trade Names**
- bis(Cyclopentadienyl)iron
- Ferrocene
- Iron dicyclopentadienyl

**CAS** 102-54-5

**RTECS** LK0700000

**DOT ID & Guide**

**Exposure Limits**
- NIOSH REL: TWA 10 mg/m\textsuperscript{3} (total) TWA 5 mg/m\textsuperscript{3} (resp)
- OSHA PEL\textsuperscript{†}: TWA 15 mg/m\textsuperscript{3} (total) TWA 5 mg/m\textsuperscript{3} (resp)
- IDLH N.D.

**Physical Description**
Orange, crystalline solid with a camphor-like odor.

**MW:** 186.1
**BP:** 480°F
**MLT:** 343°F
**Sol:** Insoluble

**VP:** ?
**IP:** 6.88 eV
**Sp.Gr:** ?

**Combustible Solid**

**Incompatibilities & Reactivities**
- Ammonium perchlorate
- Tetranitromethane
- Mercury(II) nitrate

**Measurement Methods**
- OSHA ID125G
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: Daily

**First Aid**
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

See also: INTRODUCTION
## Dieldrin

**CAS** 60-57-1  

**RTECS** IO1750000

### Synonyms & Trade Names
- HEOD; 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,exo-5,8-dimethanonaphthalene

### DOT ID & Guide
- 2761 151

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca TWA 0.25 mg/m³ [skin]</th>
<th>See Appendix A</th>
<th>OSHA PEL: TWA 0.25 mg/m³ [skin]</th>
</tr>
</thead>
</table>
| **IDLH Ca [50 mg/m³]** | Conversion | **Noncombustible Solid** | Incompatibilities & Reactivities
|                 | **Noncombustible Solid** | **Incompatibilities & Reactivities** | **Strong oxidizers, active metals such as sodium, strong acids, phenols** |

### Physical Description
- Colorless to light-tan crystals with a mild, chemical odor. [insecticide]

- **MW:** 380.9  
- **BP:** Decomposes  
- **MLT:** 349°F  
- **Sol:** 0.02%  
- **VP (77°F):** 8 x 10⁻⁷ mmHg  
- **IP:** ?  
- **Sp.Gr:** 1.75  
- **Fi.P:** NA  
- **UEL:** NA  
- **LEL:** NA

### Incompatibilities & Reactivities

- Strong oxidizers, active metals such as sodium, strong acids, phenols

### Measurement Methods

- NIOSH S283 (II-3)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma; [potential occupational carcinogen]; in animals: liver, kidney damage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>central nervous system, liver, kidneys, skin</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung, liver, thyroid &amp; adrenal gland tumors]</td>
</tr>
<tr>
<td><strong>See also:</strong></td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Diesel exhaust

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms vary depending upon the specific diesel exhaust component.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: Ca See Appendix A</td>
<td>RTECS HZ1755000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca [N.D.]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance and odor vary depending upon the specific diesel exhaust component.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Properties vary depending upon the specific component diesel exhaust component.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incompatibilities &amp; Reactivities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varies</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH 2560 , 5040 See: NMAM or OSHA Methods</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Personal Protection &amp; Sanitation (See protection )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: No recommendation</td>
</tr>
<tr>
<td>Eyes: No recommendation</td>
</tr>
<tr>
<td>Wash skin: No recommendation</td>
</tr>
<tr>
<td>Remove: No recommendation</td>
</tr>
<tr>
<td>Change: No recommendation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First Aid (See procedures )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation, skin and/or eye contact</td>
<td>Eye irritation, pulmonary function changes; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, respiratory system</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## Diethanolamine

<table>
<thead>
<tr>
<th>CAS</th>
<th>111-42-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KL2975000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- DEA; Di(2-hydroxyethyl)amine; 2,2'-Dihydroxydiethyamine; Diolamine; bis(2-Hydroxyethyl) amine; 2,2'-Iminodiethanol

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>TWA 3 ppm (15 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

| IDLH | N.D. |

### Conversion

1 ppm = 4.30 mg/m³

### Physical Description
Colorless crystals or a syrupy, white liquid (above 82°F) with a mild, ammonia-like odor.

- MW: 105.2
- BP: 516°F (Decomposes)
- MLT: 82°F
- Sol: 95%
- VP: <0.01 mmHg
- IP: ?
- Sp.Gr: 1.10
- Fl.P: 279°F
- UEL: 9.8%
- LEL: 1.6%

Class IIIB Combustible Liquid
Combustible Solid

### Incompatibilities & Reactivities
Oxidizers, strong acids, acid anhydrides, halides [Note: Reacts with CO₂ in the air. Hygroscopic (i.e., absorbs moisture from the air). Corrosive to copper, zinc & galvanized iron.]

### Measurement Methods
NIOSH 3509 ; OSHA PV2018
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection )

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
(See procedures )

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, nose, throat; eye burns, corneal necrosis; skin burns; lacrimation (discharge of tears), cough, sneezing

### Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
### Diethylamine

**CAS**: 109-89-7  
**RTECS**: HZ8750000

#### Synonyms & Trade Names
- Diethamine; N,N-Diethylamine; N-Ethylethanamine

#### DOT ID & Guide
- **ID**: 1154 132

#### Exposure Limits
- **NIOSH REL**: TWA 10 ppm (30 mg/m³) ST 25 ppm (75 mg/m³)
- **OSHA PEL†**: TWA 25 ppm (75 mg/m³)
- **IDLH**: 200 ppm

#### Physical Description
- Colorless liquid with a fishy, ammonia-like odor.
- **MW**: 73.1  
  **BP**: 132°F  
  **FRZ**: -58°F  
  **Sol**: Miscible
- **VP**: 192 mmHg  
  **IP**: 8.01 eV  
  **Sp.Gr**: 0.71
- **Fl.P**: -15°F  
  **UEL**: 10.1%  
  **LEL**: 1.8%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities
- Strong oxidizers, strong acids, cellulose nitrate

#### Measurement Methods
- NIOSH 2010 ; OSHA 41
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation
- **Provide**: Eyewash (>0.5%), Quick drench (liquid)

#### First Aid (See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Water flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 200 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; in animals; myocardial degeneration

### Target Organs
- Eyes, skin, respiratory system, cardiovascular system

See also: INTRODUCTION
2-Diethylaminoethanol

<table>
<thead>
<tr>
<th>CAS 100-37-8</th>
</tr>
</thead>
</table>

\((\text{C}_2\text{H}_5\text{)}_2\text{NCH}_2\text{CH}_2\text{OH}\)

RTECS KK5075000

**Synonyms & Trade Names**
Diethylaminoethanol; 2-Diethylaminoethyl alcohol; N,N-Diethylethanolamine; Diethyl-(2-hydroxyethyl)amine; 2-Hydroxytriethylamine

**DOT ID & Guide**
2686 132

**Exposure Limits**
- NIOSH REL: TWA 10 ppm (50 mg/m³) [skin]
- OSHA PEL: TWA 10 ppm (50 mg/m³) [skin]

**IDLH** 100 ppm

**Conversion** 1 ppm = 4.79 mg/m³

**Physical Description**
Colorless liquid with a nauseating, ammonia-like odor.

| MW: 117.2 | BP: 325°F | FRZ: -94°F | Sol: Miscible |
| VP: 1 mmHg | IP: ? | Sp.Gr: 0.89 |
| Fl.P: 126°F | UEL: 11.7% | LEL: 6.7% |

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

**Incompatibilities & Reactivities**
Strong oxidizers, strong acids

**Measurement Methods**
NIOSH 2007
See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection)**
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash (>5%), Quick drench

**First Aid (See procedures)**
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 100 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, respiratory system; nausea, vomiting

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
## Diethylenetriamine

**CAS** 111-40-0  
**RTECS** IE1225000

### Synonyms & Trade Names
N-(2-Aminoethyl)-1,2-ethanediamine; bis(2-Aminoethyl)amine; DETA; 2,2'-Diaminodichloroethylenediamine

### DOT ID & Guide
- **DOT ID & Guide**: 2079 154

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 1 ppm (4 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

**IDLH N.D.**  
**Conversion** 1 ppm = 4.22 mg/m³

### Physical Description
Colorless to yellow liquid with a strong, ammonia-like odor. [Note: Hygroscopic (i.e., absorbs moisture from the air).]

<table>
<thead>
<tr>
<th>MW: 103.2</th>
<th>BP: 405°F</th>
<th>FRZ: -38°F</th>
<th>Sol: Miscible</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0.4 mmHg</td>
<td>IP: ?</td>
<td>F.I.P: 208°F</td>
<td>UEL: 6.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LEL: 2%</td>
</tr>
</tbody>
</table>

Class IIIB Combustible Liquid: F.I.P. at or above 200°F.

### Incompatibilities & Reactivities
Oxidizers, strong acids, cellulose nitrate [Note: May form explosive complexes with silver, cobalt, or chromium compounds. Corrosive to aluminum copper, brass & zinc.]

### Measurement Methods
- **NIOSH 2540**  
- **OSHA 60**  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

| Skin: Prevent skin contact  
| Eyes: Prevent eye contact  
| Wash skin: When contaminated  
| Remove: When wet or contaminated  
| Change: No recommendation  
| Provide: Eyewash, Quick drench |

### First Aid

| Eye: Irrigate immediately  
| Skin: Water flush immediately  
| Breathing: Respiratory support  
| Swallow: Medical attention immediately |

### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, mucous membrane, upper respiratory system; dermatitis, skin sensitization; eye, skin necrosis; cough, dyspnea (breathing difficulty), pulmonary sensitization

### Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
Diethyl ketone

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃CH₂COCH₂CH₃</td>
<td>96-22-0</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

- DEK, Dimethylacetone, Ethyl ketone, Metacetone, 3-Pentanone, Propione

**Exposure Limits**

- NIOSH REL: TWA 200 ppm (705 mg/m³)
- OSHA PEL†: none

**Physical Description**

- Colorless liquid with an acetone-like odor.
- MW: 86.2
- BP: 215°F
- FRZ: -44°F
- Sol: 5%
- VP(77°F): 35 mmHg
- IP: 9.32 eV
- Sp.Gr: 0.81
- Fl.P(oc): 55°F
- UEL: 6.4%
- LEL: 1.6%

**Incompatibilities & Reactivities**

- Strong oxidizers, alkalis, mineral acids, (hydrogen peroxide + nitric acid)

**Measurement Methods**

- None available
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

- Skin: No recommendation
- Eyes: Prevent eye contact
- Wash skin: Daily
- Remove: When wet (flammable)
- Change: No recommendation

**First Aid**

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations**

- Not available.

**Exposure Routes**

- Inhalation, ingestion, skin and/or eye contact

**Symptoms**

- Irritation eyes, skin, mucous membrane, respiratory system; cough, sneezing

**Target Organs**

- Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Diethyl phthalate

<table>
<thead>
<tr>
<th>CAS</th>
<th>84-66-2</th>
</tr>
</thead>
</table>

### Chemical Structure

\[ \text{C}_6\text{H}_4(\text{COOC}_2\text{H}_5)_2 \]

### RTECS

TI1050000

### Synonyms & Trade Names

DEP, Diethyl ester of phthalic acid, Ethyl phthalate

### DOT ID & Guide

Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 5 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

**IDLH N.D.**

### Physical Description

Colorless to water-white, oily liquid with a very slight, aromatic odor. [pesticide]

<table>
<thead>
<tr>
<th>MW</th>
<th>222.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>563°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-41°F</td>
</tr>
<tr>
<td>Sol(77°F)</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

| VP(77°F) | 0.002 mmHg |
| IP | ? |
| Sp.Gr | 1.12 |

| Fl.P(oc) | 322°F |
| UEL | ? |
| LEL(368°F) | 0.7% |

Class IIIB Combustible Liquid; however, ignition is difficult.

### Incompatibilities & Reactivities

Strong oxidizers, strong acids, nitric acid, permanganates, water

### Measurement Methods

**OSHA 104**

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

<table>
<thead>
<tr>
<th>Skin</th>
<th>No recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

Wash skin: No recommendation

Remove: No recommendation

Change: No recommendation

### First Aid

(See procedures)

<table>
<thead>
<tr>
<th>Eye</th>
<th>Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Wash regularly</td>
</tr>
<tr>
<td>Breathing</td>
<td>Respiratory support</td>
</tr>
<tr>
<td>Swallow</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

Inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, nose, throat; headache, dizziness, nausea; lacrimation (discharge of tears); possible polyneuropathy, vestibular dysfunc; pain, numbness, lassitude (weakness, exhaustion), spasms in arms & legs; in animals: reproductive effects

### Target Organs

Eyes, skin, respiratory system, central nervous system, peripheral nervous system, reproductive system

See also: INTRODUCTION
## Difluorodibromomethane

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>RTECS PA7525000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dibromodifluoromethane; Freon® 12B2; Halon® 1202</td>
<td>DOT ID &amp; Guide 1941 171</td>
</tr>
</tbody>
</table>

| Exposure Limits | | |
|-----------------|-----------------|
| NIOSH REL: TWA 100 ppm (860 mg/m³) | | |
| OSHA PEL: TWA 100 ppm (860 mg/m³) | | |
| IDLH 2000 ppm | Conversion 1 ppm = 8.58 mg/m³ |

### Physical Description
Colorless, heavy liquid or gas (above 76°F) with a characteristic odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>209.8</td>
</tr>
<tr>
<td>BP</td>
<td>76°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-231°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP</td>
<td>620 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>11.07 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>2.29</td>
</tr>
</tbody>
</table>

Noncombustible Liquid
Nonflammable Gas

### Incompatibilities & Reactivities
Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium

### Measurement Methods
NIOSH 1012 ; OSHA 7
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: No recommendation
- Remove: When wet or contaminated
- Change: No recommendation

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH/OSHA</strong></td>
</tr>
<tr>
<td><strong>Up to 1000 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 2000 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>In animals: irritation respiratory system; central nervous system symptoms; liver damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Respiratory system, central nervous system, liver</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## NIOSH Pocket Guide to Chemical Hazards

### Diglycidyl ether

<table>
<thead>
<tr>
<th>Chemical Structure</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{C}<em>6\text{H}</em>{10}\text{O}_3 )</td>
<td>2238-07-5</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Diallyl ether dioxide; DGE; Di(2,3-epoxypropyl) ether; 2-Epoxypropyl ether; bis(2,3-Epoxypropyl) ether

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: Ca TWA</td>
<td>0.1 ppm (0.5 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL†: C</td>
<td>0.5 ppm (2.8 mg/m³)</td>
</tr>
</tbody>
</table>

### IDLH Ca [10 ppm]

**Conversion** 1 ppm = 5.33 mg/m³

### Physical Description

Colorless liquid with a strong, irritating odor.

- MW: 130.2
- BP: 500°F
- FRZ: ?
- Sol: ?
- VP(77°F): 0.09 mmHg
- IP: ?
- Sp.Gr: 1.12
- Fl.P: 147°F
- UEL: ?
- LEL: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities

Strong oxidizers

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated/Daily

**Remove:** When wet or contaminated

**Change:** Daily

**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately

**Skin:** Soap wash immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, skin, respiratory system; skin burns; in animals: hematopoietic system, lung, liver, kidney damage; reproductive effects; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, respiratory system, reproductive system |
| **Cancer Site** | [in animals: skin tumors] |

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Diisobutyl ketone

**CAS** 108-83-8

**[CH(CH₃)₂CH₂]₂CO**

**RTECS** MJ5775000

### Synonyms & Trade Names
- DIBK; sym-Diisopropyl acetone; 2,6-Dimethyl-4-heptanone; Isovalerone; Valerone

### DOT ID & Guide
- ID: 1157 128

## Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>500 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NIOSH REL</strong></td>
<td>TWA 25 ppm (150 mg/m³)</td>
</tr>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>TWA 50 ppm (290 mg/m³)</td>
</tr>
<tr>
<td><strong>Conversion</strong></td>
<td>1 ppm = 5.82 mg/m³</td>
</tr>
</tbody>
</table>

## Physical Description
- Colorless liquid with a mild, sweet odor.

- **MW:** 142.3
- **BP:** 334°F
- **FRZ:** -43°F
- **Sol:** 0.05%
- **VP:** 2 mmHg
- **IP:** 9.04 eV
- **Sp.Gr:** 0.81
- **Fl.P:** 120°F
- **UEL(200°F):** 7.1%
- **LEL(200°F):** 0.8%

## Incompatibilities & Reactivities
- Strong oxidizers

## Measurement Methods
- NIOSH 1300, 2555; OSHA 7
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** No recommendation
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

## First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 500 ppm:**

<table>
<thead>
<tr>
<th>APF</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>25</td>
<td>Any powered, air-purifying respirator with organic vapor cartridge(s)</td>
</tr>
<tr>
<td>50</td>
<td>Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

<table>
<thead>
<tr>
<th>APF</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

**Escape:**

<table>
<thead>
<tr>
<th>APF</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

### Exposure Routes

**inhalation, ingestion, skin and/or eye contact**

### Symptoms

**Irritation** eyes, skin, nose, throat; **headache**, **dizziness**; dermatitis; **liver**, **kidney damage**

### Target Organs

**Eyes**, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
**Diisopropylamine**

<table>
<thead>
<tr>
<th>CAS 108-18-9</th>
<th>RTECS IM4025000</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
- DIPA, N-(1-Methylethyl)-2-propanamine

**DOT ID & Guide**
- 1158 132

### Exposure Limits

- NIOSH REL: TWA 5 ppm (20 mg/m³) [skin]
- OSHA PEL: TWA 5 ppm (20 mg/m³) [skin]

- IDLH: 200 ppm

**Conversion**

1 ppm = 4.14 mg/m³

### Physical Description

Colorless liquid with an ammonia- or fish-like odor.

- MW: 101.2
- BP: 183°F
- FRZ: -141°F
- Sol: Miscible
- VP: 70 mmHg
- IP: 7.73 eV
- Sp.Gr: 0.72
- Fl.P: 20°F
- UEL: 7.1%
- LEL: 1.1%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Strong oxidizers, strong acids

### Measurement Methods

- NIOSH S141 (II-4)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

_(See protection)_

- Skin: Prevent skin contact
- Eyes: Prevent eye contact (>5%)
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash (>5%)

### First Aid

_(See procedures)_

- Eye: Irrigate immediately
- Skin: Water wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

#### Up to 125 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

#### Up to 200 ppm:
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; nausea, vomiting; headache; visual disturbance

### Target Organs
- Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
## Dimethyl acetamide

<table>
<thead>
<tr>
<th>CAS</th>
<th>127-19-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>AB7700000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- N,N-Dimethyl acetamide; DMAC

### Exposure Limits
- NIOSH REL: TWA 10 ppm (35 mg/m³) [skin]
- OSHA PEL: TWA 10 ppm (35 mg/m³) [skin]
- IDLH: 300 ppm

### Conversion
- 1 ppm = 3.56 mg/m³

### Physical Description
- Colorless liquid with a weak, ammonia- or fish-like odor.
- MW: 87.1
- BP: 329°F
- FRZ: -4°F
- Sol: Miscible
- VP: 2 mmHg
- IP: 8.81 eV
- Sp.Gr: 0.94
- Fl.P(oc): 158°F
- UEL(320°F): 11.5%
- LEL(212°F): 1.8%
- Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F

### Incompatibilities & Reactivities
- Carbon tetrachloride, other halogenated compounds when in contact with iron, oxidizers

### Measurement Methods
- NIOSH 2004
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

<table>
<thead>
<tr>
<th>Respirator Recommendations</th>
<th>NIOSH/OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 100 ppm:</strong></td>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 250 ppm:</strong></td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td><strong>Up to 300 ppm:</strong></td>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td></td>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation skin; jaundice, liver damage; depression, drowsiness, hallucinations, delusions

**Target Organs** Skin, liver, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Dimethylamine

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>124-40-3</td>
<td>IP8750000</td>
<td>Dimethylamine (anhydrous), N-Methylmethanamine</td>
<td>1032 118 (anhydrous)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1160 132 (solution)</td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 10 ppm (18 mg/m³)</th>
<th>OSHA PEL: TWA 10 ppm (18 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH</td>
<td>500 ppm</td>
<td>Conversion 1 ppm = 1.85 mg/m³</td>
</tr>
</tbody>
</table>

## Physical Description

Colorless gas with an ammonia- or fish-like odor. [Note: A liquid below 44°F. Shipped as a liquefied compressed gas.]

| MW: 45.1 | BP: 44°F | FRZ: -134°F | Sol(140°F): 24% |
| VP: 1.7 atm | IP: 8.24 eV | RGasD: 1.56 | Sp.Gr: 0.67 (Liquid at 44°F) |
| Fl.P: NA (Gas) 20°F (Liquid) | UEL: 14.4% | LEL: 2.8% |

## Incompatibilities & Reactivities

Flammable Gas

Strong oxidizers, chlorine, mercury, acraldehyde, fluorides, maleic anhydride, aluminum, brass, copper, zinc

## Measurement Methods

NIOSH 2010 ; OSHA 34

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

**Skin:** Prevent skin contact (liquid)/Frostbite
**Eyes:** Prevent eye contact (liquid)/Frostbite
**Wash skin:** When contaminated (liquid)
**Remove:** When wet (flammable)
**Change:** No recommendation
**Provide:** Eyewash (liquid), Quick drench (liquid), Frostbite wash

## First Aid

**Eye:** Irrigate immediately (liquid)/Frostbite
**Skin:** Water flush immediately (liquid)/Frostbite
**Breathing:** Respiratory support
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 250 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 500 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation nose, throat; sneezing, cough, dyspnea (breathing difficulty); pulmonary edema; conjunctivitis; dermatitis; liquid: frostbite</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## 4-Dimethylaminoazobenzene

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₆H₅NNC₆H₄N(CH₃)₂</td>
<td>60-11-7</td>
<td>BX7350000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Butter yellow; DAB; p-Dimethylaminoazobenzene; N,N-Dimethyl-4-aminoazobenzene; Methyl yellow

### Exposure Limits
- **NIOSH REL:** Ca [N.D.] See Appendix A
- **OSHA PEL:** [1910.1015] See Appendix B

### Physical Description
Yellow, leaf-shaped crystals.

### Measurement Methods
- NIOSH P&CAM284 (II-4)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection
- **Respirator Recommendations** (See Appendix E) NIOSH
  - At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration.
    - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
    - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
  - **Escape:** (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Enlarged liver; liver, kidney disturbance; contact dermatitis; cough, wheezing, dyspnea (breathing difficulty); bloody sputum; bronchial secretions; frequent urination, hematuria (blood in the urine), dysuria; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, respiratory system, liver, kidneys, bladder</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver &amp; bladder tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## bis(2-(Dimethylamino)ethyl)ether

**CAS** 3033-62-3  
**RTECS** KR9460000

### Synonyms & Trade Names
NIAX® A99; NIAX® Catalyst A1; 2,2'-Oxybis(N,N-dimethyl ethylamine) [Note: A component (5%) of NIAX® Catalyst ESN, along with dimethylaminopropionitrile (95%).]

### DOT ID & Guide

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>See Appendix C (NIAX® Catalyst ESN)</td>
<td>See Appendix C (NIAX® Catalyst ESN)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.D.</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description

- **Liquid.**
- **MW:** 160.3  
- **BP:** 372°F  
- **FRZ:** ?  
- **Sol:** ?  
- **IP:** ?  
- **Sp.Gr:** ?  
- **VP:** ?  
- **UEL:** ?  
- **LEL:** ?

### Incompatibilities & Reactivities

None reported

### Measurement Methods
None available  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated  
**Remove:** When wet or contaminated  
**Change:** No recommendation  
**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Water flush immediately  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**  
  (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
  (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- **inhalation,** skin absorption, ingestion, skin and/or eye contact

### Symptoms

Possible urinary disturbance, neurological disorders; in animals: irritation eyes, skin

### Target Organs

Eyes, skin, urinary tract, peripheral nervous system
See also: INTRODUCTION
### Dimethylaminopropionitrile

**CAS** 1738-25-6  
**RTECS** UG1575000

### Synonyms & Trade Names
3-(Dimethylamino)propionitrile; N,N-Dimethylamino-3-propionitrile [Note: A component (95%) of NIAX® Catalyst ESN, along with bis(2-(dimethylamino)ethyl) ether (5%).]

### Exposure Limits
- **NIOSH REL**: See Appendix C (NIAX® Catalyst ESN)  
- **OSHA PEL**: See Appendix C (NIAX® Catalyst ESN)

### Physical Description
- Colorless liquid.
- **MW**: 98.2  
- **BP**: 342°F  
- **FRZ**: -48°F  
- **Sol**: Miscible  
- **VP(135°F)**: 10 mmHg  
- **IP**: ?  
- **UEL**: ?  
- **LEL**: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Oxidizers [Note: Emits toxic oxides of nitrogen and cyanide fumes when heated to decomposition.]

### Measurement Methods
- None available  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove** When wet or contaminated  
- **Change**: No recommendation  
- **Provide**: Eyewash, Quick drench

### First Aid
- **Eye**: Irrigate immediately  
- **Skin**: Water flush immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations NIOSH
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration**:  
  (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
  (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin; urinary disturbance; neurological disorders; pins &amp; needles in hands &amp; feet; muscle weakness, lassitude (weakness, exhaustion), nausea, vomiting; decreased nerve conduction in lower legs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, central nervous system, urinary tract</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## N,N-Dimethylaniline

**CAS** 121-69-7  
**RTECS** BX4725000

### Synonyms & Trade Names
- N,N-Dimethylbenzeneamine; N,N-Dimethylphenylamine  
  [Note: Also known as Dimethylaniline which is a correct synonym for Xylidine.]

### DOT ID & Guide
- DOT ID & Guide 2253 153

### Exposure Limits
<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 5 ppm (25 mg/m³) ST 10 ppm (50 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>TWA 5 ppm (25 mg/m³) [skin]</td>
</tr>
</tbody>
</table>

### IDLH
- 100 ppm

### Conversion
- 1 ppm = 4.96 mg/m³

### Physical Description
- Pale yellow, oily liquid with an amine-like odor.  
  [Note: A solid below 36°F.]
- MW: 121.2  
  - BP: 378°F  
  - FRZ: 36°F  
  - Sol: 2%
- VP: 1 mmHg  
  - IP: 7.14 eV  
  - Sp.Gr: 0.96
- Fl.P: 142°F  
  - UEL: ?  
  - LEL: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Strong oxidizers, strong acids, benzoyl peroxide

### Measurement Methods
- NIOSH 2002; OSHA PV2064  
  See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
  - Wash skin: When contaminated  
  - Remove: When wet or contaminated  
  - Change: No recommendation  
  - Provide: Quick drench
- **Eyes**: Prevent eye contact
- **Respiratory**
  - Respiratory support

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Respirator Recommendations NIOSH

**Up to 50 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 100 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Anoxia symptoms: cyanosis, lassitude (weakness, exhaustion), dizziness, ataxia; methemoglobinemia

### Target Organs
- Blood, kidneys, liver, cardiovascular system

See also: [INTRODUCTION](#)
### Dimethyl carbamoyl chloride

**CAS** 79-44-7

**RTECS** FD4200000

**Synonyms & Trade Names**
- Chloroformic acid dimethylamide
- Dimethylcarbamic chloride
- N,N-Dimethylcarbamoyl chloride
- DMCC

**DOT ID & Guide**
- 2262 156

### Exposure Limits

| NIOSH REL: Ca | See Appendix A |
| OSHA PEL: none |

| IDLH Ca [N.D.] | Conversion |

### Physical Description
- Clear, colorless liquid.

| MW: 107.6 | BP: 329°F | FRZ: -27°F | Sol: Reacts |
| Fl.P: 155°F | UEL: ? | LEL: ? |

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Acids, water [Note: Rapidly hydrolyzes in water to dimethylamine, carbon dioxide, and hydrogen chloride.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

- **Escape:**
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin, nose, throat, respiratory system; eye, skin burns; cough, wheezing, laryngitis, dyspnea (breathing difficulty); headache, nausea, vomiting; liver injury; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, liver</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[in animals: nasal cancer]</td>
</tr>
<tr>
<td>See also:</td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
## Dimethyl-1,2-dibromo-2,2-dichlorethyl phosphate

(CH$_3$O)$_2$P(O)OCHBrCBrCl$_2$

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>300-76-5</td>
<td>TB9450000</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dibrom®
- 1,2-Dibromo-2,2-dichloroethyl dimethyl phosphate
- Naled

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 3 mg/m$^3$ [skin]</td>
<td>TWA 3 mg/m$^3$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 mg/m$^3$</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description

Colorless to white solid or straw-colored liquid (above 80°F) with a slightly pungent odor. [insecticide]

- MW: 380.8
- BP: Decomposes
- MLT: 80°F
- Sol: Insoluble
- VP: 0.0002 mmHg
- IP: ?
- Sp.Gr(77°F): 1.96
- Fi.P: NA
- UEL: NA
- LEL: NA

Noncombustible Solid

### Incompatibilities & Reactivities

Strong oxidizers, acids, sunlight, water [Note: Corrosive to metals. Hydrolyzed in presence of water.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated

**Remove:** When wet or contaminated

**Change:** Daily

**Provide:** Eyewash

### First Aid

**Eye:** Irrigate immediately

**Skin:** Soap wash immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 30 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

**Up to 75 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 150 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 200 mg/m³:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin; miosis, lacrimation (discharge of tears); headache; chest tightness, wheezing, laryngeal spasm; salivation; cyanosis; anorexia, nausea, vomiting, abdominal cramp, diarrhea; lassitude (weakness, exhaustion), twitching, paralysis; dizziness, ataxia, convulsions; low blood pressure; cardiac irregularities

### Target Organs
- Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: [INTRODUCTION](#)
# Dimethylformamide

**CAS**: 68-12-2  
**RTECS**: LQ2100000  
**DOT ID & Guide**: 2265 129

### Synonyms & Trade Names
- Dimethyl formamide
- N,N-Dimethylformamide
- DMF

### Exposure Limits
- **NIOSH REL**: TWA 10 ppm (30 mg/m³) [skin]
- **OSHA PEL**: TWA 10 ppm (30 mg/m³) [skin]
- **IDLH**: 500 ppm

### Conversion
- 1 ppm = 2.99 mg/m³

### Physical Description
- Colorless to pale-yellow liquid with a faint, amine-like odor.
- **MW**: 73.1  
- **BP**: 307°F  
- **FRZ**: -78°F  
- **Sol**: Miscible
- **VP**: 3 mmHg  
- **IP**: 9.12 eV  
- **Sp.Gr**: 0.95
- **Fl.P**: 136°F  
- **UEL**: 15.2%  
- **LEL (212°F)**: 2.2%

### Incompatibilities & Reactivities
- Carbon tetrachloride; other halogenated compounds when in contact with iron; strong oxidizers; alkyl aluminums; inorganic nitrates

### Measurement Methods
- NIOSH 2004  
- OSHA 66
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: No recommendation

### First Aid (See procedures )
- **Eye**: Irrigate immediately  
- **Skin**: Water flush promptly  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 100 ppm:
(APF = 10) Any supplied-air respirator*

Up to 250 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

Up to 500 ppm:
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms
Irritation eyes, skin, respiratory system; nausea, vomiting, colic; liver damage, enlarged liver; high blood pressure; face flush; dermatitis; in animals: kidney, heart damage

Target Organs
Eyes, skin, respiratory system, liver, kidneys, cardiovascular system

See also: INTRODUCTION
### NIOSH Pocket Guide to Chemical Hazards

**1,1-Dimethylhydrazine**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>57-14-7</td>
<td>MV2450000</td>
<td>1163 131</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Dimazine, DMH, UDMH, Unsymmetrical dimethylhydrazine

**Exposure Limits**
- **NIOSH REL:** Ca C 0.06 ppm (0.15 mg/m³) [2-hr] See Appendix A
- **OSHA PEL:** TWA 0.5 ppm (1 mg/m³) [skin]
- **IDLH Ca [15 ppm]**
- **Conversion** 1 ppm = 2.46 mg/m³

**Physical Description**
- Colorless liquid with an ammonia- or fish-like odor.
- MW: 60.1
- BP: 147°F
- FRZ: -72°F
- Sol: Miscible
- VP: 103 mmHg
- IP: 8.05 eV
- Sp.Gr: 0.79
- FL.P: 5°F
- UEL: 95%
- LEL: 2%

**Incompatibilities & Reactivities**
- Oxidizers, halogens, metallic mercury, fuming nitric acid, hydrogen peroxide [Note: May ignite SPONTANEOUSLY in contact with oxidizers.]

**Measurement Methods**
- NIOSH 3515
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

**First Aid**
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**
- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
- **Escape**:
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin; choking, chest pain, dyspnea (breathing difficulty); drowsiness; nausea; anoxia; convulsions; liver injury; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>central nervous system, liver, gastrointestinal tract, blood, respiratory system, eyes, skin</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors of the lungs, liver, blood vessels &amp; intestines]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Dimethylphthalate

<table>
<thead>
<tr>
<th>CAS</th>
<th>131-11-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>TI1575000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dimethyl ester of 1,2-benzenedicarboxylic acid; DMP

### Exposure Limits
- NIOSH REL: TWA 5 mg/m³
- OSHA PEL: TWA 5 mg/m³
- IDLH: 2000 mg/m³

### Physical Description
- Colorless, oily liquid with a slight, aromatic odor. [Note: A solid below 42°F.]
- MW: 194.2
- BP: 543°F
- FRZ: 42°F
- Sol: 0.4%
- VP: 0.01 mmHg
- IP: 9.64 eV
- Sp.Gr: 1.19
- Fl.P: 295°F
- UEL: ?
- LEL(358°F): 0.9%

### Incompatibilities & Reactivities
- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods
- OSHA 104
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: No recommendation
- Eyes: Prevent eye contact
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid
- Eye: Irrigate promptly
- Skin: Wash regularly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 50 mg/m³:**
(APF = 10) Any air-purifying full-facepiece respirator equipped with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

**Up to 125 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode.
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 250 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 2000 mg/m³:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

### Exposure Routes
**inhalation, ingestion, skin and/or eye contact**

### Symptoms
Irritation eyes, upper respiratory system; stomach pain

### Target Organs
Eyes, respiratory system, gastrointestinal tract

See also: [INTRODUCTION](#)
# Dimethyl sulfate

**CAS:** 77-78-1  
**RTECS:** WS8225000

## Synonyms & Trade Names
- Dimethyl ester of sulfuric acid
- Dimethylsulfate
- Methyl sulfate

## DOT ID & Guide
- DOT ID & Guide: 1595 156

## Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca TWA 0.1 ppm (0.5 mg/m³) [skin] See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: TWA 1 ppm (5 mg/m³) [skin]</td>
</tr>
<tr>
<td>IDLH Ca [7 ppm]</td>
<td>Conversion 1 ppm = 5.16 mg/m³</td>
</tr>
</tbody>
</table>

## Physical Description
Colorless, oily liquid with a faint, onion-like odor.

| MW | 126.1 |
| BP | 370°F (Decomposes) |
| IP | ? |
| FL.P | 182°F |
| Sol(64°F): | 3% |
| Sp.Gr: | 1.33 |

Class IIA Combustible Liquid: FL.P. at or above 140°F and below 200°F.

## Incompatibilities & Reactivities
- Strong oxidizers, ammonia solutions  
  [Note: Decomposes in water to sulfuric acid; corrosive to metals.]

## Measurement Methods
NIOSH 2524  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- Skin: Prevent skin contact  
- Eyes: Prevent eye contact  
- Wash skin when contaminated  
- Remove when wet or contaminated  
- Change: No recommendation  
- Provide: Eyewash, Quick drench

## First Aid
- Eye: Irrigate immediately  
- Skin: Water flush immediately  
- Breathing: Respiratory support  
- Swallow: Medical attention immediately

## Important additional information about respirator selection

### Respirator Recommendations NIOSH

- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:  
  (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
  (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus  

### Escape

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, nose; headache; dizziness; conjunctivitis; photophobia (abnormal visual intolerance to light); periorbital (situated around the eye) edema; dysphonia, aphonias, dysphagia, productive cough; chest pain; dyspnea (breathing difficulty), cyanosis; vomiting, diarrhea; dysuria; analgesia; fever; proteinuria, hematuria (blood in the urine); eye, skin burns; delirium; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, respiratory system, liver, kidneys, central nervous system |
| **Cancer Site** | [in animals: nasal & lung cancer] |
| See also: | INTRODUCTION |
## NIOSH Pocket Guide to Chemical Hazards

### Dinitolmide

<table>
<thead>
<tr>
<th>CAS</th>
<th>148-01-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>(NO₂)₂C₆H₂(CH₃)CONH₂</td>
<td>RTECS XS4200000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- 3,5-Dinitro-o-toluamide
- 2-Methyl-3,5-dinitrobenzamide
- Zoalene

**Exposure Limits**
- NIOSH REL: TWA 5 mg/m³
- OSHA PEL†: none

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

**Physical Description**
Yellowish, crystalline solid.

| Fl.P: NA  | UEL: NA| LEL: NA    |            |

Noncombustible Solid

**Incompatibilities & Reactivities**
None reported

**Measurement Methods**
- NIOSH 0500
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection )**
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

**First Aid (See procedures )**
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Contact eczema; in animals: methemoglobinemia, liver changes

**Target Organs** Skin, liver, blood

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>CAS 99-65-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>m-Dinitrobenzene</td>
<td></td>
<td>RTECS CZ7350000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide</td>
<td>1597 152</td>
</tr>
<tr>
<td>meta-Dinitrobenzene; 1,3-Dinitrobenzene</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Exposure Limits**

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 1 mg/m³ [skin]</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>TWA 1 mg/m³ [skin]</td>
</tr>
<tr>
<td>IDLH</td>
<td>50 mg/m³</td>
</tr>
</tbody>
</table>

**Physical Description**

Pale-white or yellow solid.

MW: 168.1  
BP: 572°F  
MLT: 192°F  
Sol: 0.02%

VP: ? 
IP: 10.43 eV  
Sp.Gr: 1.58

Fl.P: 302°F  
UEL: ?  
LEL: ?

**Combustible Solid**

**Incompatibilities & Reactivities**

Strong oxidizers, caustics, metals such as tin & zinc [Note: Prolonged exposure to fire and heat may result in an explosion due to SPONTANEOUS decomposition.]

**Measurement Methods**

NIOSH S214 (II-4)

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)

Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: Daily  
Provide: Quick drench

**First Aid** (See procedures)

Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately
# Important additional information about respirator selection

<table>
<thead>
<tr>
<th>Respirator Recommendations</th>
<th>NIOSH/OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 5 mg/m³:</strong></td>
<td>(APF = 5)</td>
</tr>
<tr>
<td>Any quarter-mask respirator. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 10 mg/m³:</strong></td>
<td>(APF = 10)</td>
</tr>
<tr>
<td>Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 25 mg/m³:</strong></td>
<td>(APF = 25)</td>
</tr>
<tr>
<td>Any supplied-air respirator operated in a continuous-flow mode</td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 50 mg/m³:</strong></td>
<td>(APF = 50)</td>
</tr>
<tr>
<td>Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
<td></td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
<td></td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Anoxia, cyanosis; visual disturbance, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, blood, liver, cardiovascular system, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## o-Dinitrobenzene

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₆H₄(NO₂)₂</td>
<td>528-29-0</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- ortho-Dinitrobenzene; 1,2-Dinitrobenzene

### DOT ID & Guide
- DOT ID: 1597 152

### Exposure Limits
- NIOSH REL: TWA 1 mg/m³ [skin]
- OSHA PEL: TWA 1 mg/m³ [skin]
- IDLH: 50 mg/m³

### Physical Description
- Pale-white or yellow solid.
- MW: 168.1
- BP: 606°F
- MLT: 244°F
- Sol: 0.05%
- VP: ?
- IP: 10.71 eV
- Fl.P: 302°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities
- Combustible Solid
- Strong oxidizers, caustics, metals such as tin & zinc [Note: Prolonged exposure to fire and heat may result in an explosion due to SPONTANEOUS decomposition.]

### Measurement Methods
- NIOSH S214 (II-4)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 5 mg/m³:**  
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 10 mg/m³:**  
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.  
(APF = 10) Any supplied-air respirator

**Up to 25 mg/m³:**  
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode  
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 50 mg/m³:**  
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.  
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode  
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter  
(APF = 50) Any self-contained breathing apparatus with a full facepiece  
(APF = 50) Any supplied-air respirator with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:  
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes  
inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms  
Anoxia, cyanosis; visual disturbance, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage

### Target Organs  
Eyes, skin, blood, liver, cardiovascular system, central nervous system

See also: [INTRODUCTION](#)
## p-Dinitrobenzene

<table>
<thead>
<tr>
<th>Physical Description</th>
<th>MW: 168.1</th>
<th>BP: 570°F</th>
<th>MLT: 343°F</th>
<th>Sol: 0.01%</th>
</tr>
</thead>
</table>

**Combustible Solid**

**Incompatibilities & Reactivities**
Strong oxidizers, caustics, metals such as tin & zinc [Note: Prolonged exposure to fire and heat may result in an explosion due to SPONTANEOUS decomposition.]

**Measurement Methods**
NIOSH S214 (II-4)
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Quick drench

**First Aid** *(See procedures)*
- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 5 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 10 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 25 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 50 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Anoxia, cyanosis; visual disturbance, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage

Target Organs Eyes, skin, blood, liver, cardiovascular system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

<table>
<thead>
<tr>
<th>Dinitro-o-cresol</th>
<th>CAS 534-52-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH$_3$C$_6$H$_2$OH(NO$_2$)$_2$</td>
<td>RTECS GO9625000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- 4,6-Dinitro-o-cresol; 3,5-Dinitro-2-hydroxytoluene; 4,6-Dinitro-2-methyl phenol; DNC; DNOC

**DOT ID & Guide**
- 1598 153

## Exposure Limits
- NIOSH REL: TWA 0.2 mg/m$^3$ [skin]
- OSHA PEL: TWA 0.2 mg/m$^3$ [skin]
- IDLH 5 mg/m$^3$

## Physical Description
- Yellow, odorless solid. [insecticide]
- MW: 198.1
- BP: 594°F
- MLT: 190°F
- Sol: 0.01%
- VP: 0.00005 mmHg
- IP: ?
- Sp.Gr: 1.1 (estimated)
- Fl.P: NA
- UEL: NA
- LEL: NA
- MEC: 30 g/m$^3$

## Incompatibilities & Reactivities
- Noncombustible Solid
- Strong oxidizers

## Measurement Methods
- NIOSH S166 (II-5)
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily

## First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Respirator Recommendations NIOSH/OSHA

### Up to 2 mg/m³:

**APF = 10** Any air-purifying full-facepiece respirator equipped with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

### Up to 5 mg/m³:

**APF = 50** Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

**APF = 25** Any supplied-air respirator operated in a continuous-flow mode.

**APF = 25** Any powered air-purifying respirator with a high-efficiency particulate filter.

**APF = 50** Any self-contained breathing apparatus with a full facepiece.

**APF = 50** Any supplied-air respirator with a full facepiece.

### Emergency or planned entry into unknown concentrations or IDLH conditions:

**APF = 10,000** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

**APF = 10,000** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.

### Escape:

**APF = 50** Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

## Exposure Routes

- Inhalation
- Skin absorption
- Ingestion
- Skin and/or eye contact

## Symptoms

- Sense of well being; headache, fever, lassitude (weakness, exhaustion), profuse sweating, excess thirst, tachycardia, hyperpnea, cough, shortness breath, coma

## Target Organs

- Cardiovascular system
- Endocrine system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Dinitrotoluene

<table>
<thead>
<tr>
<th>CAS</th>
<th>25321-14-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>XT1300000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dinitrotoluol, DNT, Methyldinitrobenzene [Note: Various isomers of DNT exist.]

### DOT ID & Guide
- 1600 152 (molten)
- 2038 152 (solid)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>Ca TWA 1.5 mg/m³ [skin] See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>TWA 1.5 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca</th>
<th>[50 mg/m³]</th>
</tr>
</thead>
</table>

### Physical Description
- Orange-yellow crystalline solid with a characteristic odor. [Note: Often shipped molten.]
- MW: 182.2
- BP: 572°F
- MLT: 158°F
- Sol: Insoluble
- VP: 1 mmHg
- IP: ?
- Sp.Gr: 1.32
- Fl.P: 404°F
- UEL: ?
- LEL: ?

Combustible Solid, but difficult to ignite.

### Incompatibilities & Reactivities
- Strong oxidizers, caustics, metals such as tin & zinc [Note: Commercial grades will decompose at 482°F, with self-sustaining decomposition at 536°F.]

### Measurement Methods
- OSHA 44
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Anoxia, cyanosis; anemia, jaundice; reproductive effects; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Blood, liver, cardiovascular system, reproductive system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver, skin &amp; kidney tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# Di-sec octyl phthalate

**CAS**: 117-81-7  
**RTECS**: TI0350000

## Synonyms & Trade Names
- DEHP
- Di(2-ethylhexyl)phthalate
- DOP
- bis-(2-Ethylhexyl)phthalate
- Octyl phthalate

## Exposure Limits
- **NIOSH REL**: Ca TWA 5 mg/m³ ST 10 mg/m³  
  See Appendix A
- **OSHA PEL**: TWA 5 mg/m³
- **IDLH**: Ca [5000 mg/m³]

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
</table>
| Colorless, oily liquid with a slight odor.  
| MW: 390.5 | BP: 727°F  
| VP: <0.01 mmHg | IP: ?  
| Fl.P(oc): 420°F | UEL: ?  
| Class IIIB Combustible Liquid: Fl.P. at or above 200°F.  
| Incompatibilities & Reactivities |  
| Nitrates; strong oxidizers, acids & alkalis  
| Measurement Methods |  
| NIOSH 5020  
| See: NMAM or OSHA Methods  
| Personal Protection & Sanitation |  
| Skin: No recommendation  
| Eyes: No recommendation  
| Wash skin: No recommendation  
| Remove: No recommendation  
| Change: No recommendation  
| First Aid |  
| Eye: Irrigate immediately  
| Breathing: Respiratory support  
| Swallow: Medical attention immediately  
| Important additional information about respirator selection |  
| Respirator Recommendations NIOSH |  
| At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: |  
| (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
| (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus  
| Escape: |  
| (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus  
<p>| Exposure Routes |<br />
| Inhalation, ingestion, skin and/or eye contact |<br />
| Symptoms |<br />
| Irritation eyes, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen] |</p>
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, respiratory system, central nervous system, liver, reproductive system, gastrointestinal tract</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Dioxane

<table>
<thead>
<tr>
<th>CAS 123-91-1</th>
</tr>
</thead>
</table>

### C₄H₈O₂

**RTECS** JG8225000

### Synonyms & Trade Names

Diethylene dioxide; Diethylene ether; Dioxan; p-Dioxane; 1,4-Dioxane

### DOT ID & Guide

**IDLH** Ca [500 ppm]

### Exposure Limits

| NIOSH REL: Ca C 1 ppm (3.6 mg/m³) [30-minute] See Appendix A |
| OSHA PEL†: TWA 100 ppm (360 mg/m³) [skin] |

### Conversion

| 1 ppm = 3.60 mg/m³ |

### Physical Description

Colorless liquid or solid (below 53°F) with a mild, ether-like odor.

| MW: 88.1 |
| BP: 214°F |
| FRZ: 53°F |
| Sol: Miscible |

| VP: 29 mmHg |
| IP: 9.13 eV |
| Sp.Gr: 1.03 |

| FL.P: 55°F |
| UEL: 22% |
| LEL: 2.0% |

Class IB Flammable Liquid: FL.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Strong oxidizers, decaborane, triethynyl aluminum

### Measurement Methods

NIOSH 1602 ; OSHA 7

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection )

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

### First Aid

(See procedures )

- **Eye:** Irrigate immediately
- **Skin:** Water wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, nose, throat; drowsiness, headache; nausea, vomiting; liver damage; kidney failure; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, liver, kidneys</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung, liver &amp; nasal cavity tumors]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Dioxathion

**CAS** 78-34-2

**C₄H₆O₂[SPS(OC₂H₅)₂]₂**

**RTECS** TE3350000

### Synonyms & Trade Names

- Delnav®
- p-Dioxane-2,3-diyl ethyl phosphorodithioate
- Dioxane phosphate
- 2,3-p-Dioxanethiol-S,S-bis(O,O-diethyl phosphoro-dithioate)
- Navadel®

### DOT ID & Guide

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 0.2 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

**Physical Description**

Viscous, brown, tan, or dark-amber liquid. [insecticide] [Note: Technical product is a mixture of cis- & trans-isomers.]

- **MW**: 456.6
- **BP**: ?
- **FRZ**: -4°F
- **Sol**: Insoluble

- **VP**: ?
- **IP**: ?
- **Sp.Gr(79°F)**: 1.26

**Noncombustible Liquid**

### Incompatibilities & Reactivities

Alkalis, iron or tin surfaces, heat

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash, Quick drench

### First Aid (See procedures )

- **Eye**: Irrigate immediately
- **Skin**: Soap flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin; headache, dizziness, lassitude (weakness, exhaustion); rhinorrhea (discharge of thin mucus), chest tightness; miosis; nausea, vomiting, abdominal cramps, diarrhea, salivation; muscle fasciculation; confusion, drowsiness

### Target Organs

Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

**See also**: INTRODUCTION
# Diphenyl

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>92-52-4</td>
<td>DU8050000</td>
<td>Biphenyl, Phenyl benzene</td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits

| NIOSH REL: TWA | 1 mg/m³ (0.2 ppm) |
| OSHA PEL: TWA | 1 mg/m³ (0.2 ppm) |

| IDLH | 100 mg/m³ |
| Conversion | 1 ppm = 6.31 mg/m³ |

## Physical Description

- Colorless to pale-yellow solid with a pleasant, characteristic odor. [fungicide]
- MW: 154.2
- BP: 489°F
- MLT: 156°F
- Sol: Insoluble
- VP: 0.005 mmHg
- IP: 7.95 eV
- Sp.Gr: 1.04
- Fl.P: 235°F
- UEL(311°F): 5.8%
- LEL(232°F): 0.6%

## Incompatibilities & Reactivities

- Oxidizers

## Measurement Methods

- NIOSH 2530 ; OSHA PV2022
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash (molten), Quick drench (molten)

## First Aid

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Respirator Recommendations** NIOSH/OSHA

### Up to 10 mg/m³:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

### Up to 25 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*

### Up to 50 mg/m³:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

### Up to 100 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage

**Target Organs** Eyes, respiratory system, liver, central nervous system

See also: **INTRODUCTION**
### Diphenylamine

**CAS** 122-39-4  
**RTECS** JJ7800000

#### Synonyms & Trade Names
Anilinobenzene, DPA, Phenylaniline, N-Phenylaniline, N-Phenylbenzenamine  
[Note: The carcinogen 4-Aminodiphenyl may be present as an impurity in the commercial product.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 10 mg/m³</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH N.D.</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

#### Physical Description
Colorless, tan, amber, or brown crystalline solid with a pleasant, floral odor. [fungicide]

| MW: 169.2 | BP: 576°F | MLT: 127°F | Sol: 0.03% |
| VP(227°F): 1 mmHg | IP: 7.40 eV | Sp Gr: 1.16 |
| FL.P: 307°F | UEL: ? | LEL: ? |

Combustible Solid; explosive if a cloud of dust is exposed to a source of ignition.

#### Incompatibilities & Reactivities
Oxidizers, hexachloromelamine, trichloromelamine

#### Measurement Methods
OSHA 22, 78  
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
*(See protection)*

Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: Daily  
Remove: When wet or contaminated  
Change: Daily

#### First Aid
*(See procedures)*

Eye: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations** Not available.

#### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
Irritation eyes, skin, mucous membrane; eczema; tachycardia, hypertension; cough, sneezing; methemoglobinemia; increased blood pressure, heart rate; proteinuria, hematuria (blood in the urine), bladder injury; in animals: teratogenic effects

#### Target Organs
Eyes, skin, respiratory system, cardiovascular system, blood, bladder, reproductive system

See also: INTRODUCTION
### NIOSH Pocket Guide to Chemical Hazards

**Dipropylene glycol methyl ether**  
CAS 34590-94-8

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃OC₃H₆OC₃H₆OH</td>
<td>JM1575000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**  
Dipropylene glycol monomethyl ether; Dowanol® 50B

**Exposure Limits**  
NIOSH REL: TWA 100 ppm (600 mg/m³) ST 150 ppm (900 mg/m³) [skin]  
OSHA PEL†: TWA 100 ppm (600 mg/m³) [skin]

**Conversion**  
1 ppm = 6.06 mg/m³

**Physical Description**  
Colorless liquid with a mild, ether-like odor.

- **MW:** 148.2  
- **BP:** 408°F  
- **FRZ:** -112°F  
- **Sol:** Miscible

- **VP:** 0.5 mmHg  
- **IP:** ?  
- **Sp.Gr:** 0.95

- **FI.P:** 180°F  
- **UEL:** 3.0%  
- **LEL(392°F):** 1.1%

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

**Incompatibilities & Reactivities**  
Strong oxidizers

**Measurement Methods**  
NIOSH 2554 , S69 (II-2)  
See: NMAM or OSHA Methods

**First Aid**  
(See procedures )

- Eye: Irrigate immediately  
- Skin: Water wash promptly  
- Breathing: Respiratory support  
- Swallow: Medical attention immediately

**Personal Protection & Sanitation**  
(See protection )

- Skin: No recommendation  
- Eyes: No recommendation  
- Wash skin: No recommendation  
- Remove: No recommendation  
- Change: No recommendation

**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH/OSHA

**Up to 600 ppm:**
- (APF = 10) Any supplied-air respirator  
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here]
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, nose, throat; lassitude (weakness, exhaustion), dizziness, headache</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Dipropyl ketone

**CAS** 123-19-3  
**RTECS** MJ5600000

### Synonyms & Trade Names
Butyrones, DPK, 4-Heptanone, Heptan-4-one, Propyl ketone

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 50 ppm (235 mg/m³)</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IDLH</strong> N.D.</td>
<td><strong>Conversion</strong> 1 ppm = 4.67 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

Colorless liquid with a pleasant odor.

<table>
<thead>
<tr>
<th>MW: 114.2</th>
<th>BP: 291°F</th>
<th>FRZ: -27°F</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 5 mmHg</td>
<td>IP: 9.10 eV</td>
<td>Sp.Gr: 0.82</td>
<td></td>
</tr>
<tr>
<td>Fl.P: 120°F</td>
<td>UEL: ?</td>
<td>LEL: ?</td>
<td></td>
</tr>
</tbody>
</table>

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

Oxidizers

### Measurement Methods

OSHA 7  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin: Prevent skin contact</th>
<th>Eye: Prevent eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash skin: Daily</td>
<td></td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
<td></td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Eye: Irrigate immediately</th>
<th>Skin: Soap wash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing: Respiratory support</td>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin; central nervous system depression, dizziness, drowsiness, decreased breathing; in animals: liver injury; narcosis

### Target Organs

Eyes, skin, central nervous system, liver

See also: INTRODUCTION
## Diquat (Diquat dibromide)

<table>
<thead>
<tr>
<th>CAS</th>
<th>85-00-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>JM5690000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Diquat dibromide; 1,1’-Ethylene-2,2’-bipyridyllium dibromide [Note: Diquat is a cation (C$_{12}$H$_{12}$N$_{2}$Br$_{2}$); 1,1’-Ethylene-2,2-bipyridyllium ion]. Various diquat salts are commercially available.

### DOT ID & Guide

<table>
<thead>
<tr>
<th>ID Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2781 151</td>
<td>(solid)</td>
</tr>
<tr>
<td>2782 131</td>
<td>(liquid)</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 0.5 mg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description

Dibromide salt: Yellow crystals. [herbicide] [Note: Commercial product may be found in a liquid concentrate or a solution.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>344.1</td>
</tr>
<tr>
<td>BP</td>
<td>Decomposes</td>
</tr>
<tr>
<td>MLT</td>
<td>635°F</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.22-1.27</td>
</tr>
</tbody>
</table>

Combustible Solid, but does not readily ignite and burns with difficulty.

### Incompatibilities & Reactivities

Alkalis, UV light, basic solutions [Note: Concentrated diquat solutions corrode aluminum.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Protection</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Prevent skin contact</td>
</tr>
<tr>
<td>Eyes</td>
<td>Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin</td>
<td>When contaminated</td>
</tr>
<tr>
<td>Remove</td>
<td>When wet or contaminated</td>
</tr>
<tr>
<td>Change</td>
<td>Daily</td>
</tr>
<tr>
<td>Provide</td>
<td>Quick drench</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Aid</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>Irrigate immediately</td>
</tr>
<tr>
<td>Skin</td>
<td>Water flush immediately</td>
</tr>
<tr>
<td>Breathing</td>
<td>Respiratory support</td>
</tr>
<tr>
<td>Swallow</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

**Respirator Recommendations**: Not available.

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, mucous membrane, respiratory system; rhinorrhea (discharge of thin mucus), epistaxis (nosebleed); skin burns; nausea, vomiting, diarrhea, malaise (vague feeling of discomfort); kidney, liver injury; cough, chest pain, dyspnea (breathing difficulty), pulmonary edema; tremor, convulsions; delayed healing of wounds

### Target Organs

Eyes, skin, respiratory system, kidneys, liver, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Disulfiram

<table>
<thead>
<tr>
<th>CAS</th>
<th>CAS 97-77-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>JO12250000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Antabuse®; bis(Diethylthiocarbamoyl) disulfide; Ro-Sulfiram®; TETD; Tetraethylthiuram disulfide

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>TWA 2 mg/m³ [Precautions should be taken to avoid concurrent exposure to ethylene dibromide.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

### Physical Description

White, yellowish, or light-gray powder with a slight odor. [fungicide]

<table>
<thead>
<tr>
<th>MW</th>
<th>296.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP</td>
<td>?</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>BP</td>
<td>?</td>
</tr>
<tr>
<td>MLT</td>
<td>158°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.02%</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.30</td>
</tr>
</tbody>
</table>

Noncombustible Solid

### Incompatibilities & Reactivities

None reported

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>See protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: Daily</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>See procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Skin: Soap wash immediately</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system; sensitization dermatitis; lassitude (weakness, exhaustion), tremor, restlessness, headache, dizziness; metallic taste; peripheral neuropathy; liver damage

### Target Organs

Eyes, skin, respiratory system, central nervous system, peripheral nervous system, liver

See also: **INTRODUCTION**
**Disulfoton**

C₈H₁₉O₂PS₃

**Synonyms & Trade Names**
O,O-Diethyl S-2-(ethylthio)-ethyl phosphorodithioate; Di-Syston®; Thiodemeton

**CAS** 298-04-4  
**RTECS** TD9275000

**Exposure Limits**

| NIOSH REL: | TWA 0.1 mg/m³ [skin] |
| OSHA PEL†: | none |

**IDLH** N.D.  

**Conversion**

**Physical Description**
Oily, colorless to yellow liquid with a characteristic, sulfur odor. [insecticide] [Note: Technical product is a brown liquid.]

| MW: 274.4 | BP: ? | FRZ: >-13°F | Sol(73°F): 0.003% |
| VP: 0.0002 mmHg | IP: ? | Sp.Gr: 1.14 |
| Fl.P: >180°F | UEL: ? | LEL: ? |

Combustible Liquid, but will not ignite easily.

**Incompatibilities & Reactivities**
Alkalis

**Measurement Methods**
NIOSH 5600  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

| Skin: | Prevent skin contact |
| Eyes: | Prevent eye contact |
| Wash skin: | When contaminated |
| Remove: | When wet or contaminated |
| Change: | Daily |
| Provide: | Eyewash, Quick drench |

First Aid *(See procedures)*

| Eye: | Irrigate immediately |
| Skin: | Soap flush immediately |
| Breathing: | Respiratory support |
| Swallow: | Medical attention immediately |

**Important additional information about respirator selection**

Respirator Recommendations Not available.

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; nausea, vomiting, abdominal cramps, diarrhea, salivation; headache, dizziness, lassitude (weakness, exhaustion); rhinorrhea (discharge of thin mucus), chest tightness; blurred vision, miosis; cardiac irregularities; muscle fasciculation; dyspnea (breathing difficulty); eye, skin burns

**Target Organs** Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
**Diuron**

<table>
<thead>
<tr>
<th>CAS</th>
<th>330-54-1</th>
</tr>
</thead>
</table>

**C₆H₃Cl₂NHCON(CH₃)₂**

<table>
<thead>
<tr>
<th>RTECS</th>
<th>YS8925000</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**

3-(3,4-Dichlorophenyl)-1,1-dimethylurea; Direx®; Karmex®

**DOT ID & Guide**

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>TWA 10 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
</tbody>
</table>

| IDLH | N.D. |

**Conversion**

**Physical Description**

White, odorless, crystalline solid. [herbicide]

- **MW:** 233.1
- **BP:** 356°F (Decomposes)
- **MLT:** 316°F
- **Sol:** 0.004%
- **VP:** 0.000000002 mmHg
- **IP:** ?
- **Sp.Gr.:** ?
- **Fl.P.:** NA
- **UEL:** NA
- **LEL:** NA

**Noncombustible Solid**

**Incompatibilities & Reactivities**

Strong acids

**Measurement Methods**

NIOSH 5601 ; OSHA PV2097
See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection )**

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** Daily
- **Remove:** No recommendation
- **Change:** Daily

**First Aid (See procedures )**

- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; in animals: anemia, methemoglobinemia

**Target Organs** Eyes, skin, respiratory system, blood

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Divinyl benzene

**CAS** 1321-74-0 (mixed isomers)

**RTECS** CZ9370000

### Synonyms & Trade Names
Diethyl benzene, DVB, Vinylstyrene [Note: Commercial product contains all 3 isomers, but m-isomer predominates. Usually contains an inhibitor to prevent polymerization.]

### Exposure Limits

<table>
<thead>
<tr>
<th><strong>NIOSH REL</strong></th>
<th>TWA 10 ppm (50 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
<td>N.D.</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 5.33 mg/m³

### Physical Description
Pale, straw-colored liquid.

| **MW** | 130.2 |
| **BP** | 392°F |
| **FRZ** | -88°F |
| **Sol** | 0.005% |
| **VP** | 0.7 mmHg |
| **IP** | ? |
| **UFL(oc)** | 169°F |
| **UEL** | 6.2% |
| **LEL** | 1.1% |

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
None reported

### Measurement Methods
OSHA 89
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated

**Remove:** When wet or contaminated

**Change:** No recommendation

**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately

**Skin:** Soap flush immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, respiratory system; skin burns; in animals: central nervous system depression

### Target Organs
Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 1-Dodecanethiol

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Dodecanethiol</td>
<td>112-55-0</td>
<td>JR3155000</td>
<td>Dodecyl mercaptan, 1-Dodecyl mercaptan, n-Dodecyl mercaptan, Lauryl mercaptan, n-Lauryl mercaptan, 1-Mercaptododecane</td>
<td>1228 131</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C 0.5 ppm (4.1 mg/m³) [15-minute]</th>
<th>OSHA PEL: none</th>
</tr>
</thead>
</table>

**Conversion**: 1 ppm = 8.28 mg/m³

### Physical Description

- Colorless, water-white, or pale-yellow, oily liquid with a mild, skunk-like odor. [Note: A solid below 15°F.]
- **MW**: 202.4
- **BP**: 441-478°F
- **FRZ**: 15°F
- **Sol**: Insoluble
- **VP(77°F)**: 3 mmHg
- **IP**: ?
- **Sp.Gr**: 0.85
- **FL.P(oc)**: 190°F
- **UEL**: ?
- **LEL**: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities

- Strong oxidizers & acids, strong bases, reducing agents, alkali metals, water, steam

### Measurement Methods

- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; cough; dizziness, dyspnea (breathing difficulty), lassitude (weakness, exhaustion), confusion, cyanosis; abdominal pain, nausea; skin sensitization

**Target Organs** Eyes, skin, respiratory system, central nervous system, blood

See also: INTRODUCTION
### Emery

<table>
<thead>
<tr>
<th>Al₂O₃</th>
<th>CAS 1302-74-5 (corundum)</th>
</tr>
</thead>
</table>

#### Synonyms & Trade Names

Aluminum oxide, Aluminum trioxide, Corundum, Impure corundum, Natural aluminum oxide

[Note: Emery is an impure variety of Al₂O₃ which may contain small impurities of iron, magnesium & silica Corundum is natural Al₂O₃]

#### Exposure Limits

| NIOSH REL: | See Appendix D |
| OSHA PEL†: | TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |
| IDLH: | N.D. |

#### Physical Description

Odorless, white, crystalline powder.

See alpha-Alumina for physical & chemical properties.

#### Incompatibilities & Reactivities

#### Measurement Methods

NIOSH 0500, 0600
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

#### First Aid (See procedures)

- Eye: Irrigate immediately
- Breathing: Fresh air
- Swallow: Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations**

Not available.

#### Exposure Routes

inhalation, ingestion, skin and/or eye contact

#### Symptoms

Irritation eyes, skin, respiratory system

#### Target Organs

Eyes, skin, respiratory system

See also: INTRODUCTION
### Endosulfan

<table>
<thead>
<tr>
<th>Chemical Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>115-29-7</td>
</tr>
<tr>
<td>RTECS</td>
<td>RB9275000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- Benzoepin; Endosulphan; 6,7,8,9,10-Hexachloro-1,5,5a,6,9,9a-hexachloro-6,9-methano-2,4,3-benzo-dioxathiepin-3-oxide; Thiodan®

#### Exposure Limits
- NIOSH REL: TWA 0.1 mg/m³ [skin]
- OSHA PEL†: none

#### Physical Description
- Brown crystals with a slight, sulfur dioxide odor. [insecticide] [Note: Technical product is a tan, waxy, isomer mixture.]
- MW: 406.9
- BP: Decomposes
- MLT: 223°F
- Sol: 0.00001%
- VP(77°F): 0.00001 mmHg
- IP: ?
- Sp.Gr: 1.74
- Fl.P: NA
- UEL: NA
- LEL: NA

#### Incompatibilities & Reactivities
- Alkalis, acids, water [Note: Corrosive to iron. Hydrolyzes slowly on contact with water or decomposes in presence of alkalis and acids to form sulfur dioxide.]

#### Measurement Methods
- OSHA PV2023
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

#### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

#### Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
- Irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight

#### Target Organs
- Skin, central nervous system, liver, kidneys, reproductive system

See also: INTRODUCTION
# Endrin

**CAS** 72-20-8

**Synonyms & Trade Names**
1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene; Hexadrin®

**DOT ID & Guide**
2761 151

## Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 0.1 mg/m³ [skin]</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>TWA 0.1 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

**IDLH** 2 mg/m³

## Physical Description

Colorless to tan, crystalline solid with a mild, chemical odor. [insecticide]

**MW:** 380.9  
**BP:** Decomposes  
**MLT:** 392°F ( Decomposes)  
**Sol:** Insoluble  
**VP:** Low  
**IP:** ?  
**Sp.Gr.:** 1.70  
**Fl.P.:** NA  
**UEL:** NA  
**LEL:** NA

Noncombustible Solid, but may be dissolved in flammable liquids.

## Incompatibilities & Reactivities

Strong oxidizers, strong acids, parathion [Note: May emit hydrogen chloride & phosgene when heated or burned.]

## Measurement Methods

NIOSH 5519  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact  
- Eyes: Prevent eye contact  
- Wash skin: When contaminated  
- Remove: When wet or contaminated  
- Change: Daily  
- Provide: Eyewash, Quick drench

## First Aid

(See procedures)

- Eye: Irrigate immediately  
- Skin: Soap wash immediately  
- Breathing: Respiratory support  
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

**Up to 1 mg/m³:**
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

**Up to 2 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

---

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage

**Target Organs** central nervous system, liver

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>Enflurane</strong></th>
<th><strong>CAS</strong> 13838-16-9</th>
</tr>
</thead>
</table>

**CHF₂OCF₂CHCIF**

**Synonyms & Trade Names**
- 2-Chloro-1-(difluoromethoxy)-1,1,2-trifluoroethane
- 2-Chloro-1,1,2-trifluoroethyl difluoromethyl ether
- Ethrane®

**DOT ID & Guide**

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th>NIOSH REL*: C 2 ppm (15.1 mg/m³) [60-minute] [<em>Note: REL for exposure to waste anesthetic gas.</em>]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: none</td>
<td></td>
</tr>
</tbody>
</table>

**Physical Description**
Clear, colorless liquid with a mild, sweet odor. [inhalation anesthetic]

**Properties**
- **MW:** 184.5
- **BP:** 134°F
- **FRZ:** ?
- **Sol:** Low
- **VP:** 175 mmHg
- **IP:** ?
- **Sp.Gr(77°F):** 1.52
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

**Noncombustible Liquid**

**Incompatibilities & Reactivities**
None reported

**Measurement Methods**
- OSHA 29, 103
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- **Skin:** No recommendation
- **Eyes:** Prevent eye contact
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

**First Aid** *(See procedures)*
- **Eye:** Irrigate immediately
- **Skin:** Soap wash
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes; central nervous system depression, analgesia, anesthesia, convulsions, respiratory depression

**Target Organs** Eyes, central nervous system

See also: **INTRODUCTION**
NIOSH Pocket Guide to Chemical Hazards

Epichlorohydrin

<table>
<thead>
<tr>
<th>CAS</th>
<th>106-89-8</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**

1-Chloro-2,3-epoxypropane; 2-Chloropropylene oxide; gamma-Chloropropylene oxide

**DOT ID & Guide**

2023 131 P

**Exposure Limits**

- NIOSH REL: Ca See Appendix A
- OSHA PEL†: TWA 5 ppm (19 mg/m³) [skin]

**IDLH Ca [75 ppm]**

**Conversion** 1 ppm = 3.78 mg/m³

**Physical Description**

Colorless liquid with a slightly irritating, chloroform-like odor.

- MW: 92.5
- BP: 242°F
- FRZ: -54°F
- Sol: 7%
- VP: 13 mmHg
- IP: 10.60 eV
- Sp.Gr: 1.18
- Fl.P: 93°F
- UEL: 21.0%
- LEL: 3.8%

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

**Incompatibilities & Reactivities**

Strong oxidizers, strong acids, certain salts, caustics, zinc, aluminum, water [Note: May polymerize in presence of strong acids and bases, particularly when hot.]

**Measurement Methods**

NIOSH 1010 ; OSHA 7

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection )

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

**First Aid** (See procedures )

Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor and acid gas canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, skin with deep pain; nausea, vomiting; abdominal pain; respiratory distress, cough; cyanosis; reproductive effects; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, respiratory system, kidneys, liver, reproductive system |
| **Cancer Site** | [in animals: nasal cancer] |

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### EPN

<table>
<thead>
<tr>
<th>CAS 2104-64-5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₁₄H₁₄O₄NSP</strong></td>
</tr>
<tr>
<td>RTECS TB1925000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
</tr>
<tr>
<td>Ethyl p-nitrophenyl benzenethionophosphonate, O-Ethyl O-(4-nitrophenyl) phenylphosphonothioate</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: TWA 0.5 mg/m³ [skin] |
| OSHA PEL: TWA 0.5 mg/m³ [skin] |

### IDLH

5 mg/m³

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow solid with an aromatic odor. [pesticide] [Note: A brown liquid above 97°F.]</td>
</tr>
</tbody>
</table>

| MW: 323.3 |
| BP: ? |
| MLT: 97°F |
| Sol: Insoluble |

| VP(212°F): 0.0003 mmHg |
| IP: ? |
| Sp.Gr(77°F): 1.27 |

| Fl.P: NA |
| UEL: NA |
| LEL: NA |

### Noncombustible Solid

### Incompatibilities & Reactivities

Strong oxidizers

### Measurement Methods

NIOSH 5012

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: Daily

Provide: Eyewash, Quick drench

### First Aid (See procedures )

Eye: Irrigate immediately

Skin: Soap wash immediately

Breathing: Respiratory support

Swallow: Medical attention immediately

### Respiration

<table>
<thead>
<tr>
<th><strong>Respirator Recommendations NIOSH/OSHA</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 5 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

#### Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin; miosis, lacrimation (discharge of tears); rhinorrhea (discharge of thin mucus); headache; chest tightness, wheezing, laryngeal spasm; salivation; cyanosis; anorexia, nausea, abdominal cramps, diarrhea; paralysis, convulsions; low blood pressure, cardiac irregularities</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, cardiovascular system, central nervous system, blood cholinesterase</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Ethanolamine

| CAS | 141-43-5 |

### NH₂CH₂CH₂OH

### Synonyms & Trade Names
- 2-Aminoethanol, beta-Aminoethyl alcohol, Ethylolamine, 2-Hydroxyethylamine, Monoethanolamine

### Exposure Limits

| NIOSH REL: TWA 3 ppm (8 mg/m³) ST 6 ppm (15 mg/m³) |
| OSHA PEL†: TWA 3 ppm (6 mg/m³) |

**IDLH** 30 ppm

**Conversion** 1 ppm = 2.50 mg/m³

### Physical Description
Colorless, viscous liquid or solid (below 51°F) with an unpleasant, ammonia-like odor.

| MW: 61.1 | BP: 339°F |
| VP: 0.4 mmHg | IP: 8.96 eV |
| Fl.P: 186°F | UEL: 23.5% |

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
Strong oxidizers, strong acids, iron [Note: May attack copper, brass, and rubber.]

### Measurement Methods
- NIOSH 2007, OSHA PV2111
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 30 ppm:
(APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, respiratory system; drowsiness

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# Ethion

**CAS** 563-12-2  
**RTECS** TE4550000

**Synonyms & Trade Names**  
O,O',O''-Tetraethyl S,S'-methylene di(phosphorodithioate)

## Exposure Limits

| NIOSH REL | 0.4 mg/m³ [skin] |
| OSHA PEL† | none |

| IDLH | N.D. |

## Physical Description

Colorless to amber-colored, odorless liquid. [insecticide] [Note: A solid below 10°F. The technical product has a very disagreeable odor.]

| MW | 384.5 |
| BP | >302°F (Decomposes) |
| FRZ | 10°F |
| Sol | 0.0001% |
| VP | 0.0000015 mmHg |
| IP | ? |
| Sp.Gr | 1.22 |
| UEL | ? |
| LEL | ? |

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

## Incompatibilities & Reactivities

Acids, alkalis

## Measurement Methods

NIOSH 5600  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: Daily  
- **Provide**: Eyewash, Quick drench

## First Aid

- **Eye**: Irrigate immediately  
- **Skin**: Soap wash immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately

## Important additional information about respirator selection

**Respirator Recommendations** Not available.

## Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms

Irritation eyes, skin; nausea, vomiting, abdominal cramps, diarrhea, salivation; headache, dizziness, lassitude (weakness, exhaustion); rhinorrhea (discharge of thin mucus), chest tightness; blurred vision, miosis; cardiac irregularities; muscle fasciculation; dyspnea (breathing difficulty)

## Target Organs

Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
2-Ethoxyethanol

C₂H₅OCH₂CH₂OH

Synonyms & Trade Names
Cellosolve®, EGEE, Ethylene glycol monoethyl ether

DOT ID & Guide
1171 127

Exposure Limits

NIOSH REL: TWA 0.5 ppm (1.8 mg/m³) [skin]
OSHA PEL: TWA 200 ppm (740 mg/m³) [skin]

IDLH 500 ppm

Conversion 1 ppm = 3.69 mg/m³

Physical Description
Colorless liquid with a sweet, pleasant, ether-like odor.

MW: 90.1      BP: 275°F      FRZ: -130°F
VP: 4 mmHg     IP: ?     Sol: Miscible
Fl.P: 110°F    UEL(200°F): 15.6%    LEL(200°F): 1.7%

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

Incompatibilities & Reactivities
Strong oxidizers

Measurement Methods
NIOSH 1403; OSHA 53, 79
See: NMAM or OSHA Methods

Personal Protection & Sanitation
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

First Aid
Eye: Irrigate immediately
Skin: Water flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 5 ppm:**
(APF = 10) Any supplied-air respirator*

**Up to 12.5 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 25 ppm:**
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 500 ppm:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode*

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

---

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** in animals: irritation eyes, respiratory system; blood changes; liver, kidney, lung damage; reproductive, teratogenic effects

**Target Organs** Eyes, respiratory system, blood, kidneys, liver, reproductive system, hematopoietic system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2-Ethoxyethyl acetate

**Chemical Formula:** \( \text{CH}_3\text{COOCH}_2\text{CH}_2\text{OC}_2\text{H}_5 \)

**CAS Number:** 111-15-9

**RTECS Number:** KK8225000

**Synonyms & Trade Names:**
- Cellosolve® acetate
- EGEEA
- Ethylene glycol monoethyl ether acetate
- Glycol monoethyl ether acetate

**DOT ID & Guide:** 1172 129

### Exposure Limits

| NIOSH REL | TWA 0.5 ppm (2.7 mg/m³) [skin] |
| OSHA PEL | TWA 100 ppm (540 mg/m³) [skin] |

**IDLH:** 500 ppm

**Conversion**
1 ppm = 5.41 mg/m³

### Physical Description

Colorless liquid with a mild odor.

- **MW:** 132.2
- **BP:** 313°F
- **FRZ:** -79°F
- **Sol:** 23%
- **VP:** 2 mmHg
- **IP:** ?
- **Sp.Gr:** 0.98
- **Fl.P:** 124°F
- **UEL:** ?
- **LEL:** 1.7%

**Class II Combustible Liquid:** Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

Nitrate; strong oxidizers, alkalis & acids

### Measurement Methods

NIOSH 1450; OSHA 53

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated

**Remove:** When wet or contaminated

**Change:** No recommendation

### First Aid

**Eye:** Irrigate immediately

**Skin:** Water flush promptly

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 500 ppm:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode*

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose; vomiting; kidney damage; paralysis; in animals: reproductive, teratogenic effects

**Target Organs** Eyes, respiratory system, gastrointestinal tract, reproductive system, hematopoietic system

See also: [INTRODUCTION](#)
## Ethyl acetate

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂COOC₂H₅</td>
<td>141-78-6</td>
<td>AH5425000</td>
<td>Acetic ester, Acetic ether, Ethyl ester of acetic acid, Ethyl ethanoate</td>
<td>1173 129</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 400 ppm (1400 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 400 ppm (1400 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 2000 ppm [10%LEL]

**Conversion** 1 ppm = 3.60 mg/m³

### Physical Description

- Colorless liquid with an ether-like, fruity odor.
- **MW**: 88.1
- **BP**: 171°F
- **FRZ**: -117°F
- **IP**: 10.01 eV
- **Sp.Gr**: 0.90
- **VP**: 73 mmHg
- **Sol(77°F)**: 10%
- **Fl.P.**: 24°F
- **UEL**: 11.5%
- **LEL**: 2.0%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Nitrites; strong oxidizers, alkalis & acids

### Measurement Methods

- NIOSH 1457 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2000 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; narcosis; dermatitis

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
Ethyl acrylate

CH₂=CHCOOC₂H₅

Synonyms & Trade Names
Ethyl acrylate (inhibited), Ethyl ester of acrylic acid, Ethyl propenoate

CAS 140-88-5

RTECS AT0700000

DOT ID & Guide
1917 129 P (inhibited)

Exposure Limits

NIOSH REL: Ca See Appendix A

OSHA PEL†: TWA 25 ppm (100 mg/m³) [skin]

IDLH Ca [300 ppm]

Conversion 1 ppm = 4.09 mg/m³

Physical Description
Colorless liquid with an acrid odor.

MW: 100.1  BP: 211°F  FRZ: -96°F  Sol: 2%

VP: 29 mmHg  IP: 10.30 eV  Sp.Gr: 0.92

FI.P: 48°F  UEL: 14%  LEL: 1.4%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Oxidizers, peroxides, polymerizers, strong alkalis, moisture, chlorosulfonic acid [Note: Polymerizes readily unless an inhibitor such as hydroquinone is added.]

Measurement Methods
NIOSH 1450 ; OSHA 92
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection )

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures )

Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Important additional information about respirator selection
Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, respiratory system; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors of the forestomach]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Ethyl alcohol

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>64-17-5</td>
<td>KQ6300000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Alcohol
- Cologne spirit
- Ethanol
- EtOH
- Grain alcohol

### DOT ID & Guide
- 1170 127

### Exposure Limits

- **NIOSH REL:** TWA 1000 ppm (1900 mg/m³)
- **OSHA PEL:** TWA 1000 ppm (1900 mg/m³)
- **IDLH:** 3300 ppm [10%LEL]

### Conversion
- 1 ppm = 1.89 mg/m³

### Physical Description
- Clear, colorless liquid with a weak, ethereal, vinous odor.
- **MW:** 46.1
- **BP:** 173°F
- **FRZ:** -173°F
- **Sol:** Miscible
- **VP:** 44 mmHg
- **IP:** 10.47 eV
- **Sp.Gr:** 0.79
- **FI.P:** 55°F
- **UEL:** 19%
- **LEL:** 3.3%

### Incompatibilities & Reactivities
- Strong oxidizers, potassium dioxide, bromine pentafluoride, acetyl bromide, acetyl chloride, platinum, sodium

### Measurement Methods
- NIOSH 1400 ; OSHA 100
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush promptly
- **Breathing:** Fresh air
- **Swallow:** Medical attention immediately

### Respirator Recommendations

#### NIOSH/OSHA
- **Up to 3300 ppm:**
  - (APF = 10) Any supplied-air respirator
  - (APF = 50) Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, skin, nose; headache, drowsiness, lassitude (weakness, exhaustion), narcosis; cough; liver damage; anemia; reproductive, teratogenic effects |
| **Target Organs** | Eyes, skin, respiratory system, central nervous system, liver, blood, reproductive system |

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Ethylamine

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>75-04-7</td>
</tr>
<tr>
<td>RTECS</td>
<td>KH2100000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Aminoethane, Ethylamine (anhydrous), Monoethylamine</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1036 118</td>
</tr>
</tbody>
</table>

| Exposure Limits | | |
|-----------------|---------------------------|
| NIOSH REL: TWA 10 ppm (18 mg/m³) | OSHA PEL: TWA 10 ppm (18 mg/m³) |
| IDLH            | 600 ppm                  |

**Conversion** 1 ppm = 1.85 mg/m³

## Physical Description

Colorless gas or water-white liquid (below 62°F) with an ammonia-like odor. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>45.1</td>
</tr>
<tr>
<td>BP</td>
<td>62°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-114°F</td>
</tr>
<tr>
<td>Sol.</td>
<td>Miscible</td>
</tr>
<tr>
<td>VP</td>
<td>874 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>8.86 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>1.61</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.69 (Liquid)</td>
</tr>
<tr>
<td>UEL</td>
<td>14.0%</td>
</tr>
<tr>
<td>LEL</td>
<td>3.5%</td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities

Flammable Gas

Strong acids; strong oxidizers; copper, tin & zinc in presence of moisture; cellulose nitrate; chlorine; hypochlorites

## Measurement Methods

NIOSH S144 (II-3) ; OSHA 36
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

**Skin:** Prevent skin contact (liquid)
**Eyes:** Prevent eye contact (liquid)
**Wash Skin:** When contaminated (liquid)
**Remove:** When wet or contaminated (liquid)
**Change:** No recommendation
**Provide:** Eyewash (liquid), Quick drench (liquid)

## First Aid

**Eye:** Irrigate immediately (liquid)
**Skin:** Water flush immediately (liquid)
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately (liquid)
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 250 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern

**Up to 500 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 600 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact (liquid)

**Symptoms** Irritation eyes, skin, respiratory system; skin burns, dermatitis

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
# Ethyl benzene

**CAS** 100-41-4

**RTECS** DA0700000

**Synonyms & Trade Names**
Ethylbenzol, Phenylethane

**DOT ID & Guide**
1175 130

## Exposure Limits

- NIOSH REL: TWA 100 ppm (435 mg/m³) ST 125 ppm (545 mg/m³)
- OSHA PEL†: TWA 100 ppm (435 mg/m³)

**IDLH** 800 ppm [10%LEL]

**Conversion** 1 ppm = 4.34 mg/m³

## Physical Description

Colorless liquid with an aromatic odor.

- MW: 106.2
- BP: 277°F
- FRZ: -139°F
- Sol: 0.01%
- VP: 7 mmHg
- IP: 8.76 eV
- Sp.Gr: 0.87
- Fl.P: 55°F
- UEL: 6.7%
- LEL: 0.8%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

## Incompatibilities & Reactivities

- Strong oxidizers

## Measurement Methods

- NIOSH 1501 ; OSHA 7 , 1002
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

## First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Respirator Recommendations NIOSH/OSHA

**Up to 800 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: **INTRODUCTION**
**Ethyl bromide**

**CAS** 74-96-4

**Chemical Structure** \( \text{CH}_3\text{CH}_2\text{Br} \)

**Synonyms & Trade Names**
Bromoethane, Monobromoethane

**DOT ID & Guide**

**Exposure Limits**

| NIOSH REL: See Appendix D | OSHA PEL†: TWA 200 ppm (890 mg/m³) |

| IDLH | 2000 ppm |

**Conversion** 1 ppm = 4.46 mg/m³

**Physical Description**
Colorless to yellow liquid with an ether-like odor. [Note: A gas above 101°F.]

| MW: 109.0 | BP: 101°F | FRZ: -182°F | Sol: 0.9% |
| VP: 375 mmHg | IP: 10.29 eV | Sp.Gr: 1.46 |
| Fl.P: <4°F | UEL: 8.0% | LEL: 6.8% |

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

**Incompatibilities & Reactivities**
Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium

**Measurement Methods**
NIOSH 1011; OSHA 7
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

**First Aid** (See procedures)
Eye: Irrigate immediately
Skin: Soap flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** OSHA

**Up to 2000 ppm:**
(APF = 10) Any supplied-air respirator
(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin, respiratory system; central nervous system depression; pulmonary edema; liver, kidney disease; cardiac arrhythmias, cardiac arrest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, liver, kidneys, cardiovascular system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Ethyl butyl ketone

**CAS** 106-35-4

**Chemical Formula**

\[ \text{CH}_3\text{CH}_2\text{CO}[\text{CH}_2]_3\text{CH}_3 \]

**RTECS** MJ5250000

**Synonyms & Trade Names**

Butyl ethyl ketone, 3-Heptanone

**DOT ID & Guide**

1224 127

---

#### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA</th>
<th>50 ppm (230 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA</td>
<td>50 ppm (230 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 1000 ppm

**Conversion** 1 ppm = 4.67 mg/m³

---

#### Physical Description

Colorless liquid with a powerful, fruity odor.

**MW:** 114.2

**BP:** 298°F

**FRZ:** -38°F

**Sol:** 1%

**VP:** 4 mmHg

**IP:** 9.02 eV

**Sp.Gr:** 0.82

**Fl.P(oc):** 115°F

**UEL:** ?

**LEL:** ?

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

---

#### Incompatibilities & Reactivities

Oxidizers, acetaldehyde, perchloric acid

---

#### Measurement Methods

NIOSH 1301, 2553; OSHA 7

See: NMAM or OSHA Methods

---

#### Personal Protection & Sanitation

(See protection)

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

---

#### First Aid

(See procedures)

- **Eye:** Irrigate immediately
- **Skin:** Water flush
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*

Up to 1000 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
## Ethyl chloride

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-00-3</td>
<td>KH7525000</td>
<td>1037 115</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Chloroethane, Hydrochloric ether, Monochloroethane, Muriatic ether

### Exposure Limits
- NIOSH REL: Handle with caution in the workplace. See Appendix C (Chloroethanes)
- OSHA PEL: TWA 1000 ppm (2600 mg/m³)
- IDLH 3800 ppm [10%LEL]

### Physical Description
- Colorless gas or liquid (below 54°F) with a pungent, ether-like odor. [Note: Shipped as a liquefied compressed gas.]
- MW: 64.5
- BP: 54°F
- FRZ: -218°F
- Sol: 0.6%
- VP: 1000 mmHg
- IP: 10.97 eV
- RGasD: 2.23
- Sp.Gr: 0.92 (Liquid at 32°F)
- Fl.P: NA (Gas) -58°F (Liquid)
- UEL: 15.4%
- LEL: 3.8%

### Incompatibilities & Reactivities
- Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium; oxidizers; water or steam [Note: Reacts with water to form hydrochloric acid.]

### Measurement Methods
- NIOSH 2519
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact (liquid)
- Eyes: Prevent eye contact (liquid)
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately (liquid)
- Skin: Water flush promptly (liquid)
- Breathing: Respiratory support
- Swallow: Medical attention immediately (liquid)

### Respirator Recommendations
- OSHA
  - Up to 3800 ppm:
    - (APF = 10) Any supplied-air respirator*
    - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - Emergency or planned entry into unknown concentrations or IDLH conditions:
    - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
    - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
  - Escape:
    - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Liver, kidneys, respiratory system, cardiovascular system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Ethylene chlorohydrin

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS 107-07-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂ClCH₂OH</td>
<td>RTECS KK0875000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- 2-Chloroethanol, 2-Chloroethyl alcohol, Ethylene chlorhydrin

#### DOT ID & Guide
- DOT ID: 1135 131

#### Exposure Limits
- NIOSH REL: C 1 ppm (3 mg/m³) [skin]
- OSHA PEL†: TWA 5 ppm (16 mg/m³) [skin]

#### IDLH
- 7 ppm

#### Conversion
- 1 ppm = 3.29 mg/m³

#### Physical Description
- Colorless liquid with a faint, ether-like odor.
- MW: 80.5
- BP: 262°F
- FRZ: -90°F
- Sol: Miscible
- VP: 5 mmHg
- IP: 10.90 eV
- Sp.Gr: 1.20
- Fl.P: 140°F
- UEL: 15.9%
- LEL: 4.9%

#### Incompatibilities & Reactivities
- Strong oxidizers, strong caustics, water or steam

#### Measurement Methods
- NIOSH 2513 ; OSHA 7
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

#### First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

#### Up to 7 ppm:
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation mucous membrane; nausea, vomiting; dizziness, incoordination; numbness; visual disturbance; headache; thirst; delirium; low blood pressure; collapse, shock, coma; liver, kidney damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Respiratory system, liver, kidneys, central nervous system, cardiovascular system, eyes</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# Ethylenediamine

**CAS** 107-15-3  
**RTECS** KH8575000

## Synonyms & Trade Names
1,2-Diaminoethane; 1,2-Ethanediamine; Ethylenediamine (anhydrous)

## DOT ID & Guide
1604 132

## Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 10 ppm (25 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>TWA 10 ppm (25 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>1000 ppm</td>
</tr>
</tbody>
</table>

## Conversion
1 ppm = 2.46 mg/m³

## Physical Description
Colorless, viscous liquid with an ammonia-like odor. [fungicide] [Note: A solid below 47°F.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>60.1</td>
</tr>
<tr>
<td>BP</td>
<td>241°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>47°F</td>
</tr>
<tr>
<td>VP</td>
<td>11 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>8.60 eV</td>
</tr>
<tr>
<td>Sp.Gr.</td>
<td>0.91</td>
</tr>
<tr>
<td>MW.</td>
<td>Miscible</td>
</tr>
<tr>
<td>UEL(212°F)</td>
<td>12%</td>
</tr>
<tr>
<td>LEL(212°F)</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

## Incompatibilities & Reactivities
Strong acids & oxidizers, carbon tetrachloride & other chlorinated organic compounds, carbon disulfide [Note: Corrosive to metals.]

## Measurement Methods
NIOSH 2540 ; OSHA 60  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash (>5%), Quick drench

## First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 250 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern

Up to 500 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 1000 ppm:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation nose, respiratory system; sensitization dermatitis; asthma; liver, kidney damage

Target Organs Skin, respiratory system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Ethylene dibromide

<table>
<thead>
<tr>
<th>CAS</th>
<th>106-93-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KH9275000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1605 154</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

1,2-Dibromoethane; Ethylene bromide; Glycol dibromide

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>Ca TWA 0.045 ppm C 0.13 ppm [15-minute] See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>TWA 20 ppm C 30 ppm 50 ppm [5-minute maximum peak]</td>
</tr>
<tr>
<td>IDLH Ca [100 ppm]</td>
<td>Conversion 1 ppm = 7.69 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

Colorless liquid or solid (below 50°F) with a sweet odor. [fumigant]

| MW: | 187.9 |
| BP: | 268°F |
| FRZ: | 50°F |
| Sol: | 0.4% |
| VP: | 12 mmHg |
| IP: | 9.45 eV |
| Sp.Gr: | 2.17 |

Noncombustible Liquid

### Incompatibilities & Reactivities

Chemically-active metals such as sodium, potassium, calcium, hot aluminum & magnesium; liquid ammonia; strong oxidizers

### Measurement Methods

NIOSH 1008 ; OSHA 2
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

### First Aid (See procedures)

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

*At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:*

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, skin, respiratory system; dermatitis with vesiculation; liver, heart, spleen, kidney damage; reproductive effects; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, respiratory system, liver, kidneys, reproductive system |
| **Cancer Site** | [in animals: skin & lung tumors] |

See also: INTRODUCTION
## Ethylene dichloride

**CAS** 107-06-2

**RTECS** KI0525000

### Synonyms & Trade Names
- 1,2-Dichloroethane
- Ethylene chloride
- Glycol dichloride

### Exposure Limits

**NIOSH REL:** Ca TWA 1 ppm (4 mg/m³) ST 2 ppm (8 mg/m³)  
See Appendix A  
See Appendix C (Chloroethanes)

**OSHA PEL†:** TWA 50 ppm C 100 ppm 200 ppm [5-minute maximum peak in any 3 hours]

**IDLH** Ca [50 ppm]

### Conversion

1 ppm = 4.05 mg/m³

### Physical Description

- Colorless liquid with a pleasant, chloroform-like odor. [Note: Decomposes slowly, becomes acidic & darkens in color.]
- MW: 99.0  
- BP: 182°F  
- FRZ: -32°F  
- Sol: 0.9%

**VP:** 64 mmHg  
**IP:** 11.05 eV  
**Sp.Gr:** 1.24

**FL.P:** 56°F  
**UEL:** 16%  
**LEL:** 6.2%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

- Strong oxidizers & caustics; chemically-active metals such as magnesium or aluminum powder, sodium & potassium; liquid ammonia [Note: Decomposes to vinyl chloride & HCl above 1112°F.]

### Measurement Methods

- NIOSH 1003  
- OSHA 3  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet (flammable)  
- **Change:** No recommendation  
- **Provide:** Eyewash, Quick drench

### First Aid

- **Eye:** Irrigate immediately  
- **Skin:** Soap wash promptly  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, ingestion, skin absorption, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, kidneys, liver, central nervous system, cardiovascular system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: forestomach, mammary gland &amp; circulatory system cancer]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Ethylene glycol

<table>
<thead>
<tr>
<th>CAS</th>
<th>107-21-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KW2975000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>1,2-Dihydroxyethane; 1,2-Ethanediol; Glycol; Glycol alcohol; Monoethylene glycol</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: See Appendix D</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH N.D.</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description

Clear, colorless, syrupy, odorless liquid. [antifreeze] [Note: A solid below 9°F.]

<table>
<thead>
<tr>
<th>MW: 62.1</th>
<th>BP: 388°F</th>
<th>FRZ: 9°F</th>
<th>Sol: Miscible</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0.06 mmHg</td>
<td>IP: ?</td>
<td>Sp.Gr: 1.11</td>
<td></td>
</tr>
<tr>
<td>Fl.P: 232°F</td>
<td>UEL: 15.3%</td>
<td>LEL: 3.2%</td>
<td></td>
</tr>
</tbody>
</table>

Class III B Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

Strong oxidizers, chromium trioxide, potassium permanganate, sodium peroxide [Note: Hygroscopic (i.e., absorbs moisture from the air).]

### Measurement Methods

NIOSH 5523 ; OSHA PV2024

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: Daily

### First Aid (See procedures )

Eye: Irrigate immediately

Skin: Water wash immediately

Breathing: Respiratory support

Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, nose, throat; nausea, vomiting, abdominal pain, lassitude (weakness, exhaustion); dizziness, stupor, convulsions, central nervous system depression; skin sensitization

### Target Organs

Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# Ethylene glycol dinitrate

**CAS** 628-96-6  
**RTECS** KW5600000

## Synonyms & Trade Names
- EGDN; 1,2-Ethanediol dinitrate; Ethylene dinitrate; Ethylene nitrate; Glycol dinitrate; Nitroglycol

## Exposure Limits
- **NIOSH REL**: ST 0.1 mg/m³ [skin]  
- **OSHA PEL†**: C 0.2 ppm (1 mg/m³) [skin]  
- **IDLH**: 75 mg/m³  

## Physical Description
- Colorless to yellow, oily, odorless liquid. [Note: An explosive ingredient (60-80%) in dynamite along with nitroglycerine (40-20%).]  
- **MW**: 152.1  
- **BP**: 387°F  
- **FRZ**: -8°F  
- **Sol**: Insoluble
- **VP**: 0.05 mmHg  
- **IP**: ?  
- **Sp.Gr**: 1.49
- **Fl.P**: 419°F  
- **UEL**: ?  
- **LEL**: ?

## Incompatibilities & Reactivities
- Acids, alkalis

## Measurement Methods
- NIOSH 2507 ; OSHA 43  
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet (flammable)  
- **Change**: Daily  
- **Provide**: Quick drench

## First Aid
- **Eye**: Irrigate immediately  
- **Skin**: Soap wash immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately
### Respirator Recommendations NIOSH

<table>
<thead>
<tr>
<th>Exposure Concentration</th>
<th>Respirator Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 1 mg/m³</strong></td>
<td>(APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 2.5 mg/m³</strong></td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td><strong>Up to 5 mg/m³</strong></td>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*</td>
</tr>
<tr>
<td></td>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 75 mg/m³</strong></td>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
</tbody>
</table>

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

- Throbbing headache; dizziness; nausea, vomiting, abdominal pain; hypotension, flush, palpitations, angina; methemoglobinemia; delirium, central nervous system depression; irritation skin; in animals: anemia; liver, kidney damage

### Target Organs

- Skin, cardiovascular system, blood, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Ethyleneimine

<table>
<thead>
<tr>
<th>CAS 151-56-4</th>
</tr>
</thead>
</table>

### CAS

### RTECS

### Synonyms & Trade Names
- Aminoethylene, Azirane, Aziridine, Dimethyleneimine, Dimethylamine, Ethylenimine, Ethylimine

### DOT ID & Guide
- 1185 131 P (inhibited)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca See Appendix A</th>
</tr>
</thead>
</table>

| OSHA PEL: [1910.1012] See Appendix B |

### IDLH

Ca [100 ppm]

### Conversion
- 1 ppm = 1.76 mg/m³

### Physical Description
- Colorless liquid with an ammonia-like odor. [Note: Usually contains inhibitors to prevent polymerization.]

### MW: 43.1 BP: 133°F FRZ: -97°F Sol: Miscible

| VP: 160 mmHg IP: 9.20 eV Sp.Gr: 0.83 |

| Fl.P: 12°F UEL: 54.8% LEL: 3.3% |

### Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Polymerizes explosively in presence of acids [Note: Explosive silver derivatives may be formed with silver alloys (e.g., silver solder).]

### Measurement Methods
- NIOSH 3514
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations (See Appendix E) NIOSH

- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, nose, throat; nausea, vomiting; headache, dizziness; pulmonary edema; liver, kidney damage; eye burns; skin sensitization; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, liver, kidneys</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung &amp; liver tumors]</td>
</tr>
<tr>
<td><strong>See also:</strong></td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Ethylene oxide

<table>
<thead>
<tr>
<th>CAS</th>
<th>75-21-8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₂H₄O</strong></td>
<td><strong>RTECS</strong> KX2450000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dimethylene oxide; 1,2-Epoxy ethane; Oxirane

### DOT ID & Guide
- DOT ID: 1040
- DOT Guide: 119 P

### Exposure Limits

| NIOSH REL: | Ca TWA <0.1 ppm (0.18 mg/m³) C 5 ppm (9 mg/m³) [10-min/day] See Appendix A |
| OSHA PEL: | [1910.1047] TWA 1 ppm 5 ppm [15-minute Excursion] |

**IDLH Ca [800 ppm]**

**Conversion**

1 ppm = 1.80 mg/m³

### Physical Description
- Colorless gas or liquid (below 51°F) with an ether-like odor.

| MW: | 44.1 |
| BP: | 51°F |
| FRZ: | -171°F |
| Sol: | Miscible |

| VP: | 1.46 atm |
| IP: | 10.56 eV |
| RGasD: | 1.49 |
| Sp.Gr: | 0.82 (Liquid at 50°F) |

| Fl.P: | NA (Gas) -20°F (Liquid) |
| UEL: | 100% |
| LEL: | 3.0% |

### Incompatibilities & Reactivities
- Strong acids, alkalis & oxidizers; chlorides of iron, aluminum & tin; oxides of iron & aluminum; water

### Measurement Methods
- NIOSH 1614, 3800; OSHA 30, 49, 50
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

#### Skin:
- Prevent skin contact (liquid)

#### Eyes:
- Prevent eye contact (liquid)

#### Wash skin:
- When contaminated (liquid)

#### Remove:
- When wet (flammable)

#### Change:
- No recommendation

#### Provide:
- Quick drench (liquid)

### First Aid

#### Eye:
- Irrigate immediately

#### Skin:
- Water flush immediately

#### Breathing:
- Respiratory support

#### Swallow:
- Medical attention immediately (liquid)
## Important additional information about respirator selection

### Respirator Recommendations (See Appendix E) NIOSH

#### Up to 5 ppm:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern†

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern† Any appropriate escape-type, self-contained breathing apparatus

---

### Exposure Routes

**inhalation, ingestion (liquid), skin and/or eye contact**

### Symptoms

Irritation eyes, nose, skin, throat; peculiar taste; headache; nausea, vomiting, diarrhea; dyspnea (breathing difficulty); cyanosis, pulmonary edema; drowsiness, lassitude (weakness, exhaustion), incoordination; EKG abnormalities; eye, skin burns (liquid or high vapor concentration); liquid: frostbite; reproductive effects; potential occupational carcinogen; in animals: convulsions; liver, kidney damage

### Target Organs

Eyes, skin, respiratory system, liver, central nervous system, blood, kidneys, reproductive system

### Cancer Site

[peritoneal cancer, leukemia]

See also: INTRODUCTION
## Ethylene thiourea

<table>
<thead>
<tr>
<th>CAS</th>
<th>96-45-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>NI9625000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 1,3-Ethylene-2-thiourea; N,N-Ethylenethiourea; ETU; 2-Imidazolidine-2-thione

### Exposure Limits
- **NIOSH REL:** Ca Use encapsulated form. See Appendix A
- **OSHA PEL:** none

### Physical Description
- White to pale-green, crystalline solid with a faint, amine odor. [Note: Used as an accelerator in the curing of polychloroprene & other elastomers.]
- MW: 102.2
- BP: 446-595°F
- MLT: 392°F
- Sol(86°F): 2%
- VP: 16 mmHg
- IP: 8.15 eV
- Sp.Gr: ?
- Fl.P: 486°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities
- Acrolein

### Measurement Methods
- NIOSH 5011; OSHA 95
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH
**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes; in animals: thickening of the skin; goiter; teratogenic effects; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, thyroid, reproductive system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver, thyroid &amp; lymphatic system tumors]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
### Ethyl ether

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-29-7</td>
<td>KI5775000</td>
<td>Diethyl ether, Diethyl oxide, Ethyl oxide, Ether, Solvent ether</td>
<td>1155 127</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: See Appendix D</th>
<th>OSHA PEL†: TWA 400 ppm (1200 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH 1900 ppm [10%LEL]</td>
<td>Conversion 1 ppm = 3.03 mg/m³</td>
</tr>
</tbody>
</table>

#### Physical Description

- Colorless liquid with a pungent, sweetish odor. [Note: A gas above 94°F.]
- MW: 74.1
- BP: 94°F
- FRZ: -177°F
- Sol: 8%
- VP: 440 mmHg
- IP: 9.53 eV
- Sp.Gr: 0.71
- Fl.P: -49°F
- UEL: 36.0%
- LEL: 1.9%
- Class IA Flammable Liquid: Fl.P. below 73°F and BP below 100°F.

#### Incompatibilities & Reactivities

- Strong oxidizers, halogens, sulfur, sulfur compounds [Note: Tends to form explosive peroxides under influence of air and light.]

#### Measurement Methods

- NIOSH 1610 ; OSHA 7
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation

#### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Water wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations OSHA

Up to 1900 ppm:

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, upper respiratory system; dizziness, drowsiness, headache, excited, narcosis; nausea, vomiting

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
## Ethyl formate

<table>
<thead>
<tr>
<th>CAS 109-94-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH$_3$CH$_2$OCHO</td>
</tr>
<tr>
<td>RTECS LQ8400000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Ethyl ester of formic acid, Ethyl methanoate

### DOT ID & Guide
1190 129

### Exposure Limits
<table>
<thead>
<tr>
<th>NIOSH REL: TWA 100 ppm (300 mg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 100 ppm (300 mg/m$^3$)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH 1500 ppm</th>
<th>Conversion 1 ppm = 3.03 mg/m$^3$</th>
</tr>
</thead>
</table>

### Physical Description
Colorless liquid with a fruity odor.

- MW: 74.1
- BP: 130°F
- FRZ: -113°F
- Sol(64°F): 9%
- VP: 200 mmHg
- IP: 10.61 eV
- Sp.Gr: 0.92
- Fl.P: -4°F
- UEL: 16.0%
- LEL: 2.8%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
Nitrates; strong oxidizers, alkalis & acids [Note: Decomposes slowly in water to form ethyl alcohol and formic acid.]

### Measurement Methods
NIOSH 1452 ; OSHA 7
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 1500 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, upper respiratory system; in animals: narcosis

### Target Organs
- Eyes, respiratory system, central nervous system

See also: [INTRODUCTION](#)
**Ethylidene norbornene**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>16219-75-3</td>
</tr>
<tr>
<td>RTECS</td>
<td>RB9450000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
ENB, 5-Ethylidenebicyclo(2.2.1)hept-2-ene, 5-Ethylidene-2-norbornene [Note: Due to its reactivity, ENB may be stabilized with tert-butyl catechol.]

**Exposure Limits**
- NIOSH REL: C 5 ppm (25 mg/m³)
- OSHA PEL†: none

**Physical Description**
Colorless to white liquid with a turpentine-like odor.

**Incompatibilities & Reactivities**
Oxygen [Note: ENB should be stored in a nitrogen atmosphere since it reacts with oxygen.]

**Measurement Methods**
None available
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: Prevent skin contact
  - Wash skin: Daily
  - Remove: When wet or contaminated
  - Change: No recommendation

**First Aid**
- Eye: Irrigate immediately
  - Skin: Soap wash immediately
  - Breathing: Respiratory support
  - Swallow: Medical attention immediately

**Important additional information about respirator selection**
**Respirator Recommendations** Not available.

**Exposure Routes**
inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**
Irritation eyes, skin, nose, throat; headache; cough, dyspnea (breathing difficulty); nausea, vomiting; olfactory, taste changes; chemical pneumonitis (aspiration liquid); in animals: liver, kidney, urogenital injury; bone marrow effects

**Target Organs**
Eyes, skin, respiratory system, central nervous system, liver, kidneys, urogenital system, bone marrow

See also: INTRODUCTION
## Ethyl mercaptan

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-08-1</td>
<td>KI9625000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Ethanethiol
- Ethyl sulfhydrate
- Mercaptoethane

### DOT ID & Guide
- 2363 129

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C 0.5 ppm (1.3 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: C 10 ppm (25 mg/m³)</td>
</tr>
</tbody>
</table>

### Conversion
- 1 ppm = 2.54 mg/m³

### Physical Description
- Colorless liquid with a strong, skunk-like odor. [Note: A gas above 95°F.]
- MW: 62.1
- BP: 95°F
- FRZ: -228°F
- Sol: 0.7%
- VP: 442 mmHg
- IP: 9.29 eV
- Sp.Gr: 0.84
- FL.P: -55°F
- UEL: 18.0%
- LEL: 2.8%

### Incompatibilities & Reactivities
- Strong oxidizers [Note: Reacts violently with calcium hypochlorite.]

### Measurement Methods
- NIOSH 2542
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Respiration Selection

### Respirator Recommendations NIOSH

#### Up to 5 ppm:
- \( APF = 10 \) Any chemical cartridge respirator with organic vapor cartridge(s)
- \( APF = 10 \) Any supplied-air respirator

#### Up to 12.5 ppm:
- \( APF = 25 \) Any supplied-air respirator operated in a continuous-flow mode
- \( APF = 25 \) Any powered, air-purifying respirator with organic vapor cartridge(s)

#### Up to 25 ppm:
- \( APF = 50 \) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- \( APF = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- \( APF = 50 \) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- \( APF = 50 \) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- \( APF = 50 \) Any self-contained breathing apparatus with a full facepiece
- \( APF = 50 \) Any supplied-air respirator with a full facepiece

#### Up to 500 ppm:
- \( APF = 1000 \) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- \( APF = 10,000 \) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- \( APF = 10,000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- \( APF = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation mucous membrane; headache, nausea; in animals: incoordination, lassitude (weakness, exhaustion); liver, kidney damage; cyanosis; narcosis

### Target Organs
- Eyes, respiratory system, liver, kidneys, blood

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## N-Ethylmorpholine

<table>
<thead>
<tr>
<th>CAS 100-74-3</th>
<th>RTECS QE4025000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- 4-Ethylmorpholine

### Exposure Limits
- NIOSH REL: TWA 5 ppm (23 mg/m³) [skin]
- OSHA PEL†: TWA 20 ppm (94 mg/m³) [skin]

### IDLH
- 100 ppm

### Conversion
- 1 ppm = 4.71 mg/m³

### Physical Description
- Colorless liquid with an ammonia-like odor.

### Measurement Methods
- NIOSH S146 (II-3)
- See: NMAM or OSHA Methods

### Incompatibilities & Reactivities
- Strong acids, strong oxidizers

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation
- **Provide**: Eyewash (>15%), Quick drench

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 50 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 100 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose, throat; visual disturbance: corneal edema, blue-gray vision, colored haloes

**Target Organs** Eyes, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Ethyl silicate

*(C$_2$H$_5$)$_4$SiO$_4$*  
**CAS** 78-10-4  
**RTECS** VV9450000

### Synonyms & Trade Names
- Ethyl orthosilicate
- Ethyl silicate (condensed)
- Tetraethoxysilane
- Tetraethyl orthosilicate
- Tetraethyl silicate

### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 10 ppm (85 mg/m$^3$)</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>TWA 100 ppm (850 mg/m$^3$)</td>
</tr>
</tbody>
</table>

**IDLH** 700 ppm  
**Conversion** 1 ppm = 8.52 mg/m$^3$

### Physical Description
- Colorless liquid with a sharp, alcohol-like odor.
- **MW**: 208.3  
- **BP**: 336°F  
- **FRZ**: -117°F  
- **Sol**: Reacts  
- **VP**: 1 mmHg  
- **IP**: 9.77 eV  
- **Sp.Gr**: 0.93  
- **Fl.P**: 99°F  
- **UEL**: ?  
- **LEL**: ?

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities
- Strong oxidizers, water [Note: Reacts with water to form a silicone adhesive (a milky-white mass)].

### Measurement Methods
- NIOSH S264 (II-3)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid (See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Respirator Recommendations

**NIOSH**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Respirator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 100 ppm:</strong></td>
<td>10</td>
<td>Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 250 ppm:</strong></td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td><strong>Up to 500 ppm:</strong></td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece&lt;br&gt;Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 700 ppm:</strong></td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode&lt;br&gt;Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister&lt;br&gt;Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, ingestion skin, and/or eye contact

**Symptoms** Irritation eyes, nose; in animals: lacrimation (discharge of tears); dyspnea (breathing difficulty), pulmonary edema; tremor, narcosis; liver, kidney damage; anemia

**Target Organs** Eyes, respiratory system, liver, kidneys, blood, skin

See also: [INTRODUCTION](#)
## Fenamiphos

<table>
<thead>
<tr>
<th>CAS 22224-92-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS TB3675000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
</tr>
<tr>
<td>Ethyl 3-methyl-4-(methylthio)phenyl-(1-methylethyl)phosphoramidate; Nemacur®; Phenamiphos</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: TWA 0.1 mg/m³ [skin] |
| OSHA PEL*: none |
| IDLH N.D. |

### Physical Description

Off-white to tan, waxy solid. [insecticide] [Note: Found commercially as a granular ingredient (5-15%) or in an emulsifiable concentrate (400 g/l).]

| MW: 303.4 |
| VP: 0.00005 mmHg |
| FI.P: ? |

### Incompatibilities & Reactivities

None reported [Note: May hydrolyze under alkaline conditions.]

### Measurement Methods

NIOSH 5600
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated/Daily |
| Change: Daily |
| Provide: Quick drench |

### First Aid

| Eye: Irrigate immediately |
| Skin: Soap flush immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Nausea, vomiting, abdominal cramps, diarrhea, salivation; headache, dizziness, lassitude (weakness, exhaustion); rhinorrhea (discharge of thin mucus), chest tightness; blurred vision, miosis; cardiac irregularities; muscle fasciculation; dyspnea (breathing difficulty)

**Target Organs** respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
# Fensulfothion

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS 115-90-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₁₁H₁₇O₄PS₂</td>
<td>RTECS TF3850000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Dasanit®
- O,O-Diethyl O-(p-methylsulfinyl)phenyl)phosphorothioate
- Terracur P®

## Exposure Limits
- NIOSH REL: TWA 0.1 mg/m³
- OSHA PEL†: none

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

## Physical Description
- Brown liquid or yellow oil. [pesticide]
- MW: 308.4
- BP: ?
- FRZ: ?
- Sol(77°F): 0.2%
- VP: ?
- IP: ?
- Sp.Gr: 1.20

## Measurement Methods
- None available
- See: NMAM or OSHA Methods

## Incompatibilities & Reactivities
- Alkalis

## Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash, Quick drench

## First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

## Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

## Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms
- Irritation skin; nausea, vomiting, abdominal cramps, diarrhea, salivation; headache, dizziness, lassitude (weakness, exhaustion); rhinorrhea (discharge of thin mucus), chest tightness; blurred vision, miosis; cardiac irregular; muscle fasciculation; dyspnea (breathing difficulty)

## Target Organs
- Skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
# Fenthion

**CAS** 55-38-9

**C₁₀H₁₅O₃PS**  
RTECS TF9625000

## Synonyms & Trade Names
Baytex; Entex; O,O-Dimethyl O-3-methyl-4-methylthiophenyl phosphorothioate

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix D</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

## Physical Description

Colorless to brown liquid with a slight, garlic-like odor. [insecticide]

<table>
<thead>
<tr>
<th>MW: 278.3</th>
<th>BP: ?</th>
<th>FRZ: 43°F</th>
<th>Sol: 0.006%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0.0003 mmHg</td>
<td>IP: ?</td>
<td>Sp.Gr: 1.25</td>
<td></td>
</tr>
</tbody>
</table>

Noncombustible Liquid

## Incompatibilities & Reactivities

- **Oxidizers**

## Measurement Methods

- None available
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

**(See protection )**

<table>
<thead>
<tr>
<th>Skin:</th>
<th>Prevent skin contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes:</td>
<td>Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin:</td>
<td>When contaminated</td>
</tr>
<tr>
<td>Remove:</td>
<td>When wet or contaminated</td>
</tr>
<tr>
<td>Change: Daily</td>
<td></td>
</tr>
</tbody>
</table>

## First Aid

**(See procedures )**

<table>
<thead>
<tr>
<th>Eye:</th>
<th>Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin:</td>
<td>Soap flush immediately</td>
</tr>
<tr>
<td>Breathing:</td>
<td>Respiratory support</td>
</tr>
<tr>
<td>Swallow:</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>

## Important additional information about respirator selection

**Respirator Recommendations** Not available.

## Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms

- Nausea, vomiting, abdominal cramps, diarrhea, salivation; headache, dizziness, lassitude (weakness, exhaustion); rhinorrhea (discharge of thin mucus), chest tightness; blurred vision, miosis; cardiac irregularities; muscle fasciculation; dyspnea (breathing difficulty)

## Target Organs

- Respiratory system, central nervous system, cardiovascular system, plasma cholinesterase

See also: **INTRODUCTION**
## Ferbam

- **CAS:** 14484-64-1
- **RTECS:** NO8750000

### Synonyms & Trade Names
- tris(Dimethyldithiocarbamato)iron, Ferric dimethyl dithiocarbamate

### Exposure Limits
- NIOSH REL: TWA 10 mg/m³
- OSHA PEL†: TWA 15 mg/m³
- IDLH: 800 mg/m³

### Physical Description
- Dark brown to black, odorless solid. [fungicide]
- MW: 416.5
- BP: Decomposes
- MLT: >356°F (Decomposes)
- Sol: 0.01%
- VP: 0 mmHg (approx)
- IP: 7.72 eV
- Sp.Gr: ?
- Fl.P: ?
- UEL: ?
- LEL: ?
- MEC: 55 g/m³

### Incompatibilities & Reactivities
- Combustible Solid
- Strong oxidizers, moisture

### Measurement Methods
- NIOSH 0500
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** Daily

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

---

**Note:** Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
### Important additional information about respirator selection

<table>
<thead>
<tr>
<th>Respirator Recommendations</th>
<th>NIOSH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 50 mg/m³:</strong></td>
<td>(APF = 5) Any quarter-mask respirator. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 100 mg/m³:</strong></td>
<td>(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 250 mg/m³:</strong></td>
<td>(APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 500 mg/m³:</strong></td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode* (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*</td>
</tr>
<tr>
<td><strong>Up to 800 mg/m³:</strong></td>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 800 mg/m³:</strong></td>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode* (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter* (APF = 50) Any self-contained breathing apparatus with a full facepiece (APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 800 mg/m³:</strong></td>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a></td>
</tr>
</tbody>
</table>

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, respiratory tract; dermatitis; gastrointestinal disturbance

### Target Organs
- Eyes, skin, respiratory system, gastrointestinal tract

See also: [INTRODUCTION](#)
<table>
<thead>
<tr>
<th>Ferrovanadium dust</th>
<th>CAS 12604-58-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>FeV</td>
<td>RTECS LK2900000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide</td>
</tr>
<tr>
<td>Ferrovanadium</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*: TWA 1 mg/m³ ST 3 mg/m³ [*Note: The REL also applies to Vanadium metal and Vanadium carbide.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 1 mg/m³</td>
</tr>
</tbody>
</table>

**IDLH** 500 mg/m³

### Conversion

#### Physical Description

Dark, odorless particulate dispersed in air. [Note: Ferrovanadium metal is an alloy usually containing 50-80% vanadium.]

| MW: 106.8 | BP: ? | MLT: 2696-2768°F | Sol: Insoluble |
| VP: 0 mmHg (approx) | IP: NA | Sp.Gr: ? |
| Fl.P: NA | UEL: NA | LEL: NA | MEC: 1.3 g/m³ |

Metal: Noncombustible Solid, but dust may be an explosion hazard.

### Incompatibilities & Reactivities

Strong oxidizers

### Measurement Methods

OSHA ID121, ID125G

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

Skin: No recommendation
Eyes: No recommendation
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

### First Aid

(See procedures)

Eye: Irrigate immediately
Breathing: Respiratory support
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 5 mg/m³:**
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.*

**Up to 10 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

**Up to 25 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

**Up to 50 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 500 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms** Irritation eyes, respiratory system; in animals: bronchitis, pneumonitis

**Target Organs** Eyes, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Fibrous glass dust

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS LK3651000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Fiber glass®; Fiberglass; Glass fibers; Glass wool [Note: Usually produced from borosilicate & low alkali silicate glasses.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 3 fibers/cm³ (fibers with diameter &lt; or = 3.5 µm &amp; length &gt; or = 10 µm.)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 5 mg/m³ (total)</td>
<td></td>
</tr>
</tbody>
</table>

| OSHA PEL: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

### Physical Description
Typically, glass filaments >3 µm in diameter or glass "wool" with diameters down to 0.05 µm & length > 1 µm.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0 mmHg (approx)</td>
<td>IP: NA</td>
<td>Sp.Gr: 2.5</td>
<td></td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
<td>LEL: NA</td>
<td></td>
</tr>
</tbody>
</table>

### Noncombustible Fibers

### Incompatibilities & Reactivities
None reported

### Measurement Methods
NIOSH 7400
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: Daily
- **Remove**: No recommendation
- **Change**: Daily

### First Aid

- **Eye**: Irrigate immediately
- **Breathing**: Fresh air

---

**NOTE**: Usually produced from borosilicate & low alkali silicate glasses.
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 5X REL:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 10X REL:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

Up to 25X REL:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 50X REL:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 1000X REL:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; dyspnea (breathing difficulty)

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
# Fluorine

**CAS** 7782-41-4  
**RTECS** LM64750000

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorine-19</td>
<td>9192 167 (cryogenic liquid) 1045 124</td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA</th>
<th>OSHA PEL: TWA</th>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 ppm (0.2 mg/m³)</td>
<td>0.1 ppm (0.2 mg/m³)</td>
<td>25 ppm</td>
<td>1 ppm = 1.55 mg/m³</td>
</tr>
</tbody>
</table>

## Physical Description

Pale-yellow to greenish gas with a pungent, irritating odor.

- MW: 38.0
- BP: -307°F
- FRZ: -363°F
- Sol: Reacts
- VP: >1 atm
- IP: 15.70 eV
- RGasD: 1.31
- Fl.P: NA
- UEL: NA
- LEL: NA

Nonflammable Gas, but an extremely strong oxidizer.

## Incompatibilities & Reactivities

Water, nitric acid, oxidizers, organic compounds [Note: Reacts violently with all combustible materials, except the metal containers in which it is shipped. Reacts with H₂O to form hydrofluoric acid.]

## Measurement Methods

None available  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

| Skin: Prevent skin contact (liquid) |
| Eyes: Prevent eye contact (liquid) |
| Wash skin: When contaminated (liquid) |
| Remove: When wet or contaminated (liquid) |
| Change: No recommendation |
| Provide: Eyewash (liquid), Quick drench (liquid) |

## First Aid

| Eye: Irrigate immediately |
| Skin: Water flush immediately |
| Breathing: Respiratory support |
**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH/OSHA

<table>
<thead>
<tr>
<th>Concentration Limit</th>
<th>APF</th>
<th>Recommended Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1 ppm</td>
<td>10</td>
<td>Any supplied-air respirator*</td>
</tr>
<tr>
<td>Up to 2.5 ppm</td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>Up to 5 ppm</td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>Up to 25 ppm</td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

<table>
<thead>
<tr>
<th>Concentration Limit</th>
<th>APF</th>
<th>Recommended Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1 ppm</td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Up to 25 ppm</td>
<td>10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td>Escape</td>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms** Irritation eyes, nose, respiratory system; laryngeal spasm, wheezing; pulmonary edema; eye, skin burns; in animals: liver, kidney damage

**Target Organs** Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
# Fluorotrichloromethane

<table>
<thead>
<tr>
<th>CAS</th>
<th>75-69-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>PB6125000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Freon® 11
- Monofluorotrichloromethane
- Refrigerant 11
- Trichlorofluoromethane
- Trichloromonofluoromethane

## Exposure Limits
- NIOSH REL: C 1000 ppm (5600 mg/m³)
- OSHA PEL†: TWA 1000 ppm (5600 mg/m³)
- IDLH: 2000 ppm

## Conversion
1 ppm = 5.62 mg/m³

## Physical Description
- Colorless to water-white, nearly odorless liquid or gas (above 75°F).
- MW: 137.4
- BP: 75°F
- FRZ: -168°F
- Sol(75°F): 0.1%
- VP: 690 mmHg
- IP: 11.77 eV
- RGasD: 4.74
- Sp.Gr: 1.47 (Liquid at 75°F)
- Fl.P: NA
- UEL: NA
- LEL: NA

## Incompatibilities & Reactivities
- Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc, magnesium & lithium shavings; granular barium

## Measurement Methods
- NIOSH 1006
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: No recommendation
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

## First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

**Up to 2000 ppm:**
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite

**Target Organs** skin, respiratory system, cardiovascular system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Fluoroxene

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>CAS 406-90-6</th>
<th>RTECS KO4250000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,2,2-Trifluoroethoxyethene; 2,2,2-Trifluoroethyl vinyl ether</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*: C 2 ppm (10.3 mg/m³) [60-minute] [*Note: REL for exposure to waste anesthetic gas.]</th>
<th>OSHA PEL: none</th>
</tr>
</thead>
</table>

### Physical Description

| MW: 126.1 | BP: 109°F | FRZ: ? |
| VP: 286 mmHg | IP: ? | Sol: ? |

Combustible Liquid [potentially EXPLOSIVE!]

### Incompatibilities & Reactivities

None reported

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

Skin: No recommendation
Eyes: Prevent eye contact
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

### First Aid (See procedures )

Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes; central nervous system depression, analgesia, anesthesia, convulsions, respiratory depression

### Target Organs

Eyes, central nervous system

See also: INTRODUCTION
**Fonofos**

<table>
<thead>
<tr>
<th>CAS 944-22-9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₁₀H₁₅OPS₂</strong></td>
</tr>
<tr>
<td>RTECS TA5950000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
</tr>
<tr>
<td>Dyfonate®; Dyphonate; O-Ethyl-S-phenyl ethylphosphorothioate; Fonophos</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
</tbody>
</table>

| **Exposure Limits** |
| NIOSH REL: TWA 0.1 mg/m³ [skin] |
| OSHA PEL†: none |
| IDLH N.D. |

| **Conversion** |
| 1 ppm = 10.07 mg/m³ |

| **Physical Description** |
| Light-yellow liquid with an aromatic odor. [insecticide] |
| MW: 246.3 | BP: ? | FRZ: ? | Sol: 0.001% |
| VP(77°F): 0.0002 mmHg | IP: ? | Sp.Gr: 1.15 |
| Fl.P: >201°F | UEL: ? | LEL: ? |

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

| **Incompatibilities & Reactivities** |
| None reported |

| **Measurement Methods** |
| NIOSH 5600 ; OSHA PV2027 |
| See: NMAM or OSHA Methods |

| **Personal Protection & Sanitation** (See protection ) |
| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: Daily |
| Provide: Eyewash, Quick drench |

| **First Aid** (See procedures ) |
| Eye: Irrigate immediately |
| Skin: Soap flush immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

**Important additional information about respirator selection**

| **Respirator Recommendations** |
| Not available. |

| **Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact |

| **Symptoms** Nausea, vomiting, abdominal cramps, diarrhea, salivation; headache, dizziness, lassitude (weakness, exhaustion); rhinorrhea (discharge of thin mucus), chest tightness; blurred vision, miosis; cardiac irregularities; muscle fasciculation; dyspnea (breathing difficulty) |

| **Target Organs** respiratory system, central nervous system, cardiovascular system, blood cholinesterase |

See also: INTRODUCTION
### Formaldehyde

**CAS**: 50-00-0

**RTECS**: LP8925000

**Synonyms & Trade Names**
Methanal, Methyl aldehyde, Methylene oxide

**Exposure Limits**
- NIOSH REL: Ca TWA 0.016 ppm C 0.1 ppm [15-minute] See Appendix A
- OSHA PEL: [1910.1048] TWA 0.75 ppm ST 2 ppm

**IDLH**: Ca [20 ppm]

**Conversion**: 1 ppm = 1.23 mg/m³

**Physical Description**
Nearly colorless gas with a pungent, suffocating odor. [Note: Often used in an aqueous solution (see specific listing for Formalin).]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>30.0</td>
</tr>
<tr>
<td>BP</td>
<td>-6°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-134°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Miscible</td>
</tr>
<tr>
<td>VP</td>
<td>&gt;1 atm</td>
</tr>
<tr>
<td>IP</td>
<td>10.88 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>1.04</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA (Gas)</td>
</tr>
<tr>
<td>UEL</td>
<td>73%</td>
</tr>
<tr>
<td>LEL</td>
<td>7.0%</td>
</tr>
</tbody>
</table>

**Incompatibilities & Reactivities**
Strong oxidizers, alkalis & acids; phenols; urea [Note: Pure formaldehyde has a tendency to polymerize. Reacts with HCl to form bis-Chloromethyl ether.]

**Measurement Methods**
NIOSH 2016, 2541, 3500, 3800; OSHA ID205, 52
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)
- Skin: No recommendation
- Eyes: Prevent eye contact
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

**First Aid** (See procedures)
- Eye: Irrigate immediately
- Breathing: Respiratory support

**Important additional information about respirator selection**

**Respirator Recommendations** (See Appendix E) NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(\(APF = 10,000\)) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(\(APF = 10,000\)) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:
(\(APF = 50\)) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, nose, throat, respiratory system; lacrimation (discharge of tears); cough; wheezing; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, respiratory system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[nasal cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
<table>
<thead>
<tr>
<th>Formalin (as formaldehyde)</th>
<th></th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- Formaldehyde solution [Note: Formalin is an aqueous solution that is 37% formaldehyde by weight; inhibited solutions usually contain 6-12% methyl alcohol. Also see specific listings for Formaldehyde and Methyl alcohol.]

### DOT ID & Guide
- DOT ID: 1198 132
- DOT ID: 2209 132

### Exposure Limits
- NIOSH REL: Ca TWA 0.016 ppm C 0.1 ppm [15-minute] See Appendix A
- OSHA PEL: [1910.1048] TWA 0.75 ppm ST 2 ppm

### IDLH Ca [20 ppm]

### Physical Description
- Colorless liquid with a pungent odor.
- MW: Varies
- BP: 214°F
- FRZ: ?
- Sol: Miscible
- VP: 1 mmHg
- IP: ?
- Sp.Gr(77°F): 1.08
- Fl.P: 185°F
- UEL: 73%
- LEL: 7%

### Incompatibilities & Reactivities
- Strong oxidizers, alkalis & acids; phenols; urea; oxides; isocyanates; caustics; anhydrides

### Measurement Methods
- NIOSH 2016, 2541, 3500, 3800; OSHA ID205, 52
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations (See Appendix E) NIOSH
- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, nose, throat, respiratory system; lacrimation (discharge of tears); cough; wheezing, dermatitis; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[nasal cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
## NIOSH Pocket Guide to Chemical Hazards

### Formamide

| CAS 75-12-7 |

#### HCONH₂

| RTECS LQ0525000 |

### Synonyms & Trade Names

- Carbamaldehyde, Methanamide

### Exposure Limits

- NIOSH REL: TWA 10 ppm (15 mg/m³) [skin]
- OSHA PEL†: none

| IDLH N.D. | Conversion 1 ppm = 1.85 mg/m³ |

### Physical Description

- Colorless, oily liquid. [Note: A solid below 37°F.]
- MW: 45.1
- BP: 411°F (Decomposes)
- FRZ: 37°F
- Sol: Miscible
- VP(86°F): 0.1 mmHg
- IP: 10.20 eV
- Sp.Gr: 1.13
- Fl.P(oc): 310°F
- UEL: ?
- LEL: ?

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

- Oxidizers, iodine, pyridine, sulfur trioxide, copper, brass, lead [Note: Hygroscopic (i.e., absorbs moisture from the air).]

### Measurement Methods

- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: No recommendation
- **Eyes**: Prevent eye contact
- **Wash skin**: No recommendation
- **Remove**: No recommendation
- **Change**: No recommendation

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Water wash
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations

- Not available.

### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, skin, mucous membrane; drowsiness, lassitude (weakness, exhaustion); nausea; acidosis; skin eruptions; in animals: reproductive effects

### Target Organs

- Eyes, skin, respiratory system, central nervous system, reproductive system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Formic acid

<table>
<thead>
<tr>
<th>CAS</th>
<th>64-18-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>LQ4900000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Formic acid (85-95% in aqueous solution); Hydrogen carboxylic acid; Methanoic acid

### DOT ID & Guide
1779 153

### Exposure Limits
- NIOSH REL: TWA 5 ppm (9 mg/m³)
- OSHA PEL: TWA 5 ppm (9 mg/m³)

### IDLH
30 ppm

### Conversion
1 ppm = 1.88 mg/m³

### Physical Description
Colorless liquid with a pungent, penetrating odor. [Note: Often used in an aqueous solution.]

<table>
<thead>
<tr>
<th>MW</th>
<th>46.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>224°F (90% solution)</td>
</tr>
<tr>
<td>FRZ</td>
<td>20°F (90% solution)</td>
</tr>
<tr>
<td>Sol</td>
<td>Miscible</td>
</tr>
<tr>
<td>VP</td>
<td>35 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>11.05 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.22 (90% solution)</td>
</tr>
<tr>
<td>Fl.P(oc)</td>
<td>122°F (90% solution)</td>
</tr>
<tr>
<td>UEL</td>
<td>57% (90% solution)</td>
</tr>
<tr>
<td>LEL</td>
<td>18% (90% solution)</td>
</tr>
<tr>
<td>Class</td>
<td>II Combustible Liquid (90% solution)</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
Strong oxidizers, strong caustics, concentrated sulfuric acid [Note: Corrosive to metals.]

### Measurement Methods
NIOSH 2011 ; OSHA ID186SG
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
**Respirator Recommendations** NIOSH/OSHA

**Up to 30 ppm:**
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here]
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes; skin, throat; skin burns, dermatitis; lacrimation (discharge of tears); rhinorrhea (discharge of thin mucus); cough, dyspnea (breathing difficulty); nausea</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
<tr>
<td>See also:</td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
## Furfural

**CAS** 98-01-1

**RTECS** LT7000000

**Synonyms & Trade Names**
Fural, 2-Furancarboxaldehyde, Furfuraldehyde, 2-Furfuraldehyde

**DOT ID & Guide**
1199 132 P

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: See Appendix D</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 5 ppm (20 mg/m³) [skin]</td>
</tr>
<tr>
<td><strong>IDLH</strong> 100 ppm</td>
</tr>
<tr>
<td><strong>Conversion</strong> 1 ppm = 3.93 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

Colorless to amber liquid with an almond-like odor. [Note: Darkens in light and air.]

| MW: 96.1 |
| BP: 323°F |
| FRZ: -34°F |
| Sol: 8% |
| VP: 2 mmHg |
| IP: 9.21 eV |
| Sp.Gr: 1.16 |
| Fl.P: 140°F |
| UEL: 19.3% |
| LEL: 2.1% |

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities

Strong acids, oxidizers, strong alkalis [Note: May polymerize on contact with strong acids or strong alkalis.]

### Measurement Methods

NIOSH 2529 ; OSHA 72

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations OSHA

**Up to 50 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 100 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, upper respiratory system; headache; dermatitis

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
Furfuryl alcohol

CAS 98-00-0

C₅H₆O₂

RTECS LU9100000

Synonyms & Trade Names
2-Furylmethanol, 2-Hydroxymethylfuran

DOT ID & Guide
2874 153

Exposure Limits

NIOSH REL: TWA 10 ppm (40 mg/m³) ST 15 ppm (60 mg/m³) [skin]

OSHA PEL†: TWA 50 ppm (200 mg/m³)

IDLH 75 ppm

Conversion 1 ppm = 4.01 mg/m³

Physical Description
Colorless to amber liquid with a faint, burning odor. [Note: Darkens on exposure to light.]

MW: 98.1
BP: 338°F
FRZ: 6°F
Sol: Miscible

VP(77°F): 0.6 mmHg
IP: ?
Sp.Gr: 1.13

Fl.P: 149°F
UEL: 16.3%
LEL: 1.8%

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

Incompatibilities & Reactivities
Strong oxidizers & acids [Note: Contact with organic acids may lead to polymerization.]

Measurement Methods
NIOSH 2505
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 75 ppm:**

- **(APF = 10)** Any chemical cartridge respirator with organic vapor cartridge(s)*
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor cartridge(s)*
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, mucous membrane; dizziness; nausea, diarrhea; diuresis; respiratory, body temperature depression; vomiting; dermatitis

### Target Organs

- Eyes, skin, respiratory system, central nervous system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Gasoline

<table>
<thead>
<tr>
<th>CAS</th>
<th>8006-61-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>LX3300000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1203 128</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Motor fuel, Motor spirits, Natural gasoline, Petrol [Note: A complex mixture of volatile hydrocarbons (paraffins, cycloparaffins & aromatics).]

### Exposure Limits

| NIOSH REL: Ca | See Appendix A |
| OSHA PEL†     | none           |

### IDLH Ca [N.D.]
Conversion 1 ppm = 4.5 mg/m³ (approx)

### Physical Description
Clear liquid with a characteristic odor.

| VP: 38-300 mmHg  | IP: ?     |       |                |
| Fl.P: -45°F      | UEL: 7.6% | LEL: 1.4% |

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
Strong oxidizers such as peroxides, nitric acid & perchlorates

### Measurement Methods
OSHA PV2028
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet (flammable) |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

### First Aid

| Eye: Irrigate immediately |
| Skin: Soap flush immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

1. **Respirator Recommendations NIOSH**
   - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
   - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, respiratory system, central nervous system, liver, kidneys |
| **Cancer Site** | [in animals: liver & kidney cancer] |

See also: INTRODUCTION
## Germanium tetrahydride

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>RTECS Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeH₄</td>
<td>7782-65-2</td>
<td>LY4900000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Germane, Germanium hydride, Germanomethane, Monogermane [Note: Used chiefly for the production of high purity germanium for use in semiconductors.]

### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 0.2 ppm (0.6 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

**IDLH**: N.D.

### Conversion

1 ppm = 3.13 mg/m³

### Physical Description

Colorless gas with a pungent odor. [Note: Shipped as a compressed gas.]

- MW: 76.6
- BP: -127°F
- FRZ: -267°F
- Sol: Insoluble

### Inflammability

Flammable Gas (may ignite SPONTANEOUSLY in air).

### Incompatibilities & Reactivities

Bromine

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Part</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Eyes</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Wash skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Remove</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Change</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing</td>
<td>Respiratory support</td>
</tr>
</tbody>
</table>

**Important additional information about respirator selection**

**Respirator Recommendations**: Not available.

### Exposure Routes

- Inhalation

### Symptoms

Malaise (vague feeling of discomfort), headache, dizziness, fainting; dyspnea (breathing difficulty); nausea, vomiting; kidney injury; hemolytic effects

### Target Organs

Central nervous system, kidneys, blood

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>Glutaraldehyde</strong></th>
<th><strong>CAS</strong> 111-30-8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OCH(CH₂)₃CHO</strong></td>
<td><strong>RTECS</strong> MA2450000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
<tr>
<td>Glutaric dialdehyde; 1,5-Pentanediial</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th><strong>NIOSH REL:</strong> C 0.2 ppm (0.8 mg/m³) <strong>See Appendix C</strong> (Aldehydes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
<tr>
<td><strong>IDLH</strong> N.D.</td>
<td><strong>Conversion</strong> 1 ppm = 4.09 mg/m³</td>
</tr>
</tbody>
</table>

**Physical Description**
Colorless liquid with a pungent odor.

- MW: 100.1
- BP: 212°F
- FRZ: 7°F
- Sol: Miscible
- VP: 17 mmHg
- IP: ?
- Sp.Gr: 1.10
- FL.P: NA
- UEL: NA
- LEL: NA

Noncombustible Liquid

**Incompatibilities & Reactivities**
Strong oxidizers, strong bases [Note: Alkaline solutions of glutaraldehyde (i.e., activated glutaraldehyde) react with alcohol, ketones, amines, hydrazines & proteins.]

**Measurement Methods**
NIOSH 2532 ; OSHA 64
See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection )**
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

**First Aid (See procedures )**
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**
**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; dermatitis, sensitization skin; cough, asthma; nausea, vomiting

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Glycerin (mist)

<table>
<thead>
<tr>
<th>CAS: 56-81-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS: MA8050000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Glycerin (anhydrous); Glycerol; Glycyl alcohol; 1,2,3-Propanetriol; Trihydroxypropane

### Exposure Limits

| NIOSH REL: | See Appendix D |
|------------|
| OSHA PEL†: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

| IDLH: N.D. |
| Conversion |

### Physical Description

Clear, colorless, odorless, syrupy liquid or solid (below 64°F). [Note: The solid form melts above 64°F but the liquid form freezes at a much lower temperature.]

- MW: 92.1
- BP: 554°F (Decomposes)
- MLT: 64°F
- Sol: Miscible
- VP(122°F): 0.003 mmHg
- IP: ?
- Sp.Gr: 1.26
- Fl.P: 320°F
- UEL: ?
- LEL: ?

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

Strong oxidizers (e.g., chromium trioxide, potassium chlorate, potassium permanganate) [Note: Hygroscopic (i.e., absorbs moisture from the air).]

### Measurement Methods

NIOSH 0500 , 0600
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid (See procedures )

- Eye: Irrigate immediately
- Skin: Water wash
- Breathing: Fresh air

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes

inhalation, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system; headache, nausea, vomiting; kidney injury

### Target Organs

Eyes, skin, respiratory system, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Glycidol

<table>
<thead>
<tr>
<th>CAS</th>
<th>556-52-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>UB4375000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 2,3-Epoxy-1-propanol; Epoxypropyl alcohol; Glycide; Hydroxymethyl ethylene oxide; 2-Hydroxymethyl oxiran; 3-Hydroxypropylene oxide

### Exposure Limits
| NIOSH REL | TWA 25 ppm (75 mg/m³) |
| OSHA PEL† | TWA 50 ppm (150 mg/m³) |
| IDLH | 150 ppm |

### Conversion
1 ppm = 3.03 mg/m³

### Physical Description
- **Colorless liquid.**
- **MW:** 74.1
- **BP:** 320°F (Decomposes)
- **FRZ:** -49°F
- **Sol:** Miscible
- **VP(77°F):** 0.9 mmHg
- **IP:** ?
- **Fr.P:** 162°F
- **UEL:** ?
- **Sp.Gr:** 1.12

### Incompatibilities & Reactivities
- Strong oxidizers, nitrates

### Measurement Methods
- NIOSH 1608
- OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid (See procedures)
- **Eye:** Irrigate immediately
- **Skin:** Water wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 150 ppm:**
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, nose, throat; narcosis</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Glycolonitrile

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS AM0350000</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
- Cyanomethanol
- Formaldehyde cyanohydrin
- Glycolic nitrile
- Glyconitrile
- Hydroxyacetoniitrile

**Exposure Limits**
- NIOSH REL: C 2 ppm (5 mg/m³) [15-minute]
- OSHA PEL: none

**IDLH** N.D.

**Conversion** 1 ppm = 2.34 mg/m³

## Physical Description
- Colorless, odorless, oily liquid. [Note: Forms cyanide in the body.]
- MW: 57.1
- BP: 361°F (Decomposes)
- FRZ: < -98°F
- Sol: Soluble
- VP(145°F): 1 mmHg
- IP: ?
- UEL: ?
- Sp.Gr(66°F): 1.10
- LEL: ?

**Incompatibilities & Reactivities**
- Traces of alkalis (promote violent polymerization)

## Measurement Methods
- None available
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

## First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 20 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 50 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 100 ppm:**
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 250 ppm:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/ Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; headache, dizziness, lassitude (weakness, exhaustion), confusion, convulsions; dyspnea (breathing difficulty); abdominal pain, nausea, vomiting

**Target Organs** Eyes, skin, respiratory system, central nervous system, cardiovascular system

See also: INTRODUCTION
### Grain dust (oat, wheat, barley)

**Synonyms & Trade Names**
None [Note: Grain dust consists of 60-75% organic materials (cereal grains) & 25-40% inorganic materials (soil), and includes fertilizers, pesticides & microorganisms.]

**Exposure Limits**
- NIOSH REL: TWA 4 mg/m³
- OSHA PEL: TWA 10 mg/m³

**Physical Description**
Mixture of grain and all the other substances associated with its cultivation & harvesting. Properties depend upon the specific component of the grain dust.

**Incompatibilities & Reactivities**
None reported

**Measurement Methods**
NIOSH 0500
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: Daily

**First Aid** *(See procedures)*
- Eye: Irrigate immediately
- Breathing: Fresh air

**Important additional information about respirator selection**
- Respirator Recommendations: Not available.

**Exposure Routes**
inhalation, skin and/or eye contact

**Symptoms**
Irritation eyes, skin, upper respiratory system; cough, dyspnea (breathing difficulty), wheezing, asthma, bronchitis, chronic obstructive pulmonary disease; conjunctivitis, dermatitis, rhinitis, grain fever

**Target Organs**
Eyes, skin, respiratory system

See also: INTRODUCTION
# Graphite (natural)

<table>
<thead>
<tr>
<th>CAS</th>
<th>7782-42-5</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**  
Black lead, Mineral carbon, Plumbago, Silver graphite, Stove black [Note: Also see specific listing for Graphite (synthetic).]

**Exposure Limits**  
NIOSH REL: TWA 2.5 mg/m³ (resp)  
OSHA PEL†: TWA 15 mppcf

**Physical Description**  
Steel gray to black, greasy feeling, odorless solid.

| MW: 12.0 | BP: Sublimes | MLT: 6602°F (Sublimes) | Sol: Insoluble |
| VP: 0 mmHg (approx) | IP: NA |  | Sp.Gr: 2.0-2.25 |
| Fl.P: NA | UEL: NA | LEL: NA |

**Combustible Solid**

**Incompatibilities & Reactivities**  
Very strong oxidizers such as fluorine, chlorine trifluoride & potassium peroxide

**Measurement Methods**  
NIOSH 0500, 0600  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*  
Skin: No recommendation  
Eyes: No recommendation  
Wash skin: No recommendation  
Remove: No recommendation  
Change: No recommendation

**First Aid** *(See procedures)*  
Eye: Irrigate immediately  
Breathing: Fresh air

**Conversion**  
IDLH 1250 mg/m³
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 12.5 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 25 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 62.5 mg/m³:
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 125 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator that has a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 1250 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Cough, dyspnea (breathing difficulty), black sputum, decreased pulmonary function, lung fibrosis

Target Organs respiratory system, cardiovascular system

See also: INTRODUCTION
**Graphite (synthetic)**

<table>
<thead>
<tr>
<th>CAS</th>
<th>7440-44-0 (synthetic)</th>
</tr>
</thead>
</table>

**C**

<table>
<thead>
<tr>
<th>RTECS</th>
<th>FF5250100 (synthetic)</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**

Acheson graphite, Artificial graphite [Note: Also see specific listing for Graphite (natural).]

**DOT ID & Guide**

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix D</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>OSHA PEL†:</th>
<th>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

**Physical Description**

Steel gray to black, greasy feeling, odorless solid.

<table>
<thead>
<tr>
<th>MW:</th>
<th>12.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP:</td>
<td>Sublimes</td>
</tr>
<tr>
<td>MLT:</td>
<td>6602°F (Sublimes)</td>
</tr>
<tr>
<td>Sol:</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP:</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP:</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr:</td>
<td>1.5-1.8</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>NA</td>
</tr>
<tr>
<td>UEL:</td>
<td>NA</td>
</tr>
<tr>
<td>LEL:</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Incompatibilities & Reactivities**

Very strong oxidizers such as fluorine, chlorine trifluoride & potassium peroxide

**Measurement Methods**

NIOSH 0500, 0600

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

Skin: No recommendation

Eyes: No recommendation

Wash skin: No recommendation

Remove: No recommendation

Change: No recommendation

**First Aid** *(See procedures)*

Eye: Irrigate immediately

Breathing: Fresh air

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes**

inhalation, skin and/or eye contact

**Symptoms**

Cough, dyspnea (breathing difficulty), black sputum, decreased pulmonary function, lung fibrosis

**Target Organs**

respiratory system, cardiovascular system

See also: **INTRODUCTION**
# Gypsum

**CAS** 13397-24-5  
**RTECS** MG2360000

## Synonyms & Trade Names
Calcium(II) sulfate dihydrate, Gypsum stone, Hydrated calcium sulfate, Mineral white  
[Note: Gypsum is the dihydrate form of calcium sulfate; Plaster of Paris is the hemihydrate form.]

## Exposure Limits

| NIOSH REL | TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL | TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

**IDLH** N.D.

## Physical Description
White or nearly white, odorless, crystalline solid.

| MW: 172.2 | BP: ? |
| VP: 0 mmHg (approx) | IP: NA |
| Fl.P: NA | UEL: NA |

## Incompatibilities & Reactivities
Noncombustible Solid  
Aluminum (at high temperatures), diazomethane

## Measurement Methods
NIOSH 0500, 0600  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
**Skin:** No recommendation  
**Eyes:** No recommendation  
**Wash skin:** No recommendation  
**Remove:** No recommendation  
**Change:** No recommendation

## First Aid
**Eye:** Irrigate immediately  
**Breathing:** Fresh air

## Important additional information about respirator selection
**Respirator Recommendations** Not available.

## Exposure Routes
inhalation, skin and/or eye contact

## Symptoms
Irritation eyes, skin, mucous membrane, upper respiratory system; cough, sneezing, rhinorrhea (discharge of thin mucus)

## Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Hafnium

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>7440-58-6</td>
</tr>
<tr>
<td>RTECS</td>
<td>MG4600000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1326 170 (powder, wet)</td>
</tr>
<tr>
<td></td>
<td>2545 135 (powder, dry)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Celtium
- Elemental hafnium
- Hafnium metal

### Exposure Limits

- **NIOSH REL**: TWA 0.5 mg/m³ [*Note: The REL also applies to other hafnium compounds (as Hf).]*
- **OSHA PEL**: TWA 0.5 mg/m³ [*Note: The PEL also applies to other hafnium compounds (as Hf).*]

- **IDLH**: 50 mg/m³ (as Hf)

### Conversion

- **Physical Description**
  - Highly lustrous, ductile, grayish solid.
  - MW: 178.5
  - BP: 8316°F
  - MLT: 4041°F
  - Sol: Insoluble
  - VP: 0 mmHg (approx)
  - IP: NA
  - Sp.Gr: 13.31
  - Fl.P: NA
  - UEL: NA
  - LEL: NA

### Incompatibilities & Reactivities
- Strong oxidizers, chlorine
- Explosive in powder form (either dry or with <25% water); finely divided powder can be ignited by static electricity or even SPONTANEOUSLY.

### Measurement Methods
- NIOSH S194 (II-5) ; OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated/Daily
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

---

*Authored in PDF format by Industrial Hygiene Services; www.ihresources.com*
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 2.5 mg/m³:**
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 5 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

**Up to 12.5 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

**Up to 25 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 50 mg/m³:**
(APF = 1000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
In animals: irritation eyes, skin, mucous membrane; liver damage

### Target Organs
Eyes, skin, mucous membrane, liver

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Halothane

<table>
<thead>
<tr>
<th>CAS</th>
<th>151-67-7</th>
</tr>
</thead>
</table>

### CF$_3$CHBrCl

<table>
<thead>
<tr>
<th>RTECS</th>
<th>KH6550000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

- 1-Bromo-1-chloro-2,2,2-trifluoroethane
- 2-Bromo-2-chloro-1,1,1-trifluoroethane
- 1,1,1-Trifluoro-2-bromo-2-chloroethane
- 2,2,2-Trifluoro-1-bromo-1-chloroethane

### DOT ID & Guide

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*</th>
<th>C 2 ppm (16.2 mg/m$^3$) [60-minute] [*Note: REL for exposure to waste anesthetic gas.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

### Conversion

1 ppm = 8.07 mg/m$^3$

### Physical Description

Clear, colorless liquid with a sweetish, pleasant odor. [inhalation anesthetic]

<table>
<thead>
<tr>
<th>MW</th>
<th>197.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>122°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-180°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.3%</td>
</tr>
<tr>
<td>VP</td>
<td>243 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.87</td>
</tr>
<tr>
<td>FI.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Liquid

### Incompatibilities & Reactivities

May attack rubber & some plastics; sensitive to light. [Note: Light causes decomposition. May be stabilized with 0.01% thymol.]

### Measurement Methods

OSHA 29

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash

### First Aid (See procedures )

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system; confusion, drowsiness, dizziness, nausea, analgesia, anesthesia; cardiac arrhythmias; liver, kidney damage; decreased audio-visual performance; in animals: reproductive effects

### Target Organs

Eyes, skin, respiratory system, cardiovascular system, central nervous system, liver, kidneys, reproductive system

See also: INTRODUCTION
**Heptachlor**  
$C_{10}H_5Cl_7$  
RTECS PC0700000  
CAS 76-44-8  
DOT ID & Guide 2761 151 (organochlorine pesticide, solid)  

### Synonyms & Trade Names  
1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene  

### Exposure Limits  
<table>
<thead>
<tr>
<th>NIOSH REL: Ca TWA 0.5 mg/m³ [skin]</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 0.5 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>IDLH Ca [35 mg/m³]</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description  
White to light-tan crystals with a camphor-like odor. [insecticide]

### MW: 373.4  
BP: 293°F (Decomposes)  
MLT: 203°F  
Sol: 0.0006%  
VP(77°F): 0.0003 mmHg  
IP: ?  
Sp.Gr: 1.66  

Noncombustible Solid, but may be dissolved in flammable liquids.  

### Incompatibilities & Reactivities  
Iron, rust  

### Measurement Methods  
NIOSH S287 (II-5) ; OSHA PV2029  
See: NMAM or OSHA Methods  

### Personal Protection & Sanitation  
(See protection )  
Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated/Daily  
Remove: When wet or contaminated  
Change: Daily  
Provide: Eyewash, Quick drench

### First Aid  
(See procedures )  
Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately

### Important additional information about respirator selection  

### Respirator Recommendations  
NIOSH  
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus  
Escape:  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters. Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes  
inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>In animals: tremor, convulsions; liver damage; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>central nervous system, liver</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## n-Heptane

**CAS**: 142-82-5  
**RTECS**: MI7700000

### Synonyms & Trade Names
- Heptane, normal-Heptane

### DOT ID & Guide
- 1206 128

### Exposure Limits
- **NIOSH REL**: TWA 85 ppm (350 mg/m³) C 440 ppm (1800 mg/m³) [15-minute]
- **OSHA PEL†**: TWA 500 ppm (2000 mg/m³)
- **IDLH**: 750 ppm

### Conversion
- 1 ppm = 4.10 mg/m³

### Physical Description
- Colorless liquid with a gasoline-like odor.
- **MW**: 100.2  
- **BP**: 209°F  
- **FRZ**: -131°F  
- **Sol**: 0.0003%  
- **VP(72°F)**: 40 mmHg  
- **IP**: 9.90 eV  
- **Sp.Gr**: 0.68  
- **Fl.P**: 25°F  
- **UEL**: 6.7%  
- **LEL**: 1.05%

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH 1500 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 750 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 10) Any supplied-air respirator
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness

Target Organs Skin, respiratory system, central nervous system

See also: INTRODUCTION
## 1-Heptanethiol

<table>
<thead>
<tr>
<th>CAS</th>
<th>1639-09-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>MJ1400000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Heptyl mercaptan, n-Heptyl mercaptan

### Exposure Limits
- NIOSH REL: C 0.5 ppm (2.7 mg/m³) [15-minute]
- OSHA PEL: none

### IDLH
- N.D.

### Physical Description
- Colorless liquid with a strong odor.
- MW: 132.3
- BP: 351°F
- FRZ: -46°F
- Sol: Insoluble
- VP: ?
- IP: ?
- Sp.Gr: 0.84
- Fl.P: 115°F
- UEL: ?
- LEL: ?

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivity
- Oxidizers, reducing agents, strong acids & bases, alkali metals

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; lassitude (weakness, exhaustion), cyanosis, increased respiration, nausea, drowsiness, headache, vomiting

**Target Organs** Eyes, skin, respiratory system, central nervous system, blood

See also: INTRODUCTION
### Hexachlorobutadiene

<table>
<thead>
<tr>
<th>CAS</th>
<th>87-68-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl₂C=CCICCl=CCl₂</td>
<td></td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- HCBD; Hexachloro-1,3-butadiene; 1,3-Hexachlorobutadiene; Perchlorobutadiene

#### DOT ID & Guide
- 2279 151

#### Exposure Limits
- NIOSH REL: Ca TWA 0.02 ppm (0.24 mg/m³) [skin] See Appendix A
- OSHA PEL†: none
- IDLH Ca [N.D.]
- Conversion 1 ppm = 10.66 mg/m³

#### Physical Description
- Clear, colorless liquid with a mild, turpentine-like odor.
- MW: 260.7
- BP: 419°F
- FRZ: -6°F
- Sol: Insoluble
- VP: 0.2 mmHg
- IP: ?
- Sp.Gr: 1.55
- Fl.P: ?
- UEL: ?
- LEL: ?

#### Incompatibilities & Reactivities
- Oxidizers

#### Measurement Methods
- NIOSH 2543
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

#### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

#### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
1. (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
2. (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
1. (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
- In animals: irritation eyes, skin, respiratory system; kidney damage; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, kidneys</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: kidney tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
Hexachlorocyclopentadiene

<table>
<thead>
<tr>
<th>CAS 77-47-4</th>
</tr>
</thead>
</table>

**Chemical Information**

**Synonyms & Trade Names**
HCCPD; Hexachloro-1,3-cyclopentadiene; 1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene; Perchlorocyclopentadiene

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.01 ppm (0.1 mg/m³)</th>
</tr>
</thead>
</table>

**Physical Description**
Pale-yellow to amber-colored liquid with a pungent, unpleasant odor. [Note: A solid below 16°F.]

**Incompatibilities & Reactivities**
Water, light [Note: Reacts slowly with water to form hydrochloric acid; will corrode iron & most metals in presence of moisture. Explosive hydrogen gas may collect in enclosed spaces in the presence of moisture.]

**Measurement Methods**
NIOSH 2518
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

**First Aid**
Eye: Irrigate immediately
Skin: Soap flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Exposure Routes**
inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**
Irritation eyes, skin, respiratory system; eye, skin burns; lacrimation (discharge of tears); sneezing, cough, dyspnea (breathing difficulty), salivation, pulmonary edema; nausea, vomiting, diarrhea; in animals: liver, kidney injury

**Target Organs**
Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
## Hexachloroethane

<table>
<thead>
<tr>
<th>CAS</th>
<th>67-72-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KI4025000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Carbon hexachloride
- Ethane hexachloride
- Perchloroethane

### Physical Description
Colorless crystals with a camphor-like odor.

- MW: 236.7
- BP: Sublimes
- MLT: 368°F (Sublimes)
- Sol(72°F): 0.005%
- VP: 0.2 mmHg
- IP: 11.22 eV
- Sp.Gr: 2.09

### Incompatibilities & Reactivities
- Alkalies; metals such as zinc, cadmium, aluminum, hot iron & mercury

### Measurement Methods
- NIOSH 1003
- OSHA 7

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
- **Escape:**
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, mucous membrane; in animals: kidney damage; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, kidneys</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Physical Description</th>
<th>White to light-yellow solid with an aromatic odor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW: 334.9</td>
<td>BP: 650-730°F</td>
</tr>
<tr>
<td>VP: &lt;1 mmHg</td>
<td>MLT: 279°F</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>Sol: Insoluble</td>
</tr>
<tr>
<td>UEL: NA</td>
<td>Sp.Gr: 1.78</td>
</tr>
</tbody>
</table>

**Incompatibilities & Reactivities**
Noncombustible Solid

**Measurement Methods**
NIOSH S100 (II-2)
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated/Daily
Remove: When wet or contaminated
Change: Daily

**First Aid**
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations**
NIOSH/OSHA

**Up to 2 mg/m³:**
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**
inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Acne-form dermatitis, nausea, confusion, jaundice, coma</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, liver</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 1-Hexadecanethiol

<table>
<thead>
<tr>
<th>CAS 2917-26-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CH₃(CH₂)₁₅SH</strong></td>
</tr>
<tr>
<td><strong>RTECS</strong></td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong>&lt;br&gt;Cetyl mercaptan, Hexadecanethiol-1, n-Hexadecanethiol, Hexadecyl mercaptan</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong>&lt;br&gt;1228 131 (liquid)</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C 0.5 ppm (5.3 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: none</td>
</tr>
</tbody>
</table>

**IDLH N.D.**

**Conversion** 1 ppm = 10.59 mg/m³

### Physical Description

Colorless liquid or solid (below 64-68°F) with a strong odor.

- **MW**: 258.5
- **BP**: ?
- **FRZ**: 64-68°F
- **Sol**: Insoluble
- **VP**: 0.1 mmHg
- **IP**: ?
- **Sp.Gr**: 0.85
- **Fl.P**: 215°F
- **UEL**: ?
- **LEL**: ?

Class III B Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

- Oxidizers, strong acids & bases, alkali metals, reducing agents

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily

### First Aid (See procedures)

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; headache, dizziness, lassitude (weakness, exhaustion), cyanosis, nausea, convulsions

**Target Organs** Eyes, skin, respiratory system, central nervous system, blood

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Hexafluoroacetone

<table>
<thead>
<tr>
<th>CAS</th>
<th>684-16-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>UC2450000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Hexafluoro-2-propanone
- 1,1,1,3,3,3-Hexafluoro-2-propanone
- HFA
- Perfluoroacetone

### DOT ID & Guide
- DOT ID & Guide 2420 125

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 0.1 ppm (0.7 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL‡</td>
<td>none</td>
</tr>
</tbody>
</table>

### IDLH
- N.D.

### Conversion
- 1 ppm = 6.79 mg/m³

### Physical Description
- Colorless gas with a musty odor. [Note: Shipped as a liquefied compressed gas.]

### MW
- 166.0

### BP
- -18°F

### FRZ
- -188°F

### Sol
- Reacts

### VP
- 5.8 atm

### IP
- 11.81 eV

### RGasD
- 5.76

### Fl.P
- NA

### UEL
- NA

### LEL
- NA

### Nonflammable Gas, but highly reactive with water & other substances, releasing heat.

### Incompatibilities & Reactivities
- Water, acids [Note: Hygroscopic (i.e., absorbs moisture from the air); reacts with moisture to form a highly acidic sesquihydrate.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact/Frostbite

**Eyes:** Prevent eye contact/Frostbite

**Wash skin:** No recommendation

**Remove:** No recommendation

**Change:** No recommendation

**Provide:** Frostbite wash

### First Aid

**Eye:** Frostbite

**Skin:** Frostbite

**Breathing:** Respiratory support

### Important additional information about respirator selection

**Respirator Recommendations**
- Not available.

### Exposure Routes
- Inhalation, skin absorption, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, mucous membrane, respiratory system; pulmonary edema; liquid: frostbite; in animals: teratogenic, reproductive effects; kidney injury

### Target Organs
- Eyes, skin, respiratory system, kidneys, reproductive system

See also: [INTRODUCTION](#)
Hexamethylene diisocyanate

**CAS** 822-06-0

**OCN[CH₂]₆NCO**

**RTECS** MO1740000

**Synonyms & Trade Names**
1,6-Diisocyanatohexane; HDI; Hexamethylene-1,6-diisocyanate; 1,6-Hexamethylene diisocyanate; HMDI

**DOT ID & Guide** 2281 156

---

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.005 ppm (0.035 mg/m³)</th>
<th>C 0.020 ppm (0.140 mg/m³) [10-minute]</th>
</tr>
</thead>
</table>

*OSHA PEL: none*

**IDLH** N.D.

**Conversion** 1 ppm = 6.88 mg/m³

---

**Physical Description**
Clear, colorless to slightly yellow liquid with a sharp, pungent odor.

<table>
<thead>
<tr>
<th>MW: 168.2</th>
<th>BP: 415°F</th>
<th>FRZ: -89°F</th>
<th>Sol: Low (Reacts)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>VP(77°F): 0.5 mmHg</th>
<th>IP: ?</th>
<th>Sp.Gr(77°F): 1.04</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fl.P: 284°F</th>
<th>UEL: ?</th>
<th>LEL: ?</th>
</tr>
</thead>
</table>

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

---

**Incompatibilities & Reactivities**
Water, alcohols, strong bases, amines, carboxylic acids, organotin catalysts [Note: Reacts slowly with water to form carbon dioxide. Avoid heating above 392°F (polymerizes).]

---

**Measurement Methods**
NIOSH 5521, 5522, 5525; OSHA 42
See: NMAM or OSHA Methods

---

**Personal Protection & Sanitation** (See protection)

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

---

**First Aid** (See procedures)

| Eye: Irrigate immediately |
| Skin: Soap flush immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |
# Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**Up to 0.05 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 0.125 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 0.25 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, skin, respiratory system; cough, dyspnea (breathing difficulty), bronchitis, wheezing, pulmonary edema, asthma; corneal damage, skin blisters

**Target Organs** Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# Hexamethyl phosphoramide

**CAS**: 680-31-9  
**RTECS**: TD0875000

## Synonyms & Trade Names
- Hexamethylphosphoric triamide
- Hexamethylphosphorotriamide
- HMPA
- Tris (dimethylamino)phosphine oxide

## Exposure Limits
- **NIOSH REL**: Ca See Appendix A
- **OSHA PEL**: none

## Physical Description
Clear, colorless liquid with an aromatic or mild, amine-like odor. [Note: A solid below 43°F.]

## MW: 179.2  
**BP**: 451°F  
**FRZ**: 43°F  
**Sol**: Miscible

## VP: 0.03 mmHg  
**IP**: ?  
**Sp.Gr**: 1.03

## Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

## Incompatibilities & Reactivities
- Oxidizers, strong acids, chemically-active metals (e.g., potassium, sodium, magnesium, zinc)

## Measurement Methods
None available  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: No recommendation  
- **Provide**: Eyewash, Quick drench

## First Aid
- **Eye**: Irrigate immediately  
- **Skin**: Water flush immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately

## Important additional information about respirator selection

**Respirator Recommendations NIOSH**

- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

## Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, respiratory system; dyspnea (breathing difficulty); abdominal pain; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system, gastrointestinal tract</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: cancer of the nasal cavity]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
### n-Hexane

CH₃(CH₂)₄CH₃  

**CAS:** 110-54-3  

**RTECS:** MN9275000

### Synonyms & Trade Names

Hexane, Hexyl hydride, normal-Hexane

### DOT ID & Guide

1208 128

### Exposure Limits

| NIOSH REL | TWA 50 ppm (180 mg/m³) |
| OSHA PEL† | TWA 500 ppm (1800 mg/m³) |

**IDLH** 1100 ppm [10%LEL]

### Conversion

1 ppm = 3.53 mg/m³

### Physical Description

Colorless liquid with a gasoline-like odor.

- **MW:** 86.2  
- **BP:** 156°F  
- **FRZ:** -219°F  
- **Sol:** 0.002%  
- **VP:** 124 mmHg  
- **IP:** 10.18 eV  
- **Sp.Gr:** 0.66  
- **Fl.P:** -7°F  
- **UEL:** 7.5%  
- **LEL:** 1.1%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Strong oxidizers

### Measurement Methods

- NIOSH 1500, 3800; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated  
**Remove:** When wet (flammable)  
**Change:** No recommendation

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Soap wash immediately  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 500 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 1100 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose; nausea, headache; peripheral neuropathy: numb extremities, muscle weakness; dermatitis; dizziness; chemical pneumonitis (aspiration liquid)

**Target Organs** Eyes, skin, respiratory system, central nervous system, peripheral nervous system

See also: INTRODUCTION
### Hexane isomers (excluding n-Hexane)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₆H₁₄</td>
<td></td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- Diethylmethylmethane; Diisopropyl; 2,2-Dimethylbutane; 2,3-Dimethylbutane; Isohexane; 2-Methylpentane; 3-Methylpentane [Note: Also see specific listing for n-Hexane.]

#### DOT ID & Guide
- 1208 128

#### Exposure Limits
- NIOSH REL: TWA 100 ppm (350 mg/m³) C 510 ppm (1800 mg/m³) [15-minute]
- OSHA PEL†: none
- IDLH N.D.

#### Conversion
- 1 ppm = 3.53 mg/m³

#### Physical Description
- Clear liquids with mild, gasoline-like odors. [Note: Includes all the isomers of hexane except n-hexane.]
- MW: 86.2
- BP: 122-145°F
- FRZ: -245 to -148°F
- Sol: Insoluble
- VP: ?
- IP: ?
- Fl.P: -54 to 19°F
- UEL: ?
- LEL: ?

#### Incompatibilities & Reactivities
- Strong oxidizers

#### Measurement Methods
- None available
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

#### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 1000 ppm:
(APF = 10) Any supplied-air respirator*

Up to 2500 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

Up to 5000 ppm:
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, respiratory system; headache, dizziness; nausea; chemical pneumonitis (aspiration liquid); dermatitis</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>n-Hexanethiol</strong></th>
<th><strong>CAS</strong> 111-31-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃(CH₂)₅SH</td>
<td><strong>RTECS</strong> MO4550000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
1-Hexanethiol, Hexyl mercaptan, n-Hexyl mercaptan, n-Hexylthiol

**DOT ID & Guide**
1228 131

**Exposure Limits**
- NIOSH REL: C 0.5 ppm (2.7 mg/m³) [15-minute]
- OSHA PEL: none

**IDLH N.D.**

**Conversion**
1 ppm = 4.83 mg/m³

**Physical Description**
Colorless liquid with an unpleasant odor.

<table>
<thead>
<tr>
<th><strong>MW: 118.2</strong></th>
<th><strong>BP: 304°F</strong></th>
<th><strong>FRZ: -113°F</strong></th>
<th><strong>Sol: Insoluble</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VP: ?</strong></td>
<td><strong>IP: ?</strong></td>
<td></td>
<td><strong>Sp.Gr: 0.84</strong></td>
</tr>
<tr>
<td><strong>Fl.P: 68°F</strong></td>
<td><strong>UEL: ?</strong></td>
<td><strong>LEL: ?</strong></td>
<td></td>
</tr>
</tbody>
</table>

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

**Incompatibilities & Reactivities**
Oxidizers, reducing agents, strong acids & bases, alkali metals

**Measurement Methods**
None available
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

**First Aid** *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 5 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
(APF = 10) Any supplied-air respirator

Up to 12.5 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

Up to 25 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; lassitude (weakness, exhaustion), cyanosis, increased respiration, nausea, drowsiness, headache, vomiting

Target Organs Eyes, skin, respiratory system, central nervous system, blood

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2-Hexanone

<table>
<thead>
<tr>
<th>CAS</th>
<th>591-78-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>MP1400000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Butyl methyl ketone, MBK
- Methyl butyl ketone
- Methyl n-butyl ketone

### Physical Description

- Colorless liquid with an acetone-like odor.
- MW: 100.2
- BP: 262°F
- FRZ: -71°F
- Sol: 2%
- VP: 11 mmHg
- IP: 9.34 eV
- Sp.Gr: 0.81
- Fl.P: 77°F
- UEL: 8%
- LEL: ?

### Incompatibilities & Reactivities

- Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.
- Strong oxidizers

### Measurement Methods

- NIOSH 1300, 2555; OSHA PV2031
- See NMAM or OSHA Methods

### Exposure Limits

- NIOSH REL: TWA 1 ppm (4 mg/m³)
- OSHA PEL†: TWA 100 ppm (410 mg/m³)
- IDLH 1600 ppm

### Conversion

1 ppm = 4.10 mg/m³

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
## Important additional information about respirator selection

<table>
<thead>
<tr>
<th>Respirator Recommendations</th>
<th>NIOSH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 10 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 25 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 50 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 1600 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
<td></td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system, peripheral nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Hexone

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-10-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>SA9275000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1245 127</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Isobutyl methyl ketone
- Methyl isobutyl ketone
- 4-Methyl 2-pentanone
- MIBK

### Exposure Limits
- NIOSH REL: TWA 50 ppm (205 mg/m³) ST 75 ppm (300 mg/m³)
- OSHA PEL†: TWA 100 ppm (410 mg/m³)
- IDLH: 500 ppm

### Physical Description
- Colorless liquid with a pleasant odor.
- MW: 100.2
- BP: 242°F
- FRZ: -120°F
- Sol: 2%
- VP: 16 mmHg
- IP: 9.30 eV
- Sp.Gr: 0.80
- Fl.P: 64°F
- UEL(200°F): 8.0%
- LEL(200°F): 1.2%

### Incompatibilities & Reactivities
- Strong oxidizers, potassium tert-butoxide

### Measurement Methods
- NIOSH 1300, 2555; OSHA 1004
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Conversion
- 1 ppm = 4.10 mg/m³
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 500 ppm:

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
### sec-Hexyl acetate

<table>
<thead>
<tr>
<th>Properties</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAS</strong></td>
<td>108-84-9</td>
</tr>
<tr>
<td><strong>RTECS</strong></td>
<td>SA7525000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>1,3-Dimethylbutyl acetate; Methylisoamyl acetate</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1233 130</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA</td>
<td>50 ppm (300 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL: TWA</td>
<td>50 ppm (300 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 500 ppm

### Physical Description

- Colorless liquid with a mild, pleasant, fruity odor.
- MW: 144.2
- BP: 297°F
- FRZ: -83°F
- Sol: 0.08%
- VP: 3 mmHg
- IP: ?
- Sp.Gr: 0.86
- Fl.P: 113°F
- UEL: ?
- LEL: ?

**Class II Combustible Liquid:** Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods

- NIOSH 1450
- OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid

- **Eye:** Irrigate immediately
- **Skin:** Water flush promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

#### Up to 500 ppm:
- **(APF = 10)** Any chemical cartridge respirator with organic vapor cartridge(s)*
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor cartridge(s)*
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, nose, throat; headache; in animals: narcosis</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Hexylene glycol

<table>
<thead>
<tr>
<th>CAS 107-41-5</th>
<th>RTECS SA0810000</th>
</tr>
</thead>
</table>

### Chemical Structure

\[(\text{CH}_3)_2\text{COHCH}_2\text{CHOHCH}_3\]

### Synonyms & Trade Names
2,4-Dihydroxy-2-methylpentane; 2-Methyl-2,4-pentanediol; 4-Methyl-2,4-pentanediol; 2-Methylpentane-2,4-diol

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C 25 ppm (125 mg/m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
</tr>
<tr>
<td>IDLH N.D.</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 4.83 mg/m\(^3\)

### Physical Description

Colorless liquid with a mild, sweetish odor.

- **MW:** 118.2
- **BP:** 388°F
- **FRZ:** -58°F (Sets to glass)
- **Sol:** Miscible
- **VP:** 0.05 mmHg
- **IP:** ?
- **Sp.Gr:** 0.92
- **Fl.P:** 209°F
- **UEL(est):** 7.4%
- **LEL(calc):** 1.3%

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

- Strong oxidizers, strong acids [Note: Hygroscopic (i.e., absorbs moisture from the air).]

### Measurement Methods

- OSHA PV2101
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash

### First Aid

- **Eye:** Irrigate immediately
- **Skin:** Water wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations

- Not available.

### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, skin, respiratory system; headache, dizziness, nausea, incoordination, central nervous system depression; dermatitis, skin sensitization

### Target Organs

- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
## Hydrazine

<table>
<thead>
<tr>
<th>CAS</th>
<th>302-01-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>MU7175000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Diamine, Hydrazine (anhydrous), Hydrazine base

### DOT ID & Guide
- 2029 132 (anhydrous)
- 3293 152 (< or =37% solution)
- 2030 153 (37-64% solution)
- 2029 132 (>64% solution)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca C 0.03 ppm (0.04 mg/m³) [2-hour]</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 1 ppm (1.3 mg/m³) [skin]</td>
<td></td>
</tr>
</tbody>
</table>

### IDLH Ca [50 ppm]

### Physical Description
- Colorless, fuming, oily liquid with an ammonia-like odor. [Note: A solid below 36°F.]
- MW: 32.1
- BP: 236°F
- FRZ: 36°F
- Sol: Miscible
- VP: 10 mmHg
- IP: 8.93 eV
- Sp.Gr: 1.01
- UEL: 98%
- LEL: 2.9%
- Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities
- Oxidizers, hydrogen peroxide, nitric acid, metallic oxides, acids [Note: Can ignite SPONTANEOUSLY on contact with oxidizers or porous materials such as earth, wood & cloth.]

### Measurement Methods
- NIOSH 3503 ; OSHA 20 , 108
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

<table>
<thead>
<tr>
<th>APF = 10,000</th>
<th>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>APF = 10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

### Escape
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin, nose, throat; temporary blindness; dizziness, nausea; dermatitis; eye, skin burns; in animals: bronchitis, pulmonary edema; liver, kidney damage; convulsions; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system, liver, kidneys</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[in animals: tumors of the lungs, liver, blood vessels &amp; intestine]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Hydrogenated terphenyls

<table>
<thead>
<tr>
<th>CAS</th>
<th>61788-32-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>WZ6535000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Hydrogenated diphenylbenzenes, Hydrogenated phenylbiphenyls, Hydrogenated triphenyls

[Note: Complex mixture of terphenyl isomers that are partially hydrogenated.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA</th>
<th>0.5 ppm (5 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
</tbody>
</table>

**IDLH**: N.D.

### Conversion

1 ppm = 12.19 mg/m³ (40% hydrogenated)

### Physical Description

Clear, oily, pale-yellow liquids with a faint odor. [plasticizer/heat-transfer media]

- MW: 298 (40% hydrogenated)
- BP: 644°F (40% hydrogenated)
- FRZ: ?
- Sol: Insoluble
- VP: ?
- IP: ?
- Sp.Gr(77°F): 1.003-1.009 (40% hydrogenated)
- Fl.P: 315°F (40% hydrogenated)
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities

None reported [Note: When heated, irritating vapors will be released.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin**: Prevent skin contact

**Eyes**: Prevent eye contact

**Wash skin**: When contaminated

**Remove**: When wet or contaminated

**Change**: Daily

### First Aid

**Eye**: Irrigate immediately

**Skin**: Soap wash immediately

**Breathing**: Respiratory support

**Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations**: Not available.

### Exposure Routes

Inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system; liver, kidney, hematopoietic damage

### Target Organs

Eyes, skin, respiratory system, liver, kidneys, hematopoietic system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Hydrogen bromide

### CAS
- 10035-10-6

### RTECS
- MW3850000

### DOT ID & Guide
- 1048 125 (anhydrous)
- 1788 154 (solution)

### Synonyms & Trade Names
- Anhydrous hydrogen bromide
- Aqueous hydrogen bromide (i.e., Hydrobromic acid)

### Exposure Limits
- NIOSH REL: C 3 ppm (10 mg/m³)
- OSHA PEL†: TWA 3 ppm (10 mg/m³)

### IDLH
- 30 ppm

### Conversion
- 1 ppm = 3.31 mg/m³

### Physical Description
- Colorless gas with a sharp, irritating odor. [Note: Shipped as a liquefied compressed gas. Often used in an aqueous solution.]
- MW: 80.9
- BP: -88°F
- FRZ: -124°F
- Sol: 49%
- VP: 20 atm
- IP: 11.62 eV
- RGasD: 2.81
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Strong oxidizers, strong caustics, moisture, copper, brass, zinc [Note: Hydrobromic acid is highly corrosive to most metals.]

### Measurement Methods
- NIOSH 7903 ; OSHA ID165SG
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact (solution)/Frostbite
- **Eyes**: Prevent eye contact (solution)/Frostbite
- **Wash skin**: When contaminated (solution)
- **Remove**: When wet or contaminated (solution)
- **Change**: No recommendation
- **Provide**: Eyewash (liquid), Quick drench (solution), Frostbite wash

### First Aid
- **Eye**: Irrigate immediately (solution)/Frostbite
- **Skin**: Water flush immediately (solution)/Frostbite
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately (solution)
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 30 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered, air-purifying respirator with acid gas cartridge(s)

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister

Any appropriate escape-type, self-contained breathing apparatus

---

### Exposure Routes

- Inhalation, ingestion (solution), skin and/or eye contact

### Symptoms

- Irritation eyes, skin, nose, throat; solution: eye, skin burns; liquid: frostbite

### Target Organs

- Eyes, skin, respiratory system

---

See also: INTRODUCTION
## Hydrogen chloride

### CAS

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS MW4025000</th>
</tr>
</thead>
<tbody>
<tr>
<td>7647-01-0</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Anhydrous hydrogen chloride; Aqueous hydrogen chloride (i.e., Hydrochloric acid, Muriatic acid) [Note: Often used in an aqueous solution.]

### DOT ID & Guide

<table>
<thead>
<tr>
<th>Anhydrous</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1050 125</td>
<td>1789 157</td>
</tr>
</tbody>
</table>

### Exposure Limits

- **NIOSH REL:** C 5 ppm (7 mg/m³)
- **OSHA PEL:** C 5 ppm (7 mg/m³)

<table>
<thead>
<tr>
<th>IDLH</th>
<th>50 ppm</th>
</tr>
</thead>
</table>

- **Conversion:** 1 ppm = 1.49 mg/m³

### Physical Description

Colorless to slightly yellow gas with a pungent, irritating odor. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>MW:</th>
<th>36.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP:</td>
<td>-121°F</td>
</tr>
<tr>
<td>FRZ:</td>
<td>-174°F</td>
</tr>
<tr>
<td>Sol(86°F):</td>
<td>67%</td>
</tr>
<tr>
<td>VP:</td>
<td>40.5 atm</td>
</tr>
<tr>
<td>IP:</td>
<td>12.74 eV</td>
</tr>
<tr>
<td>RGasD:</td>
<td>1.27</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>NA</td>
</tr>
<tr>
<td>UEL:</td>
<td>NA</td>
</tr>
<tr>
<td>LEL:</td>
<td>NA</td>
</tr>
</tbody>
</table>

Nonflammable Gas

### Incompatibilities & Reactivities

Hydroxides, amines, alkalis, copper, brass, zinc [Note: Hydrochloric acid is highly corrosive to most metals.]

### Measurement Methods

- NIOSH 7903 ; OSHA ID174SG
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Prevent skin contact (solution)/Frostbite
- **Eyes:** Prevent eye contact/Frostbite
- **Wash skin:** When contaminated (solution)
- **Remove:** When wet or contaminated (solution)
- **Change:** No recommendation
- **Provide:** Eyewash (solution), Quick drench (solution), Frostbite wash

### First Aid

- **Eye:** Irrigate immediately (solution)/Frostbite
- **Skin:** Water flush immediately (solution)/Frostbite
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately (solution)
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 50 ppm:**
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern*
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern*
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion (solution), skin and/or eye contact

**Symptoms** Irritation nose, throat, larynx; cough, choking; dermatitis; solution: eye, skin burns; liquid: frostbite; in animals: laryngeal spasm; pulmonary edema

**Target Organs** Eyes, skin, respiratory system

See also: **INTRODUCTION**
# Hydrogen cyanide (HCN)

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>CAS 74-90-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formonitrile, Hydrocyanic acid, Prussic acid</td>
<td>RTECS MW6825000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: ST 4.7 ppm (5 mg/m³) [skin]</td>
<td>1051 117 (&gt;20% solution)</td>
</tr>
<tr>
<td>OSHA PEL†: TWA 10 ppm (11 mg/m³) [skin]</td>
<td>1051 117 (anhydrous)</td>
</tr>
<tr>
<td>IDLH 50 ppm</td>
<td>1613 154 (&lt; or =20% solution)</td>
</tr>
</tbody>
</table>

## Physical Description
Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. [Note: Often used as a 96% solution in water.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW:</td>
<td>27.0</td>
</tr>
<tr>
<td>BP:</td>
<td>78°F (96%)</td>
</tr>
<tr>
<td>FRZ:</td>
<td>7°F (96%)</td>
</tr>
<tr>
<td>Sol:</td>
<td>Miscible</td>
</tr>
<tr>
<td>VP:</td>
<td>630 mmHg</td>
</tr>
<tr>
<td>IP:</td>
<td>13.60 eV</td>
</tr>
<tr>
<td>Sp.Gr:</td>
<td>0.69</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>0°F (96%)</td>
</tr>
<tr>
<td>UEL:</td>
<td>40.0%</td>
</tr>
<tr>
<td>LEL:</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

Class IA Flammable Liquid Flammable Gas

## Incompatibilities & Reactivities
Amines, oxidizers, acids, sodium hydroxide, calcium hydroxide, sodium carbonate, caustics, ammonia [Note: Can polymerize at 122-140°F.]

## Measurement Methods
NIOSH 6010, 6017
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

## First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 47 ppm:**
- APF = 10 Any supplied-air respirator

**Up to 50 ppm:**
- APF = 25 Any supplied-air respirator operated in a continuous-flow mode
- APF = 50 Any self-contained breathing apparatus with a full facepiece
- APF = 50 Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- APF = 10,000 Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- APF = 10,000 Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- APF = 50 Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

---

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Asphyxia; lassitude (weakness, exhaustion), headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes

**Target Organs** central nervous system, cardiovascular system, thyroid, blood

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Hydrogen fluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>7664-39-3</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

- Anhydrous hydrogen fluoride
- Aqueous hydrogen fluoride (i.e., Hydrofluoric acid); HF-A

### DOT ID & Guide

- 1052 125 (anhydrous)
- 1790 157 (solution)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 3 ppm (2.5 mg/m³) C 6 ppm (5 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 3 ppm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>30 ppm</th>
</tr>
</thead>
</table>

### Conversion

1 ppm = 0.82 mg/m³

### Physical Description

- Colorless gas or fuming liquid (below 67°F) with a strong, irritating odor. [Note: Shipped in cylinders.]
- MW: 20.0
- BP: 67°F
- FRZ: -118°F
- Sol: Miscible
- VP: 783 mmHg
- IP: 15.98 eV
- RGasD: 1.86
- Sp.Gr: 1.00 (Liquid at 67°F)
- Fl.P: NA
- UEL: NA
- LEL: NA

### Nonflammable Gas

### Incompatibilities & Reactivities

- Metals, water or steam [Note: Corrosive to metals. Will attack glass and concrete.]

### Measurement Methods

- NIOSH 3800, 7902, 7903, 7906; OSHA ID110
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact (liquid)
- **Eyes**: Prevent eye contact (liquid)
- **Wash skin**: When contaminated (liquid)
- **Remove**: When wet or contaminated (liquid)
- **Change**: No recommendation
- **Provide**: Eyewash (liquid), Quick drench (liquid)

### First Aid

- **Eye**: Irrigate immediately (solution/liquid)
- **Skin**: Water flush immediately (solution/liquid)
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately (solution)
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 30 ppm:**
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern*
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern*
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption (liquid), ingestion (solution), skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; pulmonary edema; eye, skin burns; rhinitis; bronchitis; bone changes

**Target Organs** Eyes, skin, respiratory system, bones

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Hydrogen peroxide

### CAS 7722-84-1

### RTECS MX0900000

### DOT ID & Guide
- 2984 140 (8-20% solution)
- 2014 140 (20-60% solution)
- 2015 143 (>60% solution)

### Physical Description
- Colorless liquid with a slightly sharp odor. [Note: The pure compound is a crystalline solid below 12°F. Often used in an aqueous solution.]
- MW: 34.0
- BP: 286°F
- FRZ: 12°F
- Sol: Miscible
- VP(86°F): 5 mmHg
- IP: 10.54 eV
- Sp.Gr: 1.39
- Fl.P: NA
- UEL: NA
- LEL: NA

### Noncombustible Liquid, but a powerful oxidizer.

### Incompatibilities & Reactivities
- Oxidizable materials, iron, copper, brass, bronze, chromium, zinc, lead, silver, manganese. [Note: Contact with combustible material may result in SPONTANEOUS combustion.]

### Measurement Methods
- OSHA ID126SG
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Exposure Limits
- NIOSH REL: TWA 1 ppm (1.4 mg/m³)
- OSHA PEL: TWA 1 ppm (1.4 mg/m³)
- IDLH 75 ppm

### Conversion
- 1 ppm = 1.39 mg/m³

### Synonyms & Trade Names
- High-strength hydrogen peroxide, Hydrogen dioxide, Hydrogen peroxide (aqueous), Hydroperoxide, Peroxide
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 10 ppm:**
(APF = 10) Any supplied-air respirator*

**Up to 25 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 50 ppm:**
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 75 ppm:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

---

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose, throat; corneal ulcer; erythema (skin redness), skin vesiculation; bleaching hair

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
## Hydrogen selenide

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7783-07-5</td>
<td>MX1050000</td>
<td>Selenium dihydride, Selenium hydride</td>
<td>2202 117 (anhydrous)</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>IDLH 1 ppm</th>
<th>Conversion 1 ppm = 3.31 mg/m³</th>
</tr>
</thead>
</table>

### Physical Description

Colorless gas with an odor resembling decayed horseradish. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>MW: 81.0</th>
<th>BP: -42°F</th>
<th>FRZ: -87°F</th>
<th>Sol(73°F): 0.9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(70°F): 9.5 atm</td>
<td>IP: 9.88 eV</td>
<td>RGasD: 2.80</td>
<td></td>
</tr>
<tr>
<td>Fl.P: NA (Gas)</td>
<td>UEL: ?</td>
<td>LEL: ?</td>
<td></td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Strong oxidizers, acids, water, halogenated hydrocarbons

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Frostbite wash

### First Aid

(See procedures)

- Eye: Frostbite
- Skin: Frostbite
- Breathing: Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 0.5 ppm:
(APF = 10) Any supplied-air respirator

Up to 1 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin and/or eye contact

Symptoms Irritation eyes, nose, throat; nausea, vomiting, diarrhea; metallic taste, garlic breath; dizziness, lassitude (weakness, exhaustion); liquid: frostbite; in animals: pneumonitis; liver damage

Target Organs Eyes, respiratory system, liver

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Hydrogen sulfide

### CAS
7783-06-4

### RTECS
MX1225000

### Synonyms & Trade Names
Hydrosulfuric acid, Sewer gas, Sulfuretted hydrogen

### DOT ID & Guide
1053 117

## Exposure Limits

| NIOSH REL: | C 10 ppm (15 mg/m³) [10-minute] |
| OSHA PEL†: | C 20 ppm 50 ppm [10-minute maximum peak] |

| IDLH | 100 ppm |
| Conversion | 1 ppm = 1.40 mg/m³ |

## Physical Description

Colorless gas with a strong odor of rotten eggs. [Note: Sense of smell becomes rapidly fatigued & can NOT be relied upon to warn of the continuous presence of H₂S. Shipped as a liquefied compressed gas.]

| MW: | 34.1 |
| BP: | -77°F |
| FRZ: | -122°F |
| Sol: | 0.4% |

| VP: | 17.6 atm |
| IP: | 10.46 eV |
| RGasD: | 1.19 |

## Incompatibilities & Reactivities

Strong oxidizers, strong nitric acid, metals

## Measurement Methods

NIOSH 6013 ; OSHA ID141

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

(See protection )

- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Frostbite wash

## First Aid

(See procedures )

- Eye: Frostbite
- Skin: Frostbite
- Breathing: Respiratory support
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Up to 100 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern</td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator*</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
<td></td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
<td></td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern</td>
<td></td>
</tr>
<tr>
<td>Any appropriate escape-type, self-contained breathing apparatus</td>
<td></td>
</tr>
<tr>
<td><strong>Exposure Routes</strong> inhalation, skin and/or eye contact</td>
<td></td>
</tr>
<tr>
<td><strong>Symptoms</strong> Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance; liquid: frostbite</td>
<td></td>
</tr>
<tr>
<td><strong>Target Organs</strong> Eyes, respiratory system, central nervous system</td>
<td></td>
</tr>
<tr>
<td>See also: <a href="#">INTRODUCTION</a></td>
<td></td>
</tr>
</tbody>
</table>
# Hydroquinone

**CAS**: 123-31-9  
**RTECS**: MX3500000

## Synonyms & Trade Names
p-Benzenediol; 1,4-Benzenediol; Dihydroxybenzene; 1,4-Dihydroxybenzene; Quinol

## DOT ID & Guide
2662 153

## Exposure Limits
- NIOSH REL: C 2 mg/m³ [15-minute]
- OSHA PEL: TWA 2 mg/m³
- **IDLH**: 50 mg/m³

## Physical Description
Light-tan, light-gray, or colorless crystals.

## MW: 110.1  
BP: 545°F  
MLT: 338°F  
Sol: 7%

## VP: 0.00001 mmHg  
IP: 7.95 eV  
Sp.Gr: 1.33

## Fl.P: 329°F (Molten)  
UEL: ?  
LEL: ?

Combustible Solid; dust cloud may explode if ignited in an enclosed area.

## Incompatibilities & Reactivities
Strong oxidizers, alkalis

## Measurement Methods
NIOSH 5004 ; OSHA PV2094  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
*(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash (>7%)

## First Aid
*(See procedures)*
- Eye: Irrigate immediately
- Skin: Water flush
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 50 mg/m³:**
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.£
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode£
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes: conjunctivitis; keratitis (inflammation of the cornea); central nervous system excitement; colored urine, nausea, dizziness, suffocation, rapid breathing; muscle twitching, delirium; collapse; skin irritation, sensitization, dermatitis

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

2-Hydroxypropyl acrylate

<table>
<thead>
<tr>
<th>CAS 999-61-1</th>
<th>CH₂=CHCOOCH₂CHOHCH₃</th>
<th>RTECS AT1925000</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
HPA, beta-Hydroxypropyl acrylate, Propylene glycol monoacrylate

**Exposure Limits**
<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.5 ppm (3 mg/m³) [skin]</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH N.D.</td>
<td>Conversion 1 ppm = 5.33 mg/m³</td>
</tr>
</tbody>
</table>

**Physical Description**
Clear to light-yellow liquid with a sweetish, solvent odor.

<table>
<thead>
<tr>
<th>MW: 130.2</th>
<th>BP: 376°F</th>
<th>FRZ: ?</th>
<th>Sol: ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fl.P: 149°F</td>
<td>UEL: ?</td>
<td>LEL: 1.8%</td>
<td></td>
</tr>
</tbody>
</table>

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

**Incompatibilities & Reactivities**
Water [Note: Can become unstable at high temperatures & pressures or may react with water with some release of energy, but not violently.]

**Measurement Methods**
None available
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
(See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

**First Aid**
(See procedures)
Eye: Irrigate immediately
Skin: Soap flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**
**Respirator Recommendations** Not available.

**Exposure Routes**
inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**
Irritation eyes, skin, respiratory system; eye, skin burns; cough, dyspnea (breathing difficulty)

**Target Organs**
Eyes, skin, respiratory system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Indene

<table>
<thead>
<tr>
<th>CAS</th>
<th>95-13-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Indonaphthene</td>
</tr>
</tbody>
</table>

#### Exposure Limits

- **NIOSH REL**: TWA 10 ppm (45 mg/m³)
- **OSHA PEL†**: none
- **IDLH**: N.D.
- **Conversion**: 1 ppm = 4.75 mg/m³

#### Physical Description

- Colorless liquid. [Note: A solid below 29°F.]
- **MW**: 116.2
- **BP**: 359°F
- **FRZ**: 29°F
- **Sol**: Insoluble
- **VP**: ?
- **IP**: 8.81 eV
- **Sp.Gr**: 0.997
- **Fl.P**: 173°F
- **UEL**: ?
- **LEL**: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

#### Incompatibilities & Reactivities

None reported [Note: Polymerizes & oxidizes on standing. It has exploded during nitration with (H₂SO₄ + HNO₃).]

#### Measurement Methods

None available

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: Daily
- **Remove**: When wet or contaminated
- **Change**: No recommendation

#### First Aid (See procedures)

- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

Important additional information about respirator selection

Respirator Recommendations Not available.

#### Exposure Routes

inhalation, ingestion, skin and/or eye contact

#### Symptoms

In animals: irritation eyes, skin, mucous membrane; dermatitis, skin sensitization; chemical pneumonitis (aspiration liquid); liver, kidney, spleen injury

#### Target Organs

Eyes, skin, respiratory system, liver, kidneys, spleen

See also: INTRODUCTION
## Indium

<table>
<thead>
<tr>
<th>CAS</th>
<th>7440-74-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>NL1050000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Indium metal

### Exposure Limits
- **NIOSH REL**: TWA 0.1 mg/m³ [*Note: The REL also applies to other indium compounds (as In).]*
- **OSHA PEL**: none
- **IDLH**: N.D.

### Conversion
- **MW**: 114.8
- **BP**: 3767°F
- **MLT**: 314°F
- **Sol**: Insoluble
- **VP**: 0 mmHg (approx)
- **IP**: NA
- **Sp.Gr**: 7.31
- **UEL**: NA
- **LEL**: NA

### Physical Description
Ductile, shiny, silver-white metal that is softer than lead.

### Incompatibilities & Reactivities
- (Dinitrogen tetraoxide + acetonitrile), mercury(II) bromide (at 662°F), sulfur (mixtures ignite when heated) [Note: oxidizes readily at higher temperatures.]

### Measurement Methods
- NIOSH 7303, P&CAM173 (II-5); OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: No recommendation
- **Eyes**: No recommendation
- **Wash skin**: No recommendation
- **Remove**: No recommendation
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; possible liver, kidney, heart, blood effects; pulmonary edema

### Target Organs
- Eyes, skin, respiratory system, liver, kidneys, heart, blood

See also: INTRODUCTION
### Iodine

<table>
<thead>
<tr>
<th>CAS</th>
<th>7553-56-2</th>
</tr>
</thead>
</table>

### I₂

<table>
<thead>
<tr>
<th>RTECS</th>
<th>NN1575000</th>
</tr>
</thead>
</table>

#### Synonyms & Trade Names
- Iodine crystals
- Molecular iodine

#### DOT ID & Guide

#### Exposure Limits

| NIOSH REL: | C 0.1 ppm (1 mg/m³) |
| OSHA PEL:  | C 0.1 ppm (1 mg/m³) |

#### Conversion

1 ppm = 10.38 mg/m³

#### Physical Description

Violet solid with a sharp, characteristic odor.

| MW: 253.8 | BP: 365°F | MLT: 236°F | Sol: 0.01% |
| VP(77°F): 0.3 mmHg | IP: 9.31 eV | Sp.Gr: 4.93 |
| Fl.P: NA | UEL: NA | LEL: NA |

#### Incompatibilities & Reactivities

- Ammonia
- Acetylene
- Acetaldehyde
- Powdered aluminum
- Active metals
- Liquid chlorine

#### Measurement Methods

- NIOSH 6005
- OSHA ID212

#### Personal Protection & Sanitation

(See protection)

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: Daily |
| Provide: Eyewash (>7%), Quick drench (>7%) |

#### First Aid

(See procedures)

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |
**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH/OSHA

**Up to 1 ppm:**
(APF = 10) Any supplied-air respirator*

**Up to 2 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter. Click here

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, nose; lacrimation (discharge of tears); headache; chest tightness; skin burns, rash; cutaneous hypersensitivity</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system, cardiovascular system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Iodoform

<table>
<thead>
<tr>
<th>CAS</th>
<th>75-47-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>PB7000000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Triiodomethane</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: TWA 0.6 ppm (10 mg/m³) | OSHA PEL†: none |

### IDLH

| N.D. | |

### Conversion

| 1 ppm = 16.10 mg/m³ |

### Physical Description

Yellow to greenish-yellow powder or crystalline solid with a pungent, disagreeable odor. [antiseptic for external use]

- **MW:** 393.7
- **BP:** 410°F (Decomposes)
- **MLT:** 246°F
- **Sol:** 0.01%
- **Sp.Gr:** 4.01
- **Noncombustible Solid**
- **Incompatibilities & Reactivities**
  - Strong oxidizers, lithium, metallic salts (e.g., mercuric oxide, silver nitrate), strong bases, calomel, tannin

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: Daily |

### First Aid

(See procedures)

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Important additional information about respirator selection

### Respirator Recommendations

Not available.

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin; lassitude (weakness, exhaustion), dizziness, nausea, incoordination, central nervous system depression; dyspnea (breathing difficulty); liver, kidney, heart damage; visual disturbance

### Target Organs

Eyes, skin, respiratory system, liver, kidneys, heart

See also: INTRODUCTION
## Iron oxide dust and fume (as Fe)

<table>
<thead>
<tr>
<th>CAS</th>
<th>1309-37-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>NO7400000 NO7525000 (fume)</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Ferric oxide, Iron(III) oxide</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1376 135 (spent)</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: | TWA 5 mg/m³ |
| OSHA PEL:  | TWA 10 mg/m³ |
| IDLH:     | 2500 mg/m³ (as Fe) |

### Physical Description

Reddish-brown solid. [Note: Exposure to fume may occur during the arc-welding of iron.]

| MW: 159.7 | BP: ? |
| VP: 0 mmHg (approx) | IP: NA |
| Fl.P: NA | UEL: NA |

Noncombustible Solid

### Incompatibilities & Reactivities

Calcium hypochlorite

### Measurement Methods

NIOSH 7300, 7301, 7303, 9102; OSHA ID121, ID125G

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

*(See protection)*

| Skin: No recommendation |
| Eyes: No recommendation |
| Wash skin: No recommendation |
| Remove: No recommendation |
| Change: No recommendation |

### First Aid

*(See procedures)*

| Breathing: Respiratory support |
## Respirator Recommendations NIOSH

### Up to 50 mg/m³:
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

### Up to 125 mg/m³:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

### Up to 250 mg/m³:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

### Up to 2500 mg/m³:
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

## Exposure Routes
- **Inhalation**

## Symptoms
- Benign pneumoconiosis with X-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis)

## Target Organs
- Respiratory system

See also: INTRODUCTION
### NIOSH Pocket Guide to Chemical Hazards

<table>
<thead>
<tr>
<th>Iron pentacarbonyl (as Fe)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>13463-40-6</td>
</tr>
<tr>
<td>Fe(CO)₅</td>
<td></td>
</tr>
<tr>
<td>RTECS</td>
<td>NO4900000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Iron carbonyl, Pentacarbonyl iron</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1994 131</td>
</tr>
</tbody>
</table>

#### Exposure Limits

- **NIOSH REL**: TWA 0.1 ppm (0.23 mg/m³) ST 0.2 ppm (0.45 mg/m³)
- **OSHA PEL†**: none
- **IDLH**: N.D.
- **Conversion**: 1 ppm = 2.28 mg/m³ (as Fe)

#### Physical Description

- Colorless to yellow to dark-red, oily liquid.
- MW: 195.9
- BP(749 mmHg): 217°F
- FRZ: -6°F
- Sp.Gr: 1.46-1.52
- VP(87°F): 40 mmHg
- IP: ?
- Fl.P: 5°F
- UEL: ?
- LEL: ?

#### Incompatibilities & Reactivities

- Oxidizers, nitrogen oxide, (zinc + cobalt halides) [Note: Pyrophoric (i.e., ignites spontaneously in air). Decomposed by light or air, releasing carbon monoxide.]

#### Measurement Methods

- None available
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

**Skin**: Prevent skin contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation
- **Provide**: Quick drench

**Eyes**: Prevent eye contact
**Eye**: Irrigate immediately
**Skin**: Soap flush immediately
**Breathing**: Respiratory support
**Swallow**: Medical attention immediately

---

**Important additional information about respirator selection**

**Respirator Recommendations**: Not available.

**Exposure Routes**: inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**: Irritation eyes, mucous membrane, respiratory system; headache, dizziness, nausea, vomiting; fever, cyanosis, cough, dyspnea (breathing difficulty); liver, kidney, lung injury; degenerative changes in central nervous system

**Target Organs**: Eyes, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
**Iron salts (soluble, as Fe)**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
- FeSO₄: Ferrous sulfate, Iron(II) sulfate
- FeCl₂: Ferrous chloride, Iron(II) chloride
- Fe(NO₃)₃: Ferric nitrate, Iron(III) nitrate
- Fe(SO₄)₃: Ferric sulfate, Iron(III) sulfate
- FeCl₃: Ferric chloride, Iron(III) chloride

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 1 mg/m³</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
</table>

**Physical Description**

Appearance and odor vary depending upon the specific soluble iron salt.

Properties vary depending upon the specific soluble iron salt.

| Varies |

**Incompatibilities & Reactivities**

**Measurement Methods**

NIOSH 7300, 7301, 7303, 9102; OSHA ID121, ID125G

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: No recommendation
Change: Daily

**First Aid** *(See procedures)*

Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting; possible liver damage

**Target Organs** Eyes, skin, respiratory system, liver, gastrointestinal tract

See also: **INTRODUCTION**
<table>
<thead>
<tr>
<th>** Isoamyl acetate</th>
<th>CAS 123-92-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>**CH₃COOCH₂CH₂CH(CH₃)₂</td>
<td>RTECS NS9800000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
<tr>
<td>Banana oil, Isopentyl acetate, 3-Methyl-1-butanol acetate, 3-Methylbutyl ester of acetic acid, 3-Methylbutyl ethanoate</td>
<td>1104 129</td>
</tr>
<tr>
<td><strong>Exposure Limits</strong></td>
<td><strong>Conversion</strong> 1 ppm = 5.33 mg/m³</td>
</tr>
<tr>
<td>NIOSH REL: TWA 100 ppm (525 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL: TWA 100 ppm (525 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>IDLH 1000 ppm</td>
<td></td>
</tr>
<tr>
<td><strong>Physical Description</strong></td>
<td><strong>Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.</strong></td>
</tr>
<tr>
<td>Colorless liquid with a banana-like odor.</td>
<td></td>
</tr>
<tr>
<td>MW: 130.2</td>
<td>BP: 288°F</td>
</tr>
<tr>
<td>VP: 4 mmHg</td>
<td>IP: ?</td>
</tr>
<tr>
<td>Fl.P: 77°F</td>
<td>UEL: 7.5%</td>
</tr>
<tr>
<td>Sol: 0.3%</td>
<td>LEL(212°F): 1.0%</td>
</tr>
<tr>
<td>Sp.Gr: 0.87</td>
<td></td>
</tr>
<tr>
<td><strong>Incompatibilities &amp; Reactivities</strong></td>
<td></td>
</tr>
<tr>
<td>Nitrates; strong oxidizers, alkalis &amp; acids</td>
<td></td>
</tr>
<tr>
<td><strong>Measurement Methods</strong></td>
<td></td>
</tr>
<tr>
<td>NIOSH 1450 ; OSHA 7</td>
<td></td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
<td></td>
</tr>
<tr>
<td><strong>Personal Protection &amp; Sanitation (See protection )</strong></td>
<td><strong>First Aid (See procedures )</strong></td>
</tr>
<tr>
<td>Skin: Prevent skin contact</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
<td>Skin: Water flush promptly</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Remove: When wet (flammable)</td>
<td>Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
</tbody>
</table>
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 1000 ppm:**

- *(APF = 10)* Any chemical cartridge respirator with organic vapor cartridge(s)
- *(APF = 25)* Any powered, air-purifying respirator with organic vapor cartridge(s)
- *(APF = 50)* Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- *(APF = 10)* Any supplied-air respirator
- *(APF = 50)* Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- *(APF = 10,000)* Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- *(APF = 10,000)* Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- *(APF = 50)* Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, nose, throat; dermatitis; in animals: narcosis</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
### Isoamyl alcohol (secondary)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>6032-29-7</td>
</tr>
<tr>
<td>RTECS</td>
<td>SA49000000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>3-Methyl-2-butanol, Secondary isoamyl alcohol</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1105 129</td>
</tr>
</tbody>
</table>

### Exposure Limits

- **NIOSH REL**: TWA 100 ppm (360 mg/m³) ST 125 ppm (450 mg/m³)
- **OSHA PEL**: TWA 100 ppm (360 mg/m³)
- **IDLH**: 500 ppm

### Physical Description

- Colorless liquid with a disagreeable odor.
- MW: 88.2
- BP: 234°F
- FRZ: ?
- Sol: ?
- VP: 1 mmHg
- IP: ?
- Sp.Gr: 0.82
- Fl.P(oc): 95°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities

- Strong oxidizers

### Measurement Methods

- NIOSH 1402
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Respirator Recommendations NIOSH/OSHA**

**Up to 500 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; headache, dizziness; cough, dyspnea (breathing difficulty), nausea, vomiting, diarrhea; skin cracking; in animals: narcosis

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: [INTRODUCTION](#)
### Isoamyl alcohol (primary)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>123-51-3</td>
<td>EL5425000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Fermentation amyl alcohol
- Fusel oil
- Isobutyl carbinol
- Isopentyl alcohol
- 3-Methyl-1-butanol
- Primary isoamyl alcohol

**DOT ID & Guide**
- 1105 129

**Exposure Limits**
- NIOSH REL: TWA 100 ppm (360 mg/m³) ST 125 ppm (450 mg/m³)
- OSHA PEL†: TWA 100 ppm (360 mg/m³)
- IDLH: 500 ppm

**Conversion**
- 1 ppm = 3.61 mg/m³

**Physical Description**
- Colorless liquid with a disagreeable odor.
- MW: 88.2
- BP: 270°F
- FRZ: -179°F
- Sol(57°F): 2%
- VP: 28 mmHg
- IP: ?
- Sp.Gr(57°F): 0.81
- Fl.P: 109°F
- UEL(212°F): 9.0%
- LEL: 1.2%

**Incompatibilities & Reactivities**
- Strong oxidizers

**Measurement Methods**
- NIOSH 1402, 1405
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

**First Aid**
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 500 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; headache, dizziness; cough, dyspnea (breathing difficulty), nausea, vomiting, diarrhea; skin cracking; in animals: narcosis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Isobutane

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isobutane</td>
<td>75-28-5</td>
<td>TZ4300000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

2-Methylpropane [Note: Also see specific listing for n-Butane.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 800 ppm (1900 mg/m³)</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH N.D.</td>
<td>Conversion 1 ppm = 2.38 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

Colorless gas with a gasoline-like or natural gas odor. [Note: Shipped as a liquefied compressed gas. A liquid below 11°F.]

<table>
<thead>
<tr>
<th>MW: 58.1</th>
<th>BP: 11°F</th>
<th>FRZ: -255°F</th>
<th>Sol: Slight</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(70°F): 3.1 atm</td>
<td>IP: 10.74 eV</td>
<td>RGasD: 2.06</td>
<td></td>
</tr>
<tr>
<td>Fl.P: NA (Gas)</td>
<td>UEL: 8.4%</td>
<td>LEL: 1.6%</td>
<td></td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Flammable Gas

Strong oxidizers (e.g., nitrates & perchlorates), chlorine, fluorine, (nickel carbonyl + oxygen)

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

Skin: Frostbite

Eyes: Frostbite

Wash skin: No recommendation

Remove: When wet (flammable)

Change: No recommendation

Provide: Frostbite wash

### First Aid

Eye: Frostbite

Skin: Frostbite

Breathing: Respiratory support

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes

inhalation, skin and/or eye contact (liquid)

### Symptoms

Drowsiness, narcosis, asphyxia; liquid: frostbite

### Target Organs

central nervous system

See also: INTRODUCTION
## Isobutyl acetate

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃COOCH₂CH(CH₃)₂</td>
<td>110-19-0</td>
<td>AI40250000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Isobutyl ester of acetic acid
- 2-Methylpropyl acetate
- 2-Methylpropyl ester of acetic acid
- beta-Methylpropyl ethanoate

### DOT ID & Guide
- DOT ID & Guide: 1213 129

### Exposure Limits
- NIOSH REL: TWA 150 ppm (700 mg/m³)
- OSHA PEL: TWA 150 ppm (700 mg/m³)
- IDLH: 1300 ppm [10%LEL]

### Conversion
- 1 ppm = 4.75 mg/m³

### Physical Description
- Colorless liquid with a fruity, floral odor.
- MW: 116.2
- BP: 243°F
- FRZ: -145°F
- Sol(77°F): 0.6%
- VP: 13 mmHg
- IP: 9.97 eV
- Sp.Gr: 0.87
- Fl.P: 64°F
- UEL: 10.5%
- LEL: 1.3%

### Incompatibilities & Reactivities
- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods
- NIOSH 1450
- OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 1300 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, upper respiratory system; headache, drowsiness, anesthesia; in animals: narcosis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Isobutyl alcohol

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>78-83-1</td>
<td>NP9625000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- IBA, Isobutanol, Isopropylcarbinol, 2-Methyl-1-propanol

### DOT ID & Guide
- 1212 129

### Exposure Limits
- **NIOSH REL**: TWA 50 ppm (150 mg/m³)
- **OSHA PEL†**: TWA 100 ppm (300 mg/m³)
- **IDLH**: 1600 ppm

### Conversion
- 1 ppm = 3.03 mg/m³

### Physical Description
- Colorless, oily liquid with a sweet, musty odor.
- MW: 74.1
- BP: 227°F
- FRZ: -162°F
- Sol: 10%
- VP: 9 mmHg
- IP: 10.12 eV
- Sp.Gr: 0.80
- Fl.P: 82°F
- UEL(202°F): 10.6%
- LEL(123°F): 1.7%

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH 1401, 1405; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 500 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 1250 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

**Up to 1600 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, throat; headache, drowsiness; skin cracking; in animals: narcosis

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: [INTRODUCTION](#)
### Isobutryonitrile

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isobutryonitrile</td>
<td>78-82-0</td>
<td>TZ4900000</td>
<td>Isopropyl cyanide, 2-Methylpropanenitrile, 2-Methylpropionitrile</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL</th>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 8 ppm (22 mg/m³)</td>
<td>none</td>
<td>N.D.</td>
<td>1 ppm = 2.83 mg/m³</td>
</tr>
</tbody>
</table>

#### Physical Description

- Colorless liquid with an almond-like odor. [Note: Forms cyanide in the body.]
- MW: 69.1
- BP: 219°F
- FRZ: -97°F
- Sol: Slight
- VP(130°F): 100 mmHg
- IP: ?
- Sp.Gr: 0.76
- Fl.P: 47°F
- UEL: ?
- LEL: ?
- Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities

- Oxidizers, reducing agents, strong acids & bases

#### Measurement Methods

- NIOSH 1606 (adapt)
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

#### First Aid

- Eye: Irrigate immediately
- Skin: Soap flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Respirator Selection

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Respirator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 80 ppm</td>
<td>10</td>
<td>Any chemical cartridge respirator with organic vapor cartridge(s)</td>
</tr>
<tr>
<td>Up to 200 ppm</td>
<td>25</td>
<td>Any supplied-air respirator, or any powered, air-purifying respirator with organic vapor cartridge(s)</td>
</tr>
<tr>
<td>Up to 400 ppm</td>
<td>50</td>
<td>Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s), or any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any self-contained breathing apparatus with a full facepiece, or any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s), or any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td>Up to 1000 ppm</td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
</tbody>
</table>

#### Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions

- APF = 10,000: Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
- APF = 10,000: Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.

#### Escape

- APF = 50: Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any appropriate escape-type, self-contained breathing apparatus.

#### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms

- Irritation of eyes, skin, nose, throat; headache, dizziness, lassitude (weakness, exhaustion), confusion, convulsions; dyspnea (breathing difficulty); abdominal pain, nausea, vomiting

#### Target Organs

- Eyes, skin, respiratory system, central nervous system, cardiovascular system

See also: [INTRODUCTION](#)
## Isooctyl alcohol

<table>
<thead>
<tr>
<th>CAS</th>
<th>26952-21-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>NS7700000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Isooctanol, Oxooctyl alcohol [Note: A mixture of closely related isomeric, primary alcohols with branched chains such as 2-Ethylhexanol, \( \text{CH}_3(\text{CH}_2)_3\text{CH}((\text{CH}_2\text{CH}_3)\text{CH}_2)\text{OH} \).]

### Exposure Limits
- **NIOSH REL:** TWA 50 ppm (270 mg/m³) [skin]
- **OSHA PEL†:** none
- **IDLH:** N.D.

### Physical Description
Clear, colorless liquid.

- **MW:** 130.3
- **BP:** 367°F
- **FRZ:** <-105°F
- **Sol:** Insoluble
- **VP:** 0.4 mmHg
- **IP:** ?
- **Sp.Gr:** 0.83
- **Fl.P(oc):** 180°F
- **UEL(est.):** 5.7%
- **LEL(calc.):** 0.9%

**Class IIIA Combustible Liquid:** Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
None reported

### Measurement Methods
OSHA PV2033
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, nose, throat; eye, skin burns

### Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
NIOSH Pocket Guide to Chemical Hazards

Isophorone

C$_9$H$_{14}$O

Synonyms & Trade Names
Isoacetophorone; 3,5,5-Trimethyl-2-cyclohexenone; 3,5,5-Trimethyl-2-cyclohexen-1-one

DOT ID & Guide
1993 128 (combustible liquid, n.o.s.)

CAS 78-59-1

RTECS GW7700000

Exposure Limits
NIOSH REL: TWA 4 ppm (23 mg/m$^3$)
OSHA PEL+: TWA 25 ppm (140 mg/m$^3$)

IDLH 200 ppm

Conversion 1 ppm = 5.65 mg/m$^3$

Physical Description
Colorless to white liquid with a peppermint-like odor.

MW: 138.2 BP: 419$^\circ$F FRZ: 17$^\circ$F Sol: 1%

VP: 0.3 mmHg IP: 9.07 eV Sp.Gr: 0.92

Fl.P: 184$^\circ$F UEL: 3.8% LEL: 0.8%

Class IIIA Combustible Liquid: Fl.P. at or above 140$^\circ$F and below 200$^\circ$F.

Incompatibilities & Reactivities
Oxidizers, strong alkalis, amines

Measurement Methods
NIOSH 2508, 2556; OSHA 7
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH</strong></td>
</tr>
<tr>
<td><strong>Up to 40 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 100 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*</td>
</tr>
<tr>
<td><strong>Up to 200 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

| **Exposure Routes** inhalation, ingestion, skin and/or eye contact |
| **Symptoms** Irritation eyes, nose, throat; headache, nausea, dizziness, lassitude (weakness, exhaustion), malaise (vague feeling of discomfort), narcosis; dermatitis; in animals: kidney, liver damage |
| **Target Organs** Eyes, skin, respiratory system, central nervous system, liver, kidneys |

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Isophorone diisocyanate

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>4098-71-9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td>NQ9370000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>IPDI; 3-Isocyanatomethyl-3,5,5-trimethylcyclohexyl-isocyanate; Isophorone diamine diisocyanate</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>2290 156</td>
</tr>
</tbody>
</table>

### Exposure Limits

- **NIOSH REL:**
  - TWA 0.005 ppm (0.045 mg/m³) ST 0.02 ppm (0.180 mg/m³) [skin]
- **OSHA PEL†:** none
- **IDLH:** N.D.

**Conversion** 1 ppm = 9.09 mg/m³

### Physical Description

- Colorless to slightly yellow liquid with a pungent odor.
- **MW:** 222.3
- **BP:** ?
- **FRZ:** -76°F
- **Sp.Gr.:** 1.06
- **VP:** 0.0003 mmHg
- **IP:** ?
- **UEL:** ?
- **LEL:** ?

**Class IIIB Combustible Liquid:** Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

- Water, alcohols, phenols, amines, mercaptans, amides, urethanes, ureas [Note: Reacts with water to form carbon dioxide.]

### Measurement Methods

- NIOSH 5525 ; OSHA PV2034
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Quick drench

### First Aid

- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Respirator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 0.05 ppm:</td>
<td>10</td>
<td>Any supplied-air respirator*</td>
</tr>
<tr>
<td>Up to 0.125 ppm:</td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>Up to 0.25 ppm:</td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>Up to 0.25 ppm:</td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td>Up to 1 ppm:</td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Emergency or planned entry into unknown concentrations or IDLH conditions:</td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Emergency or planned entry into unknown concentrations or IDLH conditions:</td>
<td>10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/
- Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, respiratory system; chest tightness, dyspnea (breathing difficulty), cough, sore throat; bronchitis, wheezing, pulmonary edema; possible respiratory sensitization, asthma</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
### 2-Isopropoxyethanol

**(CH)\textsubscript{2}CHOCH\textsubscript{2}CH\textsubscript{2}OH**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>109-59-1</td>
<td>KL5075000</td>
<td></td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- Ethylene glycol isopropyl ether
- beta-Hydroxyethyl isopropyl ether
- Isopropyl Cellosolve®
- Isopropyl glycol

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix D</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

#### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorless liquid with a mild, ethereal odor.</td>
</tr>
</tbody>
</table>

| MW: | 104.2 |
| BP: | 283°F |
| VP: | 3 mmHg |
| Fl.P(oc): | 92°F |

| FRZ: | ? |
| IP: | ? |
| UEL: | ? |

#### Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

#### Incompatibilities & Reactivities
- Oxidizers

#### Measurement Methods
- None available
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

#### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

#### Important additional information about respirator selection
- **Respirator Recommendations:** Not available.

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
- In animals: irritation eyes, skin; hematuria (blood in the urine), anemia, pulmonary edema

#### Target Organs
- Eyes, skin, respiratory system, blood

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Isopropyl acetate

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-21-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>AI49300000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Isopropyl ester of acetic acid, 1-Methylethyl ester of acetic acid, 2-Propyl acetate</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1220 129</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix D</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>TWA 250 ppm (950 mg/m³)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>1800 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion</td>
<td>1 ppm = 4.18 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description

- Colorless liquid with a fruity odor.
- MW: 102.2
- BP: 194°F
- FRZ: -92°F
- Sol: 3%
- VP: 42 mmHg
- IP: 9.95 eV
- Sp.Gr: 0.87
- Fl.P: 36°F
- UEL: 8%
- LEL(100°F): 1.8%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods

- NIOSH 1454, 1460; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated

**Remove:** When wet (flammable)

**Change:** No recommendation

### First Aid

**Eye:** Irrigate immediately

**Skin:** Water flush promptly

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

### Respirator Recommendations

**OSHA**

- **Up to 1800 ppm:**
  - APF = 25) Any supplied-air respirator operated in a continuous-flow mode
  - APF = 50) Any self-contained breathing apparatus with a full facepiece

- **Emergency or planned entry into unknown concentrations or IDLH conditions:**
  - APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, nose; dermatitis; in animals: narcosis</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## Isopropyl alcohol

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>67-63-0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td>NT8050000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dimethyl carbinol, IPA, Isopropanol, 2-Propanol, sec-Propyl alcohol, Rubbing alcohol

### DOT ID & Guide
- 1219 129

### Exposure Limits
- **NIOSH REL:** TWA 400 ppm (980 mg/m³) ST 500 ppm (1225 mg/m³)
- **OSHA PEL†:** TWA 400 ppm (980 mg/m³)

### IDLH
- 2000 ppm [10%LEL]

### Physical Description
- Colorless liquid with the odor of rubbing alcohol.

### MW: 60.1
- BP: 181°F
- FRZ: -127°F
- Sol: Miscible
- VP: 33 mmHg
- IP: 10.10 eV
- Sp.Gr: 0.79
- Fl.P: 53°F
- UEL(200°F): 12.7%
- LEL: 2.0%

### Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Strong oxidizers, acetaldehyde, chlorine, ethylene oxide, acids, isocyanates

### Measurement Methods
- NIOSH 1400 ; OSHA 109
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid (See procedures)
- **Eye:** Irrigate immediately
- **Skin:** Water flush
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations</strong> NIOSH/OSHA</td>
</tr>
<tr>
<td><strong>Up to 2000 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode£</td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
</tr>
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<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
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<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)£</td>
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<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
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<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
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<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

| **Exposure Routes** inhalation, ingestion, skin and/or eye contact |
| **Symptoms** irritation eyes, nose, throat; drowsiness, dizziness, headache; dry cracking skin; in animals: narcosis |
| **Target Organs** Eyes, skin, respiratory system |

See also: INTRODUCTION
### Isopropylamine

<table>
<thead>
<tr>
<th><strong>Synonyms &amp; Trade Names</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Aminopropane, Monoisopropylamine, 2-Propylamine, sec-Propylamine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DOT ID &amp; Guide</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1221 132</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: See Appendix D</td>
</tr>
<tr>
<td>OSHA PEL†: TWA 5 ppm (12 mg/m³)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>IDLH</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>750 ppm</td>
</tr>
</tbody>
</table>

**Conversion**

| 1 ppm = 2.42 mg/m³ |

<table>
<thead>
<tr>
<th><strong>Physical Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorless liquid with an ammonia-like odor. [Note: A gas above 91°F.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MW</strong></th>
<th><strong>BP</strong></th>
<th><strong>FRZ</strong></th>
<th><strong>Sol</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>59.1</td>
<td>91°F</td>
<td>-150°F</td>
<td>Miscible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>VP</strong></th>
<th><strong>IP</strong></th>
<th><strong>Sp.Gr</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>460 mmHg</td>
<td>8.72 eV</td>
<td>0.69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Fl.P(oc)</strong></th>
<th><strong>UEL</strong></th>
<th><strong>LEL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>-35°F</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Class IA Flammable Liquid</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fl.P. below 73°F and BP below 100°F.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Incompatibilities &amp; Reactivities</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong acids, strong oxidizers, aldehydes, ketones, epoxides</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Measurement Methods</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH S147 (II-3)</td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Personal Protection &amp; Sanitation</strong> (See protection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
</tr>
<tr>
<td>Remove: When wet (flammable)</td>
</tr>
<tr>
<td>Change: No recommendation</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>First Aid</strong> (See procedures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Skin: Water flush immediately</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>
**Important additional information about respirator selection**

**Respirator Recommendations OSHA**

**Up to 125 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern

**Up to 250 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 750 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; pulmonary edema; visual disturbance; eye, skin burns; dermatitis

**Target Organs** Eyes, skin, respiratory system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## N-Isopropylaniline

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>768-52-5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₆H₅NHCH(CH₃)₂</strong></td>
<td><strong>RTECS</strong></td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>N-IPA, Isopropylaniline, N-(1-Methylethyl)-benzenamine, N-Phenylisopropylamine</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th><strong>NIOSH REL</strong></th>
<th>TWA 2 ppm (10 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
<td>N.D.</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 5.53 mg/m³

### Physical Description

Clear, yellowish liquid with a sweet, aromatic odor.

| **MW** | 135.2 |
| **BP** | 397°F |
| **FRZ** | -58°F |
| **Sol** | ? |
| **VP(77°F)** | 0.03 mmHg |
| **IP** | ? |
| **Sp.Gr(60°F)** | 0.93 |
| **Fl.P(oc)** | 190°F |
| **UEL** | ? |
| **LEL** | ? |

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

None reported

### Measurement Methods

OSHA 78

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Quick drench

### First Aid (See procedures )

- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin; headache, lassitude (weakness, exhaustion), dizziness; cyanosis; ataxia; dyspnea (breathing difficulty) on effort; tachycardia; methemoglobinemia

### Target Organs

Eyes, skin, respiratory system, blood, cardiovascular system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Isopropyl ether

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(CH₃)₂CHO(CH₃)₂</td>
<td>108-20-3</td>
<td>TZ54250000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Diisopropyl ether
- Diisopropyl oxide
- 2-Isopropoxy propane

**DOT ID & Guide**
- DOT ID 1159 127

## Exposure Limits

- NIOSH REL: TWA 500 ppm (2100 mg/m³)
- OSHA PEL: TWA 500 ppm (2100 mg/m³)

**IDLH**
- 1400 ppm [10%LEL]

**Conversion**
- 1 ppm = 4.18 mg/m³

## Physical Description
- Colorless liquid with a sharp, sweet, ether-like odor.

**Properties**
- MW: 102.2
- BP: 154°F
- FRZ: -76°F
- Sol: 0.2%
- VP: 119 mmHg
- IP: 9.20 eV
- Sp.Gr: 0.73
- Fl.P: -18°F
- UEL: 7.9%
- LEL: 1.4%

**Class**
- IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

## Incompatibilities & Reactivities
- Strong oxidizers, acids [Note: Unstable peroxides may form on long contact with air.]

## Measurement Methods
- NIOSH 1618 ; OSHA 7
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

**Skin**
- Prevent skin contact

**Eyes**
- Prevent eye contact

**Wash Skin**
- When contaminated

**Remove**
- When wet (flammable)

**Change**
- No recommendation

## First Aid

**Eye**
- Irrigate immediately

**Skin**
- Soap wash promptly

**Breathing**
- Respiratory support

**Swallow**
- Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

#### Up to 1400 ppm:
- **(APF = 10)** Any chemical cartridge respirator with organic vapor cartridge(s)*
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor cartridge(s)*
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, nose; respiratory discomfort; dermatitis; in animals: drowsiness, dizziness, unconsciousness, narcosis</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## Isopropyl glycidyl ether

<table>
<thead>
<tr>
<th>CAS 4016-14-2</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

1,2-Epoxy-3-isopropoxypropane; IGE; Isopropoxymethyl oxirane

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C 50 ppm (240 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 50 ppm (240 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 400 ppm

**Conversion** 1 ppm = 4.75 mg/m³

### Physical Description

- **Colorless liquid.**
- **MW:** 116.2
- **BP:** 279°F
- **FRZ:** ?
- **Sol:** 19%
- **VP:** 9 mmHg
- **IP:** ?
- **Sp.Gr:** 0.92
- **Fl.P:** 92°F
- **UEL:** ?
- **LEL:** ?

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities

Strong oxidizers, strong caustics [Note: May form explosive peroxides upon exposure to air or light.]

### Measurement Methods

NIOSH 1620 ; OSHA 7
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection )

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid

(See procedures )

- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

- **Up to 400 ppm:**
  - (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
  - (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, upper respiratory system; skin sensitization; possible hematopoietic, reproductive effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, blood, reproductive system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Kaolin

#### CAS
1332-58-7

#### RTECS
GF1670500

#### Synonyms & Trade Names
- China clay
- Clay
- Hydrated aluminum silicate
- Hydrite
- Porcelain clay

[Note: Main constituent of Kaolin is Kaolinite (Al$_2$Si$_2$O$_5$(OH)$_4$).]

#### DOT ID & Guide

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 10 mg/m$^3$ (total) TWA 5 mg/m$^3$ (resp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

#### Physical Description
- White to yellowish or grayish powder.
- [Note: When moistened, darkens & develops a clay-like odor.]

<table>
<thead>
<tr>
<th>MW</th>
<th>VP: 0 mmHg (approx)</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>varies</td>
<td>IP: NA</td>
<td>Sp.Gr: 1.8-2.6</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
<td>LEL: NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid

#### Incompatibilities & Reactivities
- None reported

#### Measurement Methods
- NIOSH 0500, 0600
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
(See protection )

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

#### First Aid
(See procedures )

- Eye: Irrigate immediately
- Breathing: Fresh air

#### Important additional information about respirator selection

#### Respirator Recommendations
Not available.

#### Exposure Routes
- Inhalation, skin and/or eye contact

#### Symptoms
- Chronic pulmonary fibrosis, stomach granuloma

#### Target Organs
- Respiratory system, stomach

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Kepone

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>143-50-0</td>
<td>PC8575000</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Chlordecone
- Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta(cd)-pentalen-2-one
- Decachlorooctahydro-kepone-2-one
- Decachlorotetrahydro-4,7-methanoindeneone

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>Ca TWA 0.001 mg/m³ [See Appendix A]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
</tbody>
</table>

### Physical Description

- Tan to white, crystalline, odorless solid. [insecticide]
- MW: 490.6
- BP: Sublimes
- MLT: 662°F (Sublimes)
- Sol(212°F): 0.5%
- VP(77°F): 3 x 10^-7 mmHg
- IP: ?
- Sp.Gr: ?
- Fl.P: NA
- UEL: NA
- LEL: NA

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Incompatibilities & Reactivities

- Acids, acid fumes

### Measurement Methods

- NIOSH 5508
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated/Daily
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters. Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Headache, anxiety, tremor; liver, kidney damage; visual disturbance; ataxia, chest pain, skin erythema (skin redness); testicular atrophy, low sperm count; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system, liver, kidneys, reproductive system</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[in animal: liver cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Kerosene

<table>
<thead>
<tr>
<th>CAS</th>
<th>8008-20-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>OA55000000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1223 128</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Fuel Oil No. 1, Range oil [Note: A refined petroleum solvent (predominantly C9-C16), which typically is 25% normal paraffins, 11% branched paraffins, 30% monocycloparaffins, 12% dicycloparaffins, 1% tricycloparaffins, 16% mononuclear aromatics & 5% dinuclear aromatics.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 100 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description
Colorless to yellowish, oily liquid with a strong, characteristic odor.

<table>
<thead>
<tr>
<th>MW: 170 (approx)</th>
<th>BP: 347-617°F</th>
<th>FRZ: -50°F</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(100°F): 5 mmHg</td>
<td>IP: ?</td>
<td></td>
<td>Sp.Gr: 0.81</td>
</tr>
<tr>
<td>Fl.P: 100-162°F</td>
<td>UEL: 5%</td>
<td>LEL: 0.7%</td>
<td></td>
</tr>
</tbody>
</table>

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities
Strong oxidizers

### Measurement Methods
NIOSH 1550
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 1000 mg/m³:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
(APF = 10) Any supplied-air respirator

Up to 2500 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

Up to 5000 mg/m³:
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
### Ketene

**CAS**: 463-51-4  
**RTECS**: OA7700000  
**DOT ID & Guide**:  

### Synonyms & Trade Names
Carbomethene, Ethenone, Keto-ethylene

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 0.5 ppm (0.9 mg/m³) ST 1.5 ppm (3 mg/m³)</th>
<th>IDLH 5 ppm</th>
<th>Conversion 1 ppm = 1.72 mg/m³</th>
</tr>
</thead>
</table>

### Physical Description
Colorless gas with a penetrating odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW:</td>
<td>42.0</td>
</tr>
<tr>
<td>BP:</td>
<td>-69°F</td>
</tr>
<tr>
<td>FRZ:</td>
<td>-238°F</td>
</tr>
<tr>
<td>Sol:</td>
<td>Reacts</td>
</tr>
<tr>
<td>VP:</td>
<td>&gt;1 atm</td>
</tr>
<tr>
<td>IP:</td>
<td>9.61 eV</td>
</tr>
<tr>
<td>RGasD:</td>
<td>1.45</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>NA (Gas)</td>
</tr>
<tr>
<td>UEL:</td>
<td>?</td>
</tr>
<tr>
<td>LEL:</td>
<td>?</td>
</tr>
</tbody>
</table>

### Flammable Gas

### Incompatibilities & Reactivities
Water, alcohols, ammonia [Note: Readily polymerizes. Reacts with water to form acetic acid.]

### Measurement Methods
NIOSH S92 (II-2)  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection )  
Skin: No recommendation  
Eyes: No recommendation  
Wash skin: No recommendation  
Remove: No recommendation  
Change: No recommendation

### First Aid
(See procedures )  
Breathing: Respiratory support

### Important additional information about respirator selection

### Respirator Recommendations
NIOSH/OSHA  
**Up to 5 ppm:**  
(APF = 10) Any supplied-air respirator*  
(APF = 50) Any self-contained breathing apparatus with a full facepiece  
**Emergency or planned entry into unknown concentrations or IDLH conditions:**  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus  
**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
Inhalation, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, nose, throat, respiratory system; pulmonary edema</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Lead

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7439-92-1</td>
<td>OF7525000</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Lead metal, Plumbum

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*: TWA 0.050 mg/m³</th>
<th>OSHA PEL*: [1910.1025] TWA 0.050 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>See Appendix C</td>
<td>See Appendix C</td>
</tr>
</tbody>
</table>

*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.

**IDLH** 100 mg/m³ (as Pb)

### Physical Description

A heavy, ductile, soft, gray solid.

<table>
<thead>
<tr>
<th>MW: 207.2</th>
<th>BP: 3164°F</th>
<th>MLT: 621°F</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0 mmHg (approx)</td>
<td>IP: NA</td>
<td>UEL: NA</td>
<td>LEL: NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid in bulk form.

### Incompatibilities & Reactivities

Strong oxidizers, hydrogen peroxide, acids

### Measurement Methods

NIOSH 7082, 7105, 7300, 7301, 7303, 7700, 7701, 7702, 9100, 9102, 9105; OSHA ID121, ID125G, ID206

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: Daily
- Remove: When wet or contaminated
- Change: Daily

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Soap flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations (See Appendix E) NIOSH/OSHA

Up to 0.5 mg/m³:
(APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 1.25 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter

Up to 2.5 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 50 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Up to 100 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension

Target Organs Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Limestone

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaCO₃</td>
<td>1317-65-3</td>
<td>EV9580000</td>
<td>Calcium carbonate, Natural calcium carbonate [Note: Calcite &amp; aragonite are commercially important natural calcium carbonates.]</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</th>
<th>OSHA PEL: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH</td>
<td>N.D.</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description

Odorless, white to tan powder.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>100.1</td>
</tr>
<tr>
<td>BP</td>
<td>Decomposes</td>
</tr>
<tr>
<td>MLT</td>
<td>1517-2442°F (Decomposes)</td>
</tr>
<tr>
<td>Sol</td>
<td>0.001%</td>
</tr>
<tr>
<td>VP</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>2.7-2.9</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid

### Incompatibilities & Reactivities

Fluorine, magnesium, acids, alum, ammonium salts

### Measurement Methods

NIOSH 0500, 0600

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Protection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Eyes</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Wash skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Remove</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Change</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Aid</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>Irrigate immediately</td>
</tr>
<tr>
<td>Skin</td>
<td>Soap wash</td>
</tr>
<tr>
<td>Breathing</td>
<td>Fresh air</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

**Exposure Routes** Inhalation, skin and/or eye contact

**Symptoms** Irritation eyes, skin, mucous membrane; cough, sneezing, rhinorrhea (discharge of thin mucus); lacrimation (discharge of tears)

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
### Lindane

**CAS** 58-89-9  
**RTECS** GV4900000

#### Synonyms & Trade Names

BHC; HCH; gamma-Hexachlorocyclohexane; gamma isomer of 1,2,3,4,5,6-Hexachlorocyclohexane

#### Exposure Limits

| NIOSH REL | TWA 0.5 mg/m³ [skin] |
| OSHA PEL | TWA 0.5 mg/m³ [skin] |
| IDLH | 50 mg/m³ |

#### Physical Description

White to yellow, crystalline powder with a slight, musty odor. [pesticide]

| MW | 290.8 |
| BP | 614°F |
| MP | 235°F |
| Sol | 0.001% |
| VP | 0.00001 mmHg |
| IP | ? |
| Fi.P | NA |
| UEL | NA |
| LEL | NA |

Noncombustible Solid, but may be dissolved in flammable liquids.

#### Incompatibilities & Reactivities

Corrosive to metals

#### Measurement Methods

NIOSH 5502  
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

(See protection)

| Skin: Prevent skin contact  
| Eyes: No recommendation  
| Wash skin: When contaminated  
| Remove: When wet or contaminated  
| Change: Daily  
| Provide: Quick drench |

#### First Aid

(See procedures)

| Eye: Irrigate immediately  
| Skin: Soap wash promptly  
| Breathing: Respiratory support  
| Swallow: Medical attention immediately |
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 5 mg/m³:**
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

**Up to 12.5 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

(APF = 25) Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*

**Up to 25 mg/m³:**
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 50 mg/m³:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, skin, nose, throat; headache; nausea; clonic convulsions; respiratory difficulty; cyanosis; aplastic anemia; muscle spasm; in animals: liver, kidney damage

**Target Organs** Eyes, skin, respiratory system, central nervous system, blood, liver, kidneys

See also: [INTRODUCTION](#)
# Lithium hydride

<table>
<thead>
<tr>
<th>CAS</th>
<th>7580-67-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>OJ6300000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1414 138 2805 138 (fused, solid)</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
Lithium monohydride

## Exposure Limits
| NIOSH REL: TWA | 0.025 mg/m³ |
| OSHA PEL: TWA | 0.025 mg/m³ |
| IDLH | 0.5 mg/m³ |

## Physical Description
Odorless, off-white to gray, translucent, crystalline mass or white powder.

| MW: 7.95 | BP: Decomposes | MLT: 1256°F | Sol: Reacts |
| VP: 0 mmHg (approx) | IP: NA | Sp.Gr: 0.78 |
| Fl.P: NA | UEL: NA | LEL: NA |

Combustible Solid that can form airborne dust clouds which may explode on contact with flame, heat, or oxidizers.

## Incompatibilities & Reactivities
Strong oxidizers, halogenated hydrocarbons, acids, water [Note: May ignite SPONTANEOUSLY in air and may reignite after fire is extinguished. Reacts with water to form hydrogen & lithium hydroxide.]

## Measurement Methods
OSHA ID121
See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection )
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: Brush (DO NOT WASH)
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench (>0.5 mg/m³)

## First Aid (See procedures )
- **Eye**: Irrigate immediately
- **Skin**: Brush (DO NOT WASH)
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 0.25 mg/m³:**
- (APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. Click here for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

**Up to 0.5 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*  
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- (APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter*  
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, skin; eye, skin burns; mouth, esophagus burns (if ingested); nausea; muscle twitches; mental confusion; blurred vision

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## L.P.G.

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS Number</th>
<th>RTECS Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₃H₈/C₄H₆/C₄H₁₀/C₄H₈</td>
<td>68476-85-7</td>
<td>SE7545000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Bottled gas, Compressed petroleum gas, Liquefied hydrocarbon gas, Liquefied petroleum gas, LPG
  
  [Note: A fuel mixture of propane, propylene, butanes & butylenes.]

## DOT ID & Guide
- 1075 115

## Exposure Limits

<table>
<thead>
<tr>
<th>Limit Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 1000 ppm (1800 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>TWA 1000 ppm (1800 mg/m³)</td>
</tr>
</tbody>
</table>

| IDLH | 2000 ppm [10%LEL] |

## Conversion
1 ppm = 1.72-2.37 mg/m³

## Physical Description
- Colorless, noncorrosive, odorless gas when pure. [Note: A foul-smelling odorant is usually added. Shipped as a liquefied compressed gas.]
- MW: 42-58
- BP: >-44°F
- FRZ: ?
- Sol: Insoluble
- VP: >1 atm
- IP: 10.95 eV
- RGasD: 1.45-2.00

## Flammable Gas

## Incompatibilities & Reactivities
- Strong oxidizers, chlorine dioxide

## Measurement Methods
- NIOSH S93 (II-2)
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin Protection</th>
<th>Eyes Protection</th>
<th>Wash Skin</th>
<th>Remove</th>
<th>Change</th>
<th>Provide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frostbite</td>
<td>Frostbite</td>
<td>No recommendation</td>
<td>When wet (flammable)</td>
<td>No recommendation</td>
<td>Frostbite wash</td>
</tr>
</tbody>
</table>

## First Aid

<table>
<thead>
<tr>
<th>Eye Protection</th>
<th>Skin Protection</th>
<th>Breathing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigate immediately (liquid)</td>
<td>Water flush immediately (liquid)</td>
<td>Respiratory support</td>
</tr>
</tbody>
</table>

## Important additional information about respirator selection

### Respirator Recommendations
- NIOSH/OSHA

#### Up to 2000 ppm:
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape
- Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Dizziness, drowsiness, asphyxia; liquid: frostbite</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Magnesite

*Magnesite*  
**CAS 546-93-0**

**MgCO₃**  
**RTECS OM2470000**

### Synonyms & Trade Names
Carbonate magnesium, Hydromagnesite, Magnesium carbonate, Magnesium(II) carbonate  
[Note: Magnesite is a naturally-occurring form of magnesium carbonate.]

### Exposure Limits

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL:</td>
<td>TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
<tr>
<td>OSHA PEL:</td>
<td>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
</tbody>
</table>

**IDLH** N.D.  
**Conversion**

### Physical Description
White, odorless, crystalline powder.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MW:</td>
<td>84.3</td>
</tr>
<tr>
<td>BP:</td>
<td>Decomposes</td>
</tr>
<tr>
<td>MLT:</td>
<td>662°F (Decomposes)</td>
</tr>
<tr>
<td>Sol:</td>
<td>0.01%</td>
</tr>
<tr>
<td>VP:</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP:</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr:</td>
<td>2.96</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>NA</td>
</tr>
<tr>
<td>UEL:</td>
<td>NA</td>
</tr>
<tr>
<td>LEL:</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid

### Incompatibilities & Reactivities
Acids, formaldehyde

### Measurement Methods
NIOSH 0500, 0600  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
[(See protection)](https://www.ihresources.com)

| Skin: | No recommendation |
| Eyes: | No recommendation |
| Wash skin: | No recommendation |
| Remove: | No recommendation |
| Change: | No recommendation |

### First Aid
[(See procedures)](https://www.ihresources.com)

| Eye: | Irrigate immediately |
| Breathing: | Fresh air |

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, skin and/or eye contact

### Symptoms
Irritation eyes, skin, respiratory system; cough

### Target Organs
Eyes, skin, respiratory system

See also: **INTRODUCTION**
# Magnesium oxide fume

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>CAS 1309-48-4</th>
<th>RTECS OM3850000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Magnesia fume</td>
<td>DOT ID &amp; Guide</td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>750 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

## Physical Description

Finely divided white particulate dispersed in air. [Note: Exposure may occur when magnesium is burned, thermally cut, or welded upon.]

<table>
<thead>
<tr>
<th>MW</th>
<th>BP (°F)</th>
<th>MLT (°F)</th>
<th>Sol (86°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.3</td>
<td>6512</td>
<td>5072</td>
<td>0.009%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VP (mmHg)</th>
<th>IP</th>
<th>Sp.Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (approx)</td>
<td>NA</td>
<td>3.58</td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities

Chlorine trifluoride, phosphorus pentachloride

## Measurement Methods

NIOSH 7300, 7301, 7303; OSHA ID121

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin</th>
<th>Eyes</th>
<th>Wash skin</th>
<th>Remove</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>No recommendation</td>
<td>No recommendation</td>
<td>No recommendation</td>
<td>No recommendation</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

## First Aid

<table>
<thead>
<tr>
<th>Breathing</th>
<th>Respiratory support</th>
</tr>
</thead>
</table>

(See procedures)
### Respirator Recommendations OSHA

#### Up to 150 mg/m³:
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

#### Up to 375 mg/m³:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

#### Up to 750 mg/m³:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes inhalation, skin and/or eye contact

### Symptoms Irritation eyes, nose; metal fume fever: cough, chest pain, flu-like fever

### Target Organs Eyes, respiratory system

See also: [INTRODUCTION](#)
## Malathion

**CAS:** 121-75-5  
**RTECS:** WM8400000

### Synonyms & Trade Names
- S-[1,2-bis(ethoxycarbonyl) ethyl]O,O-dimethyl-phosphorodithioate; Diethyl (dimethoxyphosphinothioylthio) succinate

### DOT ID & Guide
- DOT ID & Guide: 2783 152

### Exposure Limits
- **NIOSH REL:** TWA 10 mg/m³ [skin]
- **OSHA PEL†:** TWA 15 mg/m³ [skin]
- **IDLH:** 250 mg/m³

### Physical Description
- Deep-brown to yellow liquid with a garlic-like odor. [insecticide] [Note: A solid below 37°F.]
- **MW:** 330.4  
- **BP:** 140°F (Decomposes)  
- **FRZ:** 37°F  
- **Sol:** 0.02%
- **VP:** 0.00004 mmHg  
- **IP:** ?  
- **Sp.Gr:** 1.21
- **Fl.P(oc):** >325°F  
- **UEL:** ?  
- **LEL:** ?

**Class IIIB Combustible Liquid, but may be difficult to ignite.**

### Incompatibilities & Reactivities
- Strong oxidizers, magnesium, alkaline pesticides [Note: Corrosive to metals.]

### Measurement Methods
- NIOSH 5600 ; OSHA 62
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation *(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Respirator Recommendations NIOSH

**Up to 100 mg/m\(^3\):**

\[(APF = 10)\] Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

\[(APF = 10)\] Any supplied-air respirator

**Up to 250 mg/m\(^3\):**

\[(APF = 25)\] Any supplied-air respirator operated in a continuous-flow mode*

\[(APF = 50)\] Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

\[(APF = 50)\] Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

\[(APF = 25)\] Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*

\[(APF = 50)\] Any self-contained breathing apparatus with a full facepiece

\[(APF = 50)\] Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

\[(APF = 10,000)\] Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

\[(APF = 10,000)\] Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

\[(APF = 50)\] Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes

- inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, skin; miosis, aching eyes, blurred vision, lacrimation (discharge of tears); salivation; anorexia, nausea, vomiting, abdominal cramps, diarrhea, dizziness, confusion, ataxia; rhinorrhea (discharge of thin mucus), headache; chest tightness, wheezing, laryngeal spasm

### Target Organs

- Eyes, skin, respiratory system, liver, blood cholinesterase, central nervous system, cardiovascular system, gastrointestinal tract

See also: [INTRODUCTION](#)
# Maleic anhydride

**CAS**: 108-31-6  
**RTECS**: ON3675000

## Synonyms & Trade Names
- cis-Butenedioic anhydride
- 2,5-Furanedione
- Maleic acid anhydride
- Toxilic anhydride

## DOT ID & Guide
- 2215 156

## Exposure Limits
- **NIOSH REL**: TWA 1 mg/m³ (0.25 ppm)
- **OSHA PEL**: TWA 1 mg/m³ (0.25 ppm)
- **IDLH**: 10 mg/m³

## Conversion
- 1 ppm = 4.01 mg/m³

## Physical Description
- Colorless needles, white lumps, or pellets with an irritating, choking odor.
- **MW**: 98.1  
- **BP**: 396°F  
- **MLT**: 127°F  
- **Sol**: Reacts
- **VP**: 0.2 mmHg  
- **IP**: 9.90 eV  
- **Sp.Gr**: 1.48
- **Fl.P**: 218°F  
- **UEL**: 7.1%  
- **LEL**: 1.4%

## Combustible Solid, but may be difficult to ignite.

## Incompatibilities & Reactivities
- Strong oxidizers, water, alkalis, metals, caustics & amines above 150°F  
  [Note: Reacts slowly with water (hydrolyzes) to form maleic acid.]

## Measurement Methods
- NIOSH 3512 ; OSHA 25 , 86
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection)
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash

## First Aid (See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations  NIOSH/OSHA**

**Up to 10 mg/m^3:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation nose, upper respiratory system; conjunctivitis; photophobia (abnormal visual intolerance to light), double vision; bronchial asthma; dermatitis

**Target Organs** Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Malonaldehyde

<table>
<thead>
<tr>
<th>CAS</th>
<th>542-78-9</th>
</tr>
</thead>
</table>

**CHOCH₂CHO**  
**Synonyms & Trade Names**  
Malonic aldehyde; Malonodialdehyde; Propanedial; 1,3-Propanedial [Note: Pure Malonaldehyde is unstable and may be used as its sodium salt.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>See Appendix A See Appendix C (Aldehydes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Ca [N.D.]</th>
</tr>
</thead>
</table>

### Physical Description

Solid (needles).

<table>
<thead>
<tr>
<th>MW</th>
<th>72.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>?</td>
</tr>
<tr>
<td>MLT</td>
<td>161°F</td>
</tr>
<tr>
<td>Sol</td>
<td>?</td>
</tr>
</tbody>
</table>

| VP | ?    |
| IP | ?    |
| UEL| ?    |
| LEL| ?    |

### Incompatibilities & Reactivities

Proteins [Note: Pure compound is stable under neutral conditions, but not under acidic conditions.]

### Measurement Methods

None available  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
Wash skin: When contaminated/Daily  
Remove: When wet or contaminated  
Change: Daily  
Provide: Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Water flush immediately  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**  
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus  
**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system; central nervous system depression; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, central nervous system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: thyroid gland tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## Malononitrile

<table>
<thead>
<tr>
<th>CAS</th>
<th>109-77-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>OO3150000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Cyanoacetonitrile
- Dicyanomethane
- Malonic dinitrile

### DOT ID & Guide
- 2647 153

### Exposure Limits
- NIOSH REL: TWA 3 ppm (8 mg/m³)
- OSHA PEL: none
- IDLH: N.D.
- Conversion: 1 ppm = 2.70 mg/m³

### Physical Description
- White powder or colorless crystals. [Note: Melts above 90°F. Forms cyanide in the body.]
- MW: 66.1
- BP: 426°F
- MLT: 90°F
- VP: ?
- IP: 12.88 eV
- Fl.P(oc): 266°F
- UEL: ?
- LEL: ?
- Sol: 13%
- Sp.Gr: 1.19

### Incompatibilities & Reactivities
- Strong bases [Note: May polymerize violently on prolonged heating at 265°F, or in contact with strong bases at lower temperatures.]

### Measurement Methods
- NIOSH Nitriles Crit. Doc.
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Water wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Combustible Solid
Important additional information about respirator selection

**Respirator Recommendations** NIOSH

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Respirator Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 80 mg/m³</td>
<td>10</td>
<td>Any supplied-air respirator</td>
</tr>
<tr>
<td>Up to 200 mg/m³</td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>Up to 400 mg/m³</td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td>Up to 667 mg/m³</td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Respirator Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 80 mg/m³</td>
<td>10</td>
<td>Any supplied-air respirator</td>
</tr>
<tr>
<td>Up to 200 mg/m³</td>
<td>25</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>Up to 400 mg/m³</td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td>Up to 667 mg/m³</td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Up to 800 mg/m³</td>
<td>5000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td>Up to 1000 mg/m³</td>
<td>10000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

**Escape:**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Respirator Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 80 mg/m³</td>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>Up to 200 mg/m³</td>
<td>50</td>
<td>Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; headache, dizziness, lassitude (weakness, exhaustion), confusion, convulsions; dyspnea (breathing difficulty); abdominal pain, nausea, vomiting

**Target Organs** Eyes, skin, respiratory system, central nervous system, cardiovascular system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Manganese compounds and fume (as Mn)

**Synonyms & Trade Names**
- Manganese metal: Colloidal manganese, Manganese-55
- Synonyms of other compounds vary depending upon the specific manganese compound.

**DOT ID & Guide**
- CAS 7439-96-5 (metal)
- RTECS OO9275000 (metal)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*</th>
<th>OSHA PEL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 1 mg/m³ ST 3 mg/m³</td>
<td>C 5 mg/m³</td>
</tr>
</tbody>
</table>

[*Note: Also see specific listings for Manganese cyclopentadienyl tricarbonyl, Methyl cyclopentadienyl manganese tricarbonyl, and Manganese tetroxide.*]

**IDLH** 500 mg/m³ (as Mn)

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lustrous, brittle, silvery solid.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MW: 54.9</th>
<th>BP: 3564°F</th>
<th>MLT: 2271°F</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0 mmHg (approx)</td>
<td>IP: NA</td>
<td>Sp.Gr: 7.20 (metal)</td>
<td></td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
<td>LEL: NA</td>
<td></td>
</tr>
</tbody>
</table>

**Metal:** Combustible Solid

### Incompatibilities & Reactivities

- Oxidizers [Note: Will react with water or steam to produce hydrogen.]

**Measurement Methods**

- NIOSH 7300, 7301, 7303, 9102; OSHA ID121, ID125G
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid (See procedures)

- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 10 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 25 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 50 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 500 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion

Symptoms Parkinson’s; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage

Target Organs respiratory system, central nervous system, blood, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Manganese cyclopentadienyl tricarbonyl (as Mn)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>12079-65-1</td>
</tr>
<tr>
<td>RTECS</td>
<td>OO9720000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Cyclopentadienylmanganese tricarbonyl
- Cyclopentadienyl tricarbonyl manganese
- MCT

### Exposure Limits
- NIOSH REL: TWA 0.1 mg/m³ [skin]
- OSHA PEL†: C 5 mg/m³
- IDLH: N.D.

### Physical Description
- Yellow, crystalline solid with a characteristic odor. [Note: An antiknock additive for gasoline. May be found in an oil & gaseous solution.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>204.1</td>
</tr>
<tr>
<td>BP</td>
<td>Sublimes</td>
</tr>
<tr>
<td>MLT</td>
<td>167°F (Sublimes)</td>
</tr>
<tr>
<td>Sol</td>
<td>Slight</td>
</tr>
<tr>
<td>VP</td>
<td>?</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>FI.P</td>
<td>?</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
- Oxygen

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
- Respirator Recommendations: Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- In animals: irritation skin; pulmonary edema; convulsions; central nervous system, respiratory system, kidney changes; decreased resistance to infection

### Target Organs
- Skin, respiratory system, central nervous system, kidneys

See also: INTRODUCTION
## Manganese tetroxide (as Mn)

<table>
<thead>
<tr>
<th>CAS</th>
<th>1317-35-7</th>
</tr>
</thead>
</table>

### Mn₃O₄

<table>
<thead>
<tr>
<th>RTECS</th>
<th>OP0895000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- Manganese oxide
- Manganomanganic oxide
- Trimanganese tetraoxide
- Trimanganese tetroxide

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix D</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>C 5 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

### Physical Description
- Brownish-black powder.
  - Note: Fumes are generated whenever manganese oxides are heated strongly in air.

<table>
<thead>
<tr>
<th>MW:</th>
<th>228.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP:</td>
<td>?</td>
</tr>
<tr>
<td>MLT:</td>
<td>2847°F</td>
</tr>
<tr>
<td>Sol:</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP:</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP:</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr:</td>
<td>4.88</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>NA</td>
</tr>
<tr>
<td>UEL:</td>
<td>NA</td>
</tr>
<tr>
<td>LEL:</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
- Soluble in hydrochloric acid (liberates chlorine gas)

### Measurement Methods
- NIOSH 7300, 7301, 7303, 9102; OSHA ID121, ID125G
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin:</th>
<th>No recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes:</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Wash skin:</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Remove:</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Change:</td>
<td>Daily</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Eye:</th>
<th>Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin:</td>
<td>Soap wash</td>
</tr>
<tr>
<td>Breathing:</td>
<td>Respiratory support</td>
</tr>
<tr>
<td>Swallow:</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>

### Respirator Recommendations
- Not available.

### Important additional information about respirator selection

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Asthenia, insomnia, mental confusion; low-back pain; vomiting; malaise (vague feeling of discomfort), lassitude (weakness, exhaustion); kidney damage; pneumonitis

### Target Organs
- Respiratory system, central nervous system, blood, kidneys

See also: **INTRODUCTION**
## Marble

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>1317-65-3</td>
<td>EV9580000</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Calcium carbonate, Natural calcium carbonate [Note: Marble is a metamorphic form of calcium carbonate.]

### Exposure Limits
- **NIOSH REL**: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)
- **OSHA PEL**: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)
- **IDLH**: N.D.

### Physical Description
Odorless, white powder.

<table>
<thead>
<tr>
<th>MW: 100.1</th>
<th>BP: Decomposes</th>
<th>MLT: 1517-2442°F (Decomposes)</th>
<th>Sol: 0.001%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0 mmHg (approx)</td>
<td>IP: NA</td>
<td>UEL: NA</td>
<td>Sp.Gr: 2.7-2.9</td>
</tr>
<tr>
<td>FI,P: NA</td>
<td>LEL: NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Noncombustible Solid

### Incompatibilities & Reactivities
Fluorine, magnesium, acids, alum, ammonium salts

### Measurement Methods
- NIOSH 0500, 0600
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: No recommendation
- **Eyes**: No recommendation
- **Wash skin**: No recommendation
- **Remove**: No recommendation
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Fresh air

#### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
- Inhalation, skin and/or eye contact

### Symptoms
Irritation eyes, skin, mucous membrane, upper respiratory system; cough, sneezing, rhinorrhea (discharge of thin mucus); lacrimation (discharge of tears)

### Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Mercury compounds [except (organo) alkyls] (as Hg)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7439-97-6 (metal)</td>
<td>OV4550000 (metal)</td>
<td>2809 172 (metal)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Mercury metal: Colloidal mercury, Metallic mercury, Quicksilver
- Synonyms of "other" Hg compounds vary depending upon the specific compound.

### Exposure Limits
- **NIOSH REL:** Hg Vapor: TWA 0.05 mg/m³ [skin]
- Other: C 0.1 mg/m³ [skin]
- **OSHA PEL†:** C 0.1 mg/m³
- **IDLH:** 10 mg/m³ (as Hg)

### Physical Description
- **Metal:** Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.]
- **MW:** 200.6
- **BP:** 674°F
- **FRZ:** -38°F
- **Sol:** Insoluble
- **VP:** 0.0012 mmHg
- **IP:** ?
- **Sp.Gr:** 13.6 (metal)
- **FL.P:** NA
- **UEL:** NA
- **LEL:** NA
- **Metal:** Noncombustible Liquid

### Incompatibilities & Reactivities
- Acetylene, ammonia, chlorine dioxide, azides, calcium (amalgam formation), sodium carbide, lithium, rubidium, copper

### Measurement Methods
- NIOSH 6009 ; OSHA ID140
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** No recommendation
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** Daily

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

---

*Authored in PDF format by Industrial Hygiene Services; www.ihresources.com*
Important additional information about respirator selection

Respirator Recommendations

Mercury vapor:

NIOSH

Up to 0.5 mg/m³:
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern†
- (APF = 10) Any supplied-air respirator

Up to 1.25 mg/m³:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern† (canister)

Up to 2.5 mg/m³:
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern†
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern†
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/PAPRTS (canister)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

Up to 10 mg/m³:
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

NIOSH/OSHA

Up to 1 mg/m³:
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern†
- (APF = 10) Any supplied-air respirator

Up to 2.5 mg/m³:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern† (canister)

Up to 5 mg/m³:
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern†
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern†
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/PAPRTS (canister)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

Up to 10 mg/m³:
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria

**Target Organs** Eyes, skin, respiratory system, central nervous system, kidneys

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Mercury (organo) alkyl compounds (as Hg)</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>RTECS</td>
</tr>
<tr>
<td>Synonyms vary depending upon the specific (organo) alkyl mercury compound.</td>
<td>DOT ID &amp; Guide</td>
</tr>
<tr>
<td><strong>Exposure Limits</strong></td>
<td></td>
</tr>
<tr>
<td>NIOSH REL: TWA 0.01 mg/m³ ST 0.03 mg/m³ [skin]</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL†: TWA 0.01 mg/m³ C 0.04 mg/m³</td>
<td>Conversion</td>
</tr>
<tr>
<td>IDLH 2 mg/m³ (as Hg)</td>
<td></td>
</tr>
<tr>
<td><strong>Physical Description</strong></td>
<td></td>
</tr>
<tr>
<td>Appearance and odor vary depending upon the specific (organo) alkyl mercury compound.</td>
<td></td>
</tr>
<tr>
<td>Properties vary depending upon the specific (organo) alkyl mercury compound.</td>
<td></td>
</tr>
<tr>
<td>Incompatibilities &amp; Reactivities</td>
<td></td>
</tr>
<tr>
<td>Strong oxidizers such as chlorine</td>
<td></td>
</tr>
<tr>
<td><strong>Measurement Methods</strong></td>
<td></td>
</tr>
<tr>
<td>None available</td>
<td></td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
<td></td>
</tr>
<tr>
<td><strong>Personal Protection &amp; Sanitation</strong></td>
<td></td>
</tr>
<tr>
<td>(See protection)</td>
<td></td>
</tr>
<tr>
<td>Skin: Prevent skin contact</td>
<td></td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
<td></td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
<td></td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
<td></td>
</tr>
<tr>
<td>Change: Daily</td>
<td></td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
<td></td>
</tr>
<tr>
<td><strong>First Aid</strong></td>
<td></td>
</tr>
<tr>
<td>(See procedures)</td>
<td></td>
</tr>
<tr>
<td>Eye: Irrigate immediately</td>
<td></td>
</tr>
<tr>
<td>Skin: Soap wash immediately</td>
<td></td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
<td></td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
<td></td>
</tr>
</tbody>
</table>
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Respirator Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 0.1 mg/m³</td>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td>Up to 0.25 mg/m³</td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>Up to 0.5 mg/m³</td>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode</td>
</tr>
<tr>
<td></td>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td>Up to 2 mg/m³</td>
<td>(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode</td>
</tr>
</tbody>
</table>

### Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape: Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Paresthesia; ataxia, dysarthria; vision, hearing disturbance; spasticity, jerking limbs; dizziness; salivation; lacrimation (discharge of tears); nausea, vomiting, diarrhea, constipation; skin burns; emotional disturbance; kidney injury; possible teratogenic effects</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, central nervous system, peripheral nervous system, kidneys</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Mesityl oxide

<table>
<thead>
<tr>
<th>Chemical Identifier</th>
<th>CAS 141-79-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>(CH₃)₂C=CHCOCH₃</td>
<td>RTECS SB4200000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Isobutenyl methyl ketone
- Isopropylideneacetone
- Methyl isobutenyl ketone
- 4-Methyl-3-penten-2-one

### DOT ID & Guide
- DOT ID & Guide 1229 129

### Exposure Limits
- NIOSH REL: TWA 10 ppm (40 mg/m³)
- OSHA PEL†: TWA 25 ppm (100 mg/m³)
- IDLH 1400 ppm [10%LEL]

### Conversion
- 1 ppm = 4.02 mg/m³

### Physical Description
- Oily, colorless to light-yellow liquid with a peppermint- or honey-like odor.
- MW: 98.2
- BP: 266°F
- FRZ: -52°F
- Sol: 3%
- VP: 9 mmHg
- IP: 9.08 eV
- Sp.Gr(59°F): 0.86
- Fl.P: 87°F
- UEL: 7.2%
- LEL: 1.4%

#### Class IC Flammable Liquid
- Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities
- Oxidizers, acids

### Measurement Methods
- NIOSH 1301, 2553
- OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

**Up to 250 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 500 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1400 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, mucous membrane; narcosis, coma; in animals: liver, kidney damage; central nervous system effects

**Target Organs** Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
### Methacrylic acid

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂=C(CH₃)COOH</td>
<td>79-41-4</td>
<td>OZ2975000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- Methacrylic acid (glacial), Methacrylic acid (inhibited), alpha-Methacrylic acid, 2-Methylacrylic acid, 2-Methylpropenoic acid

#### DOT ID & Guide
- DOT ID & Guide: 2531 153 P (inhibited)

#### Exposure Limits
- NIOSH REL: TWA 20 ppm (70 mg/m³) [skin]
- OSHA PEL†: none

#### IDLH
- N.D.

#### Conversion
- 1 ppm = 3.52 mg/m³

### Physical Description
- Colorless liquid or solid (below 61°F) with an acrid, repulsive odor.
- MW: 86.1
- BP: 325°F
- FRZ: 61°F
- Sol(77°F): 9%
- VP: 0.7 mmHg
- IP: ?
- Sp.Gr: 1.02 (Liquid)
- Fl.P(oc): 171°F
- UEL: ?
- LEL: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Oxidizers, elevated temperatures, hydrochloric acid [Note: Typically contains 100 ppm of the monomethyl ether of hydroquinone to prevent polymerization.]

### Measurement Methods
- OSHA PV2005
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

#### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, mucous membrane; eye, skin burns

### Target Organs
- Eyes, skin, respiratory system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Methomyl

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>16752-77-5</td>
</tr>
<tr>
<td>RTECS</td>
<td>AK2975000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Lannate®
- Methyl N-((methylamino)carbonyl)oxy)ethanimidothioate
- S-Methyl-N-(methylcarbamoyloxy)thioacetimidate

### DOT ID & Guide
- 2757 151 (carbamate pesticide, solid, toxic)

### Exposure Limits
- NIOSH REL: TWA 2.5 mg/m³
- OSHA PEL†: none
- IDLH: N.D.

### Physical Description
- White, crystalline solid with a slight, sulfur-like odor. [insecticide]
- MW: 162.2
- BP: ?
- MLT: 172°F
- Sol(77°F): 6%
- VP(77°F): 0.00005 mmHg
- IP: ?
- Sp.Gr(75°F): 1.29
- Fl.P: NA
- UEL: NA
- LEL: NA

### Noncombustible Solid, but may be dissolved in flammable liquids.

### Incompatibilities & Reactivities
- Strong bases

### Measurement Methods
- NIOSH 5601
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
- Respirator Recommendations: Not available.

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes; blurred vision, miosis; salivation; abdominal cramps, nausea, vomiting; dyspnea (breathing difficulty); lassitude (weakness, exhaustion), muscle twitching; liver, kidney damage

### Target Organs
- Eyes, respiratory system, central nervous system, cardiovascular system, liver, kidneys, blood cholinesterase

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

<table>
<thead>
<tr>
<th><strong>Methoxychlor</strong></th>
<th>CAS 72-43-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>((C_6H_4OCH_3)_2CHCCl_3)</td>
<td>RTECS KJ3675000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- \(p,p'\)-Dimethoxydiphenyltrichloroethane; DMDT; Methoxy-DDT; 2,2-bis(p-Methoxyphenyl)-1,1,1-trichloroethane; 1,1,1-Trichloro-2,2-bis-(p-methoxyphenyl)ethane

**DOT ID & Guide**
- DOT ID & Guide 2761 151 (organochlorine pesticide, solid, toxic)

**Exposure Limits**

| NIOSH REL: Ca [See Appendix A] | OSHA PEL†: TWA 15 mg/m³ |

| IDLH Ca [5000 mg/m³] | Conversion |

**Physical Description**
- Colorless to light-yellow crystals with a slight, fruity odor. [insecticide]

| MW: 345.7 | BP: Decomposes | MLT: 171°F | Sol: 0.00001% |
| Fl,P: ? | UEL: ? | LEL: ? |

**Combustible Solid, but difficult to burn.**

**Incompatibilities & Reactivities**
- Oxidizers

**Measurement Methods**
- NIOSH S371 (II-4) ; OSHA PV2038
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- Skin: Prevent skin contact
- Eyes: No recommendation
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily

**First Aid** *(See procedures)*
- Skin: Soap wash
- Breathing: Fresh air
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations**

- For concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - **For APF = 10,000** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - **For APF = 10,000** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**
- **For APF = 50** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>In animals: fasciculation, trembling, convulsions; kidney, liver damage; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>central nervous system, liver, kidneys</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver &amp; ovarian cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
## Methoxyflurane

<table>
<thead>
<tr>
<th>CAS</th>
<th>76-38-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KN7820000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 2,2-Dichloro-1,1-difluoroethy methyl ether; 2,2-Dichloro-1,1-difluoro-1-methoxyethane; Methoflurane; Methoxyfluorane; Penthrane

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*</th>
<th>C 2 ppm (13.5 mg/m³) [60-minute] [*Note: REL for exposure to waste anesthetic gas.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
<tr>
<td>IDLH</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 6.75 mg/m³

### Physical Description
- Colorless liquid with a fruity odor. [inhalation anesthetic]

<table>
<thead>
<tr>
<th>MW: 165.0</th>
<th>BP: 220°F</th>
<th>FRZ: -31°F</th>
<th>Sol: Slight</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 23 mmHg</td>
<td>IP: ?</td>
<td></td>
<td>Sp.Gr(77°F): 1.42</td>
</tr>
</tbody>
</table>

Combustible Liquid

### Incompatibilities & Reactivities
None reported

### Measurement Methods
None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** No recommendation
**Eyes:** Prevent eye contact
**Wash skin:** No recommendation
**Remove:** When wet or contaminated
**Change:** No recommendation

### First Aid

**Eye:** Irrigate immediately
**Skin:** Soap wash
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes; central nervous system depression, analgesia, anesthesia, convulsions, respiratory depression; liver, kidney injury; in animals: reproductive, teratogenic effects

### Target Organs
- Eyes, central nervous system, liver, kidneys, reproductive system

See also: INTRODUCTION
### 4-Methoxyphenol

**Chemical Abstracts Service (CAS)** 150-76-5

**Registry of Toxic Effects of Chemical Substances (RTECS)** SL7700000

**Chemical Formula** $\text{CH}_3\text{OC}_6\text{H}_4\text{OH}$

**Synonyms & Trade Names**
- Hydroquinone monomethyl ether
- $p$-Hydroxyanisole
- Mequinol
- $p$-Methoxyphenol
- Monomethyl ether hydroquinone

**Exposure Limits**
- **NIOSH REL:** TWA 5 mg/m$^3$
- **OSHA PEL†:** none

**IDLH** N.D.

**Conversion**

**Physical Description**
- Colorless to white, waxy solid with an odor of caramel & phenol.
- **MW:** 124.2
- **BP:** 469°F
- **MLT:** 135°F
- **Sol(77°F):** 4%
- **VP:** <0.01 mmHg
- **IP:** 7.50 eV
- **Sp.Gr:** 1.55
- **Fl.P(oc):** 270°F
- **UEL:** ?
- **LEL:** ?

**Combustible Solid; under certain conditions, a dust cloud can probably explode if ignited by a spark or flame.**

**Incompatibilities & Reactivities**
- Strong oxidizers, strong bases, acid chlorides, acid anhydrides

**Measurement Methods**
- None available
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

**First Aid**
- **Eye:** Irrigate immediately
- **Skin:** Soap flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes**
- Inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**
- Irritation eyes, skin, nose, throat, upper respiratory system; eye, skin burns; central nervous system depression

**Target Organs**
- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl acetate

<table>
<thead>
<tr>
<th>CAS</th>
<th>79-20-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃COOCH₃</td>
<td></td>
</tr>
<tr>
<td>RTECS</td>
<td>AI9100000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Methyl ester of acetic acid, Methyl ethanoate</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1231 129</td>
</tr>
</tbody>
</table>

### Exposure Limits

- **NIOSH REL:** TWA 200 ppm (610 mg/m³) ST 250 ppm (760 mg/m³)
- **OSHA PEL†:** TWA 200 ppm (610 mg/m³)

**IDLH** 3100 ppm [10%LEL]

**Conversion** 1 ppm = 3.03 mg/m³

### Physical Description

- Colorless liquid with a fragrant, fruity odor.

**MW:** 74.1

**BP:** 135°F

**FRZ:** -145°F

**Sol:** 25%

**VP:** 173 mmHg

**IP:** 10.27 eV

**Sp.Gr:** 0.93

**UEL:** 16%

**LEL:** 3.1%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Nitrates; strong oxidizers, alkalis & acids; water [Note: Reacts slowly with water to form acetic acid & methanol.]

### Measurement Methods

- NIOSH 1458 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid

- **Eye:** Irrigate immediately
- **Skin:** Water flush promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2000 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*

Up to 3100 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; headache, drowsiness; optic nerve atrophy; chest tightness; in animals: narcosis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
## Methyl acetylene

<table>
<thead>
<tr>
<th>Chemical Information</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>74-99-7</td>
</tr>
<tr>
<td>RTECS</td>
<td>UK4250000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Allylene, Propine, Propyne, 1-Propyne

### Exposure Limits
<table>
<thead>
<tr>
<th>Standard</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 1000 ppm (1650 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>TWA 1000 ppm (1650 mg/m³)</td>
</tr>
</tbody>
</table>

### IDLH
1700 ppm [10%LEL]

### Conversion
1 ppm = 1.64 mg/m³

### Physical Description
Colorless gas with a sweet odor. [Note: A fuel that is shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>40.1</td>
</tr>
<tr>
<td>BP</td>
<td>-10°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-153°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP</td>
<td>5.2 atm</td>
</tr>
<tr>
<td>IP</td>
<td>10.36 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>1.41</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA (Gas)</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

### Flammable Gas

### Incompatibilities & Reactivities
Strong oxidizers (such as chlorine), copper alloys [Note: Can decompose explosively at 4.5 to 5.6 atmospheres of pressure.]

### Measurement Methods
NIOSH S84 (II-5)
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
**Skin:** Frostbite
**Eyes:** Frostbite
**Wash skin:** No recommendation
**Remove:** When wet (flammable)
**Change:** No recommendation
**Provide:** Frostbite wash

### First Aid
**Eye:** Frostbite
**Skin:** Frostbite
**Breathing:** Respiratory support

### Important additional information about respirator selection

### Respirator Recommendations
**NIOSH/OSHA**

#### Up to 1700 ppm:
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation respiratory system; tremor, hyperexcitability, anesthesia; liquid: frostbite</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## Methyl acetylene-propadiene mixture

**CAS** 59355-75-8  
**RTECS** UK4920000  
**DOT ID & Guide** 1060 116 P (stabilized)

### Synonyms & Trade Names
- MAPP gas
- Methyl acetylene-allene mixture
- Methyl acetylene-propadiene mixture (stabilized)
- Propadiene-methyl acetylene
- Propyne-allene mixture
- Propyne-propadiene mixture

### Exposure Limits
- **NIOSH REL:** TWA 1000 ppm (1800 mg/m³) ST 1250 ppm (2250 mg/m³)
- **OSHA PEL†:** TWA 1000 ppm (1800 mg/m³)
- **IDLH:** 3400 ppm [10%LEL]
- **Conversion:** 1 ppm = 1.64 mg/m³

### Physical Description
- Colorless gas with a strong, characteristic, foul odor. [Note: A fuel that is shipped as a liquefied compressed gas.]
- **MW:** 40.1  
- **BP:** -36 to -4°F  
- **FRZ:** -213°F  
- **Sol:** Insoluble  
- **VP:** >1 atm  
- **IP:** ?  
- **RGasD:** 1.48

### Incompatibilities & Reactivities
- Strong oxidizers, copper alloys [Note: Forms explosive compounds at high pressure in contact with alloys containing more than 67% copper.]

### Measurement Methods
- NIOSH S85 (II-6)  
- OSHA 7  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Frostbite wash

### First Aid
- **Eye:** Frostbite
- **Skin:** Frostbite
- **Breathing:** Respiratory support
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 3400 ppm:**
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation respiratory system; excitement, confusion, anesthesia; liquid: frostbite</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
### Methyl acrylate

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>96-33-3</td>
</tr>
<tr>
<td>RTECS</td>
<td>AT2800000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Methoxycarbonylethylene, Methyl ester of acrylic acid, Methyl propenoate</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1919 129 P (inhibited)</td>
</tr>
</tbody>
</table>

#### Exposure Limits

- NIOSH REL: TWA 10 ppm (35 mg/m³) [skin]
- OSHA PEL: TWA 10 ppm (35 mg/m³) [skin]

**IDLH** 250 ppm

**Conversion** 1 ppm = 3.52 mg/m³

#### Physical Description

Colorless liquid with an acrid odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>86.1</td>
</tr>
<tr>
<td>BP</td>
<td>176°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-106°F</td>
</tr>
<tr>
<td>Sol</td>
<td>6%</td>
</tr>
<tr>
<td>VP</td>
<td>65 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>9.90 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.96</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>27°F</td>
</tr>
<tr>
<td>UEL</td>
<td>25%</td>
</tr>
<tr>
<td>LEL</td>
<td>2.8%</td>
</tr>
</tbody>
</table>

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities

Nitrates, oxidizers such as peroxides, strong alkalis [Note: Polymerizes easily; usually contains an inhibitor such as hydroquinone.]

#### Measurement Methods

NIOSH 1459, 2552; OSHA 92
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation
- **Provide**: Quick drench

#### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Water flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Respirator Recommendations NIOSH/OSHA**

**Up to 100 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 250 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, skin, upper respiratory system

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
# Methylacrylonitrile

**CAS**: 126-98-7  
**RTECS**: UD1400000  
**DOT ID & Guide**: 3079 131 P (inhibited)

### Synonyms & Trade Names
- 2-Cyanopropene-1, 2-Cyano-1-propene
- Isoprene cyanide, Isopropenyl nitrite, Methacrylonitrile, alpha-Methylacrylonitrile, 2-Methylpropenenitrile

### Exposure Limits
- NIOSH REL: TWA 1 ppm (3 mg/m³) [skin]
- OSHA PEL†: none

### IDLH
- N.D.

### Conversion
- 1 ppm = 2.74 mg/m³

### Physical Description
- Colorless liquid with an odor like bitter almonds.
- **MW**: 67.1  
- **BP**: 195°F  
- **FRZ**: -32°F  
- **Sol**: 3%
- **VP (77°F)**: 71 mmHg  
- **IP**: ?  
- **Sp.Gr**: 0.80
- **Fl.P**: 34°F  
- **UEL**: 6.8%  
- **LEL**: 2%

### Incompatibilities & Reactivities
- Strong acids, strong oxidizers, alkali, light  
  [Note: Polymerization may occur due to elevated temperature, visible light, or contact with a concentrated alkali.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin; lacrimation (discharge of tears); in animals: convulsions, loss of motor control in hind limbs

### Target Organs
- Eyes, skin, central nervous system

See also: **INTRODUCTION**
# Methylal

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>109-87-5</td>
<td>PA8750000</td>
<td>1234 127</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Dimethoxymethane, Formal, Formaldehyde dimethylacetal, Methoxymethyl methyl ether, Methylene dimethyl ether

## DOT ID & Guide
- 1234 127

## Exposure Limits
- NIOSH REL: TWA 1000 ppm (3100 mg/m³)
- OSHA PEL: TWA 1000 ppm (3100 mg/m³)

## ILDH
- 2200 ppm [10%LEL]

## Conversion
- 1 ppm = 3.11 mg/m³

## Physical Description
- Colorless liquid with a chloroform-like odor.
  - MW: 76.1
  - BP: 111°F
  - FRZ: -157°F
  - Sol: 33%
  - VP: 330 mmHg
  - IP: 10.00 eV
  - Sp.Gr: 0.86
  - Fl.P(oc): -26°F
  - UEL: 13.8%
  - LEL: 2.2%
  - Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

## Incompatibilities & Reactivities
- Strong oxidizers, acids

## Measurement Methods
- NIOSH 1611
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

## First Aid
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

## Important additional information about respirator selection

**Respirator Recommendations**

- **NIOSH/OSHA**
  - **Up to 2200 ppm**:
    - (APF = 10) Any supplied-air respirator
    - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - **Emergency or planned entry into unknown concentrations or IDLH conditions**:
    - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
    - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, upper respiratory system; anesthesia</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
### Methyl alcohol

<table>
<thead>
<tr>
<th>CH₃OH</th>
<th>CAS 67-56-1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>CAS</strong> 67-56-1</td>
</tr>
<tr>
<td>Carbinol, Columbian spirits, Methanol, Pyroligneous spirit, Wood alcohol, Wood naphtha, Wood spirit</td>
<td>RTECS PC1400000</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td><strong>DOT ID &amp; Guide</strong> 1230 131</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 200 ppm (260 mg/m³) ST 250 ppm (325 mg/m³) [skin]</th>
<th>OSHA PEL†: TWA 200 ppm (260 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH 6000 ppm</td>
<td><strong>Conversion</strong> 1 ppm = 1.31 mg/m³</td>
</tr>
</tbody>
</table>

#### Physical Description

Colorless liquid with a characteristic pungent odor.

- **MW**: 32.1
- **BP**: 147°F
- **FRZ**: -144°F
- **Sol**: Miscible
- **VP**: 96 mmHg
- **IP**: 10.84 eV
- **Sp.Gr**: 0.79
- **FI.P**: 52°F
- **UEL**: 36%
- **LEL**: 6.0%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities

Strong oxidizers.

#### Measurement Methods

NIOSH 2000, 3800; OSHA 91

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection )

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

#### First Aid (See procedures )

- **Eye**: Irrigate immediately
- **Skin**: Water flush promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
**Importantly additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 2000 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 5000 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 6000 ppm:**
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

**Up to 6000 ppm:**
(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Up to 6000 ppm:**
(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, upper respiratory system; headache, drowsiness, dizziness, nausea, vomiting; visual disturbance, optic nerve damage (blindness); dermatitis

**Target Organs** Eyes, skin, respiratory system, central nervous system, gastrointestinal tract

See also: INTRODUCTION
# Methylamine

**CAS**: 74-89-5  
**RTECS**: PF6300000

## Synonyms & Trade Names
Aminomethane, Methylamine (anhydrous), Methylamine (aqueous), Monomethylamine

## DOT ID & Guide
1061 118 (anhydrous)  
1235 132 (aqueous)

## Exposure Limits
- **NIOSH REL**: TWA 10 ppm (12 mg/m³)  
- **OSHA PEL**: TWA 10 ppm (12 mg/m³)

## IDLH
100 ppm  
**Conversion**: 1 ppm = 1.27 mg/m³

## Physical Description
Colorless gas with a fish- or ammonia-like odor. [Note: A liquid below 21°F. Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>31.1</td>
</tr>
<tr>
<td>BP</td>
<td>21°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-136°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Soluble</td>
</tr>
<tr>
<td>VP</td>
<td>3.0 atm</td>
</tr>
<tr>
<td>IP</td>
<td>8.97 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>1.08</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.70 (Liquid at 13°F)</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA (Gas) 14°F (Liquid)</td>
</tr>
<tr>
<td>UEL</td>
<td>20.7%</td>
</tr>
<tr>
<td>LEL</td>
<td>4.9%</td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities
Mercury, strong oxidizers, nitromethane [Note: Corrosive to copper & zinc alloys, aluminum & galvanized surfaces.]

## Measurement Methods
OSHA 40  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)
- **Skin**: Prevent skin contact (solution)/Frostbite  
- **Eyes**: Prevent eye contact (solution)/Frostbite  
- **Wash skin**: When contaminated (solution)  
- **Remove**: When wet (flammable)  
- **Change**: No recommendation  
- **Provide**: Frostbite wash

## First Aid
(See procedures)
- **Eye**: Irrigate immediately (solution)/Frostbite  
- **Skin**: Water flush immediately (solution)/Frostbite  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately (solution)
Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

**Up to 100 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption (solution), ingestion (solution), skin and/or eye contact (solution/liquid)

**Symptoms** Irritation eyes, skin, respiratory system; cough; skin, mucous membrane burns; dermatitis; conjunctivitis; liquid: frostbite

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

**Methyl bromide**

<table>
<thead>
<tr>
<th>CAS</th>
<th>CAS 74-83-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃Br</td>
<td>RTECS PA4900000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

Bromomethane, Monobromomethane

**DOT ID & Guide**

1062 123

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: Ca See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: C 20 ppm (80 mg/m³) [skin]</td>
</tr>
</tbody>
</table>

**IDLH** Ca [250 ppm]  
**Conversion** 1 ppm = 3.89 mg/m³

**Physical Description**

Colorless gas with a chloroform-like odor at high concentrations. [Note: A liquid below 38°F. Shipped as a liquefied compressed gas.]

| MW: 95.0 | BP: 38°F | FRZ: -137°F | Sol: 2% |
| VP: 1.9 atm | IP: 10.54 eV | RGasD: 3.36 | Sp.Gr: 1.73 (Liquid at 32°F) |

**Flammable Gas, but only in presence of a high energy ignition source.**

**Incompatibilities & Reactivities**

Aluminum, magnesium, strong oxidizers [Note: Attacks aluminum to form aluminum trimethyl, which is SPONTANEOUSLY flammable.]

**Measurement Methods**

NIOSH 2520 ; OSHA PV2040  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)

Skin: Prevent skin contact (liquid)  
Eyes: Prevent eye contact (liquid)  
Wash skin: When contaminated (liquid)  
Remove: When wet (flammable)  
Change: No recommendation  
Provide: Quick drench (liquid)

**First Aid** (See procedures)

Eye: Irrigate immediately (liquid)  
Skin: Water flush immediately (liquid)  
Breathing: Respiratory support

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

( APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

( APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

( APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption (liquid), skin and/or eye contact (liquid)
**Symptoms** Irritation eyes, skin, respiratory system; muscle weakness, incoordination, visual disturbance, dizziness; nausea, vomiting, headache; malaise (vague feeling of discomfort); hand tremor; convulsions; dyspnea (breathing difficulty); skin vesiculation; liquid: frostbite; [potential occupational carcinogen]

**Target Organs** Eyes, skin, respiratory system, central nervous system

**Cancer Site** [in animals: lung, kidney & forestomach tumors]

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl Cellosolve®

<table>
<thead>
<tr>
<th>CAS</th>
<th>109-86-4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CH₃OCH₂CH₂OH</strong></td>
<td></td>
</tr>
<tr>
<td>RTECS</td>
<td>KL5775000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>EGME, Ethylene glycol monomethyl ether, Glycol monomethyl ether, 2-Methoxyethanol</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1188 127</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.1 ppm (0.3 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 25 ppm (80 mg/m³) [skin]</td>
</tr>
</tbody>
</table>

**IDLH**: 200 ppm  
**Conversion**: 1 ppm = 3.11 mg/m³

### Physical Description

- Colorless liquid with a mild, ether-like odor.
- **MW**: 76.1  
- **BP**: 256°F  
- **FRZ**: -121°F  
- **Sol**: Miscible
- **VP**: 6 mmHg  
- **IP**: 9.60 eV  
- **Sp.Gr**: 0.96
- **FL.P**: 102°F  
- **UEL**: 14%  
- **LEL**: 1.8%

### Incompatibilities & Reactivities

- Strong oxidizers, caustics

### Measurement Methods

- NIOSH 1403 ; OSHA 53, 79
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Quick drench |

### First Aid

| Eye: Irrigate immediately |
| Skin: Water flush promptly |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

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Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 1 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 2.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 5 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 100 ppm:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode*

**Up to 200 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/
  Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, nose, throat; headache, drowsiness, lassitude (weakness, exhaustion); ataxia, tremor; anemic pallor; in animals: reproductive, teratogenic effects</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, respiratory system, central nervous system, blood, kidneys, reproductive system, hematopoietic system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# Methyl Cellosolve® acetate

<table>
<thead>
<tr>
<th>CAS</th>
<th>110-49-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KL5950000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- EGMEA, Ethylene glycol monomethyl ether acetate
- Glycol monomethyl ether acetate
- 2-Methoxyethyl acetate

## Exposure Limits
- **NIOSH REL**: TWA 0.1 ppm (0.5 mg/m³) [skin]
- **OSHA PEL**: TWA 25 ppm (120 mg/m³) [skin]
- **IDLH**: 200 ppm

## Physical Description
- Colorless liquid with a mild, ether-like odor.
- **MW**: 118.1
- **BP**: 293°F
- **FRZ**: -85°F
- **Sol**: Miscible
- **VP**: 2 mmHg
- **IP**: ?
- **Sp.Gr**: 1.01
- **Fl.P**: 120°F
- **UEL**: 8.2%
- **LEL**: 1.7%

## Incompatibilities & Reactivities
- Nitrates; strong oxidizers, alkalis & acids

## Measurement Methods
- NIOSH 1451 ; OSHA 53 , 79
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
**Skin**: Prevent skin contact
**Eyes**: Prevent eye contact
**Wash skin**: When contaminated
**Remove**: When wet or contaminated
**Change**: No recommendation

## First Aid
**Eye**: Irrigate immediately
**Skin**: Water flush promptly
**Breathing**: Respiratory support
**Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

**Up to 1 ppm:**
(APF = 10) Any supplied-air respirator*

**Up to 2.5 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 5 ppm:**
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 100 ppm:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode*

**Up to 200 ppm:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose, throat; kidney, brain damage; in animals: narcosis; reproductive, teratogenic effects

**Target Organs** Eyes, respiratory system, kidneys, brain, central nervous system, peripheral nervous system, reproductive system, hematopoietic system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl chloride

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS 74-87-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃Cl</td>
<td>RTECS PA6300000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Chloromethane, Monochloromethane

### DOT ID & Guide

- 1063 115

### Exposure Limits

- **NIOSH REL:** Ca **See Appendix A**
- **OSHA PEL†:** TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 3 hours)
- **IDLH** Ca [2000 ppm]

### Conversion

1 ppm = 2.07 mg/m³

### Physical Description

Colorless gas with a faint, sweet odor which is not noticeable at dangerous concentrations. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>50.5</td>
</tr>
<tr>
<td>BP</td>
<td>-12°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-144°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.5%</td>
</tr>
<tr>
<td>VP</td>
<td>5.0 atm</td>
</tr>
<tr>
<td>IP</td>
<td>11.28 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>1.78</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA (Gas)</td>
</tr>
<tr>
<td>UEL</td>
<td>17.4%</td>
</tr>
<tr>
<td>LEL</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Chemically-active metals such as potassium, powdered aluminum, zinc & magnesium; water [Note: Reacts with water (hydrolyzes) to form hydrochloric acid.]

### Measurement Methods

- NIOSH 1001
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Frostbite
- **Eyes:** Frostbite
- **Wash skin:** No recommendation
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Frostbite wash

### First Aid

- **Eye:** Frostbite
- **Skin:** Frostbite
- **Breathing:** Respiratory support

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

Inhalation, skin and/or eye contact (liquid)

### Symptoms

Dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>central nervous system, liver, kidneys, reproductive system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung, kidney &amp; forestomach tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## Methyl chloroform

**CAS** 71-55-6  
**RTECS** KJ2975000

### Synonyms & Trade Names
- Chlorothene; 1,1,1-Trichloroethane; 1,1,1-Trichloroethane (stabilized)

### DOT ID & Guide
- DOT ID & Guide 2831 160

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: C 350 ppm (1900 mg/m³) [15-minute] See Appendix C (Chloroethanes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: TWA 350 ppm (1900 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 700 ppm  
**Conversion** 1 ppm = 5.46 mg/m³

### Physical Description
Colorless liquid with a mild, chloroform-like odor.

- **MW**: 133.4  
- **BP**: 165°F  
- **FRZ**: -23°F  
- **Sol**: 0.4%  
- **VP**: 100 mmHg  
- **IP**: 11.00 eV  
- **Sp.Gr**: 1.34  
- **UEL**: 12.5%  
- **LEL**: 7.5%

### Incompatibilities & Reactivities
- Strong caustics; strong oxidizers; chemically-active metals such as zinc, aluminum, magnesium powders, sodium & potassium; water [Note: Reacts slowly with water to form hydrochloric acid.]

### Measurement Methods
- NIOSH 1003  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

| Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: No recommendation |
| **Eye**: Irrigate immediately  
**Skin**: Soap wash promptly  
**Breathing**: Respiratory support  
**Swallow**: Medical attention immediately |

### Important additional information about respirator selection

#### Respirator Recommendations
- **NIOSH/OSHA**
  - Up to 700 ppm:
    - (APF = 10) Any supplied-air respirator*
    - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - **Emergency or planned entry into unknown concentrations or IDLH conditions:**
    - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
    - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
  - **Escape:**
    - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

---

*Crude estimates for supplied-air respirators - use appropriate engineering controls whenever possible.
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, central nervous system, cardiovascular system, liver</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# Methyl-2-cyanoacrylate

**CAS** 137-05-3  
**RTECS** AS7000000

## Synonyms & Trade Names
Mecrylate, Methyl cyanoacrylate, Methyl alpha-cyanoacrylate, Methyl ester of 2-cyanoacrylic acid

## Exposure Limits
- **NIOSH REL**: TWA 2 ppm (8 mg/m³) ST 4 ppm (16 mg/m³)
- **OSHA PEL†**: none
- **IDLH**: N.D.

## Conversion
1 ppm = 4.54 mg/m³

## Physical Description
Colorless liquid with a characteristic odor.
- **MW**: 111.1
- **BP**: ?
- **FRZ**: ?
- **Sol**: 30%
- **VP (77°F)**: 0.2 mmHg
- **IP**: ?
- **Sp.Gr (81°F)**: 1.10
- **FL.P**: 174°F
- **UEL**: ?
- **LEL**: ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

## Incompatibilities & Reactivities
- Moisture [Note: Contact with moisture causes rapid polymerization.]

## Measurement Methods
- **OSHA 55**
- **See**: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection)
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: Daily
- **Remove**: No recommendation
- **Change**: No recommendation
- **Provide**: Eyewash

## First Aid (See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Water wash
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

## Important additional information about respirator selection
Respirator Recommendations Not available.

## Exposure Routes
- inhalation, ingestion, skin and/or eye contact

## Symptoms
Irritation eyes, skin, nose; blurred vision, lacrimation (discharge of tears); rhinitis

## Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
### Methylcyclohexane

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-87-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>GV6125000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Cyclohexylmethane, Hexahydrotoluene</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2296 128</td>
</tr>
</tbody>
</table>

#### Exposure Limits

| **NIOSH REL**: TWA 400 ppm (1600 mg/m³) |
| **OSHA PEL†**: TWA 500 ppm (2000 mg/m³) |

**IDLH** 1200 ppm [LEL]  
**Conversion** 1 ppm = 4.02 mg/m³

#### Physical Description

Colorless liquid with a faint, benzene-like odor.  
**MW**: 98.2  
**BP**: 214°F  
**FRZ**: -196°F  
**Sol**: Insoluble  
**VP**: 37 mmHg  
**IP**: 9.85 eV  
**Sp.Gr**: 0.77  
**FI.P**: 25°F  
**UEL**: 6.7%  
**LEL**: 1.2%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities

Strong oxidizers

#### Measurement Methods

NIOSH 1500; OSHA 7  
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

(See protection)

- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet (flammable)  
- **Change**: No recommendation

#### First Aid

(See procedures)

- **Eye**: Irrigate immediately  
- **Skin**: Soap wash promptly  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**Up to 1200 ppm**:

- (APF = 10) Any supplied-air respirator  
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions**:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister  
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, nose, throat; dizziness, drowsiness; in animals: narcosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Methylcyclohexanol

**CAS** 25639-42-3  
**RTECS** GW0175000

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexahydrocresol, Hexahydromethylphenol</td>
<td>2617 129</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 50 ppm (235 mg/m³)</td>
<td>OSHA PEL†: TWA 100 ppm (470 mg/m³)</td>
</tr>
<tr>
<td>IDLH: 500 ppm</td>
<td>Conversion: 1 ppm = 4.67 mg/m³</td>
</tr>
</tbody>
</table>

#### Physical Description
Straw-colored liquid with a weak odor like coconut oil.

| MW: 114.2 | BP: 311-356°F |
| VP(86°F): 2 mmHg | IP: 9.80 eV |
| Fl.P: 149-158°F | UEL: ? |

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

#### Incompatibilities & Reactivities
Strong oxidizers

#### Measurement Methods
NIOSH 1404  
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
(See protection)

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated  
**Remove:** When wet or contaminated  
**Change:** No recommendation

#### First Aid
(See procedures)

**Eye:** Irrigate immediately  
**Skin:** Soap wash promptly  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

#### Respirator Recommendations
NIOSH

**Up to 500 ppm:**  
(APF = 10) Any supplied-air respirator*  
(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin, upper respiratory system; headache; in animals: narcosis; liver, kidney damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system, kidneys, liver</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## o-Methylcyclohexanone

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>583-60-8</td>
<td>GW1750000</td>
<td>2297 128</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 2-Methylcyclohexanone

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 50 ppm (230 mg/m³) ST 75 ppm (345 mg/m³) [skin]</td>
<td>TWA 100 ppm (460 mg/m³) [skin]</td>
</tr>
</tbody>
</table>

**IDLH**: 600 ppm

**Conversion**: 1 ppm = 4.59 mg/m³

### Physical Description
- Colorless liquid with a weak, peppermint-like odor.
- **MW**: 112.2
- **BP**: 325°F
- **FRZ**: 7°F
- **Sol**: Insoluble
- **VP**: 1 mmHg
- **IP**: ?
- **Sp.Gr**: 0.93

**Class II Combustible Liquid**: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH 2521
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 500 ppm:
(APF = 10) Any supplied-air respirator*

Up to 600 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms In animals: irritation eyes, mucous membrane; narcosis; dermatitis

Target Organs Skin, respiratory system, liver, kidneys, central nervous system

See also: INTRODUCTION
### Methyl cyclopentadienyl manganese tricarbonyl (as Mn)

<table>
<thead>
<tr>
<th>Chemical Structure</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH$_3$C$_5$H$_4$Mn(CO)$_3$</td>
<td>12108-13-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI-2, Combustion Improver-2, Manganese tricarbonylmethylcyclopentadienyl, 2-Methylcyclopentadienyl manganese tricarbonyl, MMT</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 0.2 mg/m$^3$ [skin]</th>
<th>OSHA PEL†: C 5 mg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH</td>
<td>N.D.</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description

Yellow to dark-orange liquid with a faint, pleasant odor. [Note: A solid below 36°F.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>218.1</td>
<td></td>
</tr>
<tr>
<td>BP</td>
<td>449°F</td>
<td></td>
</tr>
<tr>
<td>FRZ</td>
<td>36°F</td>
<td></td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
<td></td>
</tr>
<tr>
<td>VP(212°F)</td>
<td>7 mmHg</td>
<td></td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>FI.P</td>
<td>230°F</td>
<td></td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

Light (decomposes)

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid

(See procedures)

- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes; dizziness, nausea, headache; in animals: tremor, severe clonic spasms, lassitude (weakness, exhaustion), slow respiration; liver, kidney injury

### Target Organs

Eyes, central nervous system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl demeton

<table>
<thead>
<tr>
<th>CAS</th>
<th>8022-00-2</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Demeton methyl; O,O-Dimethyl 2-ethylmercaptoethyl thiophosphate; Metasystox®; Methyl mercaptophos; Methyl systox®

### Exposure Limits

| NIOSH REL: TWA 0.5 mg/m³ [skin] |
| OSHA PEL†: none |

### Physical Description
Oily, colorless to pale-yellow liquid with an unpleasant odor. [insecticide] [Note: Technical grade consists of 2 isomers: thiono & thiolo.]

| MW: 230.3 | BP: Decomposes |
| VP: 0.0004 mmHg | IP: ? |
| Fl.P: ? | UEL: ? |

### Incompatibilities & Reactivities
Strong oxidizers, alkalis, water

### Measurement Methods
None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: Daily |
| Provide: Eyewash, Quick drench |

### First Aid

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin; ache eyes, rhinorrhea (discharge of thin mucus); nausea, headache, dizziness, vomiting

### Target Organs
Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methylene bisphenyl isocyanate

**CAS** 101-68-8  
**RTECS** NQ9350000

### Synonyms & Trade Names
- 4,4'-Diphenylmethane diisocyanate; MDI  
- Methylene bis(4-phenyl isocyanate); Methylene di-p-phenylene ester of isocyanic acid

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 0.05 mg/m³ (0.005 ppm)</th>
<th>C 0.2 mg/m³ (0.020 ppm) [10-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>C 0.2 mg/m³ (0.02 ppm)</td>
<td></td>
</tr>
</tbody>
</table>

**IDLH** 75 mg/m³  

**Conversion** 1 ppm = 10.24 mg/m³

### Physical Description

White to light-yellow, odorless flakes. [Note: A liquid above 99°F.]

<table>
<thead>
<tr>
<th>MW: 250.3</th>
<th>BP: 597°F</th>
<th>MLT: 99°F</th>
<th>Sol: 0.2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(77°F): 0.000005 mmHg</td>
<td>IP: ?</td>
<td></td>
<td>Sp.Gr: 1.23 (Solid at 77°F)</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Combustible Solid  
Strong alkalis, acids, alcohol [Note: Polymerizes at 450°F.]

### Measurement Methods

- NIOSH 5521, 5522, 5525  
- OSHA 18  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact  
- Eyes: Prevent eye contact  
- Wash skin: When contaminated  
- Remove: When wet or contaminated  
- Change: Daily

### First Aid (See procedures)

- Eye: Irrigate immediately  
- Skin: Soap wash immediately  
- Breathing: Respiratory support  
- Swallow: Medical attention immediately
### Respirator Recommendations NIOSH

**Up to 0.5 mg/m³:**
- (APF = 10) Any supplied-air respirator*

**Up to 1.25 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 2.5 mg/m³:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 75 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, nose, throat; respiratory sensitization; cough, pulmonary secretions, chest pain, dyspnea (breathing difficulty); asthma

### Target Organs
- Eyes, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Methylene chloride

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-09-2</td>
<td>PA80500000</td>
<td>1593 160</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Dichloromethane, Methylene dichloride

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>OSHA PEL: [1910.1052] TWA 25 ppm ST 125 ppm</th>
</tr>
</thead>
</table>

### IDLH Ca [2300 ppm]

### Conversion
1 ppm = 3.47 mg/m³

### Physical Description
Colorless liquid with a chloroform-like odor. [Note: A gas above 104°F.]

<table>
<thead>
<tr>
<th>MW: 84.9</th>
<th>VP: 350 mmHg</th>
<th>Fl.P: ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP: 104°F</td>
<td>IP: 11.32 eV</td>
<td>UEL: 23%</td>
</tr>
<tr>
<td>FRZ: -139°F</td>
<td>Sp.Gr: 1.33</td>
<td>LEL: 13%</td>
</tr>
</tbody>
</table>

### Sol: 2%

### Combustible Liquid

### Incompatibilities & Reactivities
Strong oxidizers; caustics; chemically-active metals such as aluminum, magnesium powders, potassium & sodium; concentrated nitric acid

### Measurement Methods
NIOSH 1005 , 3800 ; OSHA 59 , 80

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin: Prevent skin contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: No recommendation</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Eye: Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Soap wash promptly</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

**Respirator Recommendations (See Appendix E)** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, cardiovascular system, central nervous system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung, liver, salivary &amp; mammary gland tumors]</td>
</tr>
<tr>
<td><strong>See also:</strong></td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
### NIOSH Pocket Guide to Chemical Hazards

**4,4'-Methylenebis(2-chloroaniline)**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>101-14-4</td>
<td>CY1050000</td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

DACPM; 3,3’-Dichloro-4,4’-diaminodiphenylmethane; MBOCA; 4,4’-Methylenebis(o-chloroaniline); 4,4’-Methylenebis(2-chlorobenzenamine); MOCA

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca TWA 0.003 mg/m³ [skin] See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca [N.D.]</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BP: ?</td>
</tr>
<tr>
<td></td>
<td>MLT: 230°F</td>
</tr>
<tr>
<td></td>
<td>Sol: Slight</td>
</tr>
<tr>
<td></td>
<td>VP(77°F): 0.00001 mmHg</td>
</tr>
<tr>
<td></td>
<td>IP: ?</td>
</tr>
<tr>
<td></td>
<td>Sp.Gr: 1.44</td>
</tr>
<tr>
<td></td>
<td>UEL: ?</td>
</tr>
<tr>
<td></td>
<td>LEL: ?</td>
</tr>
</tbody>
</table>

**Physical Description**

Tan-colored pellets or flakes with a faint, amine-like odor.

<table>
<thead>
<tr>
<th>MW: 267.2</th>
<th>BP: ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(77°F): 0.00001 mmHg</td>
<td>IP: ?</td>
</tr>
<tr>
<td>Fl.P: ?</td>
<td>UEL: ?</td>
</tr>
<tr>
<td></td>
<td>LEL: ?</td>
</tr>
</tbody>
</table>

**Incompatibilities & Reactivities**

Chemically-active metals (e.g., potassium, sodium, magnesium, zinc)

**Measurement Methods**

OSHA 24, 71

See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

(See protection)

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated/Daily

Remove: When wet or contaminated

Change: Daily

Provide: Eyewash, Quick drench

**First Aid**

(See procedures)

Eye: Irrigate immediately

Skin: Soap flush immediately

Breathing: Respiratory support

Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Hematuria (blood in the urine), cyanosis, nausea, methemoglobinemia, kidney irritation; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Liver, blood, kidneys</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver, lung &amp; bladder tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methylene bis(4-cyclohexylisocyanate)

<table>
<thead>
<tr>
<th>CAS 5124-30-1</th>
</tr>
</thead>
</table>

### Chemical Formula

CH₂[(C₆H₁₀)NCO]₂

### RTECS Code

NQ9250000

### Synonyms & Trade Names

- Dicyclohexylmethane 4,4′-diisocyanate; DMDI; bis(4-isocyanatocyclohexyl)methane; HMDI; Hydrogenated MDI; Reduced MDI; Saturated MDI

### DOT ID & Guide

**Exposure Limits**

- NIOSH REL: C 0.01 ppm (0.11 mg/m³)
- OSHA PEL†: none
- IDLH: N.D.

### Conversion

1 ppm = 10.73 mg/m³

### Physical Description

- Clear, colorless to light-yellow liquid.
- MW: 262.4
- BP: ?
- FRZ: <14°F
- Sol: Reacts
- VP(77°F): 0.001 mmHg
- IP: ?
- Sp.Gr(77°F): 1.07
- Fl.P: >395°F
- UEL: ?
- LEL: ?

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

- Water, ethanol, alcohols, amines, bases, acids, organotin catalysts [Note: May slowly polymerize if heated above 122°F.]

### Measurement Methods

- NIOSH 5525 ; OSHA PV2092
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Quick drench

### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Respirator Recommendations NIOSH

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 0.1 ppm</td>
<td>10</td>
<td>Any supplied-air respirator*</td>
</tr>
<tr>
<td>Up to 0.25 ppm</td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>Up to 0.5 ppm</td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>Up to 1 ppm</td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1 ppm</td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Emergency</td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td>Escape</td>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; skin, respiratory sensitization; chest tightness, dyspnea (breathing difficulty), cough, dry throat, wheezing, pulmonary edema; skin blisters

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

### 4,4'-Methylenedianiline

<table>
<thead>
<tr>
<th>CAS</th>
<th>101-77-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>BY5425000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names

4,4'-Diaminodiphenylmethane; para, para'-Diaminodiphenyl-methane; Dianilinomethane; 4,4'-Diphenylmethanediamine; MDA

#### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>[1910.1050] TWA 0.010 ppm ST 0.100 ppm</td>
</tr>
</tbody>
</table>

#### IDLH

Ca [N.D.]

#### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pale-brown, crystalline solid with a faint, amine-like odor.</td>
</tr>
</tbody>
</table>

| MW: 198.3 | BP: 748°F | MLT: 198°F | Sol: 0.1% |
| VP(77°F): 0.0000002 mmHg | IP: 10.70 eV | Sp.Gr: 1.06 (Liquid at 212°F) |
| Fl.P: 374°F | UEL: ? | LEL: ? |

#### Combustible Solid

#### Incompatibilities & Reactivities

Strong oxidizers

#### Measurement Methods

NIOSH 5029

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated/Daily

**Remove:** When wet or contaminated

**Change:** Daily

**Provide:** Eyewash, Quick drench

**First Aid**

**Eye:** Irrigate immediately

**Skin:** Soap wash immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

#### Respirator Recommendations

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes; jaundice, hepatitis; myocardial damage; in animals: heart, liver, spleen damage; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, liver, cardiovascular system, spleen</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: bladder cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl ethyl ketone peroxide

<table>
<thead>
<tr>
<th>CAS 1338-23-4</th>
<th>RTECS EL9450000</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₈H₁₆O₄</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
2-Butanone peroxide, Ethyl methyl ketone peroxide, MEKP, MEK peroxide, Methyl ethyl ketone hydroperoxide

### Exposure Limits

- NIOSH REL: C 0.2 ppm (1.5 mg/m³)
- OSHA PEL‡: none

### Physical Description
Colorless liquid with a characteristic odor. [Note: Explosive decomposition occurs at 230°F.]

<table>
<thead>
<tr>
<th>MW: 176.2</th>
<th>BP: 244°F (Decomposes)</th>
<th>FRZ: ?</th>
<th>Sol: Soluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fl.P(oc): 125-200°F (60% MEKP)</td>
<td>UEL: ?</td>
<td>LEL: ?</td>
<td></td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
Organic materials, heat, flames, sunlight, trace contaminants [Note: A strong oxidizing agent. Pure MEKP is shock sensitive. Commercial product is diluted with 40% dimethyl phthalate, cyclohexane peroxide, or diallyl phthalate to reduce sensitivity to shock.]

### Measurement Methods
NIOSH 3508 ; OSHA 77
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

### First Aid
| Eye: Irrigate immediately |
| Skin: Water wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Important additional information about respirator selection
Respirator Recommendations Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, nose, throat; cough, dyspnea (breathing difficulty), pulmonary edema; blurred vision; blisters, scars skin; abdominal pain, vomiting, diarrhea; dermatitis; in animals: liver, kidney damage

### Target Organs
Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
**Methyl formate**

<table>
<thead>
<tr>
<th>CAS</th>
<th>107-31-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>LQ8925000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

- Methyl ester of formic acid
- Methyl methanoate

**DOT ID & Guide**

- DOT ID: 1243 129

**Exposure Limits**

- NIOSH REL: TWA 100 ppm (250 mg/m³) ST 150 ppm (375 mg/m³)
- OSHA PEL†: TWA 100 ppm (250 mg/m³)

**IDLH**

- 4500 ppm

**Conversion**

- 1 ppm = 2.46 mg/m³

**Physical Description**

- Colorless liquid with a pleasant odor. [Note: A gas above 89°F.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>60.1</td>
</tr>
<tr>
<td>BP</td>
<td>89°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-148°F</td>
</tr>
<tr>
<td>Sol</td>
<td>30%</td>
</tr>
<tr>
<td>VP</td>
<td>476 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>10.82 eV</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>-2°F</td>
</tr>
<tr>
<td>UEL</td>
<td>23%</td>
</tr>
<tr>
<td>LEL</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

**Class IA Flammable Liquid**: Fl.P. below 73°F and BP below 100°F.

**Incompatibilities & Reactivities**

- Strong oxidizers [Note: Reacts slowly with water to form methanol & formic acid.]

**Measurement Methods**

- NIOSH S291 (II-5) ; OSHA PV2041

**Personal Protection & Sanitation**

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

**First Aid**

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 1000 ppm:**  
(APF = 10) Any supplied-air respirator*

**Up to 2500 ppm:**  
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 4500 ppm:**  
(APF = 50) Any self-contained breathing apparatus with a full facepiece  
(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, nose; chest tightness, dyspnea (breathing difficulty); visual disturbance; central nervous system depression; in animals: pulmonary edema; narcosis</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
5-Methyl-3-heptanone

C₂H₅COCH₂CH(CH₃)CH₂CH₃

Synonyms & Trade Names
Amyl ethyl ketone, Ethyl amyl ketone, 3-Methyl-5-heptanone

CAS 541-85-5
RTECS MJ7350000

Exposure Limits
NIOSH REL: TWA 25 ppm (130 mg/m³)
OSHA PEL: TWA 25 ppm (130 mg/m³)

IDLH 100 ppm

Conversion 1 ppm = 5.24 mg/m³

Physical Description
Colorless liquid with a pungent odor.
MW: 128.2
BP: 315°F
FRZ: -70°F
Sol: Insoluble
VP: 2 mmHg
IP: ?
Sp.Gr: 0.82
Fl.P: 138°F
UEL: ?
LEL: ?

Incompatibilities & Reactivities
Strong oxidizers

Measurement Methods
NIOSH 1301, 2553
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Water flush
Breathing: Respiratory support
Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

**Up to 100 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

---

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, mucous membrane; headache; narcosis, coma; dermatitis

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl hydrazine

<table>
<thead>
<tr>
<th>CAS 60-34-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃NHNH₂</td>
</tr>
<tr>
<td>RTECS MV5600000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

MMH, Monomethylhydrazine

### DOT ID & Guide

124 131

## Exposure Limits

- **NIOSH REL:** Ca C 0.04 ppm (0.08 mg/m³) [2-hr] See Appendix A
- **OSHA PEL:** C 0.2 ppm (0.35 mg/m³) [skin]

### IDLH Ca [20 ppm]

### Conversion

| 1 ppm | 1.89 mg/m³ |

## Physical Description

Fuming, colorless liquid with an ammonia-like odor.

| MW: 46.1 | BP: 190°F |
| VP: 38 mmHg | IP: 8.00 eV |
| Fl.P: 17°F | UEL: 92% |
| FRZ: -62°F | LEL: 2.5% |

Sol: Miscible

Sp.Gr(77°F): 0.87

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

## Incompatibilities & Reactivities

Oxides of iron; copper; manganese; lead; copper alloys; porous materials such as earth, asbestos, wood & cloth; strong oxidizers such as fluorine & chlorine; nitric acid; hydrogen peroxide

## Measurement Methods

NIOSH 3510

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

## First Aid

- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

## Important additional information about respirator selection

### Respirator Recommendations

**NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes

Inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms

Irritation eyes, skin, respiratory system; vomiting, diarrhea, tremor, ataxia; anoxia, cyanosis; convulsions; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, central nervous system, liver, blood, cardiovascular system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung, liver, blood vessel &amp; intestine tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl iodide

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>74-88-4</td>
<td>PA9450000</td>
<td>2644 151</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Iodomethane, Monoiodomethane

### Exposure Limits
- NIOSH REL: Ca TWA 2 ppm (10 mg/m³) [skin] See Appendix A
- OSHA PEL: TWA 5 ppm (28 mg/m³) [skin]
- IDLH Ca [100 ppm]
- **Conversion** 1 ppm = 5.80 mg/m³

### Physical Description
- Colorless liquid with a pungent, ether-like odor. [Note: Turns yellow, red, or brown on exposure to light & moisture.]
- MW: 141.9
- BP: 109°F
- FRZ: -88°F
- Sol: 1%
- VP: 400 mmHg
- IP: 9.54 eV
- Sp.Gr: 2.28
- Fl.P: NA
- UEL: NA
- LEL: NA

### Noncombustible Liquid

### Incompatibilities & Reactivities
- Strong oxidizers [Note: Decomposes at 518°F.]

### Measurement Methods
- NIOSH 1014
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations NIOSH
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; nausea, vomiting; dizziness, ataxia; slurred speech, drowsiness; dermatitis; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, central nervous system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung, kidney &amp; forestomach tumors]</td>
</tr>
<tr>
<td><strong>See also</strong></td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Methyl isoamyl ketone

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>110-12-3</td>
</tr>
<tr>
<td>RTECS</td>
<td>MP3850000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Isoamyl methyl ketone
- Isopentyl methyl ketone
- 2-Methyl-5-hexanone
- 5-Methyl-2-hexanone
- MIAK

### DOT ID & Guide
- 2302 127

### Exposure Limits
- NIOSH REL: TWA 50 ppm (240 mg/m³)
- OSHA PEL†: TWA 100 ppm (475 mg/m³)

### IDLH
- N.D.

### Conversion
- 1 ppm = 4.67 mg/m³

### Physical Description
- Colorless, clear liquid with a pleasant, fruity odor.

### MW: 114.2
- BP: 291°F
- FRZ: -101°F
- Sol: 0.5%
- VP: 5 mmHg
- IP: 9.284 eV
- Sp.Gr: 0.81
- Fl.P: 97°F
- UEL(200°F): 8.2%
- LEL(200°F): 1.0%

### Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities
- Oxidizers

### Measurement Methods
- OSHA PV2042
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*

Up to 1250 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

Up to 2500 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 5000 ppm:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
### Methyl isobutyl carbinol

**CAS** 108-11-2  
**RTECS** SA7350000

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isobutylmethylcarbinol, Methyl amy l alcohol, 4-Methyl-2-pentanol, MIBC</td>
<td>2053 129</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 25 ppm (100 mg/m³) ST 40 ppm (165 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH</td>
<td>400 ppm</td>
</tr>
</tbody>
</table>

| Conversion | 1 ppm = 4.18 mg/m³ |

**Physical Description**  
Colorless liquid with a mild odor.

- MW: 102.2
- BP: 271°F
- FRZ: -130°F
- Sol: 2%
- VP: 3 mmHg
- IP: ?
- Sp.Gr: 0.81
- Fl.P: 106°F
- UEL: 5.5%
- LEL: 1.0%

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

**Incompatibilities & Reactivities**  
Strong oxidizers

**Measurement Methods**  
NIOSH 1402, 1405; OSHA 7  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**  
(See protection)

Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: No recommendation

**First Aid**  
(See procedures)

Eye: Irrigate immediately  
Skin: Water flush promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 250 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 400 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, skin; headache, drowsiness; dermatitis; in animals: narcosis

**Target Organs** Eyes, skin, central nervous system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Methyl isocyanate

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>624-83-9</td>
<td>NQ94500000</td>
<td>2480 155</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Methyl ester of isocyanic acid, MIC

### Exposure Limits
- NIOSH REL: TWA 0.02 ppm (0.05 mg/m³) [skin]
- OSHA PEL: TWA 0.02 ppm (0.05 mg/m³) [skin]
- IDLH: 3 ppm

### Conversion
- 1 ppm = 2.34 mg/m³

### Physical Description
- Colorless liquid with a sharp, pungent odor.
- MW: 57.1
- BP: 102-104°F
- FRZ: -49°F
- Sol(59°F): 10%
- VP: 348 mmHg
- IP: 10.67 eV
- Sp.Gr: 0.96
- Fl.P: 19°F
- UEL: 26%
- LEL: 5.3%

### Incompatibilities & Reactivities
- Water, oxidizers, acids, alkalis, amines, iron, tin, copper [Note: Usually contains inhibitors to prevent polymerization.]

### Measurement Methods
- OSHA 54
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 0.2 ppm:
(APF = 10) Any supplied-air respirator*

Up to 0.5 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

Up to 1 ppm:
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 3 ppm:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; respiratory sensitization, cough, pulmonary secretions, chest pain, dyspnea (breathing difficulty); asthma; eye, skin damage; in animals: pulmonary edema

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
# Methyl isopropyl ketone

**Chemical Formula:** CH$_3$COCH(CH$_3$)$_2$

**CAS Number:** 563-80-4

**RTECS Number:** EL9100000

## Synonyms & Trade Names
- 2-Acetyl propane
- Isopropyl methyl ketone
- 3-Methyl-2-butanone
- 3-Methyl butan-2-one
- MIPK

## Exposure Limits
- **NIOSH REL:** TWA 200 ppm (705 mg/m$^3$)
- **OSHA PEL†:** none

**IDLH:** N.D.

**Conversion:** 1 ppm = 3.53 mg/m$^3$

## Physical Description
- Colorless liquid with an acetone-like odor.
- MW: 86.2
- BP: 199°F
- FRZ: -134°F
- Sol: Very slight
- VP: 42 mmHg
- IP: 9.32 eV
- Sp.Gr: 0.81
- Fl.P: ?
- UEL: ?
- LEL: ?

## Incompatibilities & Reactivities
- **Oxidizers**

## Measurement Methods
- None available
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

## First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

## Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

## Symptoms
- Irritation eyes, skin, mucous membrane, respiratory system; cough

## Target Organs
- Eyes, skin, respiratory system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Methyl mercaptan

<table>
<thead>
<tr>
<th>CAS</th>
<th>74-93-1</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Mercaptomethane, Methanethiol, Methyl sulfhydrate

### DOT ID & Guide
1064 117

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C 0.5 ppm (1 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: C 10 ppm (20 mg/m³)</td>
</tr>
</tbody>
</table>

### IDLH
150 ppm

### Conversion
1 ppm = 1.97 mg/m³

### Physical Description
Colorless gas with a disagreeable odor like garlic or rotten cabbage. [Note: A liquid below 43°F. Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>MW: 48.1</th>
<th>BP: 43°F</th>
<th>FRZ: -186°F</th>
<th>Sol: 2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 1.7 atm</td>
<td>IP: 9.44 eV</td>
<td>RGasD: 1.66</td>
<td>Sp.Gr: 0.90 (Liquid at 32°F)</td>
</tr>
<tr>
<td>Fl.P: NA (Gas) (oc) 0°F (Liquid)</td>
<td>UEL: 21.8%</td>
<td>LEL: 3.9%</td>
<td></td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
Strong oxidizers, bleaches, copper, aluminum, nickel-copper alloys

### Measurement Methods
NIOSH 2542 ; OSHA 26
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact (liquid)/Frostbite
- Eyes: Prevent eye contact (liquid)/Frostbite
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash (liquid), Quick drench (liquid), Frostbite wash

### First Aid (See procedures)
- Eye: Irrigate immediately (liquid)/Frostbite
- Skin: Water flush immediately (liquid)/Frostbite
- Breathing: Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 5 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
(APF = 10) Any supplied-air respirator

Up to 12.5 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

Up to 25 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 150 ppm:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin and/or eye contact (liquid)

Symptoms Irritation eyes, skin, respiratory system; narcosis; cyanosis; convulsions; liquid: frostbite

Target Organs Eyes, skin, respiratory system, central nervous system, blood

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl methacrylate

CH₂=C(CH₃)COOCH₃  
RTECS OZ5075000

### Synonyms & Trade Names
- Methacrylate monomer, Methyl ester of methacrylic acid, Methyl-2-methyl-2-propenoate

### DOT ID & Guide
- 1247 129 P (inhibited)

### Exposure Limits
- NIOSH REL: TWA 100 ppm (410 mg/m³)
- OSHA PEL: TWA 100 ppm (410 mg/m³)

### IDLH
- 1000 ppm

### Conversion
- 1 ppm = 4.09 mg/m³

### Physical Description
- Colorless liquid with an acrid, fruity odor.
  - MW: 100.1
  - BP: 214°F
  - FRZ: -54°F
  - Sol: 1.5%
  - VP: 29 mmHg
  - IP: 9.70 eV
  - Sp.Gr: 0.94
  - Fl.P(oc): 50°F
  - UEL: 8.2%
  - LEL: 1.7%

### Incompatibilities & Reactivities
- Nitrates, oxidizers, peroxides, strong alkalis, moisture [Note: May polymerize if subjected to heat, oxidizers, or ultraviolet light. Usually contains an inhibitor such as hydroquinone.]

### Measurement Methods
- NIOSH 2537 ; OSHA 94
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 1000 ppm:**

- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, skin, nose, throat; dermatitis

### Target Organs

- Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# Methyl (n-amyl) ketone

**CAS** 110-43-0  
**RTECS** MJ5075000

## Synonyms & Trade Names
Amyl methyl ketone, n-Amyl methyl ketone, 2-Heptanone

## DOT ID & Guide
1110 127

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 100 ppm (465 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 100 ppm (465 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 800 ppm  
**Conversion** 1 ppm = 4.67 mg/m³

## Physical Description
Colorless to white liquid with a banana-like, fruity odor.

| MW: 114.2 | BP: 305°F |
| VP: 3 mmHg | IP: 9.33 eV |
| Fl.P: 102°F | UEL(250°F): 7.9% |
| FRZ: -32°F | LEL(151°F): 1.1% |
| Sol: 0.4% | Sp.Gr: 0.81 |

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

## Incompatibilities & Reactivities
Strong acids, alkalis & oxidizers [Note: Will attack some forms of plastic.]

## Measurement Methods

| NIOSH 1301 | 2553 |
| See: NMAM or OSHA Methods |

## Personal Protection & Sanitation
(See protection)

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |

## First Aid
(See procedures)

| Eye: Irrigate immediately |
| Skin: Soap wash |
| Breathing: Fresh air |
| Swallow: Medical attention immediately |

**NIOSH Pocket Guide to Chemical Hazards**

[Image]
### Respirator Recommendations NIOSH/OSHA

**Up to 800 ppm:**

- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, mucous membrane; headache; narcosis, coma; dermatitis

### Target Organs

Eyes, skin, respiratory system, central nervous system, peripheral nervous system

See also: INTRODUCTION
# Methyl parathion

**(CH₃O)₂P(S)OC₆H₄NO₂**

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azophos®, O,O-Dimethyl-O-p-nitrophenylphosphorothioate; Parathion methyl</td>
<td>2783 152 (solid)</td>
</tr>
<tr>
<td></td>
<td>3018 152 (liquid)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 0.2 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>White to tan, crystalline solid or powder with a pungent, garlic-like odor. [pesticide] [Note: The commercial product in xylene is a tan liquid.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MW: 263.2</th>
<th>BP: 289°F</th>
<th>MLT: 99°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0.00001 mmHg</td>
<td>IP: ?</td>
<td>Sol(77°F): 0.006%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Combustible Solid</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Incompatibilities &amp; Reactivities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong oxidizers, water [Note: Explosive risk when heated above 122°F.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH 5600 ; OSHA PV2112</td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Personal Protection &amp; Sanitation (See protection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated/Daily</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: Daily</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First Aid (See procedures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Skin: Soap wash immediately</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 2 mg/m³:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 10 mg/m³:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 200 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin; nausea, vomiting, abdominal cramps, diarrhea, salivation; headache, dizziness, lassitude (weakness, exhaustion); rhinorhea (discharge of thin mucus), chest tightness; blurred vision, miosis; cardiac irregularities; muscle fasciculation; dyspnea (breathing difficulty)

Target Organs Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Methyl silicate

<table>
<thead>
<tr>
<th>CAS 681-84-5</th>
<th>RTECS VV9800000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- Methyl orthosilicate
- Tetramethoxysilane
- Tetramethyl ester of silicic acid
- Tetramethyl silicate

### DOT ID & Guide
- 2606 155

### Exposure Limits
- NIOSH REL: TWA 1 ppm (6 mg/m³)
- OSHA PEL: none
- IDLH: N.D.

### Conversion
- 1 ppm = 6.23 mg/m³

### Physical Description
Clear, colorless liquid. [Note: A solid below 28°F.]

<table>
<thead>
<tr>
<th>MW: 152.3</th>
<th>BP: 250°F</th>
<th>FRZ: 28°F</th>
<th>Sol: Soluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(77°F): 12 mmHg</td>
<td>IP:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fl.P: 205°F</td>
<td>UEL:</td>
<td>LEL:</td>
<td></td>
</tr>
</tbody>
</table>

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities
- Oxidizers; hexafluorides of rhenium, molybdenum & tungsten

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: Daily
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, corneal damage (following even short-term exposure to the vapor); lung, kidney injury; pulmonary edema

### Target Organs
- Eyes, respiratory system, kidneys

See also: INTRODUCTION
## alpha-Methyl styrene

**CAS**: 98-83-9  
**RTECS**: WL5075300

### Synonyms & Trade Names
- AMS, Isopropenyl benzene, 1-Methyl-1-phenylethylene, 2-Phenyl propylene

### Exposure Limits
- **NIOSH REL**: TWA 50 ppm (240 mg/m³) ST 100 ppm (485 mg/m³)  
- **OSHA PEL†**: C 100 ppm (480 mg/m³)

**IDLH**: 700 ppm  
**Conversion**: $1 \text{ ppm} = 4.83 \text{ mg/m}^3$

### Physical Description
- Colorless liquid with a characteristic odor.
- **MW**: 118.2  
- **BP**: 330°F  
- **FRZ**: -10°F  
- **Sol**: Insoluble  
- **VP**: 2 mmHg  
- **IP**: 8.35 eV  
- **Sp.Gr**: 0.91  
- **Fl.P**: 129°F  
- **UEL**: 6.1%  
- **LEL**: 1.9%

**Class II Combustible Liquid**: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities
- Oxidizers, peroxides, halogens, catalysts for vinyl or ionic polymers; aluminum, iron chloride, copper [Note: Usually contains an inhibitor such as tert-butyl catechol.]

### Measurement Methods
- NIOSH 1501 ; OSHA 7  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection )
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: No recommendation

### First Aid
(See procedures )
- **Eye**: Irrigate immediately  
- **Skin**: Water flush promptly  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*

Up to 700 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; drowsiness; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Metribuzin

**CAS:** 21087-64-9  
**RTECS:** XZ2990000

### Synonyms & Trade Names

4-Amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 5 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

### IDLH

N.D.

### Conversion

<table>
<thead>
<tr>
<th>MLT</th>
<th>Sol</th>
<th>Sp.Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>257°F</td>
<td>0.1%</td>
<td>1.31</td>
</tr>
</tbody>
</table>

### Physical Description

Colorless, crystalline solid. [herbicide]

<table>
<thead>
<tr>
<th>MW</th>
<th>VP</th>
<th>Fl.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>214.3</td>
<td>0.0000004 mmHg</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid

### Incompatibilities & Reactivities

None reported

### Measurement Methods

OSHA PV2044  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated/Daily  
**Remove:** When wet or contaminated  
**Change:** Daily

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Soap wash  
**Breathing:** Fresh air  
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

**Exposure Routes** Inhalation, ingestion, skin and/or eye contact

**Symptoms** In animals: central nervous system depression; thyroid, liver enzyme changes

**Target Organs** Central nervous system, thyroid, liver

See also: INTRODUCTION
### NIOSH Pocket Guide to Chemical Hazards

**Mica (containing less than 1% quartz)**

<table>
<thead>
<tr>
<th>CAS</th>
<th>12001-26-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>VV8760000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Biotite, Lepidolite, Margarite, Muscovite, Phlogopite, Roscoelite, Zimmwaldite

**Exposure Limits**
- NIOSH REL: TWA 3 mg/m³ (resp)
- OSHA PEL†: TWA 20 mppcf

**IDLH** 1500 mg/m³

**Physical Description**
- Colorless, odorless flakes or sheets of hydrous silicates.
- MW: 797 (approx)
- BP: ?
- MLT: ?
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 2.6-3.2
- UEL: NA
- LEL: NA

**Noncombustible Solid**

**Incompatibilities & Reactivities**
- None reported

**Measurement Methods**
- NIOSH 0600
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

**First Aid**
- Eye: Irrigate immediately
- Breathing: Fresh air

**Important additional information about respirator selection**

**Respirator Recommendations**

**NIOSH**

- **Up to 15 mg/m³:** (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

- **Up to 30 mg/m³:** (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

- **APF = 10** Any supplied-air respirator

- **Up to 75 mg/m³:** (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

- **Up to 150 mg/m³:** (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on
selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1500 mg/m³:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes; pneumoconiosis, cough, dyspnea (breathing difficulty); lassitude (weakness, exhaustion); weight loss</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Respiratory system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
### NIOSH Pocket Guide to Chemical Hazards

#### Mineral wool fiber

<table>
<thead>
<tr>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS PY8070000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
Manmade mineral fibers, Rock wool, Slag wool, Synthetic vitreous fibers [Note: Produced by blowing steam or air through molten rock (rock wool) or various furnace slags that are by-products of metal smelting or refining processes (slag wool).]

#### Exposure Limits

| NIOSH REL | TWA 3 fibers/cm³ (fibers with diameter < or = 3.5 µm & length > or = 10 µm.) |
| OSHA PEL | TWA 5 mg/m³ (total) |
| TWA 5 mg/m³ (resp) |

| IDLH | N.D. |

#### Physical Description
Typically, a mineral "wool" with diameters >0.5 µm & length >1.5 µm.

| MW | varies |
| VP | 0 mmHg (approx) |
| IP | NA |
| Fl.P | NA |

#### Noncombustible Fibers

#### Incompatibilities & Reactivities
None reported

#### Measurement Methods

| NIOSH 0500, 7400 |
| See: NMAM or OSHA Methods |

#### Personal Protection & Sanitation

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** Daily
**Remove:** No recommendation
**Change:** Daily

**First Aid**

**Eye:** Irrigate immediately
**Breathing:** Fresh air
<table>
<thead>
<tr>
<th><strong>Important additional information about respirator selection</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH</strong></td>
</tr>
<tr>
<td><strong>Up to 5X REL:</strong></td>
</tr>
<tr>
<td>(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 10X REL:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 25X REL:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.</td>
</tr>
<tr>
<td><strong>Up to 50X REL:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 1000X REL:</strong></td>
</tr>
<tr>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here</td>
</tr>
<tr>
<td><strong>Exposure Routes</strong> inhalation, skin and/or eye contact</td>
</tr>
<tr>
<td><strong>Symptoms</strong> Irritation eyes, skin, respiratory system; dyspnea (breathing difficulty)</td>
</tr>
<tr>
<td><strong>Target Organs</strong> Eyes, skin, respiratory system</td>
</tr>
<tr>
<td>See also: INTRODUCTION</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Molybdenum

<table>
<thead>
<tr>
<th>CAS</th>
<th>7439-98-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>QA4680000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Molybdenum metal

### Exposure Limits

| NIOSH REL: | See Appendix D |
| OSHA PEL*: | TWA 15 mg/m³ [*Note: The PEL also applies to other insoluble molybdenum compounds (as Mo).] |

**IDLH**: 5000 mg/m³ (as Mo)

### Physical Description
- Dark gray or black powder with a metallic luster.
- MW: 95.9
- BP: 8717°F
- MLT: 4752°F
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 10.28
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH 7300, 7301, 7303, 9102; OSHA ID121, ID125G
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **(See protection)**
  - Skin: No recommendation
  - Eyes: No recommendation
  - Wash skin: No recommendation
  - Remove: No recommendation
  - Change: No recommendation

### First Aid
- **(See procedures)**
  - Eye: Irrigate immediately
  - Breathing: Respiratory support
  - Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations OSHA

Up to 75 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 150 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 375 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 750 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 5000 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms In animals: irritation eyes, nose, throat; anorexia, diarrhea, weight loss; listlessness; liver, kidney damage

Target Organs Eyes, respiratory system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Molybdenum (soluble compounds, as Mo)

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms vary depending upon the specific soluble molybdenum compound.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: See Appendix D</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL: TWA 5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>IDLH 1000 mg/m³ (as Mo)</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

## Physical Description
Appearance and odor vary depending upon the specific soluble molybdenum compound.
Properties vary depending upon the specific soluble molybdenum compound.

## Incompatibilities & Reactivities
Varies

## Measurement Methods
NIOSH 7300, 7301, 7303, 9102; OSHA ID121, ID125G
See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection)
Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: No recommendation

## First Aid (See procedures)
Eye: Irrigate immediately  
Skin: Water flush  
Breathing: Respiratory support  
Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations OSHA**

**Up to 25 mg/m³:**
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.*

**Up to 50 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

**Up to 125 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

**Up to 250 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1000 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** In animals: irritation eyes, nose, throat; anorexia; incoordination; dyspnea (breathing difficulty); anemia

**Target Organs** Eyes, respiratory system, kidneys, blood

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Monocrotophos

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>6923-22-4</td>
<td>TC4375000</td>
<td>TC4375000</td>
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</tbody>
</table>

### Physical Description
Colorless to reddish-brown solid with a mild, ester odor. [insecticide]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>223.2</td>
</tr>
<tr>
<td>BP</td>
<td>257°F</td>
</tr>
<tr>
<td>MLT</td>
<td>129°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Miscible</td>
</tr>
<tr>
<td>VP</td>
<td>0.000007 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Fl.P</td>
<td>&gt;200°F</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
Metals, low molecular weight alcohols & glycols [Note: Corrosive to black iron, drum steel, stainless steel 304 & brass. Should be stored at 70-80°F.]

### Measurement Methods
NIOSH 5600 ; OSHA PV2045
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated  
**Remove:** When wet or contaminated  
**Change:** Daily

### First Aid
**Eye:** Irrigate immediately  
**Skin:** Water flush immediately  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations
Not available.

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, miosis, blurred vision; dizziness, convulsions; dyspnea (breathing difficulty); salivation, abdominal cramps, nausea, diarrhea, vomiting; in animals: possible teratogenic effects

### Target Organs
Eyes, respiratory system, central nervous system, cardiovascular system, blood cholinesterase, reproductive system

See also: INTRODUCTION
# Monomethyl aniline

**CAS** 100-61-8

**CAS** C₆H₅NHCH₃

**RTECS** BY4550000

**Synonyms & Trade Names**
MA, (Methylamino)benzene, N-Methyl aniline, Methylphenylamine, N-Phenylmethylamine

**DOT ID & Guide**
2294 153

## Exposure Limits

| | 
|---|---|
| NIOSH REL: | TWA 0.5 ppm (2 mg/m³) [skin] |
| OSHA PEL†: | TWA 2 ppm (9 mg/m³) [skin] |

**IDLH** 100 ppm

**Conversion** 1 ppm = 4.38 mg/m³

## Physical Description

Yellow to light-brown liquid with a weak, ammonia-like odor.

- **MW:** 107.2
- **BP:** 384°F
- **FRZ:** -71°F
- **Sol:** Insoluble
- **VP:** 0.3 mmHg
- **IP:** 7.32 eV
- **Sp.Gr:** 0.99
- **Fl.P:** 175°F
- **UEL:** ?
- **LEL:** ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

## Incompatibilities & Reactivities

Strong acids, strong oxidizers

## Measurement Methods

NIOSH 3511

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |

## First Aid

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |
Important additional information about respirator selection

Respirator Recommendations NIOSH

**Up to 5 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 25 ppm:**
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 100 ppm:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Lassitude (weakness, exhaustion), dizziness, headache; dyspnea (breathing difficulty), cyanosis; methemoglobinemia; pulmonary edema; liver, kidney damage

**Target Organs** respiratory system, liver, kidneys, blood, central nervous system

See also: INTRODUCTION
## Morpholine

<table>
<thead>
<tr>
<th>CAS</th>
<th>110-91-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>QD6475000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2054 132</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Diethylene imidoxide
- Diethylene oximide
- Tetrahydro-1,4-oxazine
- Tetrahydro-p-oxazine

### Exposure Limits
- NIOSH REL: TWA 20 ppm (70 mg/m³) ST 30 ppm (105 mg/m³) [skin]
- OSHA PEL+: TWA 20 ppm (70 mg/m³) [skin]
- IDLH 1400 ppm [10%LEL]

### Conversion
- 1 ppm = 3.56 mg/m³

### Physical Description
- Colorless liquid with a weak, ammonia- or fish-like odor. [Note: A solid below 23°F.]
- MW: 87.1
- BP: 264°F
- FRZ: 23°F
- Sol: Miscible
- VP: 6 mmHg
- IP: 8.88 eV
- Sp.Gr: 1.007
- Fl.P(oc): 98°F
- UEL: 11.2%
- LEL: 1.4%

### Incompatibilities & Reactivities
- Strong acids, strong oxidizers, metals, nitro compounds [Note: Corrosive to metals.]

### Measurement Methods
- NIOSH S150 (II-3)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation
- **Provide**: Eyewash (>15%), Quick drench (>25%)

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 500 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

Up to 1000 ppm:
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 1400 ppm:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, respiratory system; visual disturbance; cough; in animals: liver, kidney damage

Target Organs Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Naphtha (coal tar)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>8030-30-6</td>
<td>DE3030000</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Crude solvent coal tar naphtha, High solvent naphtha, Naphtha

### Exposure Limits

- **NIOSH REL:** TWA 100 ppm (400 mg/m³)
- **OSHA PEL:** TWA 100 ppm (400 mg/m³)

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 ppm [10%LEL]</td>
<td>1 ppm = 4.50 mg/m³ (approx)</td>
</tr>
</tbody>
</table>

### Physical Description

- Reddish-brown, mobile liquid with an aromatic odor.
- MW: 110 (approx)
- BP: 320-428°F
- FRZ: ?
- Sol: Insoluble
- VP: <5 mmHg
- IP: ?
- Sp.Gr: 0.89-0.97
- F.I.P: 100-109°F
- UEL: ?
- LEL: 1.0%

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities

- Strong oxidizers

### Measurement Methods

- NIOSH 1550
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid

- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Respirator Recommendations

**NIOSH/OSHA**

- **Up to 1000 ppm:**
  - (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
  - (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
  - (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
  - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
<table>
<thead>
<tr>
<th><strong>Escape:</strong></th>
<th>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exposure Routes</strong></td>
<td>inhalation, ingestion, skin and/or eye contact</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, nose; dizziness, drowsiness; dermatitis; in animals: liver, kidney damage</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system, liver, kidneys</td>
</tr>
<tr>
<td>See also:</td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Naphthalene

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>91-20-3</td>
<td>QJ05250000</td>
<td>1334 133 (crude or refined)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2304 133 (molten)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Naphthalin
- Tar camphor
- White tar

### Exposure Limits
- NIOSH REL: TWA 10 ppm (50 mg/m³) ST 15 ppm (75 mg/m³)
- OSHA PEL†: TWA 10 ppm (50 mg/m³)
- IDLH: 250 ppm
- Conversion: 1 ppm = 5.24 mg/m³

### Physical Description
- Colorless to brown solid with an odor of mothballs. [Note: Shipped as a molten solid.]
- MW: 128.2
- BP: 424°F
- MLT: 176°F
- Sol: 0.003%
- VP: 0.08 mmHg
- IP: 8.12 eV
- Sp.Gr: 1.15
- Fl.P: 174°F
- UEL: 5.9%
- LEL: 0.9%
- Combustible Solid, but will take some effort to ignite.

### Incompatibilities & Reactivities
- Strong oxidizers, chromic anhydride

### Measurement Methods
- NIOSH 1501 ; OSHA 35
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid

**Eye:** Irrigate immediately
- **Skin:** Molten flush immediately/solid-liquid soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 100 ppm:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 250 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 25) Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage

Target Organs Eyes, skin, blood, liver, kidneys, central nervous system

See also: INTRODUCTION
### Naphthalene diisocyanate

<table>
<thead>
<tr>
<th>CAS</th>
<th>3173-72-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>NQ9600000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- 1,5-Diisocyanatonaphthalene
- 1,5-Naphthalene diisocyanate
- 1,5-Naphthalene ester of isocyanic acid
- NDI

#### Exposure Limits
- NIOSH REL: TWA 0.040 mg/m³ (0.005 ppm) C 0.170 mg/m³ (0.020 ppm) [10-minute]
- OSHA PEL: none

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

#### Conversion
1 ppm = 8.60 mg/m³

#### Physical Description
- White to light-yellow, crystalline flakes.
- MW: 210.2
- BP: 505°F
- MLT: 261°F
- Sol: ?
- VP(75°F): 0.003 mmHg
- IP: ?
- Sp.Gr: ?
- Fl.P(oc): 311°F
- UEL: ?
- LEL: ?

#### Incompatibilities & Reactivities
- None reported

#### Measurement Methods
- NIOSH 5525 ; OSHA PV2046
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

#### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

- **Up to 0.05 ppm:**
  - \( \text{APF} = 10 \) Any supplied-air respirator*

- **Up to 0.125 ppm:**
  - \( \text{APF} = 25 \) Any supplied-air respirator operated in a continuous-flow mode*

- **Up to 0.25 ppm:**
  - \( \text{APF} = 50 \) Any self-contained breathing apparatus with a full facepiece
  - \( \text{APF} = 50 \) Any supplied-air respirator with a full facepiece

- **Up to 1 ppm:**
  - \( \text{APF} = 2000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- \( \text{APF} = 10,000 \) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- \( \text{APF} = 10,000 \) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- \( \text{APF} = 50 \) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

---

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose, throat; respiratory sensitization, cough, pulmonary secretions, chest pain, dyspnea (breathing difficulty); asthma

**Target Organs** Eyes, respiratory system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### alpha-Naphthylamine

CAS 134-32-7

C_{10}H_{7}NH_{2} RTECS QM1400000

**Synonyms & Trade Names**
1-Aminonaphthalene, 1-Naphthylamine

**DOT ID & Guide**
2077 153

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL</th>
<th>CAS 134-32-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH Ca [N.D.]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Conversion**

<table>
<thead>
<tr>
<th>MW: 143.2</th>
<th>BP: 573°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(220°F): 1 mmHg</td>
<td>IP: 7.30 eV</td>
</tr>
<tr>
<td>FL: 315°F</td>
<td>UEL: ?</td>
</tr>
</tbody>
</table>

**Physical Description**
Colorless crystals with an ammonia-like odor. [Note: Darkens in air to a reddish-purple color.]

**Combustible Solid**

**Incompatibilities & Reactivities**
Oxidizes in air

**Measurement Methods**
NIOSH 5518 ; OSHA 93
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

**First Aid**
(See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations**
(See Appendix E) NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

1. (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
2. (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

1. (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**
inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**
Dermatitis; hemorrhagic cystitis; dyspnea (breathing difficulty), ataxia, methemoglobinemia; hematuria (blood in the urine); dysuria; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Bladder, skin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[bladder cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## beta-Naphthylamine

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>91-59-8</td>
<td>QM2100000</td>
<td>1650 153</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 2-Aminonaphthalene, 2-Naphthylamine

### Physical Description
Odorless, white to red crystals with a faint, aromatic odor. [Note: Darkens in air to a reddish-purple color.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>143.2</td>
</tr>
<tr>
<td>BP</td>
<td>583°F</td>
</tr>
<tr>
<td>MLT</td>
<td>232°F</td>
</tr>
<tr>
<td>VP(226°F)</td>
<td>1 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>9.71 eV</td>
</tr>
<tr>
<td>Sp.Gr(208°F)</td>
<td>1.06</td>
</tr>
<tr>
<td>Fl.P</td>
<td>315°F</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
None reported

### Measurement Methods
- NIOSH 5518
- OSHA 93
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Dermatitis; hemorrhagic cystitis; dyspnea (breathing difficulty); ataxia; methemoglobinemia, hematuria (blood in the urine); dysuria; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Bladder, skin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[bladder cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Niax® Catalyst ESN

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>None [Note: A mixture of 95% dimethylaminopropionitrile &amp; 5% bis(2-dimethylamino)ethyl ether.]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: See Appendix C</th>
<th>OSHA PEL: See Appendix C</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

## Physical Description
A liquid mixture. [Note: Used in the past as a catalyst in the manufacture of flexible polyurethane foams.]

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities

**Oxidizers**

## Measurement Methods
None available
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated
**Remove:** When wet or contaminated
**Change:** Daily
**Provide:** Eyewash, Quick drench

## First Aid
(See procedures)

**Eye:** Irrigate immediately
**Skin:** Soap flush immediately
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

## Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms
Irritation eyes, skin; urinary disturbance; neurological disorders; pins & needles in hands & feet; muscle weakness, lassitude (weakness, exhaustion), nausea, vomiting; decreased nerve conduction in lower legs
Target Organs  Eyes, skin, urinary tract, peripheral nervous system

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

**Nickel carbonyl**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>13463-39-3</td>
<td>QR6300000</td>
<td>1259 131</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Nickel tetracarbonyl, Tetracarbonyl nickel

**Exposure Limits**
- NIOSH REL: Ca TWA 0.001 ppm (0.007 mg/m³) See Appendix A
- OSHA PEL: TWA 0.001 ppm (0.007 mg/m³)

**IDLH Ca [2 ppm]**

**Conversion** 1 ppm = 6.98 mg/m³

**Physical Description**
- Colorless to yellow liquid with a musty odor. [Note: A gas above 110°F.]

**MW** 170.7

**BP** 110°F

**FRZ** -13°F

**Sol** 0.05%

**IP** 8.28 eV

**Sp.Gr(63°F)** 1.32

**Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.**

**Incompatibilities & Reactivities**
- Nitric acid, bromine, chlorine & other oxidizers; flammable materials

**Measurement Methods**
- NIOSH 6007
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

**First Aid** (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH
- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin absorption, skin and/or eye contact
| **Symptoms** | Headache, dizziness; nausea, vomiting, epigastric pain; substernal pain; cough, hyperpnea; cyanosis; lassitude (weakness, exhaustion); leukocytosis (increased blood leukocytes), pneumonitis; delirium, convulsions; [potential occupational carcinogen]; in animals: reproductive, teratogenic effects |
| **Target Organs** | Lungs, paranasal sinus, central nervous system, reproductive system |
| **Cancer Site** | [lung & nasal cancer] |

See also: **INTRODUCTION**
# Nickel metal and other compounds (as Ni)

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>CAS 7440-02-0 (Metal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>RTECS QR5950000 (Metal)</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Nickel metal: Elemental nickel, Nickel catalyst
Synonyms of other nickel compounds vary depending upon the specific compound.

## Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>CAS 7440-02-0 (Metal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL*: Ca TWA 0.015 mg/m³ See Appendix A [*Note: The REL does not apply to Nickel carbonyl.]</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL*: TWA 1 mg/m³ [*Note: The PEL does not apply to Nickel carbonyl.]</td>
<td></td>
</tr>
<tr>
<td>IDLH Ca [10 mg/m³ (as Ni)]</td>
<td></td>
</tr>
</tbody>
</table>

## Conversion

<table>
<thead>
<tr>
<th>Conversion</th>
<th></th>
</tr>
</thead>
</table>

## Physical Description

Metal: Lustrous, silvery, odorless solid.

MW: 58.7
BP: 5139°F
MLT: 2831°F
Sol: Insoluble

VP: 0 mmHg (approx)
IP: NA
Sp.Gr: 8.90 (Metal)

Metal: Combustible Solid; nickel sponge catalyst may ignite SPONTANEOUSLY in air.

## Incompatibilities & Reactivities

Strong acids, sulfur, selenium, wood & other combustibles, nickel nitrate

## Measurement Methods

NIOSH 7300 , 7301 , 7303 , 9102 ; OSHA ID121 , ID125G
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

(See protection )

Skin: Prevent skin contact
Eyes: No recommendation
Wash skin: When contaminated/Daily
Remove: When wet or contaminated
Change: Daily

## First Aid

(See procedures )

Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

## Important additional information about respirator selection

Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes

inhalation, ingestion, skin and/or eye contact

## Symptoms

Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Nasal cavities, lungs, skin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung and nasal cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Nicotine

<table>
<thead>
<tr>
<th>CAS</th>
<th>54-11-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>QS5250000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>3-(1-Methyl-2-pyrrolidyl)pyridine</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1654 151</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL | TWA 0.5 mg/m³ [skin] |
| OSHA PEL | TWA 0.5 mg/m³ [skin] |
| IDLH | 5 mg/m³ |

### Physical Description
Pale-yellow to dark-brown liquid with a fish-like odor when warm. (insecticide)

| MW | 162.2 |
| VP | 0.08 mmHg |
| BP | 482°F (Decomposes) |
| FRZ | -110°F |
| Sol | Miscible |
| IP | 8.01 eV |
| Sp.Gr | 1.01 |
| Fl.P | 203°F |
| UEL | 4.0% |
| LEL | 0.7% |

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities
Strong oxidizers, strong acids

### Measurement Methods
NIOSH 2544, 2551
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection )

| Skin | Prevent skin contact |
| Eyes | Prevent eye contact |
| Wash skin | When contaminated |
| Remove | When wet or contaminated |
| Change | No recommendation |
| Provide | Eyewash, Quick drench |

### First Aid
(See procedures )

| Eye | Irrigate immediately |
| Skin | Water flush immediately |
| Breathing | Respiratory support |
| Swallow | Medical attention immediately |

### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 5 mg/m³:**
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Nausea, salivation, abdominal pain, vomiting, diarrhea; headache, dizziness, hearing, visual disturbance; confusion, lassitude (weakness, exhaustion), incoordination; cardiac arrhythmias; convulsions, dyspnea (breathing difficulty); in animals: teratogenic effects</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Central nervous system, cardiovascular system, lungs, gastrointestinal tract, reproductive system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## Nitric acid

**CAS** 7697-37-2

**RTECS** QU5775000

### Synonyms & Trade Names
- Aqua fortis, Engravers acid, Hydrogen nitrate, Red fuming nitric acid (RFNA), White fuming nitric acid (WFNA)

### DOT ID & Guide
- 2031 157 (other than red fuming)
- 2032 157 (fuming)

### Exposure Limits

<table>
<thead>
<tr>
<th><strong>NIOSH REL</strong></th>
<th>TWA 2 ppm (5 mg/m³) ST 4 ppm (10 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>TWA 2 ppm (5 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 25 ppm

**Conversion** 1 ppm = 2.58 mg/m³

### Physical Description
- Colorless, yellow, or red, fuming liquid with an acrid, suffocating odor. [Note: Often used in an aqueous solution. Fuming nitric acid is concentrated nitric acid that contains dissolved nitrogen dioxide.]

<table>
<thead>
<tr>
<th><strong>MW:</strong> 63.0</th>
<th><strong>BP:</strong> 181°F</th>
<th><strong>FRZ:</strong> -44°F</th>
<th><strong>Sol:</strong> Miscible</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VP:</strong> 48 mmHg</td>
<td><strong>IP:</strong> 11.95 eV</td>
<td></td>
<td><strong>Sp.Gr(77°F):</strong> 1.50</td>
</tr>
<tr>
<td><strong>Fl.P:</strong> NA</td>
<td><strong>UEL:</strong> NA</td>
<td><strong>LEL:</strong> NA</td>
<td></td>
</tr>
</tbody>
</table>

Noncombustible Liquid, but increases the flammability of combustible materials.

### Incompatibilities & Reactivities
- Combustible materials, metallic powders, hydrogen sulfide, carbides, alcohols [Note: Reacts with water to produce heat. Corrosive to metals.]

### Measurement Methods
- NIOSH 7903 ; OSHA ID165SG
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated  
**Remove:** When wet or contaminated  
**Change:** No recommendation  
**Provide:** Eyewash (pH<2.5), Quick drench (pH<2.5)

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Water flush immediately  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

---

Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 25 ppm:**
(\(APF = 25\)) Any supplied-air respirator operated in a continuous-flow mode
(\(APF = 50\)) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
(\(APF = 50\)) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
(\(APF = 50\)) Any self-contained breathing apparatus with a full facepiece
(\(APF = 50\)) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(\(APF = 10,000\)) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(\(APF = 10,000\)) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(\(APF = 50\)) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion

**Target Organs** Eyes, skin, respiratory system, teeth

See also: [INTRODUCTION](#)
## NIOSH Pocket Guide to Chemical Hazards

### Nitric oxide

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAS</strong></td>
<td>10102-43-9</td>
</tr>
<tr>
<td><strong>RTECS</strong></td>
<td>QX0525000</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1660 124</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Mononitrogen monoxide
- Nitrogen monoxide

### Exposure Limits
- **NIOSH REL:** TWA 25 ppm (30 mg/m³)
- **OSHA PEL:** TWA 25 ppm (30 mg/m³)
- **IDLH:** 100 ppm

### Conversion
- 1 ppm = 1.23 mg/m³

### Physical Description
- Colorless gas. [Note: Shipped as a nonliquefied compressed gas.]
- **MW:** 30.0
- **BP:** -241°F
- **FRZ:** -263°F
- **Sol:** 5%
- **VP:** 34.2 atm
- **IP:** 9.27 eV
- **RGasD:** 1.04
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

Nitric oxide is nonflammable but will accelerate the burning of combustible materials.

### Incompatibilities & Reactivities
- Fluorine, combustible materials, ozone, NH₃, chlorinated hydrocarbons, metals, carbon disulfide [Note: Reacts with water to form nitric acid. Rapidly converted in air to nitrogen dioxide.]

### Measurement Methods
- NIOSH 6014 ; OSHA ID190
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

### First Aid
- **Breathing:** Respiratory support

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*Authored in PDF format by Industrial Hygiene Services; www.ihresources.com*
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 100 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern.*
(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern.*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern.*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern./Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation

Symptoms Irritation eyes, wet skin, nose, throat; drowsiness, unconsciousness; methemoglobinemia

Target Organs Eyes, skin, respiratory system, blood, central nervous system

See also: INTRODUCTION
### p-Nitroaniline

<table>
<thead>
<tr>
<th>CAS</th>
<th>100-01-6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO₂C₆H₄NH₂</strong></td>
<td></td>
</tr>
<tr>
<td><strong>RTECS</strong></td>
<td>BY7000000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>para-Aminonitrobenzene, 4-Nitroaniline, 4-Nitrobenzenamine, p-Nitrophenylamine, PNA</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1661 153</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: TWA | 3 mg/m³ [skin] |
| OSHA PEL†: TWA | 6 mg/m³ (1 ppm) [skin] |
| **IDLH**       | 300 mg/m³ |

### Physical Description
Bright yellow, crystalline powder with a slight ammonia-like odor.

| MW: 138.1     | BP: 630°F |
| VP: 0.00002 mmHg | IP: 8.85 eV |
| Fl.P: 390°F   | UEL: ?    |

Sol: 0.08%
Sp.Gr: 1.42
Combustible Solid

### Incompatibilities & Reactivities
Strong oxidizers, strong reducers [Note: May result in spontaneous heating of organic materials in the presence of moisture.]

### Measurement Methods
NIOSH 5033
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated/Daily
Remove: When wet or contaminated
Change: Daily
Provide: Quick drench

### First Aid (See procedures)
Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

<table>
<thead>
<tr>
<th>Concentration (mg/m³)</th>
<th>APF</th>
<th>Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 30 mg/m³:</strong></td>
<td>10</td>
<td>Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 75 mg/m³:</strong></td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td><strong>Up to 150 mg/m³:</strong></td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 300 mg/m³:</strong></td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

<table>
<thead>
<tr>
<th>Concentration (mg/m³)</th>
<th>APF</th>
<th>Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 10,000 mg/m³:</strong></td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td></td>
<td>10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

**Escape:**

<table>
<thead>
<tr>
<th>Concentration (mg/m³)</th>
<th>APF</th>
<th>Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 50 mg/m³:</strong></td>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here</td>
</tr>
</tbody>
</table>

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

- Irritation nose, throat; cyanosis, ataxia; tachycardia, tachypnea; dyspnea (breathing difficulty); irritability; vomiting, diarrhea; convulsions; respiratory arrest; anemia; methemoglobinemia; jaundice

### Target Organs

- Respiratory system, blood, heart, liver

See also: INTRODUCTION
## Nitrobenzene

[C6H5NO2]  

**CAS** 98-95-3  

**RTECS** DA64750000

### Synonyms & Trade Names
- Essence of mirbane
- Nitrobenzol
- Oil of mirbane

### DOT ID & Guide
- 1662 152

### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 1 ppm (5 mg/m³) [skin]</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>TWA 1 ppm (5 mg/m³) [skin]</td>
</tr>
<tr>
<td>IDLH</td>
<td>200 ppm</td>
</tr>
</tbody>
</table>

### Conversion
1 ppm = 5.04 mg/m³

### Physical Description
Yellow, oily liquid with a pungent odor like paste shoe polish. [Note: A solid below 42°F.]

### MW: 123.1  
BP: 411°F  
FRZ: 42°F  
Sol: 0.2%

### VP(77°F): 0.3 mmHg  
IP: 9.92 eV  
Sp.Gr: 1.20

### Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Concentrated nitric acid
- Nitrogen tetroxide
- Caustics
- Phosphorus pentachloride
- Chemically-active metals such as tin or zinc

### Measurement Methods
- NIOSH 2005, 2017
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** No recommendation  
- **Remove:** When wet or contaminated  
- **Change:** Daily  
- **Provide:** Quick drench

### First Aid
- **Eye:** Irrigate immediately  
- **Skin:** Soap wash immediately  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

**Up to 10 ppm:**
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*

**Up to 25 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

**Up to 50 ppm:**
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 200 ppm:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; anoxia; dermatitis; anemia; methemoglobinemia; in animals: liver, kidney damage; testicular effects

**Target Organs** Eyes, skin, blood, liver, kidneys, cardiovascular system, reproductive system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 4-Nitrobiphenyl

<table>
<thead>
<tr>
<th>CAS 92-93-3</th>
</tr>
</thead>
</table>

**C₆H₅C₆H₄NO₂**

**RTECS** DV5600000

**Synonyms & Trade Names**
- p-Nitrobiphenyl, p-Nitrodiphenyl, 4-Nitrodiphenyl, p-Phenylnitrobenzene, 4-Phenylnitrobenzene, PNB

<table>
<thead>
<tr>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca [See Appendix A]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>OSHA PEL: [1910.1003] [See Appendix B]</th>
</tr>
</thead>
</table>

**IDLH Ca [N.D.]**

**Conversion**

## Physical Description
White to yellow, needle-like, crystalline solid with a sweetish odor.

**MW: 199.2**

**BP: 644°F**

**MLT: 237°F**

**Sol: Insoluble**

**VP:**

**IP:**

**Sp.Gr:**

**Fl.P: 290°F**

**UEL:**

**LEL:**

**Combustible Solid**

## Incompatibilities & Reactivities
- Strong reducers

## Measurement Methods
- NIOSH P&CAM273 (II-4); OSHA PV2082
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection)
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

## First Aid (See procedures)
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

## Important additional information about respirator selection

### Respirator Recommendations (See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
**Symptoms**  Headache, drowsiness, dizziness; dyspnea (breathing difficulty); ataxia, lassitude (weakness, exhaustion); methemoglobinemia; urinary burning; acute hemorrhagic cystitis; [potential occupational carcinogen]

**Target Organs**  Bladder, blood

**Cancer Site**  [in animals: bladder tumors]

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>p-Nitrochlorobenzene</th>
<th>CAS 100-00-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIC₆H₄NO₂</td>
<td>RTECS CZ1050000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide 1578 152</td>
</tr>
<tr>
<td>p-Chloronitrobenzene, 4-Chloronitrobenzene, 1-Chloro-4-nitrobenzene, 4-Nitrochlorobenzene, PCNB, PNCB</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca [skin]</th>
<th>OSHA PEL: TWA 1 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH Ca [100 mg/m³]</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description

Yellow, crystalline solid with a sweet odor.

MW: 157.6  BP: 468°F  MLT: 182°F  Sol: Slight

VP(86°F): 0.2 mmHg  IP: 9.96 eV  Sp.Gr: 1.52

Fl.P: 261°F  UEL: ?  LEL: ?

Solid that does not burn, or burns with difficulty.

### Incompatibilities & Reactivities

Strong oxidizers, alkalis

### Measurement Methods

NIOSH 2005
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated/Daily
**Remove:** When wet or contaminated
**Change:** Daily
**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately
**Skin:** Soap wash immediately
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Anoxia; unpleasant taste; anemia; methemoglobinemia; in animals: hematuria (blood in the urine); spleen, kidney, bone marrow changes; reproductive effects; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Blood, liver, kidneys, cardiovascular system, spleen, bone marrow, reproductive system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: vascular &amp; liver tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Nitroethane

<table>
<thead>
<tr>
<th>CAS</th>
<th>79-24-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KI5600000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2842 129</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Nitroetan

### Exposure Limits

- NIOSH REL: TWA 100 ppm (310 mg/m³)
- OSHA PEL: TWA 100 ppm (310 mg/m³)

ID LH 1000 ppm

### Conversion

1 ppm = 3.07 mg/m³

### Physical Description

Colorless, oily liquid with a mild, fruity odor.

- MW: 75.1
- BP: 237°F
- FRZ: -130°F
- Sol: 5%
- VP(77°F): 21 mmHg
- IP: 10.88 eV
- Sp.Gr: 1.05
- FL.P: 82°F
- UEL: ?
- LEL: 3.4%

Class IC Flammable Liquid: FL.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities

- Amines; strong acids, alkalis & oxidizers; hydrocarbons; combustibles; metal oxides

### Measurement Methods

NIOSH 2526
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid

(See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 1000 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact
| **Symptoms** Dermatitis; in animals: lacrimation (discharge of tears); dyspnea (breathing difficulty), pulmonary rales, edema; liver, kidney injury; narcosis |
| **Target Organs** Skin, respiratory system, central nervous system, kidneys, liver |

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Nitrogen dioxide

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>10102-44-0</td>
<td>QW98000000</td>
<td>1067 124</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Dinitrogen tetroxide (N$_2$O$_4$), Nitrogen peroxide

### Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: ST 1 ppm (1.8 mg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: C 5 ppm (9 mg/m$^3$)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion 1 ppm = 1.88 mg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 ppm</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description

Yellowish-brown liquid or reddish-brown gas (above 70°F) with a pungent, acrid odor. [Note: In solid form (below 15°F) it is found structurally as N$_2$O$_4$.]

| MW: 46.0 | BP: 70°F | FRZ: 15°F | Sol: Reacts |
| VP: 720 mmHg | IP: 9.75 eV | RGasD: 2.62 | Sp.Gr: 1.44 (Liquid at 68°F) |
| Fl.P: NA | UEL: NA | LEL: NA |

Noncombustible Liquid/Gas, but will accelerate the burning of combustible materials.

### Incompatibilities & Reactivities

Combustible material, water, chlorinated hydrocarbons, carbon disulfide, ammonia [Note: Reacts with water to form nitric acid.]

### Measurement Methods

NIOSH 6014 ; OSHA ID182
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Respirator Recommendations NIOSH

**Up to 20 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, nose, throat; cough, mucoid frothy sputum, decreased pulmonary function, chronic bronchitis, dyspnea (breathing difficulty); chest pain; pulmonary edema, cyanosis, tachypnea, tachycardia

### Target Organs
- Eyes, respiratory system, cardiovascular system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Nitrogen trifluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>7783-54-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>QX1925000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Nitrogen fluoride
- Trifluoramine
- Trifluorammonia

### DOT ID & Guide
- DOT ID: 2451 122

### Exposure Limits
- NIOSH REL: TWA 10 ppm (29 mg/m³)
- OSHA PEL: TWA 10 ppm (29 mg/m³)
- IDLH: 1000 ppm

### Conversion
- 1 ppm = 2.90 mg/m³

### Physical Description
- Colorless gas with a moldy odor. [Note: Shipped as a nonliquefied compressed gas.]
- MW: 71.0
- BP: -200°F
- FRZ: -340°F
- Sol: Slight
- VP: >1 atm
- IP: 12.97 eV
- RGasD: 2.46
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Water, oil, grease, oxidizable materials, ammonia, carbon monoxide, methane, hydrogen, hydrogen sulfide, activated charcoal, diborane

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid
(See procedures)
- Breathing: Respiratory support
## Respirator Recommendations NIOSH/OSHA

**Up to 100 ppm:**
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern
- (APF = 10) Any supplied-air respirator

**Up to 250 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern

**Up to 500 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern*
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1000 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes inhalation

### Symptoms
In animals: anoxia, cyanosis; methemoglobinemia; lassitude (weakness, exhaustion), dizziness, headache; liver, kidney injury

### Target Organs
Blood, liver, kidneys

See also: [INTRODUCTION](#)
## NIOSH Pocket Guide to Chemical Hazards

### Nitroglycerine

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH$_2$NO$_3$CHNO$_3$CH$_2$NO$_3$</td>
<td>55-63-0</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Glyceryl trinitrate; NG; 1,2,3-Propanetriol trinitrate; Trinitroglycerine

### DOT ID & Guide
- 1204 127 (< or = 1% solution in alcohol)
- 3064 127 (1-5% solution in alcohol)

### Exposure Limits
- NIOSH REL: ST 0.1 mg/m$^3$ [skin]
- OSHA PEL: C 0.2 ppm (2 mg/m$^3$) [skin]
- IDLH: 75 mg/m$^3$

### Physical Description
- Colorless to pale-yellow, viscous liquid or solid (below 56°F). [Note: An explosive ingredient in dynamite (20-40%) with ethylene glycol dinitrate (80-60%).]
- MW: 227.1
- BP: Begins to decompose at 122-140°F
- FRZ: 56°F
- Sol: 0.1%
- VP: 0.0003 mmHg
- IP: ?
- Sp.Gr: 1.60
- Fl.P: Explodes
- UEL: ?
- LEL: ?

### Explosive Liquid

### Incompatibilities & Reactivities
- Heat, ozone, shock, acids [Note: An OSHA Class A Explosive (1910.109).]

### Measurement Methods
- NIOSH 2507 ; OSHA 43
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: Daily
- Provide: Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 1 mg/m³:
(APF = 10) Any supplied-air respirator*

Up to 2.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

Up to 5 mg/m³:
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 75 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Throbbing headache; dizziness; nausea, vomiting, abdominal pain; hypotension; flush; palpitations; methemoglobinemia; delirium, central nervous system depression; angina; skin irritation

Target Organs cardiovascular system, blood, skin, central nervous system

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Nitromethane</th>
<th>CAS 75-52-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃NO₂</td>
<td>RTECS PA9800000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide 1261 129</td>
</tr>
</tbody>
</table>

**Exposure Limits**

- NIOSH REL: See Appendix D
- OSHA PEL: TWA 100 ppm (250 mg/m³)
- IDLH 750 ppm
- Conversion: 1 ppm = 2.50 mg/m³

**Physical Description**

Colorless, oily liquid with a disagreeable odor.

- MW: 61.0
- BP: 214°F
- FRZ: -20°F
- Sol: 10%
- VP: 28 mmHg
- IP: 11.08 eV
- Sp.Gr: 1.14
- Fl.P: 95°F
- UEL: ?
- LEL: 7.3%

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

**Incompatibilities & Reactivities**

- Amines; strong acids, alkalis & oxidizers; hydrocarbons & other combustible materials; metallic oxides [Note: Slowly corrodes steel & copper when wet.]

**Measurement Methods**

- NIOSH 2527
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

**First Aid**

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations**

- Up to 750 ppm:
  - (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
  - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - (APF = 50) Any supplied-air respirator with a full facepiece

- Emergency or planned entry into unknown concentrations or IDLH conditions:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**

Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**

inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Dermatitis; in animals: irritation eyes, respiratory system; convulsions, narcosis; liver damage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, central nervous system, liver</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## 2-Nitronaphthalene

<table>
<thead>
<tr>
<th>CAS</th>
<th>581-89-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>QJ9760000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2538 133</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- beta-Nitronaphthalene

### Exposure Limits
- **NIOSH REL:** Ca* See Appendix A [*Note: Since metabolized to beta-Naphthylamine.]*
- **OSHA PEL:** none

**IDLH** Ca [N.D.]

### Conversion

### Physical Description
- Colorless solid.
- **MW:** 178.2
- **BP:** ?
- **MLT:** 174°F
- **Sol:** Insoluble
- **IP:** 8.67 eV
- **Sp.Gr:** ?
- **UEL:** ?
- **LEL:** ?

### Incompatibilities & Reactivities
- For "Nitrates" in general: Aluminum, cyanides, esters, phosphorus, tin chlorides, thiocyanates, sodium hypophosphite

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
- **Escape:**
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation skin, respiratory system; dermatitis; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Skin, respiratory system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>bladder cancer</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
1-Nitropropane

CH$_3$CH$_2$CH$_2$NO$_2$

**CAS** 108-03-2

**RTECS** TZ5075000

**Synonyms & Trade Names**
Nitropropane, 1-NP

**DOT ID & Guide**
2608 129

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 25 ppm (90 mg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 25 ppm (90 mg/m$^3$)</td>
</tr>
</tbody>
</table>

**IDLH** 1000 ppm

**Conversion** 1 ppm = 3.64 mg/m$^3$

### Physical Description

Colorless liquid with a somewhat disagreeable odor.

- **MW:** 89.1
- **BP:** 269°F
- **FRZ:** -162°F
- **Sol:** 1%
- **VP:** 8 mmHg
- **IP:** 10.81 eV
- **Sp.Gr:** 1.00
- **Fl.P:** 96°F
- **UEL:** ?
- **LEL:** 2.2%

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

### Incompatibilities & Reactivities

Amines; strong acids, alkalis & oxidizers; hydrocarbons & other combustible materials; metal oxides

### Measurement Methods

OSHA 46

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- **Skin:** No recommendation
- **Eyes:** Prevent eye contact
- **Wash skin:** No recommendation
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid (See procedures)

- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH/OSHA

**Up to 250 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 625 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*  
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Up to 1000 ppm:**
- (APF = 50) Any supplied-air respirator with a full facepiece  
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes; headache, nausea, vomiting, diarrhea; in animals: liver, kidney damage</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, central nervous system, liver, kidneys</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
2-Nitropropane

**(CAS)** 79-46-9

**(RTECS)** TZ5250000

**Synonyms & Trade Names**
- Dimethylnitromethane
- iso-Nitropropane
- 2-NP

**DOT ID & Guide**
- 2608 129

**Exposure Limits**
- **NIOSH REL**: Ca See Appendix A
- **OSHA PEL†**: TWA 25 ppm (90 mg/m³)

**IDLH** Ca [100 ppm]

**Conversion** 1 ppm = 3.64 mg/m³

**Physical Description**
- Colorless liquid with a pleasant, fruity odor.
- **MW**: 89.1
- **BP**: 249°F
- **FRZ**: -135°F
- **Sol**: 2%
- **VP**: 13 mmHg
- **IP**: 10.71 eV
- **Sp.Gr**: 0.99
- **Fl.P**: 75°F
- **UEL**: 11.0%
- **LEL**: 2.6%

**Incompatibilities & Reactivities**
- Amines; strong acids, alkalis & oxidizers; metal oxides; combustible materials

**Measurement Methods**
- NIOSH 2528 ; OSHA 15, 46
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

**First Aid** (See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**: Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, respiratory system; headache, anorexia, nausea, vomiting, diarrhea; kidney, liver damage; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, central nervous system, kidneys, liver</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver tumors]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## NIOSH Pocket Guide to Chemical Hazards

### N-Nitrosodimethylamine

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>62-75-9</td>
</tr>
<tr>
<td>RTECS</td>
<td>IQ0525000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Dimethylnitrosamine
- N,N-Dimethylnitrosamine
- DMNA
- N-Methyl-N-nitroso-methanamine
- NDMA
- N-Nitroso-N,N-dimethylamine

### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>Ca See Appendix A</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>[1910.1016] See Appendix B</td>
</tr>
<tr>
<td>IDLH</td>
<td>Ca [N.D.]</td>
</tr>
</tbody>
</table>

### Physical Description
- Yellow, oily liquid with a faint, characteristic odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>74.1</td>
</tr>
<tr>
<td>BP</td>
<td>306°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>?</td>
</tr>
<tr>
<td>Sol</td>
<td>Soluble</td>
</tr>
<tr>
<td>VP</td>
<td>3 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>8.69 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.005</td>
</tr>
</tbody>
</table>

### Combustible Liquid

### Incompatibilities & Reactivities
- Strong oxidizers [Note: Should be stored in dark bottles.]

### Measurement Methods
- NIOSH 2522
- OSHA 38
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- **APF = 10,000** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **APF = 10,000** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**

- **APF = 50** Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**
- Inhalation
- Skin absorption
- Ingestion
- Skin and/or eye contact
| **Symptoms** | Nausea, vomiting, diarrhea, abdominal cramps; headache; fever; enlarged liver, jaundice; decreased liver, kidney, pulmonary function; [potential occupational carcinogen] |
| **Target Organs** | Liver, kidneys, lungs |
| **Cancer Site** | [in animals; lung, kidney, liver & nasal cavity tumors] |

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## m-Nitrotoluene

<table>
<thead>
<tr>
<th>CAS 99-08-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₂C₆H₄CH₃</td>
</tr>
<tr>
<td>RTECS XT2975000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- m-Methylnitrobenzene
- 3-Methylnitrobenzene
- meta-Nitrotoluene
- 3-Nitrotoluene

### DOT ID & Guide
- 1664 152

### Exposure Limits
- NIOSH REL: TWA 2 ppm (11 mg/m³) [skin]
- OSHA PEL†: TWA 5 ppm (30 mg/m³) [skin]

### IDLH
- 200 ppm

### Conversion
- 1 ppm = 5.61 mg/m³

### Physical Description
- Yellow liquid with a weak, aromatic odor. [Note: A solid below 59°F.]

### MW: 137.1  BP: 450°F  FRZ: 59°F  Sol: 0.05%
### VP: 0.1 mmHg  IP: 9.48 eV  Sp.Gr: 1.16
### Fl.P: 223°F  UEL: ?  LEL: 1.6%

### Incompatibilities & Reactivities
- Strong oxidizers, sulfuric acid

### Measurement Methods
- NIOSH 2005
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
#### (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

### First Aid
#### (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH

**Up to 20 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 50 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 100 ppm:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 200 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Anoxia, cyanosis; headache, lassitude (weakness, exhaustion), dizziness; ataxia; dyspnea (breathing difficulty); tachycardia; nausea, vomiting

### Target Organs
- Blood, central nervous system, cardiovascular system, skin, gastrointestinal tract

See also: [INTRODUCTION](#)
# o-Nitrotoluene

**CAS** 88-72-2  
**RTECS** XT3150000

## Synonyms & Trade Names
- o-Methylnitrobenzene, 2-Methylnitrobenzene, ortho-Nitrotoluene, 2-Nitrotoluene

## DOT ID & Guide
- DOT ID & Guide 1664 152

## Exposure Limits
- NIOSH REL: TWA 2 ppm (11 mg/m³) [skin]
- OSHA PEL†: TWA 5 ppm (30 mg/m³) [skin]

## IDLH
- 200 ppm

## Conversion
- 1 ppm = 5.61 mg/m³

## Physical Description
- Yellow liquid with a weak, aromatic odor. [Note: A solid below 25°F.]

## MW: 137.1  
BP: 432°F  
FRZ: 25°F  
Sol: 0.07%

## VP: 0.1 mmHg  
IP: 9.43 eV  
Sp.Gr: 1.16

## Fl.P: 223°F  
UEL: ?  
LEL: 2.2%

## Incompatibilities & Reactivities
- Strong oxidizers, sulfuric acid

## Measurement Methods
- NIOSH 2005  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet or contaminated  
- **Change:** No recommendation

## First Aid
- **Eye:** Irrigate immediately  
- **Skin:** Soap wash immediately  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations</strong> NIOSH</td>
</tr>
<tr>
<td><strong>Up to 20 ppm:</strong> (APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 50 ppm:</strong> (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td><strong>Up to 100 ppm:</strong> (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 200 ppm:</strong> (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong> (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong> (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. <a href="#">Click here</a></td>
</tr>
<tr>
<td><strong>Exposure Routes</strong> inhalation, skin absorption, ingestion, skin and/or eye contact</td>
</tr>
<tr>
<td><strong>Symptoms</strong> Anoxia, cyanosis; headache, lassitude (weakness, exhaustion), dizziness; ataxia; dyspnea (breathing difficulty); tachycardia; nausea, vomiting</td>
</tr>
<tr>
<td><strong>Target Organs</strong> Blood, central nervous system, cardiovascular system, skin, gastrointestinal tract</td>
</tr>
<tr>
<td>See also: <a href="#">INTRODUCTION</a></td>
</tr>
</tbody>
</table>
**NIOSH Pocket Guide to Chemical Hazards**

### p-Nitrotoluene

**CAS**: 99-99-0  
**RTECS**: XT3325000

#### Synonyms & Trade Names
- p-Methyl nitrobenzene
- 4-Methyl nitrobenzene
- para-Nitrotoluene
- 4-Nitrotoluene

#### DOT ID & Guide
- 1664 152

#### Exposure Limits
- NIOSH REL: TWA 2 ppm (11 mg/m³) [skin]
- OSHA PEL†: TWA 5 ppm (30 mg/m³) [skin]

#### IDLH
- 200 ppm

#### Conversion
- 1 ppm = 5.61 mg/m³

#### Physical Description
- Crystalline solid with a weak, aromatic odor.
- MW: 137.1  
- BP: 460°F  
- MLT: 126°F  
- Sol: 0.04%
- VP: 0.1 mmHg  
- IP: 9.50 eV  
- Sp.Gr: 1.12
- Fl.P: 223°F  
- UEL: ?  
- LEL: 1.6%

#### Incompatibilities & Reactivities
- Combustible Solid
- Strong oxidizers, sulfuric acid

#### Measurement Methods
- NIOSH 2005
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: Daily

#### First Aid
- **Eye**: Irrigate immediately  
- **Skin**: Soap wash immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately
## Respirator Recommendations NIOSH

**Up to 20 ppm:**
(APF = 10) Any supplied-air respirator*

**Up to 50 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 100 ppm:**
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 200 ppm:**
(APF = 200) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Anoxia, cyanosis; headache, lassitude (weakness, exhaustion), dizziness; ataxia; dyspnea (breathing difficulty); tachycardia; nausea, vomiting

### Target Organs
- Blood, central nervous system, cardiovascular system, skin, gastrointestinal tract

See also: [INTRODUCTION](#)
### Nitrous oxide

<table>
<thead>
<tr>
<th>CAS</th>
<th>10024-97-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>QX1350000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1070 122 2201 122 (refrigerated liquid)</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
Dinitrogen monoxide, Hyponitrous acid anhydride, Laughing gas

#### Exposure Limits
- NIOSH REL*: TWA 25 ppm (46 mg/m³) (TWA over the time exposed) [*Note: REL for exposure to waste anesthetic gas.]
- OSHA PEL: none

**Conversion**: 1 ppm = 1.80 mg/m³

#### Physical Description
Colorless gas with a slightly sweet odor. [inhalation anesthetic] [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>MW: 44.0</th>
<th>BP: -127°F</th>
<th>FRZ: -132°F</th>
<th>Sol(77°F): 0.1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 51.3 atm</td>
<td>IP: 12.89 eV</td>
<td>RGasD: 1.53</td>
<td></td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
<td>LEL: NA</td>
<td></td>
</tr>
</tbody>
</table>

Nonflammable Gas, but supports combustion at elevated temperatures.

#### Incompatibilities & Reactivities
Aluminum, boron, hydrazine, lithium hydride, phosphine, sodium

#### Measurement Methods
NIOSH 3800, 6600; OSHA ID166
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)
- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation
- Provide: Frostbite wash

#### First Aid (See procedures)
- Eye: Frostbite
- Skin: Frostbite
- Breathing: Fresh air

#### Important additional information about respirator selection
Respirator Recommendations Not available.

#### Exposure Routes
inhalation, skin and/or eye contact (liquid)

#### Symptoms
Dyspnea (breathing difficulty); drowsiness, headache; asphyxia; reproductive effects; liquid: frostbite

#### Target Organs
respiratory system, central nervous system, reproductive system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Nonane

<table>
<thead>
<tr>
<th>CAS</th>
<th>111-84-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RA6115000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>n-Nonane, Nonyl hydride</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1920 128</td>
</tr>
</tbody>
</table>

### Exposure Limits

- NIOSH REL: TWA 200 ppm (1050 mg/m³)
- OSHA PEL†: none
- IDLH: N.D.
- Conversion: 1 ppm = 5.25 mg/m³

### Physical Description

- Colorless liquid with a gasoline-like odor.
- MW: 128.3
- BP: 303°F
- FRZ: -60°F
- Sol: Insoluble
- VP: 3 mmHg
- IP: 10.21 eV
- Sp.Gr: 0.72
- Fl.P: 88°F
- UEL: 2.9%
- LEL: 0.8%

### Incompatibilities & Reactivities

- Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.
- Strong oxidizers (e.g., peroxides, nitrates, perchlorates)

### Measurement Methods

- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: No recommendation
- Eyes: Prevent eye contact
- Wash skin: Daily
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash

### First Aid

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations**: Not available.

**Exposure Routes**: inhalation, ingestion, skin and/or eye contact

**Symptoms**: Irritation eyes, skin, nose, throat; headache, drowsiness, dizziness, confusion, nausea, tremor, incoordination; chemical pneumonitis (aspiration liquid)

**Target Organs**: Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
NIOSH Pocket Guide to Chemical Hazards

1-Nonanethiol

<table>
<thead>
<tr>
<th>CAS</th>
<th>1455-21-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃(CH₂)₈SH</td>
<td>RTECS</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide</td>
</tr>
<tr>
<td>1-Mercaptononane, n-Nonyl mercaptan, Nonylthiol</td>
<td>1228 131</td>
</tr>
</tbody>
</table>

Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>0.5 ppm (3.3 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>none</td>
</tr>
<tr>
<td>IDLH:</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

Conversion

1 ppm = 6.56 mg/m³

Physical Description

Liquid.

<table>
<thead>
<tr>
<th>MW:</th>
<th>160.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP:</td>
<td>?</td>
</tr>
<tr>
<td>FRZ:</td>
<td>?</td>
</tr>
<tr>
<td>Sol:</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP:</td>
<td>?</td>
</tr>
<tr>
<td>IP:</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr:</td>
<td>?</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>?</td>
</tr>
<tr>
<td>UEL:</td>
<td>?</td>
</tr>
<tr>
<td>LEL:</td>
<td>?</td>
</tr>
</tbody>
</table>

Incompatibilities & Reactivities

Oxidizers, reducing agents, strong acids & bases, alkali metals

Measurement Methods

None available
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection)

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

First Aid (See procedures)

Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat; lassitude (weakness, exhaustion), cyanosis, increased respiration, nausea, drowsiness, headache, vomiting

### Target Organs
- Eyes, skin, respiratory system, blood, central nervous system

See also: INTRODUCTION
### Octachloronaphthalene

| CAS 2234-13-1 |

**C₁₀Cl₈**

**RTECS QK0250000**

#### Synonyms & Trade Names
Halowax® 1051; 1,2,3,4,5,6,7,8-Octachloronaphthalene; Perchloronaphthalene

#### DOT ID & Guide

#### Exposure Limits

| NIOSH REL: TWA 0.1 mg/m³ ST 0.3 mg/m³ [skin] |
| OSHA PEL†: TWA 0.1 mg/m³ [skin] |

**IDLH Unknown**

#### Conversion

#### Physical Description

Waxy, pale-yellow solid with an aromatic odor.

| MW: 403.7 | BP: 770°F | MLT: 365°F | Sol: Insoluble |
| VP: <1 mmHg | IP: ? | Sp.Gr: 2.00 |
| FI.P: NA | UEL: NA | LEL: NA |

Noncombustible Solid

#### Incompatibilities & Reactivities

Strong oxidizers

#### Measurement Methods

NIOSH S97 (II-2)

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated/Daily

**Remove:** When wet or contaminated

**Change:** Daily

#### First Aid

**Eye:** Irrigate immediately

**Skin:** Water flush immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations**

(See Appendix F) NIOSH/OSHA

**Up to 1 mg/m³:**

(APF = 10) Any supplied-air respirator

(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Acne-form dermatitis; liver damage, jaundice</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, liver</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## 1-Octadecanethiol

<table>
<thead>
<tr>
<th>CAS</th>
<th>2885-00-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td></td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>1-Mercaptooctadecane, Octadecyl mercaptan, Stearyl mercaptan</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1228 131 (liquid)</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>C 0.5 ppm (5.9 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
<tr>
<td>IDLH</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 11.72 mg/m³

### Physical Description

Solid or liquid (above 77°F).

<table>
<thead>
<tr>
<th>MW</th>
<th>286.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>?</td>
</tr>
<tr>
<td>MLT</td>
<td>77°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.85</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Oxidizers, reducing agents, strong acids & bases, alkali metals

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

<table>
<thead>
<tr>
<th>Skin</th>
<th>Prevent skin contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin</td>
<td>When contaminated</td>
</tr>
<tr>
<td>Remove</td>
<td>When wet or contaminated</td>
</tr>
<tr>
<td>Change</td>
<td>Daily</td>
</tr>
</tbody>
</table>

### First Aid (See procedures)

<table>
<thead>
<tr>
<th>Eye</th>
<th>Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Soap wash immediately</td>
</tr>
<tr>
<td>Breathing</td>
<td>Respiratory support</td>
</tr>
<tr>
<td>Swallow</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, respiratory system; headache, dizziness, lassitude (weakness, exhaustion), cyanosis, nausea, convulsions</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system, blood</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Octane

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>111-65-9</td>
<td>RG8400000</td>
<td>1262 128</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- n-Octane, normal-Octane

### Exposure Limits
- **NIOSH REL:** TWA 75 ppm (350 mg/m³) C 385 ppm (1800 mg/m³) [15-minute]
- **OSHA PEL†:** TWA 500 ppm (2350 mg/m³)

**IDLH** 1000 ppm [10%LEL]

**Conversion** 1 ppm = 4.67 mg/m³

### Physical Description
- Colorless liquid with a gasoline-like odor.
- **MW:** 114.2
- **BP:** 258°F
- **FRZ:** -70°F
- **Sol(77°F):** 0.00007%
- **VP:** 10 mmHg
- **IP:** 9.82 eV
- **Sp.Gr:** 0.70
- **Fl.P:** 56°F
- **UEL:** 6.5%
- **LEL:** 1.0%

**Class IB Flammable Liquid:** Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH 1500 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 750 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 1000 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose; drowsiness; dermatitis; chemical pneumonitis (aspiration liquid); in animals: narcosis

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: **INTRODUCTION**
1-Octanethiol  
CH$_3$(CH$_2$)$_7$SH  
RTECS

**Synonyms & Trade Names**  
1-Mercaptooctane, n-Octyl mercaptan, Octylthiol, 1-Octylthiol  
DOT ID & Guide  
1228 131

**Exposure Limits**  
NIOSH REL: C 0.5 ppm (3.0 mg/m$^3$) [15-minute]  
OSHA PEL: none  
IDLH N.D.

**Conversion**  
1 ppm = 5.98 mg/m$^3$

**Physical Description**  
Water-white liquid with a mild odor.

- MW: 146.3  
- BP: 390°F  
- FRZ: -57°F  
- Sol: Insoluble

- VP(212°F): 3 mmHg  
- IP: ?  
- Sp.Gr: 0.84

- Fl.P(oc): 115°F  
- UEL: ?  
- LEL: ?

Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

**Incompatibilities & Reactivities**  
Oxidizers, reducing agents, strong acids & bases, alkali metals

**Measurement Methods**  
NIOSH 2510  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)  
Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: No recommendation

**First Aid** (See procedures)  
Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; lassitude (weakness, exhaustion), cyanosis, increased respiration, nausea, drowsiness, headache, vomiting

**Target Organs** Eyes, skin, respiratory system, blood, central nervous system

See also: INTRODUCTION
**Oil mist (mineral)**

<table>
<thead>
<tr>
<th>CAS</th>
<th>8012-95-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>PY8030000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

Heavy mineral oil mist, Paraffin oil mist, White mineral oil mist

**Exposure Limits**

NIOSH REL: TWA 5 mg/m³ ST 10 mg/m³

OSHA PEL: TWA 5 mg/m³

**IDLH** 2500 mg/m³

**Physical Description**

Colorless, oily liquid aerosol dispersed in air. [Note: Has an odor like burned lubricating oil.]

- MW: Varies
- BP: 680°F
- FRZ: 0°F
- Sol: Insoluble
- VP: <0.5 mmHg
- IP: ?
- Sp.Gr: 0.90
- Fl.P(oc): 380°F
- UEL: ?
- LEL: ?

**Incompatibilities & Reactivities**

None reported

**Measurement Methods**

NIOSH 5026, 5524

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

- Skin: Prevent skin contact
- Eyes: No recommendation
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

**First Aid** *(See procedures)*

- Skin: Soap wash
- Breathing: Fresh air

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 50 mg/m³:**

(APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

**Up to 125 mg/m³:**

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter

**Up to 250 mg/m³:**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
Any self-contained breathing apparatus with a full facepiece
Any supplied-air respirator with a full facepiece

**Up to 2500 mg/m³:**
Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, respiratory system</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## Osmium tetroxide

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS RN1140000</th>
</tr>
</thead>
<tbody>
<tr>
<td>OsO₄</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Osmic acid anhydride, Osmium oxide

### DOT ID & Guide
- 2471 154

### Exposure Limits
- NIOSH REL: TWA 0.002 mg/m³ (0.0002 ppm) ST 0.006 mg/m³ (0.0006 ppm)
- OSHA PEL†: TWA 0.002 mg/m³

### IDLH
- 1 mg/m³

### Conversion
- 1 ppm = 10.40 mg/m³

### Physical Description
- Colorless, crystalline solid or pale-yellow mass with an unpleasant, acrid, chlorine-like odor. [Note: A liquid above 105°F.]
- MW: 254.2
- BP: 266°F
- MLT: 105°F
- Sol(77°F): 6%
- VP: 7 mmHg
- IP: 12.60 eV
- Sp.Gr: 5.10
- Fl.P: NA
- UEL: NA
- LEL: NA

### Noncombustible Solid

### Incompatibilities & Reactivities
- Hydrochloric acid, easily oxidized organic materials [Note: Begins to sublime below BP. Contact with other materials may cause fire.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash

### First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 0.1 mg/m³:

(APF = 50) Any air-purifying full-facepiece respirator equipped with cartridge(s) providing protection against the compound of concern in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

Up to 1 mg/m³:

(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, respiratory system; lacrimation (discharge of tears), visual disturbance; conjunctivitis; headache; cough, dyspnea (breathing difficulty); dermatitis

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
### Oxalic acid

<table>
<thead>
<tr>
<th>CAS</th>
<th>144-62-7</th>
<th>RTECS</th>
<th>RO24500000</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
Ethanedioic acid, Oxalic acid (aqueous), Oxalic acid dihydrate

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 1 mg/m³ ST 2 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: TWA 1 mg/m³</td>
</tr>
<tr>
<td>IDLH</td>
<td>500 mg/m³</td>
</tr>
</tbody>
</table>

**Physical Description**
Colorless, odorless powder or granular solid. [Note: The anhydrous form (COOH)₂ is an odorless, white solid.]

| MW: 126.1       | BP: Sublimes                     |
| VP: <0.001 mmHg | MLT: 215°F (Sublimes)            |
| Fl.P: ?         | Sol: 14%                         |
|                 | Sp.Gr: 1.90                      |
|                 | UEL: ?                           |
|                 | LEL: ?                           |

**Combustible Solid**

**Incompatibilities & Reactivities**
Strong oxidizers, silver compounds, strong alkalis, chlorites [Note: Gives off water of crystallization at 215°F and begins to sublime.]

**Measurement Methods**
None available
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash

**First Aid** (See procedures)
Eye: Irrigate immediately
Skin: Water flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 25 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode.
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 50 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 500 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; eye burns; localized pain, cyanosis; shock, collapse, convulsions; kidney damage

Target Organs Eyes, skin, respiratory system, kidneys

See also: INTRODUCTION
### Oxygen difluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>7783-41-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RS2100000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names

Difluorine monoxide, Fluorine monoxide, Oxygen fluoride

#### DOT ID & Guide

2190 124

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C 0.05 ppm (0.1 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 0.05 ppm (0.1 mg/m³)</td>
</tr>
<tr>
<td>IDLH 0.5 ppm</td>
</tr>
</tbody>
</table>

#### Conversion

1 ppm = 2.21 mg/m³

### Physical Description

Colorless gas with a peculiar, foul odor. [Note: Shipped as a nonliquefied compressed gas.]

<table>
<thead>
<tr>
<th>MW</th>
<th>54.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>-230°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-371°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.02%</td>
</tr>
<tr>
<td>VP</td>
<td>&gt;1 atm</td>
</tr>
<tr>
<td>IP</td>
<td>13.11 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>1.88</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

Nonflammable gas, but a strong oxidizer.

### Incompatibilities & Reactivities

Combustible materials, chlorine, bromine, iodine, platinum, metal oxides, moist air, hydrogen sulfide, hydrocarbons, water

[Note: Reacts very slowly with water to form hydrofluoric acid.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

Skin: No recommendation

Eyes: No recommendation

Wash skin: No recommendation

Remove: No recommendation

Change: No recommendation

### First Aid

Eye: Irrigate immediately

Skin: Water flush immediately

Breathing: Respiratory support

### Respirator Recommendations

#### NIOSH/OSHA

Up to 0.5 ppm:

- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern (Any appropriate escape-type, self-contained breathing apparatus)
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, respiratory system; headache; pulmonary edema; eye, skin burns (from contact with the gas under pressure)</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Ozone

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>10028-15-6</td>
</tr>
<tr>
<td>RTECS</td>
<td>RS8225000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Triatomic oxygen

### Exposure Limits
- NIOSH REL: C 0.1 ppm (0.2 mg/m³)
- OSHA PEL†: TWA 0.1 ppm (0.2 mg/m³)
- IDLH: 5 ppm

### Conversion
- 1 ppm = 1.96 mg/m³

### Physical Description
Colorless to blue gas with a very pungent odor.
- MW: 48.0
- BP: -169°F
- FRZ: -315°F
- Sol(32°F): 0.001%
- VP: >1 atm
- IP: 12.52 eV
- RGasD: 1.66
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
Nonflammable Gas, but a powerful oxidizer.
- All oxidizable materials (both organic & inorganic)

### Measurement Methods
- OSHA ID214
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid
- Eye: Medical attention
- Breathing: Fresh air, 100% O₂
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 1 ppm:**
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern.
- (APF = 10) Any supplied-air respirator

**Up to 2.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern.

**Up to 5 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern.
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern.
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern.
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms** Irritation eyes, mucous membrane; pulmonary edema; chronic respiratory disease

**Target Organs** Eyes, respiratory system

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>Paraffin wax fume</strong></th>
<th><strong>CAS</strong> 8002-74-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C(<em>n)H(</em>{2n+2})</strong></td>
<td><strong>RTECS</strong> RV03500000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
<tr>
<td>Paraffin fume, Paraffin scale fume</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 2 mg/m(^3)</td>
<td>OSHA PEL(†): none</td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Physical Description</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraffin wax is a white to slightly yellowish, odorless solid. [Note: Consists of a mixture of high molecular weight hydrocarbons (e.g., C(<em>36)H(</em>{74})).]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MW</strong>: 350-420</th>
<th><strong>BP</strong>: ?</th>
<th><strong>MLT</strong>: 115-154°F</th>
<th><strong>Sol</strong>: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VP</strong>: ?</td>
<td><strong>IP</strong>: ?</td>
<td></td>
<td><strong>Sp.Gr</strong>: 0.88-0.92</td>
</tr>
<tr>
<td><strong>Fl.P</strong>: 390°F</td>
<td><strong>UEL</strong>: ?</td>
<td><strong>LEL</strong>: ?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Combustible Solid</strong></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Incompatibilities &amp; Reactivities</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>None reported</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Measurement Methods</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PV2047</td>
<td>See: NMAM or OSHA Methods</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Personal Protection &amp; Sanitation (See protection)</strong></th>
<th><strong>First Aid (See procedures)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: No recommendation</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Wash skin: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Remove: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Important additional information about respirator selection</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Respirator Recommendations Not available.</td>
</tr>
</tbody>
</table>

| **Exposure Routes** | inhalation, skin and/or eye contact |

| **Symptoms** | Irritation eyes, skin, respiratory system; discomfort, nausea |

| **Target Organs** | Eyes, skin, respiratory system |

See also: INTRODUCTION
## Paraquat (Paraquat dichloride)

<table>
<thead>
<tr>
<th>CAS</th>
<th>1910-42-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>DW2275000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- 1,1'-Dimethyl-4,4'-bipyridinium dichloride
- N,N'-Dimethyl-4,4'-bipyridinium dichloride
- Paraquat chloride
- Paraquat dichloride
  
  [Note: Paraquat is a cation (C\textsubscript{12}H\textsubscript{14}N\textsubscript{2}++; 1,1-Dimethyl-4,4-bipyridinium ion); the commercial product is the dichloride salt of paraquat.]

### Exposure Limits
- NIOSH REL: TWA 0.1 mg/m\textsuperscript{3} (resp) [skin]
- OSHA PEL\textdagger: TWA 0.5 mg/m\textsuperscript{3} (resp) [skin]
- IDLH 1 mg/m\textsuperscript{3}

### Physical Description
- Yellow solid with a faint, ammonia-like odor. [herbicide]
  
  [Note: Paraquat may also be found commercially as a methyl sulfate salt C\textsubscript{12}H\textsubscript{14}N\textsubscript{2}•2CH\textsubscript{3}SO\textsubscript{4}.]

| MW | 257.2 |
| BP: Decomposes | |
| VP: <0.0000001 mmHg | IP: ? |
| Fl.P: NA | UEL: NA |

### Incompatibilities & Reactivities
- Strong oxidizers, alkylaryl-sulfonate wetting agents
  
  [Note: Corrosive to metals. Decomposes in presence of ultraviolet light.]

### Measurement Methods
- NIOSH 5003
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Quick drench

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Respirator Recommendations NIOSH

#### Up to 1 mg/m³:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
(APF = 25) Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat, respiratory system; epistaxis (nosebleed); dermatitis; fingernail damage; irritation gastrointestinal tract; heart, liver, kidney damage

### Target Organs
- Eyes, skin, respiratory system, heart, liver, kidneys, gastrointestinal tract

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Parathion

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>56-38-2</td>
<td>TF4550000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- O,O-Diethyl-O(p-nitrophenyl) phosphorothioate; Diethyl parathion; Ethyl parathion; Parathion-ethyl

### Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>NIOSH REL: TWA 0.05 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mg/m³</td>
<td>OSHA PEL: TWA 0.1 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

### Physical Description
- Pale-yellow to dark-brown liquid with a garlic-like odor. [Note: A solid below 43°F. Pesticide that may be absorbed on a dry carrier.]
- MW: 291.3
- BP: 707°F
- FRZ: 43°F
- Sol: 0.001%
- VP: 0.00004 mmHg
- IP: ?
- Sp.Gr: 1.27
- Fl.P(oc): 392°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities
- Strong oxidizers, alkaline materials

### Measurement Methods
- NIOSH 5600; OSHA 62
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 0.5 mg/m³:
- (APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

Up to 1.25 mg/m³:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 2.5 mg/m³:
- (APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter.
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

Up to 10 mg/m³:
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, respiratory system; miosis; rhinorrhea (discharge of thin mucus); headache; chest tightness, wheezing, laryngeal spasm, salivation, cyanosis; anorexia, nausea, vomiting, abdominal cramps, diarrhea; sweating; muscle fasciculation, lassitude (weakness, exhaustion), paralysis; dizziness, confusion, ataxia; convulsions, coma; low blood pressure; cardiac irregularities

Target Organs Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Particulates not otherwise regulated</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>RTECS</td>
</tr>
<tr>
<td>&quot;Inert&quot; dusts, Nuisance dusts, PNOR [Note: Includes all inert or nuisance dusts, whether mineral, inorganic, not listed specifically in 1910.1000.]</td>
<td>DOT ID &amp; Guide</td>
</tr>
<tr>
<td>Exposure Limits</td>
<td>NIOSH REL: See Appendix D</td>
</tr>
<tr>
<td></td>
<td>OSHA PEL: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
<tr>
<td>Physical Description</td>
<td>IDLH N.D.</td>
</tr>
<tr>
<td>Dusts from solid substances without specific occupational exposure standards.</td>
<td>Conversion</td>
</tr>
<tr>
<td>Properties vary depending upon the specific solid.</td>
<td></td>
</tr>
<tr>
<td>Incompatibilities &amp; Reactivities</td>
<td>Varies</td>
</tr>
<tr>
<td>Measurement Methods</td>
<td>NIOSH 0500, 0600</td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
<td></td>
</tr>
<tr>
<td>Personal Protection &amp; Sanitation</td>
<td>First Aid (See procedures)</td>
</tr>
<tr>
<td>(See protection) Skin: No recommendation</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Eyes: No recommendation</td>
<td>Breathing: Fresh air</td>
</tr>
<tr>
<td>Wash skin: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Remove: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Important additional information about respirator selection</td>
<td></td>
</tr>
<tr>
<td>Respirator Recommendations Not available.</td>
<td></td>
</tr>
<tr>
<td>Exposure Routes inhalation, skin and/or eye contact</td>
<td></td>
</tr>
<tr>
<td>Symptoms Irritation eyes, skin, throat, upper respiratory system</td>
<td></td>
</tr>
<tr>
<td>Target Organs Eyes, skin, respiratory system</td>
<td></td>
</tr>
<tr>
<td>See also: INTRODUCTION</td>
<td></td>
</tr>
</tbody>
</table>
NIOSH Pocket Guide to Chemical Hazards

**Pentaborane**

<table>
<thead>
<tr>
<th>CAS</th>
<th>19624-22-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RY89250000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

Pentaboron nonahydride

**DOT ID & Guide**

1380 135

**Exposure Limits**

- NIOSH REL: TWA 0.005 ppm (0.01 mg/m³) ST 0.015 ppm (0.03 mg/m³)
- OSHA PEL†: TWA 0.005 ppm (0.01 mg/m³)

**IDLH** 1 ppm

**Conversion** 1 ppm = 2.58 mg/m³

**Physical Description**

Colorless liquid with a pungent odor like sour milk.

- MW: 63.1
- BP: 140°F
- FRZ: -52°F
- Sol: Reacts
- VP: 171 mmHg
- IP: 9.90 eV
- Sp.Gr: 0.62
- Fl.P: 86°F
- UEL: ?
- LEL: 0.42%

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

**Incompatibilities & Reactivities**

Oxidizers, halogens, water, halogenated hydrocarbons [Note: May ignite SPONTANEOUSLY in moist air. Corrosive to natural rubber. Hydrolyzes slowly with heat in water to form boric acid.]

**Measurement Methods**

None available

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

**First Aid** *(See procedures)*

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH/OSHA

**Up to 0.05 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 0.125 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 0.25 ppm:**
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1 ppm:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; dizziness, headache, drowsiness, incoordination, tremor, convulsions, behavioral changes; tonic spasm face, neck, abdominal, limbs

**Target Organs** Eyes, skin, central nervous system

See also: INTRODUCTION
## Pentachloroethane

**CAS** 76-01-7

**RTECS** KI6300000

**Synonyms & Trade Names**
- Ethane pentachloride
- Pentalin

**DOT ID & Guide**
- 1669 151

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>Handle with care in the workplace. See Appendix C (Chloroethanes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>none</td>
</tr>
</tbody>
</table>

**IDLH** N.D.

**Conversion**

<table>
<thead>
<tr>
<th>MW: 202.3</th>
<th>BP: 322°F</th>
<th>FRZ: -20°F</th>
<th>Sol: 0.05%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 3 mmHg</td>
<td>IP: 11.28 eV</td>
<td>Sp.Gr: 1.68</td>
<td></td>
</tr>
<tr>
<td>FL.P: ?</td>
<td>UEL: ?</td>
<td>LEL: ?</td>
<td></td>
</tr>
</tbody>
</table>

**Physical Description**

Colorless liquid with a sweetish, chloroform-like odor.

**Incompatibilities & Reactivities**

(Sodium-potassium alloy + bromoform), alkalis, metals, water [Note: Hydrolysis produces dichloroacetic acid. Reaction with alkalis & metals produces spontaneously explosive chloroacetylenes.]

**Measurement Methods**

- NIOSH 2517
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection )

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

**First Aid** (See procedures )

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** In animals: irritation eyes, skin; lassitude (weakness, exhaustion), restlessness, irregular respiration, muscle incoordination; liver, kidney, lung changes

**Target Organs** Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
**Pentachloronaphthalene**

<table>
<thead>
<tr>
<th>CAS</th>
<th>1321-64-8</th>
</tr>
</thead>
</table>

**Formula**

C₁₀H₃Cl₅

**Synonyms & Trade Names**
Halowax® 1013; 1,2,3,4,5-Pentachloronaphthalene

**DOT ID & Guide**

Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>TWA 0.5 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>TWA 0.5 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

**IDLH**

Unknown

**Conversion**

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pale-yellow or white solid or powder with an aromatic odor.</td>
</tr>
</tbody>
</table>

**MW:** 300.4  
**BP:** 636°F  
**MLT:** 248°F  
**Sol:** Insoluble

**VP:** <1 mmHg  
**IP:** ?  
**Sp.Gr:** 1.67

Noncombustible Solid

**Incompatibilities & Reactivities**

Strong oxidizers

**Measurement Methods**

NIOSH S96 (II-2)  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**  
(See protection)

Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: Daily

**First Aid**  
(See procedures)

Eye: Irrigate immediately  
Skin: Soap promptly/molten flush immediately  
Breathing: Respiratory support  
Swallow: Medical Attention immediately

**Respirator Recommendations**  
(See Appendix F) NIOSH/OSHA

**Up to 5 mg/m³:**

(APF = 10) Any supplied-air respirator*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Headache, lassitude (weakness, exhaustion), dizziness, anorexia; pruritus, acne-form skin eruptions; jaundice, liver necrosis</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, liver, central nervous system</td>
</tr>
<tr>
<td>See also:</td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
# Pentachlorophenol

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorless to white, crystalline solid with a benzene-like odor. [fungicide]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 0.5 mg/m³ [skin]</td>
</tr>
<tr>
<td>OSHA PEL: TWA 0.5 mg/m³ [skin]</td>
</tr>
<tr>
<td>IDLH: 2.5 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sol: 0.001%</td>
</tr>
<tr>
<td>Sp.Gr: 1.98</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incompatibilities &amp; Reactivities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong oxidizers, acids, alkalis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH 5512</td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Personal Protection &amp; Sanitation (See protection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: Daily</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First Aid (See procedures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Skin: Soap wash immediately</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 2.5 mg/m³:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.*
(APF = 25) Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, nose, throat; sneezing, cough; lassitude (weakness, exhaustion), anorexia, weight loss; sweating; headache, dizziness; nausea, vomiting; dyspnea (breathing difficulty), chest pain; high fever; dermatitis

Target Organs Eyes, skin, respiratory system, cardiovascular system, liver, kidneys, central nervous system

See also: INTRODUCTION
# Pentaerythritol

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>115-77-5</td>
</tr>
<tr>
<td>RTECS</td>
<td>RZ24900000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>2,2-bis(Hydroxymethyl)-1,3-propanediol; Methane tetramethylol; Monopentaerythritol; PE; Tetrahydroxymethylolmethane; Tetramethylolmethane</td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
</tbody>
</table>

## Physical Description

Colorless to white, crystalline, odorless powder. [Note: Technical grade is 88% monopentaerythritol & 12% dipentaerythritol.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>136.2</td>
</tr>
<tr>
<td>BP</td>
<td>Sublimes</td>
</tr>
<tr>
<td>MLT</td>
<td>500°F (Sublimes)</td>
</tr>
<tr>
<td>Sol(59°F)</td>
<td>6%</td>
</tr>
<tr>
<td>VP</td>
<td>0.0000000008 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>FI.P.</td>
<td>?</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
<tr>
<td>Combustible Solid</td>
<td></td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities

Organic acids, oxidizers [Note: Explosive compound is formed when a mixture of PE & thiophosphoryl chloride is heated.]

## Measurement Methods

NIOSH 0500, 0600

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Protection Type</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Eyes</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Wash skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Remove</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Change</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

## First Aid

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>Irrigate immediately</td>
</tr>
<tr>
<td>Skin</td>
<td>Water wash</td>
</tr>
<tr>
<td>Breathing</td>
<td>Fresh air</td>
</tr>
<tr>
<td>Swallow</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>

## Important additional information about respirator selection

Respirator Recommendations: Not available.

## Exposure Routes

Inhalation, ingestion, skin and/or eye contact

## Symptoms

Irritation eyes, respiratory system

## Target Organs

Eyes, respiratory system

See also: INTRODUCTION
## n-Pentane

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-Pentane</td>
<td>109-66-0</td>
<td>RZ9450000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Pentane, normal-Pentane

### DOT ID & Guide
1265 128

### Exposure Limits

<table>
<thead>
<tr>
<th>Limit Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA</td>
<td>120 ppm (350 mg/m³)</td>
</tr>
<tr>
<td>NIOSH REL: C</td>
<td>610 ppm (1800 mg/m³) [15-minute]</td>
</tr>
<tr>
<td>OSHA PEL†: TWA</td>
<td>1000 ppm (2950 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>1500 ppm [10%LEL]</td>
</tr>
</tbody>
</table>

### Conversion
1 ppm = 2.95 mg/m³

### Physical Description
Colorless liquid with a gasoline-like odor. [Note: A gas above 97°F. May be utilized as a fuel.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>72.2</td>
</tr>
<tr>
<td>BP</td>
<td>97°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-202°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.04%</td>
</tr>
<tr>
<td>VP</td>
<td>420 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>10.34 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.63</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>-57°F</td>
</tr>
<tr>
<td>UEL</td>
<td>7.8%</td>
</tr>
<tr>
<td>LEL</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

Class IA Flammable Liquid: Fl.P. below 73°F and BP below 100°F.

### Incompatibilities & Reactivities
Strong oxidizers

### Measurement Methods
NIOSH 1500 ; OSHA 7
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Water wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 1200 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 1500 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose; dermatitis; chemical pneumonitis (aspiration liquid); drowsiness; in animals: narcosis

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 1-Pentanethiol

<table>
<thead>
<tr>
<th>Chemical Identification</th>
<th>CAS No.</th>
<th>RTECS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃(CH₂)₄SH</td>
<td>110-66-7</td>
<td>SA3150000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Amyl hydrosulfide
- Amyl mercaptan
- Amyl sulfhydrate
- Pentyl mercaptan

### DOT ID & Guide
- ID: 1111 130

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 0.5 ppm (2.1 mg/m³) [15-minute]</td>
<td>none</td>
</tr>
</tbody>
</table>

### IDLH
- N.D.

### Conversion
- 1 ppm = 4.26 mg/m³

## Physical Description
- Water-white to yellowish liquid with a strong, garlic-like odor.
- MW: 104.2
- BP: 260°F
- FRZ: -104°F
- Sol: Insoluble
- VP(77°F): 14 mmHg
- IP: ?
- Sp.Gr: 0.84
- Fl.P(oc): 65°F
- UEL: ?
- LEL: ?

## Incompatibilities & Reactivities
- Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
- Oxidizers, reducing agents, alkali metals, calcium hypochlorite, concentrated nitric acid

## Measurement Methods
- None available
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

## First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
# Important additional information about respirator selection

**Respirator Recommendations** NIOSH

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, nose, throat, respiratory system; headache, nausea, dizziness; vomiting, diarrhea; dermatitis, skin sensitization</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## 2-Pentanone

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃COCH₂CH₂CH₃</td>
<td>107-87-9</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Ethyl acetone
- Methyl propyl ketone
- MPK

### DOT ID & Guide
- ID: 1249
- Guide: 127

### Exposure Limits
- NIOSH REL: TWA 150 ppm (530 mg/m³)
- OSHA PEL*: TWA 200 ppm (700 mg/m³)

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 ppm</td>
<td>1 ppm = 3.52 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description
- Colorless to water-white liquid with a characteristic acetone-like odor.

- MW: 86.1
- BP: 215°F
- FRZ: -108°F
- Sol: 6%
- VP: 27 mmHg
- IP: 9.39 eV
- Sp.Gr: 0.81
- Fl.P: 45°F
- UEL: 8.2%
- LEL: 1.5%

### Incompatibilities & Reactivities
- Oxidizers, bromine trifluoride

### Measurement Methods
- NIOSH 1300, 2555
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Water flush
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 1500 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
## Perchloromethyl mercaptan

<table>
<thead>
<tr>
<th>CAS</th>
<th>594-42-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>PB0370000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1670 157</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- PCM, PMM, Trichloromethane sulfenyl chloride, Trichloromethyl sulfur chloride

### Exposure Limits
- NIOSH REL: TWA 0.1 ppm (0.8 mg/m³)
- OSHA PEL: TWA 0.1 ppm (0.8 mg/m³)

### IDLH
10 ppm

### Conversion
1 ppm = 7.60 mg/m³

### Physical Description
Pale-yellow, oily liquid with an unbearable, acrid odor.

- MW: 185.9
- BP: 297°F (Decomposes)
- FRZ: ?
- Sol: Insoluble
- VP: 3 mmHg
- IP: ?
- Sp.Gr: 1.69
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
Noncombustible Liquid, but will support combustion.
- Alkalis, amines, hot iron, water [Note: Corrosive to most metals. Forms HCl, sulfur & CO₂ on contact with water.]

### Measurement Methods
None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

<table>
<thead>
<tr>
<th>Respirator Recommendations</th>
<th>NIOSH/OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 1 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*</td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator*</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 2.5 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 5 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 10 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
<td></td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

| (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode |             |
| (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus |             |
| (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus |             |

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; lacrimation (discharge of tears); cough, dyspnea (breathing difficulty), deep breathing pain, coarse rales; vomiting; pallor, tachycardia; acidosis; anuria; liver, kidney damage

**Target Organs** Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
# Perchloryl fluoride

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>7616-94-6</td>
</tr>
<tr>
<td>RTECS</td>
<td>SD1925000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Chlorine fluoride oxide, Chlorine oxyfluoride, Trioxychlorofluoride</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>3083 124</td>
</tr>
</tbody>
</table>

## Exposure Limits

- **NIOSH REL:** TWA 3 ppm (14 mg/m³) ST 6 ppm (28 mg/m³)
- **OSHA PEL†:** TWA 3 ppm (13.5 mg/m³)

**IDLH:** 100 ppm  
**Conversion:** 1 ppm = 4.19 mg/m³

## Physical Description

Colorless gas with a characteristic, sweet odor. [Note: Shipped as a liquefied compressed gas.]

- **MW:** 102.5  
- **BP:** -52°F  
- **FRZ:** -234°F  
- **Sol:** 0.06%  
- **VP:** 10.5 atm  
- **IP:** 13.60 eV  
- **RGasD:** 3.64  
- **Fl.P:** NA  
- **UEL:** NA  
- **LEL:** NA

Nonflammable Gas, but will support combustion.

## Incompatibilities & Reactivities

Combustibles, strong bases, amines, finely divided metals, reducing agents, alcohols

## Measurement Methods

None available  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

(See protection)

- **Skin:** Frostbite  
- **Eyes:** Frostbite  
- **Wash skin:** No recommendation  
- **Remove:** No recommendation  
- **Change:** No recommendation  
- **Provide:** Frostbite wash

## First Aid

(See procedures)

- **Eye:** Frostbite  
- **Skin:** Frostbite  
- **Breathing:** Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 30 ppm:
(APF = 10) Any supplied-air respirator

Up to 75 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

Up to 100 ppm:
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
(Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin and/or eye contact (liquid)

Symptoms Irritation respiratory system; liquid: frostbite; in animals: methemoglobinemia; cyanosis; lassitude (weakness, exhaustion), dizziness, headache; pulmonary edema; pneumonitis; anoxia

Target Organs Skin, respiratory system, blood

See also: INTRODUCTION
# Perlite

| NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

**Synonyms & Trade Names**
Expanded perlite [Note: An amorphous material consisting of fused sodium potassium aluminum silicate.]

**Physical Description**
Odorless, light-gray to glassy-black solid. [Note: Expanded perlite is a fluffy, white particulate.]

**Incompatibilities & Reactivities**
None reported

**Measurement Methods**
NIOSH 0500, 0600
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
Skin: No recommendation
Eyes: No recommendation
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

**First Aid** *(See procedures)*
Eye: Irrigate immediately
Breathing: Fresh air

**Important additional information about respirator selection**
Respirator Recommendations Not available.
### Petroleum distillates (naphtha)

**CAS** 8002-05-9  
**RTECS** SE7449000  
**DOT ID & Guide**

#### Synonyms & Trade Names
- Aliphatic petroleum naphtha
- Petroleum naphtha
- Rubber solvent

#### Exposure Limits
<table>
<thead>
<tr>
<th>NIOSH REL: TWA 350 mg/m³</th>
<th>C 1800 mg/m³ [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 500 ppm (2000 mg/m³)</td>
<td></td>
</tr>
</tbody>
</table>

| IDLH| 1100 ppm [10%LEL] |
| Conversion| 1 ppm = 4.05 mg/m³ |

#### Physical Description
Colorless liquid with a gasoline- or kerosene-like odor. [Note: A mixture of paraffins (C5 to C13) that may contain a small amount of aromatic hydrocarbons.]

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 40 mmHg (approx)</td>
<td>IP: ?</td>
<td>Sp.Gr: 0.63-0.66</td>
<td></td>
</tr>
<tr>
<td>Fl.P: -40 to -86°F</td>
<td>UEL: 5.9%</td>
<td>LEL: 1.1%</td>
<td></td>
</tr>
</tbody>
</table>

**Flammable Liquid**

#### Incompatibilities & Reactivities
- Strong oxidizers

#### Measurement Methods
- NIOSH 1550
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
(See protection)

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet (flammable) |
| Change: No recommendation |

#### First Aid
(See procedures)

| Eye: Irrigate immediately |
| Skin: Soap wash promptly |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |
## Important additional information about respirator selection

### Respirator Recommendations NIOSH

**Up to 850 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 1100 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, nose, throat; dizziness, drowsiness, headache, nausea; dry cracked skin; chemical pneumonitis (aspiration liquid)

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Phenol

**CAS** 108-95-2

**RTECS** SJ3325000

### Synonyms & Trade Names
- Carbolic acid
- Hydroxybenzene
- Monohydroxybenzene
- Phenyl alcohol
- Phenyl hydroxide

### DOT ID & Guide
- 1671 153 (solid)
- 2312 153 (molten)
- 2821 153 (solution)

### Exposure Limits
- NIOSH REL: TWA 5 ppm (19 mg/m³) C 15.6 ppm (60 mg/m³) [15-minute] [skin]
- OSHA PEL: TWA 5 ppm (19 mg/m³) [skin]

### Physical Description
- Colorless to light-pink, crystalline solid with a sweet, acrid odor. [Note: Phenol liquefies by mixing with about 8% water.]
- MW: 94.1
- BP: 359°F
- MLT: 109°F
- Sol(77°F): 9%
- VP: 0.4 mmHg
- IP: 8.50 eV
- Fl.P: 175°F
- UEL: 8.6%
- LEL: 1.8%

### Incompatibilities & Reactivities
- Strong oxidizers, calcium hypochlorite, aluminum chloride, acids

### Measurement Methods
- NIOSH 2546 ; OSHA 32
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Conversion
- 1 ppm = 3.85 mg/m³
<table>
<thead>
<tr>
<th><strong>Important additional information about respirator selection</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations</strong> NIOSH/OSHA</td>
</tr>
<tr>
<td><strong>Up to 50 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 125 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td><strong>Up to 250 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. <a href="#">Click here</a></td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching

**Target Organs** Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Phenothiazine

<table>
<thead>
<tr>
<th>CAS</th>
<th>92-84-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S(C₆H₄)₂NH</strong></td>
<td>RTECS  SN5075000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**  
Dibenzothiazine, Fenothiazine, Thiodiphenylamine

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 5 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

**IDLH** N.D.  
**Conversion**

**Physical Description**  
Grayish-green to greenish-yellow solid. [insecticide]

| MW: 199.3 | BP: 700°F | MLT: 365°F | Sol: Insoluble |
| VP: 0 mmHg (approx) | IP: ? | UEL: ? | LEL: ? |

Combustible Solid, but not a high fire risk.

**Incompatibilities & Reactivities**  
None reported

**Measurement Methods**  
OSHA PV2048  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**  
(See protection)

- **Skin**: Prevent skin contact  
  - Wash skin: When contaminated/Daily  
  - Remove: When wet or contaminated  
  - Change: Daily

**First Aid**  
(See procedures)

- **Eye**: Irrigate immediately  
  - Skin: Soap wash promptly  
  - Breathing: Respiratory support  
  - Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations**  
Not available.

**Exposure Routes**  
inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**  
Itching, irritation, reddening skin; hepatitis, hemolytic anemia, abdominal cramps, tachycardia; kidney damage; skin photo sensitization

**Target Organs**  
Skin, cardiovascular system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## p-Phenylenediamine

- **CAS**: 106-50-3
- **RTECS**: SS8050000

### Physical Description
- White to slightly red, crystalline solid.
- **MW**: 108.2
- **BP**: 513°F
- **MLT**: 295°F
- **Sol(75°F)**: 4%
- **VP**: <1 mmHg
- **IP**: 6.89 eV
- **Fl.P**: 312°F
- **UEL**: ?
- **LEL**: ?

### Incompatibilities & Reactivities
- Combustible solid
- Strong oxidizers

### Measurement Methods
- OSHA 87
- See: NMAM or OSHA Methods

### Exposure Limits
- **NIOSH REL**: TWA 0.1 mg/m³ [skin]
- **OSHA PEL**: TWA 0.1 mg/m³ [skin]
- **IDLH**: 25 mg/m³

### Conversion

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated/Daily
- **Remove**: When wet or contaminated
- **Change**: Daily

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 2.5 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 5 mg/m³:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 25 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. [Click here](#)

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation pharynx, larynx; bronchial asthma; sensitization dermatitis</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Respiratory system, skin</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
### Phenyl ether-biphenyl mixture (vapor)

<table>
<thead>
<tr>
<th>CAS 8004-13-5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₆H₅OC₆H₅/C₆H₅C₆H₅</strong></td>
</tr>
<tr>
<td>RTECS DV1500000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
Diphenyl oxide-diphenyl mixture; Dowtherm® A

#### Exposure Limits
- **NIOSH REL:** TWA 1 ppm (7 mg/m³)
- **OSHA PEL:** TWA 1 ppm (7 mg/m³)

#### IDLH
10 ppm

#### Conversion
1 ppm = 6.79 mg/m³ (approx)

#### Physical Description
Colorless to straw-colored liquid or solid (below 54°F) with a disagreeable, aromatic odor. [Note: A mixture typically contains 75% phenyl ether & 25% biphenyl.]

- MW: 166 (approx)
- BP: 495°F
- FRZ: 54°F
- Sol: Insoluble
- VP(77°F): 0.08 mmHg
- IP: ?
- Sp.Gr(77°F): 1.06
- Fl.P: 239°F
- UEL: ?
- LEL: ?

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

#### Incompatibilities & Reactivities
Strong oxidizers

#### Measurement Methods
NIOSH 2013
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

**First Aid**
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 10 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode.
- (APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

#### Exposure Routes  
Inhalation, skin and/or eye contact

#### Symptoms  
Irritation eyes, nose, skin; nausea

#### Target Organs  
Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Phenyl ether (vapor)

<table>
<thead>
<tr>
<th>CAS</th>
<th>101-84-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KN8970000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Diphenyl ether
- Diphenyl oxide
- Phenoxy benzene
- Phenyl oxide

### Exposure Limits
- **NIOSH REL:** TWA 1 ppm (7 mg/m³)
- **OSHA PEL:** TWA 1 ppm (7 mg/m³)

### IDLH
- 100 ppm

### Conversion
- 1 ppm = 6.96 mg/m³

### Physical Description
- Colorless, crystalline solid or liquid (above 82°F) with a geranium-like odor.

### MW: 170.2 | BP: 498°F | MLT: 82°F | Sol: Insoluble
### VP(77°F): 0.02 mmHg | IP: 8.09 eV | Sp.Gr: 1.08
### Fl.P: 239°F | UEL: 6.0% | LEL: 0.7%

### Incompatibilities & Reactivities
- Strong oxidizers

### Combustible Solid Class IIIB Combustible Liquid

### Measurement Methods
- NIOSH 1617 ; OSHA PV2022
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 25 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode£

Up to 50 ppm:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 100 ppm:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Irritation eyes, nose, skin; nausea

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
**Phenyl glycidyl ether**

<table>
<thead>
<tr>
<th>CAS</th>
<th>122-60-1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₉H₁₀O₂</strong></td>
<td></td>
</tr>
<tr>
<td>RTECS</td>
<td>TZ3675000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
1,2-Epoxy-3-phenoxy propane; Glycidyl phenyl ether; PGE; Phenyl 2,3-epoxypropyl ether

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>Ca C 1 ppm (6 mg/m³) [15-minute] See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>TWA 10 ppm (60 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH Ca [100 ppm]**

**Conversion** 1 ppm = 6.14 mg/m³

**Physical Description**
Colorless liquid. [Note: A solid below 38°F.]

| MW: | 150.1 |
| VP: | 0.01 mmHg |
| BP: | 473°F |
| FRZ: | 38°F |
| Sol: | 0.2% |
| Sp.Gr: | 1.11 |

**Class IIIB Combustible Liquid**: Fl. P. at or above 200°F.

**Incompatibilities & Reactivities**
Strong oxidizers, amines, strong acids, strong bases

**Measurement Methods**
NIOSH 1619; OSHA 7
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

**First Aid** (See procedures)

| Eye: Irrigate immediately |
| Skin: Soap wash promptly |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; upper respiratory system; skin sensitization; narcosis; possible hematopoietic, reproductive effects; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, central nervous system, hematopoietic system, reproductive system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: nasal cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

### Phenylhydrazine

**CAS** 100-63-0

**C₆H₅NHNH₂**

**RTECS** MV8925000

**Synonyms & Trade Names**

- Hydrazinobenzene
- Monophenylhydrazine

**DOT ID & Guide**

- 2572 153

### Exposure Limits

- **NIOSH REL**: Ca C 0.14 ppm (0.6 mg/m³) [2-hr] [skin] See Appendix A
- **OSHA PEL†**: TWA 5 ppm (22 mg/m³) [skin]

**IDLH** Ca [15 ppm]

**Conversion** 1 ppm = 4.42 mg/m³

### Physical Description

Colorless to pale-yellow liquid or solid (below 67°F) with a faint, aromatic odor.

| MW: 108.1 | VP(77°F): 0.04 mmHg | FI.P: 190°F | UEL: ? |
| BP: 470°F (Decomposes) | IP: 7.64 eV | UEL: ? | LEL: ? |
| FRZ: 67°F | Sp.Gr: 1.10 |

Class IIIA Combustible Liquid Combustible Solid

### Incompatibilities & Reactivities

- Strong oxidizers, lead dioxide

### Measurement Methods

- NIOSH 3518
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated/Daily
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

### First Aid (See procedures )

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**: Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

- Skin sensitization, hemolytic anemia, dyspnea (breathing difficulty), cyanosis; jaundice; kidney damage; vascular thrombosis; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th>Target Organs</th>
<th>Blood, respiratory system, liver, kidneys, skin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer Site</td>
<td>[in animals: tumors of the lungs, liver, blood vessels &amp; intestine]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## N-Phenyl-beta-naphthylamine

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>135-88-6</td>
</tr>
<tr>
<td>RTECS</td>
<td>QM4550000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>2-Anilinonaphthalene, beta-Naphthylphenylamine, PBNA, 2-Phenylaminonaphthalene, Phenyl-beta-naphthylamine</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>Ca* [Note: Since metabolized to beta-Naphthylamine.]</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
<tr>
<td>IDLH</td>
<td>Ca [N.D.]</td>
</tr>
</tbody>
</table>

### Physical Description

- **Color**: White to yellow crystals or gray to tan flakes or powder. [Note: Commercial product may contain 20-30 ppm of beta-Naphthylamine.]
- **MW**: 219.3
- **BP**: 743°F
- **MLT**: 226°F
- **Sol**: Insoluble
- **VP**: ?
- **IP**: ?
- **Sp.Gr**: 1.24
- **FI.P**: ?
- **UEL**: ?
- **LEL**: ?

### Incompatibilities & Reactivities

- **Combustible Solid**
- **Oxidizers**

### Measurement Methods

- **OSHA 96**
- **See: NMAM or OSHA Methods**

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated/Daily
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations**

- **NIOSH**
  - At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
    - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
    - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
- **Escape**
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation; leucoplakia; acne, hypersensitivity to sunlight; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, bladder</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[bladder cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Phenylphosphine

<table>
<thead>
<tr>
<th>CAS</th>
<th>638-21-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>SZ2100000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Fenylfosfin, PF, Phosphaniline</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: C 0.05 ppm (0.25 mg/m³)</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH N.D.</td>
<td>Conversion 1 ppm = 4.50 mg/m³</td>
</tr>
</tbody>
</table>

## Physical Description

Clear, colorless liquid with a foul odor.

- MW: 110.1
- BP: 320°F
- FRZ: ?
- Sol: Insoluble
- VP: ?
- IP: ?
- Sp.Gr(59°F): 1.001
- Fl.P: ?
- UEL: ?
- LEL: ?

## Incompatibilities & Reactivities

None reported [Note: Spontaneously combustible in high concentrations in air. Potential exposure to gaseous PF when polyphosphinates are heated above 392°F.]

## Measurement Methods

None available

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: Daily
- **Remove**: When wet or contaminated
- **Change**: No recommendation

## First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

## Important additional information about respirator selection

**Respirator Recommendations** Not available.

## Exposure Routes

Inhalation, ingestion, skin and/or eye contact

## Symptoms

In animals: blood changes, anemia, testicular degeneration; loss of appetite, diarrhea, lacrimation (discharge of tears), hind leg tremor; dermatitis

## Target Organs

Blood, central nervous system, skin, reproductive system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Phorate

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>298-02-2</td>
<td>TD9450000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- O,O-Diethyl S-(ethylthio)methylphosphorodithioate
- O,O-Diethyl S-ethylthiomethylthiothionophosphate
- Thimet
- Timet

### DOT ID & Guide
- 3018 152 (organophosphorus pesticide, liquid, toxic)

### Exposure Limits
- NIOSH REL: TWA 0.05 mg/m³ ST 0.2 mg/m³ [skin]
- OSHA PEL†: none

### IDLH N.D. Conversion

### Physical Description
- Clear liquid with a skunk-like odor. [insecticide]
- MW: 260.4
- VP: 0.0008 mmHg
- FI.P(oc): 320°F
- Class IIB Combustible Liquid, but does not readily ignite.

### Incompatibilities & Reactivities
- Water, alkalis [Note: Hydrolyzed in the presence of moisture and by alkalis.]

### Measurement Methods
- NIOSH 5600
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

#### Skin: Prevent skin contact
- Wash skin: When contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

#### Eyes: Prevent eye contact
- Remove: When wet or contaminated
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### First Aid

#### Eye: Irrigate immediately
- Skin: Soap flush immediately
- Breathing: Respiratory support

### Important additional information about respirator selection
- Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; miosis; rhinorrhea (discharge of thin mucus); headache; chest tightness, wheezing, laryngeal spasm, salivation, cyanosis; anorexia, nausea, vomiting, abdominal cramps, diarrhea; sweating; muscle fasciculation, lassitude (weakness, exhaustion), paralysis; dizziness, confusion, ataxia; convulsions, coma; low blood pressure; cardiac irregularities

### Target Organs
- Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Phosdrin®

<table>
<thead>
<tr>
<th>CAS</th>
<th>7786-34-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>GQ52500000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2783 152</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
2-Carbomethoxy-1-methylvinyl dimethyl phosphate, Mevinphos [Note: Commercial product is a mixture of the cis- & trans-isomers.]

### Exposure Limits

| NIOSH REL: TWA 0.01 ppm (0.1 mg/m³) ST 0.03 ppm (0.3 mg/m³) [skin] |
| OSHA PEL: TWA 0.1 mg/m³ [skin] |
| IDLH 4 ppm |

### Conversion
1 ppm = 9.17 mg/m³

### Physical Description
Pale-yellow to orange liquid with a weak odor. [Note: Insecticide that may be absorbed on a dry carrier.]

| MW: 224.2 | BP: Decomposes |
| VP: 0.003 mmHg | IP: ? |
| F.P(oc): 347°F | UEL: ? |
| Sol: Miscible |
| Sp.Gr: 1.25 |

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities
Strong oxidizers [Note: Corrosive to cast iron, some stainless steels & brass.]

### Measurement Methods
NIOSH 5600
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection )

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

### First Aid
(See procedures )

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

**Up to 0.1 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 0.25 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 0.5 ppm:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 4 ppm:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; miosis; rhinorrhea (discharge of thin mucus); headache; chest tightness, wheezing, laryngeal spasm, salivation, cyanosis; anorexia, nausea, vomiting, abdominal cramps, diarrhea; paralysis; ataxia, convulsions; low blood pressure, cardiac irregularities

### Target Organs
- Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Phosgene

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-44-5</td>
<td>SY5600000</td>
<td>1076 125</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

- Carbon oxychloride
- Carbonyl chloride
- Carbonyl dichloride
- Chloroformyl chloride

### Exposure Limits

- **NIOSH REL**
  - TWA 0.1 ppm (0.4 mg/m³)
  - C 0.2 ppm (0.8 mg/m³) [15-minute]

- **OSHA PEL**
  - TWA 0.1 ppm (0.4 mg/m³)

- **IDLH**
  - 2 ppm

### Conversion

1 ppm = 4.05 mg/m³

### Physical Description

- Colorless gas with a suffocating odor like musty hay. [Note: A fuming liquid below 47°F. Shipped as a liquefied compressed gas.]
- **MW**: 98.9
- **BP**: 47°F
- **FRZ**: -198°F
- **Sol**: Slight
- **VP**: 1.6 atm
- **IP**: 11.55 eV
- **RGasD**: 3.48
- **Sp.Gr**: 1.43 (Liquid at 32°F)
- **FL.P**: NA
- **UEL**: NA
- **LEL**: NA

### Incompatibilities & Reactivities

- Moisture, alkalis, ammonia, alcohols, copper [Note: Reacts slowly in water to form hydrochloric acid & carbon dioxide.]

### Measurement Methods

- OSHA 61
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact (liquid)
- **Eyes**: Prevent eye contact (liquid)
- **Wash skin**: When contaminated (liquid)
- **Remove**: When wet or contaminated (liquid)
- **Change**: No recommendation
- **Provide**: Quick drench (liquid)

### First Aid

- **Eye**: Irrigate immediately (liquid)
- **Skin**: Water flush immediately (liquid)
- **Breathing**: Respiratory support
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 1 ppm:**
- (APF = 10) Any supplied-air respirator*

**Up to 2 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/
- Any appropriate escape-type, self-contained breathing apparatus

---

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes; dry burning throat; vomiting; cough, foamy sputum, dyspnea (breathing difficulty), chest pain, cyanosis; liquid: frostbite</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# Phosphine

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS SY7525000</th>
<th>DOT ID &amp; Guide 2199 119</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>Hydrogen phosphide, Phosphorated hydrogen, Phosphorus hydride, Phosphorus trihydride</td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.3 ppm (0.4 mg/m³) ST 1 ppm (1 mg/m³)</th>
<th>OSHA PEL†: TWA 0.3 ppm (0.4 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH 50 ppm</td>
<td>Conversion 1 ppm = 1.39 mg/m³</td>
</tr>
</tbody>
</table>

## Physical Description

Colorless gas with a fish- or garlic-like odor. [pesticide] [Note: Shipped as a liquefied compressed gas. Pure compound is odorless.]

<table>
<thead>
<tr>
<th>MW: 34.0</th>
<th>BP: -126°F</th>
<th>FRZ: -209°F</th>
<th>Sol: Slight</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 41.3 atm</td>
<td>IP: 9.96 eV</td>
<td>RGasD: 1.18</td>
<td></td>
</tr>
<tr>
<td>Fl.P: NA (Gas)</td>
<td>UEL: ?</td>
<td>LEL: 1.79%</td>
<td></td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities

Air, oxidizers, chlorine, acids, moisture, halogenated hydrocarbons, copper [Note: May ignite SPONTANEOUSLY on contact with air.]

## Measurement Methods

OSHA 1003, ID180
See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection)

- Skin: Frostbite
- Eyes: Frostbite
- Wash skin: No recommendation
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Frostbite wash

## First Aid (See procedures)

- Eye: Frostbite
- Skin: Frostbite
- Breathing: Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

**Up to 3 ppm:**
(APF = 10) Any supplied-air respirator

**Up to 7.5 ppm:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 15 ppm:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 50 ppm:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin and/or eye contact (liquid)

**Symptoms** Nausea, vomiting, abdominal pain, diarrhea; thirst; chest tightness, dyspnea (breathing difficulty); muscle pain, chills; stupor or syncope; pulmonary edema; liquid: frostbite

**Target Organs** respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Phosphoric acid

<table>
<thead>
<tr>
<th>CAS 7664-38-2</th>
<th>RTECS TB6300000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Orthophosphoric acid, Phosphoric acid (aqueous), White phosphoric acid

### DOT ID & Guide
1805 154 (liquid or solution)
3453 154 (solid)

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 1 mg/m³</th>
<th>ST 3 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 1 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

**IDLH** 1000 mg/m³

### Physical Description
Thick, colorless, odorless, crystalline solid. [Note: Often used in an aqueous solution.]

<table>
<thead>
<tr>
<th>MW: 98.0</th>
<th>BP: 415°F</th>
<th>MLT: 108°F</th>
<th>Sol: Miscible</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0.03 mmHg</td>
<td>IP: ?</td>
<td>Sp.Gr(77°F): 1.87 (pure) 1.33 (50% solution)</td>
<td></td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
<td>LEL: NA</td>
<td></td>
</tr>
</tbody>
</table>

**Noncombustible Solid**

### Incompatibilities & Reactivities
Strong caustics, most metals [Note: Readily reacts with metals to form flammable hydrogen gas. DO NOT MIX WITH SOLUTIONS CONTAINING BLEACH OR AMMONIA.]

### Measurement Methods
NIOSH 7903 ; OSHA ID165SG
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash (>1.6%), Quick drench (>1.6%)

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

**Up to 25 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

**Up to 50 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1000 mg/m³:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

---

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, upper respiratory system; eye, skin, burns; dermatitis

**Target Organs** Eyes, skin, respiratory system

See also: INTRODUCTION
NIOSH Pocket Guide to Chemical Hazards

**Phosphorus oxychloride**

**CAS** 10025-87-3

**POCl₃**

**RTECS** TH4897000

**Synonyms & Trade Names**
Phosphorus chloride, Phosphorus oxytrichloride, Phosphoryl chloride

**DOT ID & Guide**
1810 137

---

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 0.1 ppm (0.6 mg/m³)</th>
<th>ST 0.5 ppm (3 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>

**IDLH** N.D.

**Conversion**

1 ppm = 6.27 mg/m³

---

**Physical Description**
Clear, colorless to yellow, oily liquid with a pungent & musty odor. [Note: A solid below 34°F.]

**MW**: 153.3  
**BP**: 222°F  
**FRZ**: 34°F  
**Sol**: Decomposes

**VP (81°F)**: 40 mmHg  
**IP**: ?  
**Sp.Gr (77°F)**: 1.65

**Noncombustible Liquid, but may set fire to combustible materials.**

---

**Incompatibilities & Reactivities**
Water, combustible materials, carbon disulfide, dimethyl-formamide, metals (except nickel & lead) [Note: Decomposes in water to hydrochloric & phosphoric acids.]

---

**Measurement Methods**
None available  
See: NMAM or OSHA Methods

---

**Personal Protection & Sanitation**  
(See protection)

**Skin**: Prevent skin contact  
**Eyes**: Prevent eye contact  
**Wash skin**: When contaminated  
**Remove**: When wet or contaminated  
**Change**: No recommendation  
**Provide**: Eyewash, Quick drench

---

**First Aid**  
(See procedures)

**Eye**: Irrigate immediately  
**Skin**: Water flush immediately  
**Breathing**: Respiratory support  
**Swallow**: Medical attention immediately

---

**Important additional information about respirator selection**

**Respirator Recommendations**  
Not available.

---

**Exposure Routes**  
inhalation, ingestion, skin and/or eye contact

**Symptoms**  
Irritation eyes, skin, respiratory system; eye, skin burns; dyspnea (breathing difficulty), cough, pulmonary edema; dizziness, headache, lassitude (weakness, exhaustion); abdominal pain, nausea, vomiting; nephritis

**Target Organs**  
Eyes, skin, respiratory system, central nervous system, kidneys

---

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Phosphorus pentachloride

**CAS** 10026-13-8

**RTECS** TB6125000

### Synonyms & Trade Names
- Pentachlorophosphorus, Phosphoric chloride, Phosphorus perchloride

### DOT ID & Guide
- DOT ID & Guide 1806 137

### Exposure Limits
- NIOSH REL: TWA 1 mg/m³
- OSHA PEL: TWA 1 mg/m³
- IDLH 70 mg/m³

### Physical Description
- White to pale-yellow, crystalline solid with a pungent, unpleasant odor.

### MW: 208.3 BP: Sublimes MLT: 324°F (Sublimes) Sol: Reacts

### VP(132°F): 1 mmHg IP: ? Sp.Gr: 3.60

### Fl.P: NA UEL: NA LEL: NA

### Noncombustible Solid

### Incompatibilities & Reactivities
- Water, magnesium oxide, chemically-active metals such as sodium & potassium, alkalis, amines [Note: Hydrolyzes in water (even in humid air) to form hydrochloric acid & phosphoric acid. Corrosive to metals.]

### Measurement Methods
- NIOSH S257 (II-5)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Conversion

---
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
<th>Respirator Recommendations NIOSH/OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 10 mg/m³:</td>
<td>(APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td>Up to 25 mg/m³:</td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>Up to 50 mg/m³:</td>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>Up to 70 mg/m³:</td>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Emergency or planned entry into unknown concentrations or IDLH conditions:</td>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
<td></td>
</tr>
<tr>
<td>Escape:</td>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin, respiratory system; bronchitis; dermatitis</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Target Organs</th>
<th>Eyes, skin, respiratory system</th>
</tr>
</thead>
</table>

See also: INTRODUCTION
### Phosphorus pentasulfide

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1314-80-3</td>
<td>TH4375000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- Phosphorus persulfide
- Phosphorus sulfide
- Sulfur phosphide

#### DOT ID & Guide
- 1340 139

#### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 1 mg/m³ ST 3 mg/m³</td>
<td>TWA 1 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

#### Physical Description
Greenish-gray to yellow, crystalline solid with an odor of rotten eggs.

#### MW
- P₂S₅: 222.3
- P₄S₁₀: 444.6

#### BP
- 957°F

#### MLT
- 550°F

#### Sol
- Reacts

#### VP
- 1 mmHg

#### IP
- ?

#### Sp.Gr
- 2.09

#### Flammable Solid
- May SPONTANEOUSLY ignite in presence of moisture.

#### Incompatibilities & Reactivities
- Water, alcohols, strong oxidizers, acids, alkalis [Note: Reacts with water to form hydrogen sulfide, sulfur dioxide, and phosphoric acid.]

#### Measurement Methods
- None available
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated
**Remove:** When wet or contaminated
**Change:** Daily

#### First Aid
**Eye:** Irrigate immediately
**Skin:** Dust off solid; water flush
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 10 mg/m³:
(APF = 10) Any supplied-air respirator*

#### Up to 25 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

#### Up to 50 mg/m³:
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

#### Up to 250 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, respiratory system; apnea, coma, convulsions; conjunctivitis pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), kerato-conjunctivity, corneal vesiculation; dizziness; headache; lassitude (weakness, exhaustion); irritability, insomnia; gastrointestinal disturbance

### Target Organs
Eyes, skin, respiratory system, central nervous system

See also: [INTRODUCTION](#)
### NIOSH Pocket Guide to Chemical Hazards

**Phosphorus trichloride**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7719-12-2</td>
<td>TH36750000</td>
<td>1809 137</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

- Phosphorus chloride

**Exposure Limits**

- NIOSH REL: TWA 0.2 ppm (1.5 mg/m³) ST 0.5 ppm (3 mg/m³)
- OSHA PEL†: TWA 0.5 ppm (3 mg/m³)
- IDLH 25 ppm

**Conversion**

1 ppm = 5.62 mg/m³

**Physical Description**

- Colorless to yellow, fuming liquid with an odor like hydrochloric acid.
- MW: 137.4
- BP: 169°F
- FRZ: -170°F
- Sol: Reacts
- VP: 100 mmHg
- IP: 9.91 eV
- Sp.Gr: 1.58
- Fl.P: NA
- UEL: NA
- LEL: NA

**Noncombustible Liquid; however, a strong oxidizer that may ignite combustibles upon contact.**

**Incompatibilities & Reactivities**

- Water, chemically-active metals such as sodium & potassium, aluminum, strong nitric acid, acetic acid, organic matter
- [Note: Hydrolyzes in water to form hydrochloric acid and phosphoric acid.]

**Measurement Methods**

- NIOSH 6402
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection )**

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

**First Aid (See procedures )**

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH

#### Up to 10 ppm:
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Up to 25 ppm:
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat; pulmonary edema; eye, skin burns

### Target Organs
- Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Phosphorus (yellow)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7723-14-0</td>
<td>TH3500000</td>
<td>Elemental phosphorus, White phosphorus</td>
<td>1381 136</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 0.1 mg/m³</td>
<td>TWA 0.1 mg/m³</td>
</tr>
</tbody>
</table>

**IDLH**: 5 mg/m³

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>White to yellow, soft, waxy solid with acrid fumes in air. [Note: Usually shipped or stored in water.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MW</th>
<th>BP</th>
<th>MLT</th>
<th>Sol</th>
</tr>
</thead>
<tbody>
<tr>
<td>124.0</td>
<td>536°F</td>
<td>111°F</td>
<td>0.0003%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VP</th>
<th>IP</th>
<th>Sp.Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03 mmHg</td>
<td>?</td>
<td>1.82</td>
</tr>
</tbody>
</table>

**Flammable Solid**

### Incompatibilities & Reactivities

Air, oxidizers (including elemental sulfur & strong caustics), halogens [Note: Ignites SPONTANEOUSLY in moist air.]

### Measurement Methods

NIOSH 7905
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- Skin: Prevent skin contact* [*Note: Flame retardant personal protective equipment should be provided.]
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid (See procedures )

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

<table>
<thead>
<tr>
<th>Respirator Recommendations</th>
<th>NIOSH/OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 1 mg/m³:</strong></td>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 2.5 mg/m³:</strong></td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td><strong>Up to 5 mg/m³:</strong></td>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, respiratory tract; eye, skin burns; abdominal pain, nausea, jaundice; anemia; cachexia; dental pain, salivation, jaw pain, swelling</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, liver, kidneys, jaw, teeth, blood</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
<table>
<thead>
<tr>
<th><strong>Phthalic anhydride</strong></th>
<th><strong>CAS</strong> 85-44-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{C}_6\text{H}_4(\text{CO})_2\text{O} )</td>
<td><strong>RTECS</strong> TI3150000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong> 2214 156</td>
</tr>
<tr>
<td>1,2-Benzenedicarboxylic anhydride; PAN; Phthalic acid anhydride</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

| | NIOSH REL: TWA 6 mg/m\(^3\) (1 ppm) |
| | OSHA PEL\(\dagger\): TWA 12 mg/m\(^3\) (2 ppm) |
| **IDLH** | 60 mg/m\(^3\) |

**Conversion**

1 ppm = 6.06 mg/m\(^3\)

### Physical Description

White solid (flake) or a clear, colorless, mobile liquid (molten) with a characteristic, acrid odor.

| MW: 148.1 | BP: 563°F |
| VP: 0.0015 mmHg | IP: 10.00 eV |
| Fl.P: 305°F | UEL: 10.5% |

**Incompatibilities & Reactivities**

Combustible solid

Strong oxidizers, water [Note: Converted to phthalic acid in hot water.]

### Measurement Methods

NIOSH S179 (II-3) ; OSHA 90
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: Daily |

### First Aid (See procedures )

| Eye: Irrigate immediately |
| Skin: Soap wash promptly |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |
## Respirator Recommendations NIOSH

### Up to 30 mg/m³:
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.*

### Up to 60 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*

(APF = 10) Any air-purifying, full-facepiece respirator equipped with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

(APF = 10) Any supplied-air respirator*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, upper respiratory system; conjunctivitis; nasal ulcer bleeding; bronchitis, bronchial asthma; dermatitis; in animals: liver, kidney damage

### Target Organs
Eyes, skin, respiratory system, liver, kidneys

See also: [INTRODUCTION](#)
**m-Phthalodinitrile**

<table>
<thead>
<tr>
<th>CAS 626-17-5</th>
</tr>
</thead>
</table>

**C₆H₄(CN)₂**

**RTECS CZ1900000**

**Synonyms & Trade Names**

1,3-Benzenedicarbonitrile; m-Dicyanobenzene; 1,3-Dicyanobenzene; Isophthalodinitrile; m-PDN

**DOT ID & Guide**

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 5 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

**IDLH N.D.**

**Conversion**

**Physical Description**

Needle-like, colorless to white, crystalline, flaky solid with an almond-like odor.

MW: 128.1  BP: Sublimes  MLT: 324°F (Sublimes)  Sol: Slight

VP: 0.01 mmHg  IP: ?  Sp.Gr: 4.42

FI.P: ?  UEL: ?  LEL: ?

Combustible Solid and a severe explosion hazard.

**Incompatibilities & Reactivities**

Strong oxidizers (e.g., chlorine, bromine, fluorine)

**Measurement Methods**

None available

See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection )**

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: Daily

Remove: When wet or contaminated

Change: Daily

**First Aid (See procedures )**

Eye: Irrigate immediately

Skin: Soap wash immediately

Breathing: Respiratory support

Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Headache, nausea, confusion; in animals: irritation eyes, skin

**Target Organs** Eyes, skin, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Picloram

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>1918-02-1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₆H₃Cl₃O₂N₂</strong></td>
<td>RTECS T7525000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
4-Amino-3,5,6-trichloropicolinic acid; 4-Amino-3,5,6-trichloro-2-picolinic acid; ATCP; Tordon®

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix D</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
</tbody>
</table>

| IDLH | N.D. |

### Physical Description

- Colorless to white crystals with a chlorine-like odor. [herbicide]
- MW: 241.5
- BP: Decomposes
- MLT: 424°F (Decomposes)
- Sol: 0.04%
- VP(95°F): 0.0000006 mmHg
- IP: ?
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities

- Hot concentrated alkali (hydrolyzes)

### Measurement Methods

- NIOSH 0500, 0600
- See NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: No recommendation
- Change: Daily

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Fresh air
- Swallow: Medical attention immediately

### Important additional information about respirator selection

- **Respirator Recommendations**: Not available.

### Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, skin, respiratory system; nausea; in animals: liver, kidney changes

### Target Organs

- Eyes, skin, respiratory system, liver, kidneys

See also: **INTRODUCTION**
# Picric acid

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>88-89-1</td>
<td>TJ7875000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names

- Phenol trinitrate
- 2,4,6-Trinitrophenol

**Note:** An OSHA Class A Explosive (1910.109).

## DOT ID & Guide

- 1344 113 (wet, > or =10% water)
- 3364 113 (wetted, > or =10% water)

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 0.1 mg/m³ ST 0.3 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 0.1 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

**IDLH** 75 mg/m³

**Conversion** 1 ppm = 9.37 mg/m³

## Physical Description

- Yellow, odorless solid. **[Note: Usually used as an aqueous solution.]**
- MW: 229.1
- BP: Explodes above 572°F
- MLT: 252°F
- Sol: 1%
- VP (383°F): 1 mmHg
- IP: ?
- Fl.P: 302°F
- UEL: ?
- LEL: ?
- Sp.Gr: 1.76

## Combustible Solid

**Incompatibilities & Reactivities**

- Copper, lead, zinc & other metals; salts; plaster; concrete; ammonia **[Note: Corrosive to metals. An explosive mixture results when the aqueous solution crystallizes.]**

## Measurement Methods

- NIOSH S228 (II-4)
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated/Daily
**Remove:** When wet or contaminated
**Change:** Daily

## First Aid

**Eye:** Irrigate immediately
**Skin:** Soap wash promptly
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately
Respirator Recommendations NIOSH/OSHA

Up to 0.5 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 1 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 2.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 5 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 75 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin; sensitization dermatitis; yellow-stained hair, skin; lassitude (weakness, exhaustion), myalgia, anuria, polyuria; bitter taste, gastrointestinal disturbance; hepatitis, hematuria (blood in the urine), albuminuria, nephritis

Target Organs Eyes, skin, kidneys, liver, blood

See also: INTRODUCTION
## Pindone

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₉H₅O₂C(O)C(CH₃)₃</td>
<td>83-26-1</td>
<td>NK63000000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- tert-Butyl valone
- 1,3-Dioxo-2-pivaloy-lindane
- Pival®
- Pivalyl
- 2-Pivalyl-1,3-indandione

### Exposure Limits
- NIOSH REL: TWA 0.1 mg/m³
- OSHA PEL: TWA 0.1 mg/m³
- IDLH: 100 mg/m³

### Physical Description
- Bright-yellow powder with almost no odor. [rodenticide]
- MW: 230.3
- BP: Decomposes
- MLT: 230°F
- Sol(77°F): 0.002%
- Sp.Gr: 1.06

### Incompatibilities & Reactivities
- None reported

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: Daily

### First Aid
- Eye: Irrigate immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Respirator Recommendations

**NIOSH/OSHA**

**Up to 0.5 mg/m³:**
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 1 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

**Up to 2.5 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 5 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
Any self-contained breathing apparatus with a full facepiece
Any supplied-air respirator with a full facepiece

**Up to 100 mg/m³:**
Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

**Exposure Routes** inhalation, ingestion

**Symptoms** Epistaxis (nosebleed), excess bleeding from minor cuts, bruises; smoky urine, black tarry stools; abdominal, back pain

**Target Organs** Blood prothrombin

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

<table>
<thead>
<tr>
<th><strong>Piperazine dihydrochloride</strong></th>
<th>CAS 142-64-3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₄H₁₀N₂ • 2HCl</strong></td>
<td>RTECS TL4025000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**  
Piperazine hydrochloride [Note: The monochloride, C₄H₁₀N₂ HCl, is also commercially available.]

**Exposure Limits**  
NIOSH REL: TWA 5 mg/m³  
OSHA PEL†: none

**IDLH N.D.**

**Conversion**

**Physical Description**  
White to cream-colored needles or powder.

| MW: 159.1 | BP: ? | MLT: 635°F | Sol: 41% |

**Combustible Solid, but does not ignite easily.**

**Incompatibilities & Reactivities**  
Water [Note: Slightly hygroscopic (i.e., absorbs moisture from the air).]

**Measurement Methods**  
None available  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**  
Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: Daily  
Provide: Eyewash, Quick drench

**First Aid**  
Eye: Irrigate immediately  
Skin: Water flush immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; skin burns, sensitization; asthma; gastrointestinal upset, headache, nausea, vomiting, incoordination, muscle weakness

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
**Plaster of Paris**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>26499-65-0</td>
<td>TP0700000</td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Calcium sulfate hemihydrate, Dried calcium sulfate, Gypsum hemihydrate, Hemihydrate gypsum [Note: Plaster of Paris is the hemihydrate form of Calcium Sulfate & Gypsum is the dihydrate form.]

**Exposure Limits**

| NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

**Physical Description**
White or yellowish, finely divided, odorless powder.

**Noncombustible Solid**

**Incompatibilities & Reactivities**
Moisture, water [Note: Hygroscopic (i.e., absorbs moisture from the air). Reacts with water to form Gypsum.]

**Measurement Methods**
NIOSH 0500, 0600
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
(Saw, wash, wash, wash, wash)

**First Aid**
(See procedures)
Eye: Irrigate immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

**Important additional information about respirator selection**
Respirator Recommendations: Not available.

**Exposure Routes**
inhalation, ingestion, skin and/or eye contact

**Symptoms**
Irritation eyes, skin, mucous membrane, respiratory system; cough

**Target Organs**
Eyes, skin, respiratory system

See also: INTRODUCTION
# Platinum

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>7440-06-4</td>
</tr>
<tr>
<td>RTECS</td>
<td>TP2160000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Platinum black, Platinum metal, Platinum sponge</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits

- **NIOSH REL**: TWA 1 mg/m³
- **OSHA PEL†**: none
- **IDLH**: N.D.

## Physical Description

- Silvery, whitish-gray, malleable, ductile metal.
- MW: 195.1
- BP: 6921°F
- MLT: 3222°F
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 21.45
- UEL: NA
- LEL: NA

Noncombustible Solid in bulk form, but finely divided powder can be dangerous to handle.

## Incompatibilities & Reactivities

- Aluminum, acetone, arsenic, ethane, hydrazine, hydrogen peroxide, lithium, phosphorus, selenium, tellurium, various fluorides

## Measurement Methods

- NIOSH 7300, 7303; OSHA ID121, ID130SG
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: Daily

## First Aid

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

## Important additional information about respirator selection

**Respirator Recommendations**: Not available.

## Exposure Routes

- Inhalation, ingestion, skin and/or eye contact

## Symptoms

- Irritation skin, respiratory system; dermatitis

## Target Organs

- Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Platinum (soluble salts, as Pt)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Synonyms vary depending upon the specific soluble platinum salt.

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.002 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 0.002 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH 4 mg/m³ (as Pt)</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description

Appearance and odor vary depending upon the specific soluble platinum salt.

Properties vary depending upon the specific soluble platinum salt.

### Incompatibilities & Reactivities

Varies

### Measurement Methods

NIOSH 7300, 7303, S191 (II-7)

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

#### Up to 0.05 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode.

#### Up to 0.1 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

#### Up to 4 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, nose; cough, dyspnea (breathing difficulty), wheezing, cyanosis; dermatitis, sensitization skin; lymphocytosis

### Target Organs
Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
## Portland cement

<table>
<thead>
<tr>
<th>CAS</th>
<th>65997-15-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>VV87700000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Cement, Hydraulic cement, Portland cement silicate [Note: A class of hydraulic cements containing tri- and dicalcium silicate in addition to alumina, tricalcium aluminate, and iron oxide.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 50 mppcf</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>5000 mg/m³</th>
</tr>
</thead>
</table>

### Physical Description
Gray, odorless powder.

<table>
<thead>
<tr>
<th>MW</th>
<th>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>NA</td>
</tr>
<tr>
<td>MLT</td>
<td>NA</td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>?</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid

### Incompatibilities & Reactivities
None reported

### Measurement Methods
NIOSH 0500 ; OSHA ID207
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

### First Aid
(See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Fresh air
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 50 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 100 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 250 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 500 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 5000 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose; cough, expectoration; exertional dyspnea (breathing difficulty), wheezing, chronic bronchitis; dermatitis

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Potassium cyanide (as CN)

<table>
<thead>
<tr>
<th>KCN</th>
<th>CAS 151-50-8</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- Potassium salt of hydrocyanic acid

### DOT ID & Guide
- 1680 157 (solid)
- 3413 157 (solution)

### Exposure Limits
- **NIOSH REL**: C 5 mg/m³ (4.7 ppm) [10-minute] [*Note: The REL also applies to other cyanides (as CN) except Hydrogen cyanide.]*
- **OSHA PEL**: TWA 5 mg/m³ [*Note: The PEL also applies to other cyanides (as CN) except Hydrogen cyanide.]*
- **IDLH**: 25 mg/m³ (as CN)

### Physical Description
- White, granular or crystalline solid with a faint, almond-like odor.
- **MW**: 65.1
- **BP**: 2957°F
- **MLT**: 1173°F
- **Sol(77°F)**: 72%
- **VP**: 0 mmHg (approx)
- **IP**: NA
- **Sp.Gr**: 1.55
- **Fl.P**: NA
- **UEL**: NA
- **LEL**: NA

Noncombustible Solid, but contact with acids releases highly flammable hydrogen cyanide.

### Incompatibilities & Reactivities
- Strong oxidizers (such as acids, acid salts, chlorates & nitrates) [Note: Absorbs moisture from the air forming a syrup.]

### Measurement Methods
- NIOSH 6010, 7904
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Conversion
- **Conversion**
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 25 mg/m³:
(APF = 10) Any supplied-air respirator
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, upper respiratory system; asphyxia; lassitude (weakness, exhaustion), headache, confusion; nausea, vomiting; increased respiratory rate, slow gasping respiration; thyroid, blood changes

Target Organs Eyes, skin, respiratory system, cardiovascular system, central nervous system, thyroid, blood

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Potassium hydroxide

<table>
<thead>
<tr>
<th>CAS</th>
<th>1310-58-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>TT2100000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1813 154 (dry, solid) 1814 154 (solution)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Caustic potash, Lye, Potassium hydrate

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:  C 2 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

### Physical Description
Odorless, white or slightly yellow lumps, rods, flakes, sticks, or pellets. [Note: May be used as an aqueous solution.]

<table>
<thead>
<tr>
<th>MW: 56.1</th>
<th>BP: 2415°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(1317°F): 1 mmHg</td>
<td>IP: ?</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid; however, may react with H₂O & other substances and generate sufficient heat to ignite combustible materials.

### Incompatibilities & Reactivities
Acids, water, metals (when wet), halogenated hydrocarbons, maleic anhydride [Note: Heat is generated if KOH comes in contact with H₂O & CO₂ from the air.]

### Measurement Methods
NIOSH 7401
See: NMAM or OSHA Methods

### Personal Protection & Sanitation  
(See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

### First Aid  
(See procedures)
Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

### Important additional information about respirator selection
Respirator Recommendations Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, respiratory system; cough, sneezing; eye, skin burns; vomiting, diarrhea

### Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
## Propane

### CAS
74-98-6

### RTECS
TX2275000

### Synonyms & Trade Names
- Bottled gas, Dimethyl methane, n-Propane, Propyl hydride

### DOT ID & Guide
- 1075 115
- 1978 115

### Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 1000 ppm (1800 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: TWA 1000 ppm (1800 mg/m³)</td>
</tr>
</tbody>
</table>

### IDLH
2100 ppm (10%LEL)

### Conversion
1 ppm = 1.80 mg/m³

### Physical Description
- Colorless, odorless gas. [Note: A foul-smelling odorant is often added when used for fuel purposes. Shipped as a liquefied compressed gas.]
- MW: 44.1
- BP: -44°F
- FRZ: -306°F
- Sol: 0.01%
- VP(70°F): 8.4 atm
- IP: 11.07 eV
- RGasD: 1.55
- Fl.P: NA (Gas)
- UEL: 9.5%
- LEL: 2.1%

### Incompatibilities & Reactivities
- Flammable Gas
- Strong oxidizers

### Measurement Methods
- NIOSH S87 (II-2) ; OSHA PV2077
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Frostbite
- **Eyes:** Frostbite
- **Wash skin:** No recommendation
- **Remove:** When wet (flammable)
- **Change:** No recommendation
- **Provide:** Frostbite wash

### First Aid
- **Eye:** Frostbite
- **Skin:** Frostbite
- **Breathing:** Respiratory support

### Respirator Recommendations
- **NIOSH/OSHA**
  - **Up to 2100 ppm:**
    - (APF = 10) Any supplied-air respirator
    - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - **Emergency or planned entry into unknown concentrations or IDLH conditions:**
    - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
    - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
  - **Escape:** Any appropriate escape-type, self-contained breathing apparatus

### Important additional information about respirator selection
- See procedures
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>inhalation, skin and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Dizziness, confusion, excitation, asphyxia; liquid: frostbite</td>
</tr>
<tr>
<td>Target Organs</td>
<td>central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
Propane sultone

<table>
<thead>
<tr>
<th>CAS</th>
<th>1120-71-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RP5425000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>3-Hydroxy-1-propanesulphonic acid sultone; 1,3-Propane sultone</td>
</tr>
</tbody>
</table>

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: none</td>
<td></td>
</tr>
</tbody>
</table>

**Physical Description**

White, crystalline solid or a colorless liquid (above 86°F). [Note: Releases a foul odor as it melts.]

<table>
<thead>
<tr>
<th>MW</th>
<th>122.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP:</td>
<td>?</td>
</tr>
<tr>
<td>MLT:</td>
<td>86°F</td>
</tr>
<tr>
<td>Sol:</td>
<td>10%</td>
</tr>
<tr>
<td>VP:</td>
<td>?</td>
</tr>
<tr>
<td>IP:</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr:</td>
<td>1.39</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>&gt;235°F</td>
</tr>
<tr>
<td>UEL:</td>
<td>?</td>
</tr>
<tr>
<td>LEL:</td>
<td>?</td>
</tr>
</tbody>
</table>

**Incompatibilities & Reactivities**

None reported

**Measurement Methods**

None available

See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

<table>
<thead>
<tr>
<th>Skin: Prevent skin contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated/Daily</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: Daily</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

**First Aid**

<table>
<thead>
<tr>
<th>Eye: Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Water flush immediately</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here for information on selection of N, R, or P filters.]

Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: skin tumors, leukemia, gliomas]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
## 1-Propanethiol

### CAS

107-03-9

### RTECS

TZ7300000

### Synonyms & Trade Names

3-Mercaptopropane, Propane-1-thiol, Propyl mercaptan, n-Propyl mercaptan

### DOT ID & Guide

2402 130

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>0.5 ppm (1.6 mg/m³) [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>none</td>
</tr>
</tbody>
</table>

### IDLH

N.D.

### Conversion

1 ppm = 3.12 mg/m³

### Physical Description

Colorless liquid with an offensive, cabbage-like odor.

- MW: 76.2
- BP: 153°F
- FRZ: -172°F
- Sol: Slight
- VP(77°F): 155 mmHg
- IP: 9.195 eV
- Sp.Gr: 0.84
- FL.P: -5°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities

Oxidizers, reducing agents, strong acids & bases, alkali metals, calcium hypochlorite

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

Skin: No recommendation

Eyes: Prevent eye contact

Wash skin: No recommendation

Remove: When wet (flammable)

Change: No recommendation

Provide: Eyewash

### First Aid

Eye: Irrigate immediately

Skin: Soap wash

Breathing: Respiratory support

Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH</strong></td>
</tr>
<tr>
<td><strong>Up to 5 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 12.5 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)</td>
</tr>
<tr>
<td><strong>Up to 25 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
<tr>
<td><strong>Exposure Routes</strong></td>
</tr>
<tr>
<td>inhalation, ingestion, skin and/or eye contact</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
</tr>
<tr>
<td>Irritation eyes, skin, nose, throat, respiratory system; headache, nausea, dizziness, cyanosis; in animals: liver, kidney damage</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
</tr>
<tr>
<td>Eyes, skin, respiratory system, central nervous system, blood, liver, kidneys</td>
</tr>
<tr>
<td>See also: INTRODUCTION</td>
</tr>
</tbody>
</table>
Propargyl alcohol

<table>
<thead>
<tr>
<th>CAS</th>
<th>107-19-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms</td>
<td>C₃H₃OH</td>
</tr>
<tr>
<td>Trade Names</td>
<td>1-Propyn-3-ol; 2-Propyn-1-ol; 2-Propynyl alcohol</td>
</tr>
<tr>
<td>RTECS</td>
<td>UK5075000</td>
</tr>
<tr>
<td>IDLH</td>
<td>N.D.</td>
</tr>
<tr>
<td>Exposure Limits</td>
<td>NIOSH REL: TWA 1 ppm (2 mg/m³) [skin]</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
<tr>
<td>Conversion</td>
<td>1 ppm = 2.29 mg/m³</td>
</tr>
<tr>
<td>Physical Description</td>
<td>Colorless to straw-colored liquid with a mild, geranium odor.</td>
</tr>
<tr>
<td>MW</td>
<td>56.1</td>
</tr>
<tr>
<td>BP</td>
<td>237°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-62°F</td>
</tr>
<tr>
<td>IP</td>
<td>10.51 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.97</td>
</tr>
<tr>
<td>VP</td>
<td>12 mmHg</td>
</tr>
<tr>
<td>Fl.P(oc)</td>
<td>97°F</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
<tr>
<td>Incompatibilities &amp; Reactivities</td>
<td>Phosphorus pentoxide, oxidizers</td>
</tr>
<tr>
<td>Measurement Methods</td>
<td>OSHA 97</td>
</tr>
<tr>
<td></td>
<td>See: NMAM or OSHA Methods</td>
</tr>
<tr>
<td>Personal Protection &amp; Sanitation (See protection)</td>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
<td></td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
<td></td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
<td></td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td></td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
<td></td>
</tr>
<tr>
<td>First Aid (See procedures)</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Skin: Water flush promptly</td>
<td></td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
<td></td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
<td></td>
</tr>
<tr>
<td>Important additional information about respirator selection</td>
<td></td>
</tr>
<tr>
<td>Respirator Recommendations</td>
<td>Not available.</td>
</tr>
<tr>
<td>Exposure Routes</td>
<td>Inhalation, skin absorption, ingestion, skin and/or eye contact</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Irritation skin, mucous membrane; central nervous system depression; in animals: liver, kidney damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Skin, respiratory system, central nervous system, liver, kidneys</td>
</tr>
<tr>
<td>See also: INTRODUCTION</td>
<td></td>
</tr>
</tbody>
</table>
## beta-Propiolactone

C₃H₄O₂

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>57-57-8</td>
<td>RQ73500000</td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

BPL; Hydroacrylic acid, beta-lactone; 3-Hydroxy-beta-lactone; 3-Hydroxy-propionic acid; beta-Lactone; 2-Oxetanone; 3-Propiolactone

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>OSHA PEL: [1910.1013]</th>
</tr>
</thead>
<tbody>
<tr>
<td>See Appendix A</td>
<td>See Appendix B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>[N.D]</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description

Colorless liquid with a slightly sweet odor.

- **MW:** 72.1
- **BP:** 323°F (Decomposes)
- **FRZ:** -28°F
- **Sol:** 37%
- **VP(77°C):** 3 mmHg
- **IP:** ?
- **Fl.P:** 165°F
- **UEL:** ?
- **LEL:** 2.9%

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities

Acetates, halogens, thiocyanates, thiosulfates [Note: May polymerize upon storage.]

### Measurement Methods

None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated/Daily
**Remove:** When wet or contaminated
**Change:** Daily
**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately
**Skin:** Soap wash immediately
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

### Respirator Recommendations

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape

**Escape:**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Skin irritation, blistering, burns; corneal opacity; frequent urination; dysuria; hematuria (blood in the urine); [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Kidneys, skin, lungs, eyes</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors of the liver, skin &amp; stomach]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Propionic acid

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>79-09-4</td>
<td>UE5950000</td>
<td>1848 132</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Carboxyethane, Ethanecarboxylic acid, Ethylformic acid, Metacetonic acid, Methyl acetic acid, Propanoic acid

### Exposure Limits
- NIOSH REL: TWA 10 ppm (30 mg/m³) ST 15 ppm (45 mg/m³)
- OSHA PEL†: none
- IDLH: N.D.

### Conversion
- 1 ppm = 3.03 mg/m³

### Physical Description
- Colorless, oily liquid with a pungent, disagreeable, rancid odor. [Note: A solid below 5°F.]
- MW: 74.1
- BP: 286°F
- FRZ: 5°F
- Sol: Miscible
- VP: 3 mmHg
- IP: 10.24 eV
- Sp.Gr: 0.99
- Fl.P: 126°F
- UEL: 12.1%
- LEL: 2.9%
- Class II Combustible Liquid: Fl.P. at or above 100°F and below 140°F.

### Incompatibilities & Reactivities
- Alkalis, strong oxidizers (e.g., chromium trioxide) [Note: Corrosive to steel.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations
- Not available.

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat; blurred vision, corneal burns; skin burns; abdominal pain, nausea, vomiting

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
### Propionitrile

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>107-12-0</td>
</tr>
<tr>
<td>RTECS</td>
<td>UF9625000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Cyanoethane, Ethyl cyanide, Propanenitrile, Propionic nitrile, Propiononitrile</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2404 131</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 6 ppm (14 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
<tr>
<td>IDLH</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

#### Physical Description

Colorless liquid with a pleasant, sweetish, ethereal odor. [Note: Forms cyanide in the body.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>55.1</td>
</tr>
<tr>
<td>BP</td>
<td>207°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-133°F</td>
</tr>
<tr>
<td>Sol</td>
<td>11.9%</td>
</tr>
<tr>
<td>VP</td>
<td>35 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>11.84 eV</td>
</tr>
<tr>
<td>Fl.P</td>
<td>36°F</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

#### Incompatibilities & Reactivities

Strong oxidizers & reducing agents, strong acids & bases [Note: Hydrogen cyanide is produced when propionitrile is heated to decomposition.]

#### Measurement Methods

NIOSH 1606 (adapt)
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated
**Remove:** When wet or contaminated
**Change:** No recommendation
**Provide:** Quick drench

#### First Aid

**Eye:** Irrigate immediately
**Skin:** Water flush immediately
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Up to 60 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)</td>
<td></td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 150 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
<td></td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 300 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
<td></td>
</tr>
<tr>
<td><strong>Up to 1000 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
<td></td>
</tr>
<tr>
<td>Emergency or planned entry into unknown concentrations or IDLH conditions:</td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
<td></td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
<td></td>
</tr>
<tr>
<td>Any appropriate escape-type, self-contained breathing apparatus</td>
<td></td>
</tr>
<tr>
<td><strong>Exposure Routes</strong></td>
<td>inhalation, skin absorption, ingestion, skin and/or eye contact</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, respiratory system; nausea, vomiting; chest pain; lassitude (weakness, exhaustion); stupor, convulsions; in animals: liver, kidney damage</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, cardiovascular system, central nervous system, liver, kidneys</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Propoxur

**CAS** 114-26-1

CH$_3$NHCOOC$_6$H$_4$OCH(CH$_3$)$_2$

**RTECS** FC3150000

### Synonyms & Trade Names

Aprocarb®; o-Isopropoxyphenyl-N-methylcarbamate; N-Methyl-2-isopropoxyphenyl-carbamate

### DOT ID & Guide

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 0.5 mg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: none</td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td>Conversion</td>
</tr>
</tbody>
</table>

### Physical Description

White to tan, crystalline powder with a faint, characteristic odor. [insecticide]

MW: 209.3  BP: Decomposes  MLT: 187-197°F  Sol: 0.2%

VP: 0.00007 mmHg  IP: ?  Sp.Gr: ?

Fl.P: >300°F  UEL: ?  LEL: ?

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

Strong oxidizers, alkalis [Note: Emits highly toxic methyl isocyanate fumes when heated to decomposition.]

### Measurement Methods

NIOSH 5601 ; OSHA PV2007  See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: Daily  
Remove: When wet or contaminated  
Change: Daily

### First Aid (See procedures )

Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

Miosis, blurred vision; sweating, salivation; abdominal cramps, nausea, diarrhea, vomiting; headache, lassitude (weakness, exhaustion), muscle twitching

### Target Organs

central nervous system, liver, kidneys, gastrointestinal tract, blood cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## n-Propyl acetate

<table>
<thead>
<tr>
<th>CAS 109-60-4</th>
</tr>
</thead>
</table>

**CH₃COOCH₂CH₂CH₃**

**RTECS AJ3675000**

### Synonyms & Trade Names
- Propylacetate, n-Propyl ester of acetic acid

### DOT ID & Guide
- 1276 129

### Exposure Limits
- **NIOSH REL:** TWA 200 ppm (840 mg/m³) ST 250 ppm (1050 mg/m³)
- **OSHA PEL‡:** TWA 200 ppm (840 mg/m³)

### IDLH
- 1700 ppm

### Conversion
- 1 ppm = 4.18 mg/m³

### Physical Description
- Colorless liquid with a mild, fruity odor.

| MW: 102.2 | BP: 215°F | FRZ: -134°F | Sol: 2% |
| VP: 25 mmHg | IP: 10.04 eV | Sp.Gr: 0.84 |
| FL.P: 55°F | UEL: 8% | LEL(100°F): 1.7% |

### Incompatibilities & Reactivities
- Nitrates; strong oxidizers, alkalis & acids

### Measurement Methods
- NIOSH 1450 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 1700 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms In animals: irritation eyes, nose, throat; narcosis; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>n-Propyl alcohol</th>
<th>CAS 71-23-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃CH₂CH₂OH</td>
<td>RTECS UH8225000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Ethyl carbinol, 1-Propanol, n-Propanol, Propyl alcohol

**DOT ID & Guide**
1274 129

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 200 ppm (500 mg/m³) ST 250 ppm (625 mg/m³) [skin]</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL†: TWA 200 ppm (500 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>IDLH 800 ppm</td>
<td>Conversion 1 ppm = 2.46 mg/m³</td>
</tr>
</tbody>
</table>

**Physical Description**
Colorless liquid with a mild, alcohol-like odor.

| MW: 60.1 | BP: 207°F | FRZ: -196°F | Sol: Miscible |
| VP: 15 mmHg | IP: 10.15 eV | Sp.Gr: 0.81 |
| Fl.P: 72°F | UEL: 13.7% | LEL: 2.2% |

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

**Incompatibilities & Reactivities**
Strong oxidizers

**Measurement Methods**
NIOSH 1401, 1405; OSHA 7
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

**First Aid** *(See procedures)*
Eye: Irrigate immediately
Skin: Water flush
Breathing: Respiratory support
Swallow: Medical attention immediately
## Respirator Recommendations NIOSH/OSHA

**Up to 800 ppm:**

- **(APF = 10)** Any chemical cartridge respirator with organic vapor cartridge(s)*
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor cartridge(s)*
- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

---

**Exposure Routes** Inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose, throat; dry cracking skin; drowsiness, headache; ataxia, gastrointestinal pain; abdominal cramps, nausea, vomiting, diarrhea; in animals: narcosis

**Target Organs** Eyes, skin, respiratory system, gastrointestinal tract, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Propylene dichloride

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>78-87-5</td>
<td>TX9625000</td>
<td>1279 130</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Dichloro-1,2-propane; 1,2-Dichloropropane

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>OSHA PEL†: TWA 75 ppm (350 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td></td>
</tr>
</tbody>
</table>

### Conversion
1 ppm = 4.62 mg/m³

### Physical Description
Colorless liquid with a chloroform-like odor. [pesticide]

<table>
<thead>
<tr>
<th>MW</th>
<th>BP</th>
<th>FRZ</th>
<th>Sol</th>
</tr>
</thead>
<tbody>
<tr>
<td>113.0</td>
<td>206°F</td>
<td>-149°F</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VP</th>
<th>IP</th>
<th>Fl.P</th>
<th>UEL</th>
<th>LEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 mmHg</td>
<td>10.87 eV</td>
<td>60°F</td>
<td>14.5%</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
Strong oxidizers, strong acids, active metals

### Measurement Methods
NIOSH 1013 ; OSHA 7
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation
- **Provide**: Eyewash, Quick drench

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, respiratory system; drowsiness, dizziness; liver, kidney damage; in animals: central nervous system depression; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, liver, kidneys, central nervous system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver &amp; mammary gland tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
<table>
<thead>
<tr>
<th>Propylene glycol dinitrate</th>
<th>CAS 6423-43-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃CNO₂OHCHNO₂OH</td>
<td>RTECS TY6300000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>DOT ID &amp; Guide</td>
</tr>
<tr>
<td>PGDN; Propylene glycol-1,2-dinitrate; 1,2-Propylene glycol dinitrate</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: TWA 0.05 ppm (0.3 mg/m³) [skin] |
| OSHA PEL†: none |
| IDLH N.D. | Conversion 1 ppm = 6.79 mg/m³ |

#### Physical Description

Colorless liquid with a disagreeable odor. [Note: A solid below 18°F.]

| MW: 166.1 | BP: ? |
| VP(72°F): 0.07 mmHg | IP: ? |
| Fl.P: ? | UEL: ? |
| FRZ: 18°F | Sp.Gr(77°F): 1.23 |
| Sol: 0.1% | LEL: ? |

Combustible Liquid

#### Incompatibilities & Reactivities

Ammonia compounds, amines, oxidizers, reducing agents, combustible materials [Note: Similar to Ethylene glycol dinitrate in explosion potential.]

#### Measurement Methods

None available

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection )

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: No recommendation |
| Remove: No recommendation |
| Change: No recommendation |

#### First Aid (See procedures )

| Eye: Irrigate immediately |
| Skin: Soap wash |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

#### Important additional information about respirator selection

Respirator Recommendations Not available.

#### Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms Irritation eyes; conjunctivitis; methemoglobinemia; headache, impaired balance, visual disturbance; in animals: liver, kidney damage

#### Target Organs Eyes, central nervous system, blood, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Propylene glycol monomethyl ether

**CAS 107-98-2**

**RTECS UB7700000**

### Synonyms & Trade Names
- Dowtherm® 209; 1-Methoxy-2-hydroxypropane; 1-Methoxy-2-propanol; 2-Methoxy-1-methylethanol; Propylene glycol methyl ether

### Exposure Limits
- **NIOSH REL:** TWA 100 ppm (360 mg/m³) ST 150 ppm (540 mg/m³)
- **OSHA PEL†:** none
- **IDLH N.D.**

### Conversion
- 1 ppm = 3.69 mg/m³

### Physical Description
- Clear, colorless liquid with a mild, ethereal odor.
- **MW:** 90.1
- **BP:** 248°F
- **FRZ:** -139°F (Sets to glass)
- **Sol:** Miscible
- **VP(77°F):** 12 mmHg
- **IP:** ?
- **Sp.Gr:** 0.96
- **FL.P:** 97°F
- **UEL(calc):** 13.8%
- **LEL(calc.):** 1.6%

### Incompatibilities & Reactivities
- Oxidizers, strong acids [Note: Hygroscopic (i.e., absorbs moisture from the air). May slowly form reactive peroxides during prolonged storage.]

### Measurement Methods
- NIOSH 2554 ; OSHA 99
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** No recommendation
- **Eyes:** Prevent eye contact
- **Wash skin:** No recommendation
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water wash
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Respirator Recommendations
- Not available.

### Exposure Routes
- inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat; headache, nausea, dizziness, drowsiness, incoordination; vomiting, diarrhea

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: **INTRODUCTION**
Propylene imine

C₃H₇N

Synonyms & Trade Names
- 2-Methylaziridine
- 2-Methylethyleneimine
- Propyleneimine
- Propylene imine (inhibited)
- Propylenimine

DOT ID & Guide
- 1921 131 P (inhibited)

Exposure Limits

NIOSH REL: Ca TWA 2 ppm (5 mg/m³) [skin] See Appendix A

OSHA PEL: TWA 2 ppm (5 mg/m³) [skin]

IDLH Ca [100 ppm]

Conversion 1 ppm = 2.34 mg/m³

Physical Description
Colorless, oily liquid with an ammonia-like odor.

MW: 57.1
BP: 152°F
FRZ: -85°F
Sol: Miscible

VP: 112 mmHg
IP: 9.00 eV
Sp.Gr: 0.80

Fl.P: 25°F
UEL: ?
LEL: ?

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Acids, strong oxidizers, water, carbonyl compounds, quinones, sulfonyl halides [Note: Subject to violent polymerization in contact with acids. Hydrolyzes in water to form methylethanolamine.]

Measurement Methods
None available
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection )
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures )
Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Important additional information about respirator selection

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Eye, skin burns; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: nasal tumors]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
Propylene oxide

CAS 75-56-9

C₃H₆O

RTECS TZ2975000

Synonyms & Trade Names
1,2-Epoxy propane; Methyl ethylene oxide; Methyloxirane; Propene oxide; 1,2-Propylene oxide

DOT ID & Guide
1280 127 P

Exposure Limits

NIOSH REL: Ca See Appendix A
OSHA PEL†: TWA 100 ppm (240 mg/m³)

IDLH Ca [400 ppm] Conversion 1 ppm = 2.38 mg/m³

Physical Description
Colorless liquid with a benzene-like odor. [Note: A gas above 94°F.]
MW: 58.1 BP: 94°F FRZ: -170°F Sol: 41%
VP: 445 mmHg IP: 9.81 eV Sp.Gr: 0.83
Fl.P: -35°F UEL: 36% LEL: 2.3%

Class IA Flammable Liquid: Fl.P. below 73°F and BP below 100°F.

Incompatibilities & Reactivities
Anhydrous metal chlorides; iron; strong acids, caustics & peroxides [Note: Polymerization may occur due to high temperatures or contamination with alkalis, aqueous acids, amines & acidic alcohols.]

Measurement Methods
NIOSH 1612 ; OSHA 88
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection )
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Quick drench

First Aid (See procedures )
Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Important additional information about respirator selection
Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact
### Symptoms
Irritation eyes, skin, respiratory system; skin blisters, burns; [potential occupational carcinogen]

### Target Organs
Eyes, skin, respiratory system

### Cancer Site
[in animals: nasal tumors]

See also: [INTRODUCTION](#)
# n-Propyl nitrate

<table>
<thead>
<tr>
<th>Chemical Information</th>
<th>Data Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS 627-13-4</td>
<td>RTECS UK0350000</td>
</tr>
<tr>
<td>CH₃CH₂CH₂ONO₂</td>
<td>DOT ID &amp; Guide 1865 131</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Propyl ester of nitric acid

## Exposure Limits
- **NIOSH REL:** TWA 25 ppm (105 mg/m³) ST 40 ppm (170 mg/m³)
- **OSHA PEL†:** TWA 25 ppm (110 mg/m³)

**IDLH:** 500 ppm

**Conversion:** 1 ppm = 4.30 mg/m³

## Physical Description
- Colorless to straw-colored liquid with an ether-like odor.
- **MW:** 105.1
- **BP:** 231°F
- **FRZ:** -148°F
- **Sol:** Slight
- **VP:** 18 mmHg
- **IP:** 11.07 eV
- **Sp.Gr:** 1.07
- **Fl.P:** 68°F
- **UEL:** 100%
- **LEL:** 2%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

## Incompatibilities & Reactivities
- Strong oxidizers, combustible materials [Note: Forms explosive mixtures with combustible materials.]

## Measurement Methods
- NIOSH S227 (II-3) ; OSHA 7
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

## First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 250 ppm:
(APF = 10) Any supplied-air respirator

Up to 500 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern

Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms In animals: irritation eyes, skin; methemoglobinemia, anoxia, cyanosis; dyspnea (breathing difficulty), lassitude (weakness, exhaustion), dizziness, headache

Target Organs Eyes, skin, blood

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Pyrethrum

<table>
<thead>
<tr>
<th>CAS</th>
<th>8003-34-7</th>
</tr>
</thead>
</table>

**Chemical Formulae:**
- $C_{20}H_{28}O_3$
- $C_{21}H_{28}O_5$
- $C_{21}H_{30}O_3$
- $C_{22}H_{30}O_5$
- $C_{21}H_{28}O_3$
- $C_{22}H_{28}O_5$

**RTECS:** UR4200000

### Synonyms & Trade Names

Cinerin I or II, Jasmolin I or II, Pyrethrin I or II, Pyrethrum I or II [Note: Pyrethrum is a variable mixture of Cinerin, Jasmolin, and Pyrethrin.]

### Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 5 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: TWA 5 mg/m³</td>
</tr>
</tbody>
</table>

**IDLH:** 5000 mg/m³

### Physical Description

Brown, viscous oil or solid. [insecticide]

- **MW:** 316-374
- **BP:** ?
- **MLT:** ?
- **Sol:** Insoluble
- **VP:** Low
- **IP:** ?
- **Sp.Gr:** 1 (approx)
- **Fl.P.:** 180-190°F
- **UEL:** ?
- **LEL:** ?

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities

Strong oxidizers.

### Measurement Methods

NIOSH 5008 ; OSHA 70

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated

**Remove:** When wet or contaminated

**Change:** Daily

### First Aid

**Eye:** Irrigate immediately

**Skin:** Soap wash immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

[See procedures]
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 50 mg/m³:**
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

**Up to 125 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*

**Up to 250 mg/m³:**
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 5000 mg/m³:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Erythema, dermatitis, papules, pruritus, rhinorrhea (discharge of thin mucus); sneezing; asthma

**Target Organs** respiratory system, skin, central nervous system

See also: [INTRODUCTION](#)
## Pyridine

**CAS** 110-86-1  

**C₅H₅N**  

**RTECS** UR8400000  

### Synonyms & Trade Names  
Azabenzene, Azine  

### DOT ID & Guide  
1282 129  

### Exposure Limits  
- **NIOSH REL:** TWA 5 ppm (15 mg/m³)  
- **OSHA PEL:** TWA 5 ppm (15 mg/m³)  

**IDLH** 1000 ppm  

**Conversion** 1 ppm = 3.24 mg/m³  

### Physical Description  
Colorless to yellow liquid with a nauseating, fish-like odor.  

- **MW:** 79.1  
- **BP:** 240°F  
- **FRZ:** -44°F  
- **Sol:** Miscible  
- **VP:** 16 mmHg  
- **IP:** 9.27 eV  
- **Sp.Gr:** 0.98  
- **Fl.P:** 68°F  
- **UEL:** 12.4%  
- **LEL:** 1.8%  

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.  

### Incompatibilities & Reactivities  
Strong oxidizers, strong acids  

### Measurement Methods  
NIOSH 1613 ; OSHA 7  
See: NMAM or OSHA Methods  

### Personal Protection & Sanitation  
(See protection )  
- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet (flammable)  
- **Change:** No recommendation  
- **Provide:** Eyewash, Quick drench  

### First Aid  
(See procedures )  
- **Eye:** Irrigate immediately  
- **Skin:** Water flush immediately  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately
**Respirator Recommendations NIOSH/OSHA**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 125 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 25)</td>
<td>Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 25)</td>
<td>Any powered, air-purifying respirator with organic vapor cartridge(s)</td>
</tr>
<tr>
<td><strong>Up to 50 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 1000 ppm:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000)</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000)</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 10,000)</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000)</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td></td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>(APF = 50)</td>
<td>Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** irritation of eyes; headache, anxiety, dizziness, insomnia; nausea, anorexia; dermatitis; liver, kidney damage

**Target Organs** Eyes, skin, central nervous system, liver, kidneys, gastrointestinal tract,

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Quinone

<table>
<thead>
<tr>
<th>CAS</th>
<th>106-51-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC₆H₄O</td>
<td></td>
</tr>
<tr>
<td>RTECS</td>
<td>DK2625000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>1,4-Benzquinone; p-Benzquinone; 1,4-Cyclohexadiene dioxide; p-Quinone</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2587 153</td>
</tr>
</tbody>
</table>

### Exposure Limits

- **NIOSH REL**: TWA 0.4 mg/m³ (0.1 ppm)
- **OSHA PEL**: TWA 0.4 mg/m³ (0.1 ppm)

- **IDLH**: 100 mg/m³

**Conversion**: 1 ppm = 4.42 mg/m³

### Physical Description

Pale-yellow solid with an acrid, chlorine-like odor.

- **MW**: 108.1
- **BP**: Sublimes
- **MLT**: 240°F
- **Sol**: Slight
- **VP (77°F)**: 0.1 mmHg
- **IP**: 9.68 eV
- **Sp.Gr**: 1.32
- **Fl.P**: 100-200°F
- **UEL**: ?
- **LEL**: ?

### Incompatibilities & Reactivities

Combustible Solid

Strong oxidizers

### Measurement Methods

NIOSH S181 (II-4)

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

### First Aid

(See procedures)

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
## Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>APF</th>
<th>Respirator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 10 mg/m³</td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td>Up to 20 mg/m³</td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td>Up to 100 mg/m³</td>
<td>2000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Emergency or planned entry into unknown concentrations or IDLH conditions:</td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td></td>
<td>10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td>Escape:</td>
<td>50</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. <a href="#">Click here</a></td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Eye irritation, conjunctivitis; keratitis (inflammation of the cornea); skin irritation

**Target Organs** Eyes, skin

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Resorcinol

<table>
<thead>
<tr>
<th>CAS 108-46-3</th>
<th>RTECS VG9625000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
1,3-Benzenediol; m-Benzenediol; 1,3-Dihydroxybenzene; m-Dihydroxybenzene; 3-Hydroxyphenol; m-Hydroxyphenol

### DOT ID & Guide
2876 153

### Exposure Limits
- NIOSH REL: TWA 10 ppm (45 mg/m³) ST 20 ppm (90 mg/m³)
- OSHA PEL†: none

### Conversion
1 ppm = 4.50 mg/m³

### Physical Description
White needles, plates, crystals, flakes, or powder with a faint odor. [Note: Turns pink on exposure to air or light, or contact with iron.]

### MW: 110.1
BP: 531°F
MLT: 228°F
Sol: 110%

### VP(77°F): 0.0002 mmHg
IP: 8.63 eV
Sp.Gr: 1.27

### Fl.P: 261°F
UEL: ?
LEL(392°F): 1.4%

### Incompatibilities & Reactivities
Acetanilide, albumin, alkalis, antipyrine, camphor, ferric salts, menthol, spirit nitrous ether, strong oxidizers & bases [Note: Hygroscopic (i.e., absorbs moisture from the air).]

### Measurement Methods
NIOSH 5701; OSHA PV2053
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash

### First Aid
- Eye: Irrigate immediately
- Skin: Water wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
Respirator Recommendations Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, nose, throat, upper respiratory system; methemoglobinemia; cyanosis, convulsions; restlessness, bluish skin, increased heart rate, dyspnea (breathing difficulty); dizziness, drowsiness, hypothermia, hematuria (blood in the urine); spleen, kidney, liver changes; dermatitis

### Target Organs
Eyes, skin, respiratory system, cardiovascular system, central nervous system, blood, spleen, liver, kidneys

See also: INTRODUCTION
## Rhodium (metal fume and insoluble compounds, as Rh)

**Synonyms & Trade Names**
- **Rhodium metal:** Elemental rhodium
- Synonyms of other insoluble rhodium compounds vary depending upon the specific compound.

### Exposure Limits
- **NIOSH REL:** TWA 0.1 mg/m³
- **OSHA PEL:** TWA 0.1 mg/m³

**IDLH:** 100 mg/m³ (as Rh)

### Physical Description
- **Metal:** White, hard, ductile, malleable solid with a bluish-gray luster.
  - **MW:** 102.9
  - **BP:** 6741°F
  - **MLT:** 3571°F
  - **Sol:** Insoluble
  - **VP:** 0 mmHg (approx)
  - **IP:** NA
  - **Fl.P:** NA
  - **UEL:** NA
  - **Sp.Gr:** 12.41 (metal)

### Incompatibilities & Reactivities
- Chlorine trifluoride, oxygen difluoride

### Measurement Methods
- **NIOSH S188 (II-3)**
- **See:** NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

### First Aid (See procedures)
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 0.5 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 1 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 2.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 5 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 100 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation

Symptoms Possible respiratory sensitization

Target Organs respiratory system

See also: INTRODUCTION
# Rhodium (soluble compounds, as Rh)

<table>
<thead>
<tr>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
Synonyms vary depending upon the specific soluble rhodium compound.

## Exposure Limits
<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.001 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 0.001 mg/m³</td>
</tr>
</tbody>
</table>

**IDLH**: 2 mg/m³ (as Rh)

## Physical Description
Appearance and odor vary depending upon the specific soluble rhodium compound.

Properties vary depending upon the specific soluble rhodium compound.

## Incompatibilities & Reactivities
Varies

## Measurement Methods
NIOSH S189 (II-3)
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

## First Aid
(See procedures)

- Eye: Irrigate immediately
- Skin: Water flush
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 0.01 mg/m³:
(APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. Click here for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 0.025 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter*

Up to 0.05 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 2 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms In animals: irritation eyes; central nervous system damage

Target Organs Eyes, central nervous system

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Ronnel

<table>
<thead>
<tr>
<th>CAS</th>
<th>299-84-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>(CH₃O)₂P(S)OC₆H₂Cl₃</td>
<td>RTECS TG0525000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- O,O-Dimethyl O-(2,4,5-trichlorophenyl) phosphorothioate; Fenchlorophos

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 10 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>TWA 15 mg/m³</td>
</tr>
</tbody>
</table>

| IDLH       | 300 mg/m³    |

### Physical Description
- White to light-tan, crystalline solid. [insecticide] [Note: A liquid above 106°F.]
- MW: 321.6
- BP: Decomposes
- MLT: 106°F
- Sol(77°F): 0.004%
- VP(77°F): 0.0008 mmHg
- IP: ?
- Fl.P: NA
- UEL: NA
- Sp.Gr(77°F): 1.49
- LEL: NA

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH 5600 ; OSHA PV2054
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 100 mg/m³:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 250 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 300 mg/m³:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms In animals: irritation eyes; cholinesterase inhibition; liver, kidney damage

Target Organs Eyes, liver, kidneys, blood plasma

See also: INTRODUCTION
Rosin core solder, pyrolysis products (as formaldehyde)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Rosin flux pyrolysis products, Rosin core soldering flux pyrolysis products

**Exposure Limits**
NIOSH REL*: TWA 0.1 mg/m³ [*Note: "Ca" in the presence of formaldehyde, acetaldehyde, or malonaldehyde. See Appendices A & C (Aldehydes).]
OSHA PEL†: none

**Physical Description**
Pyrolysis products of rosin core solder include acetone, aliphatic aldehydes, methyl alcohol, methane, ethane, various abietic acids (the major components of rosin), CO & CO₂.

Properties vary depending upon the specific rosin core solder being used.

**Incompatibilities & Reactivities**
Varies

**Measurement Methods**
NIOSH 2541, 3500
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
Skin: No recommendation
Eyes: No recommendation
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

**First Aid** *(See procedures)*
Eye: Irrigate immediately
Breathing: Respiratory support
## Important additional information about respirator selection

### Respirator Recommendations

In the presence of Formaldehyde, Acetaldehyde, or Malonaldehyde:

**NIOSH**

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- \((APF = 10,000)\) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- \((APF = 10,000)\) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- \((APF = 50)\) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters. Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- **inhalation**

### Symptoms

- Irritation to eyes, nose, throat, upper respiratory system [potential occupational carcinogen (in the presence of Formaldehyde, Acetaldehyde, or Malonaldehyde)]

### Target Organs

- Eyes, respiratory system

### Cancer Site

- Nasal cancer; thyroid gland tumors in animals (in presence of Formaldehyde, Acetaldehyde, or Malonaldehyde)

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Rotenone

<table>
<thead>
<tr>
<th>CAS 83-79-4</th>
</tr>
</thead>
</table>

### C23H22O6

### RTECS DJ2800000

### Synonyms & Trade Names

1,2,12,12a-Tetrahydro-8,9-dimethoxy-2-(1-methyl-ethenyl)-[1]benzopyrano [3,4-b]furo[2,3-h][1] benzopyran-6(6aH)-one

### DOT ID & Guide

### Exposure Limits

- NIOSH REL: TWA 5 mg/m³
- OSHA PEL: TWA 5 mg/m³
- IDLH 2500 mg/m³

### Physical Description

- Colorless to red, odorless, crystalline solid. [insecticide]
- MW: 394.4
- BP: Decomposes
- MLT: 330°F
- Sol: Insoluble
- VP: <0.00004 mmHg
- IP: ?
- Sp.Gr: 1.27
- Fl.P: ?
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities

- Combustible Solid
- Strong oxidizers, alkalis

### Measurement Methods

- NIOSH 5007
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

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**Authored in PDF format by Industrial Hygiene Services; www.ihresources.com**
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 50 mg/m³:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 125 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 250 mg/m³:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 2500 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, respiratory system; numb mucous membrane; nausea, vomiting, abdominal pain; muscle tremor, incoordination, clonic convulsions, stupor

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
### Rouge

<table>
<thead>
<tr>
<th>CAS</th>
<th>1309-37-1</th>
</tr>
</thead>
</table>

**Fe₂O₃**

<table>
<thead>
<tr>
<th>RTECS</th>
<th>NO7400000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

Iron(III)oxide, Iron oxide red, Red iron oxide, Red oxide

### DOT ID & Guide

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix D</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>OSHA PEL†:</th>
<th>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>N.D.</th>
</tr>
</thead>
</table>

### Physical Description

A fine, red powder of ferric oxide. [Note: Usually used in cake form or impregnated in paper or cloth.]

<table>
<thead>
<tr>
<th>MW:</th>
<th>159.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP:</td>
<td>?</td>
</tr>
<tr>
<td>MLT:</td>
<td>2849°F</td>
</tr>
<tr>
<td>Sol:</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP:</td>
<td>0 mmHg (approx)</td>
</tr>
<tr>
<td>IP:</td>
<td>NA</td>
</tr>
<tr>
<td>Sp.Gr:</td>
<td>5.24</td>
</tr>
<tr>
<td>FL.P:</td>
<td>NA</td>
</tr>
<tr>
<td>UEL:</td>
<td>NA</td>
</tr>
<tr>
<td>LEL:</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Calcium hypochlorite, carbon monoxide, hydrogen peroxide

### Measurement Methods

NIOSH 0500, 0600

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

<table>
<thead>
<tr>
<th>Skin:</th>
<th>No recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes:</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Wash skin:</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Remove:</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Change:</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

### First Aid (See procedures)

<table>
<thead>
<tr>
<th>Eye:</th>
<th>Irrigate immediately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing:</td>
<td>Fresh air</td>
</tr>
</tbody>
</table>

### Important additional information about respirator selection

Respirator Recommendations Not available.

### Exposure Routes

inhalation, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system

### Target Organs

Eyes, skin, respiratory system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Selenium

<table>
<thead>
<tr>
<th>CAS</th>
<th>7782-49-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>VS7700000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2658 152 (powder)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Elemental selenium, Selenium alloy

### Exposure Limits
- NIOSH REL*: TWA 0.2 mg/m³ [*Note: The REL also applies to other selenium compounds (as Se) except Selenium hexafluoride.]
- OSHA PEL*: TWA 0.2 mg/m³ [*Note: The PEL also applies to other selenium compounds (as Se) except Selenium hexafluoride.]

### IDLH
- 1 mg/m³ (as Se)

### Physical Description
- Amorphous or crystalline, red to gray solid. [Note: Occurs as an impurity in most sulfide ores.]

### MW: 79.0   BP: 1265°F   MLT: 392°F   Sol: Insoluble
### VP: 0 mmHg (approx)   IP: NA
### Fl.P: NA   UEL: NA   LEL: NA

### Combustible Solid

### Incompatibilities & Reactivities
- Acids, strong oxidizers, chromium trioxide, potassium bromate, cadmium

### Measurement Methods
- NIOSH 7300, 7301, 7303, 9102, S190 (II-7); OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **(See protection)**
  - Skin: Prevent skin contact
  - Eyes: No recommendation
  - Wash skin: When contaminated
  - Remove: When wet or contaminated
  - Change: No recommendation
  - Provide: Quick drench

### First Aid
- **(See procedures)**
  - Eye: Irrigate immediately
  - Skin: Soap wash immediately
  - Breathing: Respiratory support
  - Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 1 mg/m³:**
- *(APF = 5)* Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.*
- *(APF = 10)* Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.*
- *(APF = 50)* Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- *(APF = 25)* Any powered air-purifying respirator with a high-efficiency particulate filter.*
- *(APF = 10)* Any supplied-air respirator*
- *(APF = 50)* Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- *(APF = 10,000)* Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- *(APF = 10,000)* Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- *(APF = 50)* Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

---

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage

**Target Organs** Eyes, skin, respiratory system, liver, kidneys, blood, spleen

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Selenium hexafluoride

**CAS** 7783-79-1

**RTECS** VS9450000

### Synonyms & Trade Names
Selenium fluoride

### DOT ID & Guide
2194 125

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.05 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 0.05 ppm (0.4 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH** 2 ppm

**Conversion** 1 ppm = 7.89 mg/m³

### Physical Description
Colorless gas.

- **MW**: 193.0
- **BP**: -30°F
- **FRZ**: -59°F
- **Sol**: Insoluble
- **VP**: >1 atm
- **IP**: ?
- **RGasD**: 6.66
- **Fl.P**: NA
- **UEL**: NA
- **LEL**: NA

### Incompatibilities & Reactivities
Water [Note: Hydrolyzes very slowly in cold water.]

### Measurement Methods
None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid
(See procedures)

- Breathing: Respiratory support
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Respirator Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 0.5 ppm:</strong></td>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 1.25 ppm:</strong></td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td><strong>Up to 2 ppm:</strong></td>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode</td>
</tr>
<tr>
<td></td>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Respirator Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>(APF = 10,000)</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000)</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

**Escape:**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Respirator Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>(APF = 50)</td>
<td>Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>

### Exposure Routes

**Inhalation**

### Symptoms

**In animals:** pulmonary irritation, edema

### Target Organs

**Respiratory system**

See also: [INTRODUCTION](#)
# Silica, amorphous

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>7631-86-9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td>VV7310000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Diatomaceous earth
- Diatomaceous silica
- Diatomite
- Precipitated amorphous silica
- Silica gel
- Silicon dioxide (amorphous)

## Exposure Limits
- **NIOSH REL:** TWA 6 mg/m³
- **OSHA PEL†:** TWA 20 mppcf (80 mg/m³/%SiO₂)
- **IDLH:** 3000 mg/m³

## Physical Description
- Transparent to gray, odorless powder. [Note: Amorphous silica is the non-crystalline form of SiO₂.]
- **MW:** 60.1
- **BP:** 4046°F
- **MLT:** 3110°F
- **Sol:** Insoluble
- **VP:** 0 mmHg (approx)
- **IP:** NA
- **Sp.Gr:** 2.20
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

## Incompatibilities & Reactivities
- Fluorine, oxygen difluoride, chlorine trifluoride

## Measurement Methods
- NIOSH 7501
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

## First Aid
- **Eye:** Irrigate immediately
- **Breathing:** Fresh air
<table>
<thead>
<tr>
<th><strong>Respirator Recommendations</strong> NIOSH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 30 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 60 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 150 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td><strong>Up to 300 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 3000 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here</td>
</tr>
</tbody>
</table>

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms** Irritation eyes, pneumoconiosis

**Target Organs** Eyes, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Silica, crystalline (as respirable dust)

<table>
<thead>
<tr>
<th>CAS</th>
<th>14808-60-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>VV7330000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Cristobalite, Quartz, Tridymite, Tripoli</td>
</tr>
</tbody>
</table>

### Exposure Limits

- **NIOSH REL:** Ca TWA 0.05 mg/m³  
  See Appendix A
- **OSHA PEL:** See Appendix C (Mineral Dusts)

**IDLH**

- Ca [25 mg/m³ (cristobalite, tridymite); 50 mg/m³ (quartz, tripoli)]

### Physical Description

- Colorless, odorless solid. [Note: A component of many mineral dusts.]
- MW: 60.1
- BP: 4046°F
- MLT: 3110°F
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- MLT: 3110°F
- Sp.Gr: 2.66
- FI.P: NA
- UEL: NA
- LEL: NA

Noncombustible Solid

### Incompatibilities & Reactivities

- Powerful oxidizers: fluorine, chlorine trifluoride, manganese trioxide, oxygen difluoride, hydrogen peroxide, etc.; acetylene; ammonia

### Measurement Methods

- NIOSH 7500, 7601, 7602; OSHA ID142
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid

- Eye: Irrigate immediately
- Breathing: Fresh air
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 0.5 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.

Up to 1.25 mg/m³:
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 2.5 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter

Up to 25 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Cough, dyspnea (breathing difficulty), wheezing; decreased pulmonary function, progressive respiratory symptoms (silicosis); irritation eyes; [potential occupational carcinogen]

Target Organs Eyes, respiratory system

Cancer Site [in animals: lung cancer]

See also: INTRODUCTION
**Silicon**

<table>
<thead>
<tr>
<th>CAS</th>
<th>7440-21-3</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
Elemental silicon [Note: Does not occur free in nature, but is found in silicon dioxide (silica) & in various silicates.]

**CAS**
7440-21-3

**RTECS**
VW0400000

**DOT ID & Guide**
1346 170 (amorphous powder)

**Exposure Limits**
NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)
OSHA PEL†: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)

**Physical Description**
Black to gray, lustrous, needle-like crystals. [Note: The amorphous form is a dark-brown powder.]

| MW | 28.1 |
| BP | 4271°F |
| MLT | 2570°F |
| Sol | Insoluble |
| VP | 0 mmHg (approx) |
| IP | NA |
| Sp.Gr(77°F) | 2.33 |

**Combustible Solid in powder form.**

**Incompatibilities & Reactivities**
Chlorine, fluorine, oxidizers, calcium, cesium carbide, alkaline carbonates

**Measurement Methods**
NIOSH 0500 , 0600
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
(See protection)
Skin: No recommendation
Eyes: Prevent eye contact
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

**First Aid**
(See procedures)
Eye: Irrigate immediately
Breathing: Fresh air
Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes**
inhalation, ingestion, skin and/or eye contact

**Symptoms**
Irritation eyes, skin, upper respiratory system; cough

**Target Organs**
Eyes, skin, respiratory system

See also: INTRODUCTION
## Silicon carbide

<table>
<thead>
<tr>
<th>CAS</th>
<th>409-21-2</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- Carbon silicide
- Carborundum®
- Silicon monocarbide

### Exposure Limits
- **NIOSH REL:** TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)
- **OSHA PEL†:** TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)

### Physical Description
- Yellow to green to bluish-black, iridescent crystals.

### MW: 40.1  BP: Sublimes  MLT: 4892°F (Sublimes)  Sol: Insoluble
- VP: 0 mmHg (approx)  IP: 9.30 eV  Sp.Gr: 3.23
- Fl.P: NA  UEL: NA  LEL: NA

### Noncombustible Solid

### Incompatibilities & Reactivities
None reported [Note: Sublimes with decomposition at 4892°F.]

### Measurement Methods
- NIOSH 0500, 0600
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Breathing:** Fresh air
- **Swallow:** Medical attention immediately

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, upper respiratory system; cough

### Target Organs
- Eyes, skin, respiratory system

See also: **INTRODUCTION**
**Silicon tetrahydride**

<table>
<thead>
<tr>
<th>CAS</th>
<th>7803-62-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>VV1400000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2203 116</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Monosilane, Silane, Silicane

**Exposure Limits**
- NIOSH REL: TWA 5 ppm (7 mg/m³)
- OSHA PEL†: none
- IDLH N.D.
- Conversion: 1 ppm = 1.31 mg/m³

**Physical Description**
- Colorless gas with a repulsive odor.
- MW: 32.1
- BP: -169°F
- FRZ: -301°F
- Sol: Decomposes
- VP: >1 atm
- IP: ?
- RGasD: 1.11
- Fl.P: NA (Gas)
- UEL: ?
- LEL: ?

**Incompatibilities & Reactivities**
- Flammable Gas (may ignite SPONTANEOUSLY in air).
- Halogens (bromine, chlorine, carbonyl chloride, antimony pentachloride, tin(IV) chloride), water

**Measurement Methods**
- None available
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

**First Aid**
- Breathing: Respiratory support

**Important additional information about respirator selection**
- Respirator Recommendations: Not available.

**Exposure Routes**
- Inhalation

**Symptoms**
- Irritation eyes, skin, mucous membrane; nausea, headache

**Target Organs**
- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
**Silver (metal dust and soluble compounds, as Ag)**

<table>
<thead>
<tr>
<th>Ag (metal)</th>
<th>RTECS VW3500000 (metal)</th>
</tr>
</thead>
</table>

**Synonyms & Trade Names**
- Silver metal: Argentum
- Synonyms of soluble silver compounds such as Silver nitrate (AgNO₃) vary depending upon the specific compound.

**Exposure Limits**
- NIOSH REL: TWA 0.01 mg/m³
- OSHA PEL: TWA 0.01 mg/m³
- IDLH 10 mg/m³ (as Ag)

**Physical Description**
- Metal: White, lustrous solid.
- MW: 107.9
- BP: 3632°F
- MLT: 1761°F
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 10.49 (metal)
- Metal: Noncombustible Solid, but flammable in form of dust or powder.

**Incompatibilities & Reactivities**
- Acetylene, ammonia, hydrogen peroxide, bromoazide, chlorine trifluoride, ethyleneimine, oxalic acid, tartaric acid

**Measurement Methods**
- NIOSH 7300, 7301, 9102; OSHA ID121
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated (AgNO₃)
- Change: Daily
- Provide: Eyewash

**First Aid**
- Eye: Irrigate immediately
- Skin: Water flush
- Breathing: Respiratory support
- Swallow: Medical attention immediately

**Conversion**
- Sp.Gr: 10.49 (metal)
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 0.25 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter

**Up to 0.5 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 10 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance

**Target Organs** Nasal septum, skin, eyes

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Soapstone (containing less than 1% quartz)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS VV8780000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- Massive talc
- Soapstone silicate
- Steatite

### Exposure Limits
- NIOSH REL: TWA 6 mg/m³ (total) TWA 3 mg/m³ (resp)
- OSHA PEL†: TWA 20 mppcf
- IDLH 3000 mg/m³

### Physical Description
- Odorless, white-gray powder.
- MW: 379.3
- BP: ?
- MLT: ?
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 2.7-2.8
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- None reported

### Measurement Methods
- NIOSH 0500
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid
- Eye: Irrigate immediately
- Breathing: Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 30 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 60 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 150 mg/m³:
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 300 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 3000 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Pneumoconiosis: cough, dyspnea (breathing difficulty); digital clubbing; cyanosis; basal crackles, cor pulmonale

Target Organs respiratory system, cardiovascular system

See also: INTRODUCTION
# Sodium aluminum fluoride (as F)

**CAS** 15096-52-3  
**RTECS** WA9625000  
**DOT ID & Guide**  

## Synonyms & Trade Names  
Cryocide, Cryodust, Cryolite, Sodium hexafluoroaluminate

## Exposure Limits  
**NIOSH REL**: TWA 2.5 mg/m³  
*[Note: The REL also applies to other inorganic, solid fluorides (as F).]*  
**OSHA PEL**: TWA 2.5 mg/m³  
*[Note: The PEL also applies to other inorganic, solid fluorides (as F).]*  

**IDLH**: 250 mg/m³ (as F)

## Physical Description  
Colorless to dark odorless solid. [pesticide]  
*[Note: Loses color on heating.]*

**MW**: 209.9  
**BP**: Decomposes  
**MLT**: 1832°F  
**Sol**: 0.04%  
**VP**: 0 mmHg (approx)  
**IP**: NA  
**Sp.Gr**: 2.90  

Noncombustible Solid

## Incompatibilities & Reactivities  
Strong oxidizers

## Measurement Methods  
NIOSH 7902 ; OSHA ID110  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation  
(See protection)

**Skin**: Prevent skin contact  
**Eyes**: Prevent eye contact  
**Wash skin**: When contaminated  
**Remove**: When wet or contaminated  
**Change**: Daily

## First Aid  
(See procedures)

**Eye**: Irrigate immediately  
**Skin**: Soap wash promptly  
**Breathing**: Fresh air  
**Swallow**: Medical attention immediately
### Important additional information about respirator selection

<table>
<thead>
<tr>
<th>Respirator Recommendations</th>
<th>NIOSH/OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 12.5 mg/m³:</strong></td>
<td>(APF = 5) Any quarter-mask respirator. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 25 mg/m³:</strong></td>
<td>(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. <a href="#">Click here</a> for information on selection of N, R, or P filters.*</td>
</tr>
<tr>
<td><strong>Up to 62.5 mg/m³:</strong></td>
<td>(APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 125 mg/m³:</strong></td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td><strong>Up to 250 mg/m³:</strong></td>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.*</td>
</tr>
<tr>
<td><strong>Up to 250 mg/m³:</strong></td>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 250 mg/m³:</strong></td>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, respiratory system; nausea, abdominal pain, diarrhea; salivation, thirst, sweating; stiff spine; dermatitis; calcification of ligaments of ribs, pelvis

### Target Organs
- Eyes, skin, respiratory system, central nervous system, skeleton, kidneys

See also: INTRODUCTION
### Sodium azide

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>26628-22-8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td>VY8050000</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1687 153</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names

Azide, Azium, Sodium salt of hydrazoic acid

#### Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: C 0.1 ppm (as HN₃) [skin] C 0.3 mg/m³ (as NaN₃) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
<td>N.D.</td>
</tr>
</tbody>
</table>

#### Physical Description

Colorless to white, odorless, crystalline solid. [pesticide] [Note: Forms hydrazoic acid (HN₃) in water.]

| **MW** | 65.0 |
| **BP** | Decomposes |
| **MLT** | 527°F (Decomposes) |
| **Sol (63°F)** | 42% |
| **IP** | 11.70 eV |
| **Sp.Gr** | 1.85 |

Combustible Solid (if heated above 572°F).

#### Incompatibilities & Reactivities

Acids, metals, water [Note: Over a period of time, sodium azide may react with copper, lead, brass, or solder in plumbing systems to form an accumulation of the HIGHLY EXPLOSIVE compounds of lead azide & copper azide.]

#### Measurement Methods

OSHA ID121 , ID211

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection )

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

#### First Aid (See procedures )

- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations** Not available.

#### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms

Irritation eyes, skin; headache, dizziness, lassitude (weakness, exhaustion), blurred vision; low blood pressure, bradycardia; kidney changes

#### Target Organs

Eyes, skin, central nervous system, cardiovascular system, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Sodium bisulfite

<table>
<thead>
<tr>
<th>CAS</th>
<th>7631-90-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>VZ2000000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2693 154 (solution)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Monosodium salt of sulfurous acid, Sodium acid bisulfite, Sodium bisulphite, Sodium hydrogen sulfite

### Exposure Limits

| NIOSH REL: | TWA 5 mg/m³ |
| OSHA PEL†: | none |
| IDLH N.D.: | |

### Physical Description
White crystals or powder with a slight odor of sulfur dioxide.

| MW: 104.1 | BP: Decomposes |
| VP: ?     | IP: NA         |
| FL.P: NA  | UEL: NA        |

**Noncombustible Solid**

### Incompatibilities & Reactivities
Heat (decomposes) [Note: Slowly oxidized to the sulfate on exposure to air.]

### Measurement Methods

| NIOSH 0500 |
| See: NMAM or OSHA Methods |

### Personal Protection & Sanitation
- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately
- **Breathing:** Fresh air
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, mucous membrane

### Target Organs
Eyes, skin, respiratory system

See also: INTRODUCTION
**Sodium cyanide (as CN)**

<table>
<thead>
<tr>
<th>CAS</th>
<th>VZ7525000</th>
</tr>
</thead>
</table>

**NaCN**

**Synonyms & Trade Names**
- Sodium salt of hydrocyanic acid

**DOT ID & Guide**
- 1689 157 (solid)
- 3413 157 (solution)

**Exposure Limits**
- NIOSH REL*: C 5 mg/m³ (4.7 ppm) [10-minute] [*Note: The REL also applies to other cyanides (as CN) except Hydrogen cyanide.]
- OSHA PEL*: TWA 5 mg/m³ [*Note: The PEL also applies to other cyanides (as CN) except Hydrogen cyanide.]

**IDLH**
- 25 mg/m³ (as CN)

**Conversion**

**Physical Description**
- White, granular or crystalline solid with a faint, almond-like odor.
- MW: 49.0
- BP: 2725°F
- MLT: 1047°F
- Sol(77°F): 58%
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 1.60
- Fl.P: NA
- UEL: NA
- LEL: NA

**Incompatibilities & Reactivities**
- Noncombustible Solid, but contact with acids releases highly flammable hydrogen cyanide.
- Strong oxidizers (such as acids, acid salts, chlorates & nitrates) [Note: Absorbs moisture from the air forming a syrup.]

**Measurement Methods**
- NIOSH 6010 , 7904
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

**First Aid**
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

**Up to 25 mg/m³:**
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having an N100, R100, or P100 filter. [Click here](#)

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin; asphyxia; lassitude (weakness, exhaustion), headache, confusion; nausea, vomiting; increased respiratory rate; slow gasping respiration; thyroid, blood changes</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, cardiovascular system, central nervous system, thyroid, blood</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# Sodium fluoride (as F)

<table>
<thead>
<tr>
<th>CAS</th>
<th>7681-49-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>WB0350000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1690 154</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
Floridine, Sodium monofluoride

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL* (as F)</th>
<th>TWA 2.5 mg/m³ [*Note: The REL also applies to other inorganic, solid fluorides (as F).]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL* (as F)</td>
<td>TWA 2.5 mg/m³ [*Note: The PEL also applies to other inorganic, solid fluorides (as F).]</td>
</tr>
</tbody>
</table>

## IDLH
250 mg/m³ (as F)

### Physical Description
Odorless, white powder or colorless crystals. [Note: Pesticide grade is often dyed blue.]

<table>
<thead>
<tr>
<th>MW: 42.0</th>
<th>BP: 3099°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0 mmHg (approx)</td>
<td>IP: NA</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid

## Incompatibilities & Reactivities
Strong oxidizers

## Measurement Methods
NIOSH 7902, 7906; OSHA ID110
See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

## First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Fresh air
- Swallow: Medical attention immediately
## Respirator Selection

### NIOSH/OSHA

#### Important additional information about respirator selection

#### Respirator Recommendations

**Up to 12.5 mg/m³:**
- (APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 25 mg/m³:**
- (APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

**Up to 62.5 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*+

**Up to 125 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.+
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 250 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

#### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) +Note: May need acid gas sorbent

---

### Exposure Routes

- *inhalation, ingestion, skin and/or eye contact*

### Symptoms

- *Irritation eyes, respiratory system; nausea, abdominal pain, diarrhea; salivation, thirst, sweating; stiff spine; dermatitis; calcification of ligaments of ribs, pelvis*

### Target Organs

- *Eyes, skin, respiratory system, central nervous system, skeleton, kidneys*

See also: [INTRODUCTION](#)
## Sodium fluoroacetate

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCH₂COONa</td>
<td>62-74-8</td>
<td>AH9100000</td>
<td>2629 151</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- SFA, Sodium monofluoroacetate

### Exposure Limits
- NIOSH REL: TWA 0.05 mg/m³ ST 0.15 mg/m³ [skin]
- OSHA PEL*: TWA 0.05 mg/m³ [skin]

**IDLH:** 2.5 mg/m³

### Physical Description
Fluffy, colorless to white (sometimes dyed black), odorless powder. [Note: A liquid above 95°F.] [rodenticide]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>100.0</td>
</tr>
<tr>
<td>BP</td>
<td>Decomposes</td>
</tr>
<tr>
<td>MLT</td>
<td>392°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Miscible</td>
</tr>
<tr>
<td>VP</td>
<td>Low</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>?</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

Noncombustible Solid

### Incompatibilities & Reactivities
None reported

### Measurement Methods
- NIOSH S301 (I-5)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Quick drench

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations</strong> NIOSH/OSHA</td>
</tr>
<tr>
<td><strong>Up to 0.25 mg/m³</strong>:</td>
</tr>
<tr>
<td>(APF = 5) Any quarter-mask respirator. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td><strong>Up to 0.5 mg/m³</strong>:</td>
</tr>
<tr>
<td>(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 1.25 mg/m³</strong>:</td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.</td>
</tr>
<tr>
<td><strong>Up to 2.5 mg/m³</strong>:</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions</strong>:</td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape</strong>:</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a></td>
</tr>
<tr>
<td><strong>Exposure Routes</strong> inhalation, skin absorption, ingestion, skin and/or eye contact</td>
</tr>
<tr>
<td><strong>Symptoms</strong> Vomiting; anxiety, auditory hallucinations; facial paresthesia; twitching face muscle; pulsus altenans, ectopic heartbeat, tachycardia, cardiac arrhythmias; pulmonary edema; nystagmus; convulsions; liver, kidney damage</td>
</tr>
<tr>
<td><strong>Target Organs</strong> respiratory system, cardiovascular system, liver, kidneys, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# Sodium hydroxide

**CAS** 1310-73-2  
**RTECS** WB4900000

## Synonyms & Trade Names
- Caustic soda, Lye, Soda lye, Sodium hydrate

## DOT ID & Guide
- 1823 154 (dry, solid)  
- 1824 154 (solution)

## Exposure Limits
- **NIOSH REL**: C 2 mg/m³  
- **OSHA PEL†**: TWA 2 mg/m³  
- **IDLH**: 10 mg/m³

## Physical Description
- Colorless to white, odorless solid (flakes, beads, granular form).
- **MW**: 40.0  
- **BP**: 2534°F  
- **MLT**: 605°F  
- **Sol**: 111%  
- **VP**: 0 mmHg (approx)  
- **IP**: NA  
- **Sp.Gr**: 2.13  
- **Fl.P**: NA  
- **UEL**: NA  
- **LEL**: NA

## Incompatibilities & Reactivities
- Noncombustible Solid, but when in contact with water may generate sufficient heat to ignite combustible materials.
- Water; acids; flammable liquids; organic halogens; metals such as aluminum, tin & zinc; nitromethane [Note: Corrosive to metals.]

## Measurement Methods
- NIOSH 7401  
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin**: Prevent skin contact  
- **Eyes**: Prevent eye contact  
- **Wash skin**: When contaminated  
- **Remove**: When wet or contaminated  
- **Change**: Daily  
- **Provide**: Eyewash, Quick drench

## First Aid
- **Eye**: Irrigate immediately  
- **Skin**: Water flush immediately  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 10 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode.
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; pneumonitis; eye, skin burns; temporary loss of hair

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
# Sodium metabisulfite

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7681-57-4</td>
<td>UX8225000</td>
<td>Disodium pyrosulfite, Sodium metabisulphite, Sodium pyrosulfite</td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.D.</td>
<td></td>
</tr>
</tbody>
</table>

## Physical Description

White to yellowish crystals or powder with an odor of sulfur dioxide.

<table>
<thead>
<tr>
<th>MW</th>
<th>BP</th>
<th>MLT</th>
<th>Sol</th>
<th>Sp.Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>190.1</td>
<td>Decomposes</td>
<td>&gt;302°F (Decomposes)</td>
<td>54%</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Noncombustible Solid

## Incompatibilities & Reactivities

Heat (decomposes) [Note: Slowly oxidized to the sulfate on exposure to air & moisture.]

## Measurement Methods

NIOSH 0500

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

**Skin:** No recommendation

**Eyes:** No recommendation

**Wash skin:** No recommendation

**Remove:** No recommendation

**Change:** No recommendation

## First Aid

**Eye:** Irrigate immediately

**Breathing:** Fresh air

**Swallow:** Medical attention immediately

## Important additional information about respirator selection

**Respirator Recommendations:** Not available.

## Exposure Routes

Inhalation, ingestion, skin and/or eye contact

## Symptoms

Irritation eyes, skin, mucous membrane

## Target Organs

Eyes, skin, respiratory system

See also: INTRODUCTION
## Starch

(C₆H₁₀O₅)ₙ

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn starch, Rice starch, Sorghum gum, alpha-Starch, Starch gum, Tapioca starch</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
<tr>
<td>OSHA PEL: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine, white, odorless powder. [Note: A carbohydrate polymer composed of 25% amylose &amp; 75% amylpectin.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MW: varies</th>
<th>BP: Decomposes</th>
<th>MLT: Decomposes</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0 mmHg (approx)</td>
<td>IP: NA</td>
<td>NA</td>
<td>Sp.Gr: 1.45</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
<td>LEL: NA</td>
<td>MEC: 50 g/m³</td>
</tr>
</tbody>
</table>

Noncombustible Solid, but may form explosive mixture with air.

<table>
<thead>
<tr>
<th>Incompatibilities &amp; Reactivities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidizers, acids, iodine, alkalis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH 0500 , 0600</td>
</tr>
</tbody>
</table>

See: NMAM or OSHA Methods

<table>
<thead>
<tr>
<th>Personal Protection &amp; Sanitation</th>
<th>First Aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>(See protection )</td>
<td>(See procedures )</td>
</tr>
<tr>
<td>Skin: Prevent skin contact</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
<td>Skin: Soap wash</td>
</tr>
<tr>
<td>Wash skin: Daily</td>
<td>Breathing: Fresh air</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
<td>Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>Change: Daily</td>
<td></td>
</tr>
</tbody>
</table>

Important additional information about respirator selection

Respirator Recommendations Not available.

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; cough, chest pain; dermatitis; rhinorrhea (discharge of thin mucus)

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Stibine

<table>
<thead>
<tr>
<th>CAS</th>
<th>CAS 7803-52-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RTECS WJ0700000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Antimony hydride, Antimony trihydride, Hydrogen antimonide

### Exposure Limits
- **NIOSH REL:** TWA 0.1 ppm (0.5 mg/m³)
- **OSHA PEL:** TWA 0.1 ppm (0.5 mg/m³)

**IDLH:** 5 ppm

### Conversion
- 1 ppm = 5.10 mg/m³

### Physical Description
- Colorless gas with a disagreeable odor like hydrogen sulfide.
- **MW:** 124.8
- **BP:** -1°F
- **FRZ:** -126°F
- **Sol:** Slight
- **VP:** >1 atm
- **IP:** 9.51 eV
- **RGasD:** 4.31
- **Fi.P:** NA (Gas)
- **UEL:** ?
- **LEL:** ?

### Incompatibilities & Reactivities
- Acids, halogenated hydrocarbons, oxidizers, moisture, chlorine, ozone, ammonia

### Measurement Methods
- NIOSH 6008
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

### First Aid
- **Breathing:** Respiratory support

---

Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
### Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

**Up to 1 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 2.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 5 ppm:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

## Exposure Routes

**inhalation**

- **Symptoms** Headache, lassitude (weakness, exhaustion); nausea, abdominal pain; lumbar pain, hematuria (blood in the urine), hemolytic anemia; jaundice; pulmonary irritation

- **Target Organs** Blood, liver, kidneys, respiratory system

See also: [INTRODUCTION](#)
## Stoddard solvent

**Synonyms & Trade Names**
Dry cleaning safety solvent, Mineral spirits, Petroleum solvent, Spotting naphtha [Note: A refined petroleum solvent with a flash point of 102-110°F, boiling point of 309-396°F, and containing >65% C10 or higher hydrocarbons.]

**Exposure Limits**
- NIOSH REL: TWA 350 mg/m³ C 1800 mg/m³ [15-minute]
- OSHA PEL†: TWA 500 ppm (2900 mg/m³)
- IDLH 20,000 mg/m³

**Physical Description**
- Colorless liquid with a kerosene-like odor.
- MW: Varies
- BP: 309-396°F
- FRZ: ?
- Sol: Insoluble
- VP: ?
- IP: ?
- Sp.Gr: 0.78
- Fl.P: 102-110°F
- UEL: ?
- LEL: ?

**Incompatibilities & Reactivities**
- Strong oxidizers

**Measurement Methods**
- NIOSH 1550
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

**First Aid** *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 3500 mg/m³:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 8750 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

**Up to 17,500 mg/m³:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 20,000 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose, throat; dizziness; dermatitis; chemical pneumonitis (aspiration liquid); in animals: kidney damage

**Target Organs** Eyes, skin, respiratory system, central nervous system, kidneys

See also: INTRODUCTION
### Strychnine

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>57-24-9</td>
<td>WL2275000</td>
<td>1692 151</td>
</tr>
</tbody>
</table>

#### Physical Description
- Colorless to white, odorless, crystalline solid. [pesticide]
- MW: 334.4
- BP: Decomposes
- MLT: 514°F
- Sol: 0.02%
- VP: Low
- IP: ?
- Sp.Gr: 1.36
- Fl.P: ?
- UEL: ?
- LEL: ?

Combustible Solid, but difficult to ignite.

#### Incompatibilities & Reactivities
- Strong oxidizers

#### Measurement Methods
- NIOSH 5016
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: No recommendation
- Wash skin: When contaminated
- Remove: No recommendation
- Change: Daily

#### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 0.75 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 1.5 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 3 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Stiff neck, facial muscle; restlessness, anxiety, increased acuity of perception; increased reflex excitability; cyanosis; tetanic convulsions with opisthotonos

Target Organs central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Styrene

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-42-5</td>
<td>WL3675000</td>
<td>2055 128 P (inhibited)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Ethyl benzene
- Phenylethylene
- Styrene monomer
- Styrol
- Vinyl benzene

### Exposure Limits
- **NIOSH REL**: TWA 50 ppm (215 mg/m³) ST 100 ppm (425 mg/m³)
- **OSHA PEL†**: TWA 100 ppm C 200 ppm 600 ppm (5-minute maximum peak in any 3 hours)
- **IDLH**: 700 ppm

### Conversion
- 1 ppm = 4.26 mg/m³

### Physical Description
- Colorless to yellow, oily liquid with a sweet, floral odor.
- **MW**: 104.2
- **BP**: 293°F
- **FRZ**: -23°F
- **Sol**: 0.03%
- **VP**: 5 mmHg
- **IP**: 8.40 eV
- **Sp.Gr**: 0.91
- **Fl.P**: 88°F
- **UEL**: 6.8%
- **LEL**: 0.9%

### Incompatibilities & Reactivities
- Oxidizers, catalysts for vinyl polymers, peroxides, strong acids, aluminum chloride [Note: May polymerize if contaminated or subjected to heat. Usually contains an inhibitor such as tert-butylcatechol.]

### Measurement Methods
- NIOSH 1501, 3800; OSHA 9, 89
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet (flammable)
- **Change**: No recommendation

### First Aid (See procedures)
- **Eye**: Irrigate immediately
- **Skin**: Water flush
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 500 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 700 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects

**Target Organs** Eyes, skin, respiratory system, central nervous system, liver, reproductive system

See also: [INTRODUCTION](#)
### Subtilisins

<table>
<thead>
<tr>
<th>CAS</th>
<th>1395-21-7 (BPN) 9014-01-1 (Carlsburg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>CO94500000 (BPN) CO95500000 (Carlsburg)</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names

Bacillus subtilis, Bacillus subtilis BPN, Bacillus subtilis Carlsburg, Proteolytic enzymes, Subtilisin BPN, Subtilisin Carlsburg [Note: Commercial proteolytic enzymes are used in laundry detergents.]

#### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>ST 0.00006 mg/m³ [60-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>none</td>
</tr>
</tbody>
</table>

#### Physical Description

Light-colored, free-flowing powders. [Note: A protein containing numerous amino acids.]

<table>
<thead>
<tr>
<th>MW: 28,000 (approx)</th>
<th>BP: ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0 mmHg (approx)</td>
<td>IP: NA</td>
</tr>
<tr>
<td>Fl.P: NA</td>
<td>UEL: NA</td>
</tr>
</tbody>
</table>

#### Incompatibilities & Reactivities

None reported

#### Measurement Methods

None available

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection )

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily

#### First Aid (See procedures )

Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately

#### Important additional information about respirator selection

Respirator Recommendations Not available.

#### Exposure Routes

inhalation, ingestion, skin and/or eye contact

#### Symptoms

Irritation eyes, skin, respiratory system; respiratory sensitization (enzyme asthma): sweating, headache, chest pain, flu-like symptoms, cough, breathlessness, wheezing

#### Target Organs

Eyes, skin, respiratory system

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

### Succinonitrile

<table>
<thead>
<tr>
<th>CAS</th>
<th>110-61-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>WN3850000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Butanedinitrile
- 1,2-Dicyanoethane
- Dinile
- Ethylene cyanide
- Ethylene dicyanide
- Succinic dinitrile

### Exposure Limits
- NIOSH REL: TWA 6 ppm (20 mg/m³)
- OSHA PEL: none

### Physical Description
- Colorless, odorless, waxy solid. [Note: Forms cyanide in the body.]
- MW: 80.1
- BP: 509°F
- MLT: 134°F
- Sol: 13%
- VP(212°F): 2 mmHg
- IP: ?
- FL.P: 270°F
- UEL: ?
- LEL: ?

### Combustible Solid

### Incompatibilities & Reactivities
- Oxidizers

### Measurement Methods
- NIOSH Nitriles Crit. Doc.
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Water wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

<table>
<thead>
<tr>
<th>Concentration Range</th>
<th>Respirator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 60 ppm:</strong></td>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 150 ppm:</strong></td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
</tbody>
</table>
| **Up to 250 ppm:**  | (APF = 50) Any self-contained breathing apparatus with a full facepiece  
                       | (APF = 50) Any supplied-air respirator with a full facepiece |
| **Emergency or planned entry into unknown concentrations or IDLH conditions:** | (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
                       | (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus |
| **Escape:**         | (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus |

#### Exposure Routes
- inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
- Irritation eyes, skin, respiratory system; headache, dizziness, lassitude (weakness, exhaustion), confusion, convulsions; blurred vision; dyspnea (breathing difficulty); abdominal pain, nausea, vomiting

#### Target Organs
- Eyes, skin, respiratory system, central nervous system, cardiovascular system

See also: [INTRODUCTION](#)
## NIOSH Pocket Guide to Chemical Hazards

### Sucrose

**CAS**: 57-50-1  
**RTECS**: WN6500000

### Synonyms & Trade Names
- Beet sugar, Cane sugar, Confectioner's sugar, Granulated sugar, Rock candy, Saccarose, Sugar, Table sugar

### DOT ID & Guide

### Exposure Limits

| NIOSH REL | TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL | TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

### Physical Description
- Hard, white, odorless crystals, lumps, or powder. [Note: May have a characteristic, caramel odor when heated.]
- **MW**: 342.3  
- **BP**: Decomposes  
- **MLT**: 320-367°F (Decomposes)  
- **Sol**: 200%  
- **VP**: 0 mmHg (approx)  
- **IP**: NA  
- **F.P.**: NA  
- **Sp.Gr**: 1.59  
- **UEL**: NA  
- **LEL**: NA  
- **MEC**: 45 g/m³

### Incompatibilities & Reactivities
- Oxidizers, sulfuric acid, nitric acid

### Measurement Methods
- NIOSH 0500, 0600  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: No recommendation  
- **Eyes**: No recommendation  
- **Wash skin**: No recommendation  
- **Remove**: No recommendation  
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately  
- **Breathing**: Fresh air

### Important additional information about respirator selection
- **Respirator Recommendations**: Not available.

### Exposure Routes
- Inhalation, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, upper respiratory system; cough

### Target Organs
- Eyes, respiratory system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Sulfur dioxide

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>7446-09-5</td>
</tr>
<tr>
<td>RTECS</td>
<td>WS4550000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Sulfurous acid anhydride, Sulfurous oxide, Sulfur oxide</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1079 125</td>
</tr>
</tbody>
</table>

### Exposure Limits

- **NIOSH REL:** TWA 2 ppm (5 mg/m³) ST 5 ppm (13 mg/m³)
- **OSHA PEL†:** TWA 5 ppm (13 mg/m³)
- **IDLH:** 100 ppm

### Conversion

1 ppm = 2.62 mg/m³

### Physical Description

Colorless gas with a characteristic, irritating, pungent odor. [Note: A liquid below 14°F. Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>64.1</td>
</tr>
<tr>
<td>BP</td>
<td>14°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-104°F</td>
</tr>
<tr>
<td>Sol</td>
<td>10%</td>
</tr>
<tr>
<td>VP</td>
<td>3.2 atm</td>
</tr>
<tr>
<td>IP</td>
<td>12.30 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>2.26</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities

Powdered alkaline metals (such as sodium & potassium), water, ammonia, zinc, aluminum, brass, copper [Note: Reacts with water to form sulfurous acid (H₂SO₃).]

### Measurement Methods

NIOSH 3800, 6004; OSHA ID104, ID200

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Frostbite
- **Eyes:** Frostbite
- **Wash skin:** No recommendation
- **Remove:** When wet or contaminated (liquid)
- **Change:** No recommendation
- **Provide:** Frostbite wash

### First Aid

- **Eye:** Frostbite
- **Skin:** Frostbite
- **Breathing:** Respiratory support
## Respirator Recommendations

**NIOSH**

### Up to 20 ppm:
- (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern*
- (APF = 10) Any supplied-air respirator*

### Up to 50 ppm:
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*  
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern*

### Up to 100 ppm:
- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern*
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

---

### Exposure Routes
- Inhalation, skin and/or eye contact

### Symptoms
- Irritation eyes, nose, throat; rhinorrhea (discharge of thin mucus); choking, cough; reflex bronchoconstriction; liquid: frostbite

### Target Organs
- Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
<table>
<thead>
<tr>
<th><strong>Sulfur hexafluoride</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAS</strong></td>
</tr>
<tr>
<td>2551-62-4</td>
</tr>
<tr>
<td><strong>RTECS</strong></td>
</tr>
<tr>
<td>WS4900000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
</tr>
<tr>
<td>Sulfur fluoride [Note: May contain highly toxic sulfur pentafluoride as an impurity.]</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
<tr>
<td>1080 126</td>
</tr>
<tr>
<td><strong>Exposure Limits</strong></td>
</tr>
<tr>
<td>NIOSH REL: TWA 1000 ppm (6000 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL: TWA 1000 ppm (6000 mg/m³)</td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
</tr>
<tr>
<td>N.D.</td>
</tr>
<tr>
<td><strong>Conversion</strong></td>
</tr>
<tr>
<td>1 ppm = 5.98 mg/m³</td>
</tr>
<tr>
<td><strong>Physical Description</strong></td>
</tr>
<tr>
<td>Colorless, odorless gas. [Note: Shipped as a liquefied compressed gas. Condenses directly to a solid upon cooling.]</td>
</tr>
<tr>
<td><strong>MW</strong>: 146.1</td>
</tr>
<tr>
<td><strong>BP</strong>: Sublimes</td>
</tr>
<tr>
<td><strong>FRZ</strong>: -83°F (Sublimes)</td>
</tr>
<tr>
<td><strong>Sol(77°F)</strong>: 0.003%</td>
</tr>
<tr>
<td><strong>VP</strong>: 21.5 atm</td>
</tr>
<tr>
<td><strong>IP</strong>: 19.30 eV</td>
</tr>
<tr>
<td><strong>RGasD</strong>: 5.11</td>
</tr>
<tr>
<td><strong>Fl.P</strong>: NA</td>
</tr>
<tr>
<td><strong>UEL</strong>: NA</td>
</tr>
<tr>
<td><strong>LEL</strong>: NA</td>
</tr>
<tr>
<td><strong>Nonflammable Gas</strong></td>
</tr>
<tr>
<td><strong>Incompatibilities &amp; Reactivities</strong></td>
</tr>
<tr>
<td>Disilane</td>
</tr>
<tr>
<td><strong>Measurement Methods</strong></td>
</tr>
<tr>
<td>NIOSH 6602</td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
</tr>
<tr>
<td><strong>Personal Protection &amp; Sanitation</strong> (See protection)</td>
</tr>
<tr>
<td>Skin: Frostbite</td>
</tr>
<tr>
<td>Eyes: Frostbite</td>
</tr>
<tr>
<td>Wash skin: No recommendation</td>
</tr>
<tr>
<td>Remove: No recommendation</td>
</tr>
<tr>
<td>Change: No recommendation</td>
</tr>
<tr>
<td>Provide: Frostbite wash</td>
</tr>
<tr>
<td><strong>First Aid</strong> (See procedures)</td>
</tr>
<tr>
<td>Eye: Frostbite</td>
</tr>
<tr>
<td>Skin: Frostbite</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td><strong>Important additional information about respirator selection</strong></td>
</tr>
<tr>
<td><strong>Respirator Recommendations</strong> Not available.</td>
</tr>
<tr>
<td><strong>Exposure Routes</strong></td>
</tr>
<tr>
<td>Inhalation</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
</tr>
<tr>
<td>Asphyxia: increased breathing rate, pulse rate; slight muscle incoordination, emotional upset; lassitude (weakness, exhaustion), nausea, vomiting, convulsions; liquid: frostbite</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
</tr>
<tr>
<td>Respiratory system</td>
</tr>
<tr>
<td>See also: INTRODUCTION</td>
</tr>
</tbody>
</table>
## Sulfuric acid

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>H₂SO₄</td>
</tr>
<tr>
<td>CAS</td>
<td>7664-93-9</td>
</tr>
<tr>
<td>RTECS</td>
<td>WS5600000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Battery acid
- Hydrogen sulfate
- Oil of vitriol
- Sulfuric acid (aqueous)

### DOT ID & Guide
- 1830 137
- 1831 137 (fuming)
- 1832 137 (spent)

### Exposure Limits
- NIOSH REL: TWA 1 mg/m³
- OSHA PEL: TWA 1 mg/m³
- IDLH: 15 mg/m³

### Physical Description
Colorless to dark-brown, oily, odorless liquid. [Note: Pure compound is a solid below 51°F. Often used in an aqueous solution.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>98.1</td>
</tr>
<tr>
<td>BP</td>
<td>554°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>51°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Miscible</td>
</tr>
<tr>
<td>VP</td>
<td>0.001 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.84 (96-98% acid)</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
Noncombustible Liquid, but capable of igniting finely divided combustible materials.

**Organic materials, chlorates, carbides, fulminates, water, powdered metals [Note: Reacts violently with water with evolution of heat. Corrosive to metals.]

### Measurement Methods
- NIOSH 7903
- OSHA ID113, ID165SG
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash (>1%), Quick drench (>1%)

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 15 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode £
(APF = 25) Any powered, air-purifying respirator with acid gas cartridge(s) in combination with a high-efficiency particulate filter £

(APF = 50) Any chemical cartridge respirator with a full facepiece and acid gas cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; eye, skin burns; dermatitis

Target Organs Eyes, skin, respiratory system, teeth

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Sulfur monochloride

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S₂Cl₂</strong></td>
<td></td>
</tr>
<tr>
<td><strong>CAS</strong></td>
<td>10025-67-9</td>
</tr>
<tr>
<td><strong>RTECS</strong></td>
<td>WS4300000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td>Sulfur chloride, Sulfur subchloride, Thiosulfurous dichloride</td>
</tr>
<tr>
<td><strong>DOT ID &amp; Guide</strong></td>
<td>1828 137</td>
</tr>
</tbody>
</table>

## Exposure Limits

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NIOSH REL</strong></td>
<td>C 1 ppm (6 mg/m³)</td>
</tr>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>TWA 1 ppm (6 mg/m³)</td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
<td>5 ppm</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 5.52 mg/m³

## Physical Description

Light-amber to yellow-red, oily liquid with a pungent, nauseating, irritating odor.

- **MW**: 135.0
- **BP**: 280°F
- **FRZ**: -107°F
- **Sol**: Decomposes
- **VP**: 7 mmHg
- **IP**: 9.40 eV
- **Sp.Gr**: 1.68
- **Fl.P**: 245°F
- **UEL**: ?
- **LEL**: ?

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

## Incompatibilities & Reactivities

Peroxides, oxides of phosphorous, organics, water [Note: Decomposes violently in water to form hydrochloric acid, sulfur dioxide, sulfur, sulfite, thiosulfate, and hydrogen sulfide. Corrosive to metals.]

## Measurement Methods

None available

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

## First Aid

| Eye: Irrigate immediately |
| Skin: Water flush immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

---

*Authored in PDF format by Industrial Hygiene Services; www.ihresources.com*
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 5 ppm:**

- (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

#### Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Irritation eyes, skin, mucous membrane; lacrimation (discharge of tears); cough; eye, skin burns; pulmonary edema</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
## NIOSH Pocket Guide to Chemical Hazards

### Sulfur pentafluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>5714-22-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>WS4480000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Disulfur decafluoride, Sulfur decafluoride</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>1 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL:</td>
<td>C 0.01 ppm (0.1 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL†:</td>
<td>TWA 0.025 ppm (0.25 mg/m³)</td>
</tr>
</tbody>
</table>

**Conversion** 1 ppm = 10.39 mg/m³

### Physical Description

- Colorless liquid or gas (above 84°F) with an odor like sulfur dioxide.

<table>
<thead>
<tr>
<th>MW:</th>
<th>254.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP:</td>
<td>84°F</td>
</tr>
<tr>
<td>FRZ:</td>
<td>-134°F</td>
</tr>
<tr>
<td>Sol:</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP:</td>
<td>561 mmHg</td>
</tr>
<tr>
<td>IP:</td>
<td>?</td>
</tr>
<tr>
<td>RGasD:</td>
<td>8.77</td>
</tr>
<tr>
<td>Sp.Gr(32°F):</td>
<td>2.08</td>
</tr>
<tr>
<td>Fl.P:</td>
<td>NA</td>
</tr>
<tr>
<td>UEL:</td>
<td>NA</td>
</tr>
<tr>
<td>LEL:</td>
<td>NA</td>
</tr>
</tbody>
</table>

- Noncombustible Liquid Nonflammable Gas

### Incompatibilities & Reactivities

- None reported

### Measurement Methods

- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: No recommendation
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash, Quick drench

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
### Respirator Recommendations NIOSH

**Up to 0.1 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 0.25 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 0.5 ppm:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1 ppm:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; in animals: pulmonary edema, hemorrhage

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Sulfur tetrafluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7783-60-0</td>
<td>WT4800000</td>
<td>2418 125</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Tetrafluorosulfurane

### Exposure Limits
- NIOSH REL: C 0.1 ppm (0.4 mg/m³)
- OSHA PEL†: none
- IDLH: N.D.

### Conversion
1 ppm = 4.42 mg/m³

### Physical Description
- Colorless gas with an odor like sulfur dioxide. [Note: Shipped as a liquefied compressed gas.]

### Incompatibilities & Reactivities
- Moisture, concentrated sulfuric acid, dioxygen difluoride [Note: Readily hydrolyzed by moisture, forming hydrofluoric acid & thionyl fluoride.]

### Measurement Methods
- OSHA ID110
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Frostbite
- **Eyes:** Frostbite
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation
- Provide: Frostbite wash

### First Aid
- **Eye:** Frostbite
- **Skin:** Frostbite
- **Breathing:** Respiratory support

### Important additional information about respirator selection
- **Respirator Recommendations:** Not available.

### Exposure Routes
- Inhalation, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, mucous membrane; eye, skin burns (from SF₄ releasing hydrofluoric acid on exposure to moisture); liquid: frostbite; in animals: dyspnea (breathing difficulty), lassitude (weakness, exhaustion), rhinorrhea (discharge of thin mucus)

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
### Sulfuryl fluoride

**CAS** 2699-79-8  
**RTECS** WT5075000  
**Synonyms & Trade Names**  
Sulfur difluoride dioxide, Vikane®  
**DOT ID & Guide**  
2191 123

### Exposure Limits

- NIOSH REL: TWA 5 ppm (20 mg/m³) ST 10 ppm (40 mg/m³)  
- OSHA PEL†: TWA 5 ppm (20 mg/m³)

**IDLH** 200 ppm  
**Conversion** 1 ppm = 4.18 mg/m³

### Physical Description

- Colorless, odorless gas. [insecticide/fumigant] [Note: Shipped as a liquefied compressed gas.]
- MW: 102.1  
- BP: -68°F  
- FRZ: -212°F  
- Sol(32°F): 0.2%
- VP(70°F): 15.8 atm  
- IP: 13.04 eV  
- RGasD: 3.72
- Fl.P: NA  
- UEL: NA  
- LEL: NA

### Incompatibilities & Reactivities

None reported

### Measurement Methods

- NIOSH 6012  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** Frostbite  
- **Eyes:** Frostbite  
- Wash skin: No recommendation  
- Remove: No recommendation  
- Change: No recommendation  
- Provide: Frostbite wash

### First Aid

- **Eye:** Frostbite  
- **Skin:** Frostbite  
- **Breathing:** Respiratory support
### Respirator Recommendations NIOSH/OSHA

<table>
<thead>
<tr>
<th>Concentration Range</th>
<th>APF</th>
<th>Respirator Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50 ppm</td>
<td>10</td>
<td>Any supplied-air respirator*</td>
</tr>
<tr>
<td>Up to 125 ppm</td>
<td>25</td>
<td>Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>Up to 200 ppm</td>
<td>50</td>
<td>Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td>Emergency or planned entry into unknown concentrations or IDLH conditions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10,000</td>
<td>Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td></td>
<td>10,000</td>
<td>Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
</tbody>
</table>

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin and/or eye contact (liquid)

### Symptoms
- Conjunctivitis, rhinitis, pharyngitis, paresthesia; liquid: frostbite; in animals: narcosis, tremor, convulsions; pulmonary edema; kidney injury

### Target Organs
- Eyes, skin, respiratory system, central nervous system, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Sulprofos

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>CAS Number</th>
<th>RTECS Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₁₂H₁₉O₂PS₃</td>
<td>35400-43-2</td>
<td>TE4165000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Bolstar®, O-Ethyl O-(4-methylthio)phenyl S-propylphosphorodithioate

## Exposure Limits

<table>
<thead>
<tr>
<th>Limit Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA</td>
<td>1 mg/m³</td>
</tr>
<tr>
<td>OSHA PEL†:</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.D.</td>
<td></td>
</tr>
</tbody>
</table>

## Conversion

1 ppm = 13.19 mg/m³

## Physical Description
Tan-colored liquid with a sulfide-like odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>322.5</td>
</tr>
<tr>
<td>BP</td>
<td>?</td>
</tr>
<tr>
<td>FRZ</td>
<td>?</td>
</tr>
<tr>
<td>Sol</td>
<td>Low</td>
</tr>
<tr>
<td>VP</td>
<td>&lt;8 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.20</td>
</tr>
<tr>
<td>Fl.P</td>
<td>?</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities
None reported

## Measurement Methods
- NIOSH 5600
- OSHA PV2037
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)

<table>
<thead>
<tr>
<th>Protection Type</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Prevent skin contact</td>
</tr>
<tr>
<td>Eyes</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Wash skin</td>
<td>When contaminated</td>
</tr>
<tr>
<td>Remove</td>
<td>When wet or contaminated</td>
</tr>
<tr>
<td>Change</td>
<td>No recommendation</td>
</tr>
</tbody>
</table>

## First Aid
(See procedures)

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>Irrigate immediately</td>
</tr>
<tr>
<td>Skin</td>
<td>Soap wash immediately</td>
</tr>
<tr>
<td>Breathing</td>
<td>Respiratory support</td>
</tr>
<tr>
<td>Swallow</td>
<td>Medical attention immediately</td>
</tr>
</tbody>
</table>

## Important additional information about respirator selection

## Respirator Recommendations
Not available.

## Exposure Routes
- Inhalation, ingestion

## Symptoms
- Nausea, vomiting, abdominal cramps, diarrhea, salivation; headache, dizziness, lassitude (weakness, exhaustion); rhinorrhea (discharge of thin mucus), chest tightness; blurred vision, miosis; cardiac irregularities; muscle fasciculation; dyspnea (breathing difficulty)

## Target Organs
- Respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2,4,5-T

<table>
<thead>
<tr>
<th>CAS</th>
<th>93-76-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>AJ8400000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>2,4,5-Trichlorophenoxyacetic acid</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2765 152</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 10 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 10 mg/m³</td>
</tr>
</tbody>
</table>

### IDLH

250 mg/m³

### Physical Description

Colorless to tan, odorless, crystalline solid. [herbicide]

<table>
<thead>
<tr>
<th>MW: 255.5</th>
<th>BP: Decomposes</th>
<th>MLT: 307°F</th>
<th>Sp.Gr: 1.80</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 1 x 10-7 mmHg</td>
<td>IP: ?</td>
<td>Sol(77°F): 0.03%</td>
<td></td>
</tr>
</tbody>
</table>

Combustible Solid, but burns with difficulty.

### Incompatibilities & Reactivities

None reported

### Measurement Methods

NIOSH 5001

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 50 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 100 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 250 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms In animals: ataxia; skin irritation, acne-like rash; liver damage

Target Organs Skin, liver, gastrointestinal tract

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Talc (containing no asbestos and less than 1% quartz)  
**CAS 14807-96-6**

<table>
<thead>
<tr>
<th>Formula</th>
<th>RTECS WW2710000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mg₃Si₄O₁₀(OH)₂</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Hydrous magnesium silicate
- Steatite talc

### Exposure Limits
- **NIOSH REL:** TWA 2 mg/m³ (resp)
- **OSHA PEL†:** TWA 20 mppcf
- **IDLH:** 1000 mg/m³

### Physical Description
- **Odorless, white powder.**
- **MW:** Varies
- **BP:** ?
- **MLT:** 1652 to 1832°F
- **Sol:** Insoluble
- **VP:** 0 mmHg (approx)
- **IP:** NA
- **Sp.Gr:** 2.70-2.80
- **Fl.P:** NA
- **UEL:** NA
- **LEL:** NA

### Incompatibilities & Reactivities
- None reported

### Measurement Methods
- **NIOSH P&CAM355 (III)**
- **See:** NMAM or OSHA Methods

### Personal Protection & Sanitation
- (See protection)
  - **Skin:** No recommendation
  - **Eyes:** No recommendation
  - **Wash skin:** No recommendation
  - **Remove:** No recommendation
  - **Change:** No recommendation

### First Aid
- (See procedures)
  - **Eye:** Irrigate immediately
  - **Breathing:** Fresh air

---

**Authored in PDF format by Industrial Hygiene Services; www.ihresources.com**
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 10 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 20 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 50 mg/m³:
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 100 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 1000 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Fibrotic pneumoconiosis; irritation eyes

Target Organs Eyes, respiratory system, cardiovascular system

See also: INTRODUCTION
### NIOSH Pocket Guide to Chemical Hazards

#### Tantalum (metal and oxide dust, as Ta)

<table>
<thead>
<tr>
<th>CAS 7440-25-7 (metal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS WW5505000 (metal)</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- Tantalum metal: Tantalum-181
- Synonyms of other tantalum dusts (including oxide dusts) vary depending upon the specific compound.

#### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 5 mg/m³ ST 10 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 5 mg/m³</td>
</tr>
</tbody>
</table>

| IDLH 2500 mg/m³ (as Ta) |

#### Conversion

| MW: 180.9 |
| BP: 9797°F |
| MLT: 5425°F |
| Sol: Insoluble |

| VP: 0 mmHg (approx) |
| IP: NA |

| Fl.P: NA |
| UEL: NA |
| LEL: NA |

| MEC: <200 g/m³ |

#### Physical Description
- Metal: Steel-blue to gray solid or black, odorless powder.
- MW: 180.9
- BP: 9797°F
- MLT: 5425°F
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Fl.P: NA
- UEL: NA
- LEL: NA

Metal: Combustible Solid; powder ignites SPONTANEOUSLY in air.

#### Incompatibilities & Reactivities
- Strong oxidizers, bromine trifluoride, fluorine

#### Measurement Methods
- NIOSH 0500
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

**Skin:** No recommendation
**Eyes:** No recommendation
**Wash skin:** No recommendation
**Remove:** No recommendation
**Change:** No recommendation

#### First Aid

**Eye:** Irrigate immediately
**Breathing:** Respiratory support
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 25 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 50 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 125 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 250 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 2500 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Irritation eyes, skin; in animals: pulmonary irritation

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION
<table>
<thead>
<tr>
<th><strong>NIOSH Pocket Guide to Chemical Hazards</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEDP</strong></td>
</tr>
<tr>
<td>CAS 3689-24-5</td>
</tr>
<tr>
<td>RTECS XN4375000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Synonyms &amp; Trade Names</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bladafum®, Dithion®, Sulfope, Tetraethyl dithionopyrophosphate, Tetraethyl dithiopyrophosphate, Thiotepp®</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DOT ID &amp; Guide</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1704 153</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 0.2 mg/m³ [skin]</td>
</tr>
<tr>
<td>OSHA PEL: TWA 0.2 mg/m³ [skin]</td>
</tr>
<tr>
<td>IDLH 10 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Conversion</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ppm = 13.18 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Physical Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pale-yellow liquid with a garlic-like odor. [Note: A pesticide that may be absorbed on a solid carrier or mixed in a more flammable liquid.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MW:</strong> 322.3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BP:</strong> Decomposes</td>
</tr>
<tr>
<td><strong>FRZ:</strong> ?</td>
</tr>
<tr>
<td><strong>Sol:</strong> 0.0007%</td>
</tr>
<tr>
<td><strong>VP:</strong> 0.0002 mmHg</td>
</tr>
<tr>
<td><strong>IP:</strong> ?</td>
</tr>
<tr>
<td><strong>Sp.Gr(77°F):</strong> 1.20</td>
</tr>
<tr>
<td><strong>Fl.P:</strong> ?</td>
</tr>
<tr>
<td><strong>UEL:</strong> ?</td>
</tr>
<tr>
<td><strong>LEL:</strong> ?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Combustible Liquid</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Incompatibilities &amp; Reactivities</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong oxidizers, iron [Note: Corrosive to iron.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Measurement Methods</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>None available</td>
</tr>
<tr>
<td>See: NMAM or OSHA Methods</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Personal Protection &amp; Sanitation (See protection )</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td>Change: No recommendation</td>
</tr>
<tr>
<td>Provide: Eyewash, Quick drench</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>First Aid (See procedures )</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Skin: Soap wash immediately</td>
</tr>
<tr>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Swallow: Medical attention</td>
</tr>
<tr>
<td>immediately</td>
</tr>
</tbody>
</table>
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 2 mg/m³:**
(APF = 10) Any supplied-air respirator

**Up to 5 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 10 mg/m³:**
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin; eye pain, blurred vision, lacrimation (discharge of tears); rhinorrhea (discharge of thin mucus); headache; cyanosis; anorexia, nausea, vomiting, diarrhea; localized sweating, lassitude (weakness, exhaustion), twitching, paralysis, Cheyne-Stokes respiration, convulsions, low blood pressure, cardiac irregularities

**Target Organs** Eyes, skin, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: [INTRODUCTION](#)
## Tellurium

**CAS** 13494-80-9  
**RTECS** WY2625000  
**DOT ID & Guide**

### Synonyms & Trade Names
- Aurum paradoxum
- Metallum problematum

### Exposure Limits
- **NIOSH REL**: TWA 0.1 mg/m³ [*Note: The REL also applies to other tellurium compounds (as Te) except Tellurium hexafluoride and Bismuth telluride.]*  
- **OSHA PEL**: TWA 0.1 mg/m³ [*Note: The PEL also applies to other tellurium compounds (as Te) except Tellurium hexafluoride and Bismuth telluride.]*  
- **IDLH**: 25 mg/m³ (as Te)

### Physical Description
- Odorless, dark-gray to brown, amorphous powder or grayish-white, brittle solid.
- **MW**: 127.6  
- **BP**: 1814°F  
- **MLT**: 842°F  
- **Sol**: Insoluble  
- **IP**: NA  
- **Sp.Gr**: 6.24  
- **UEL**: NA  
- **LEL**: NA

### Incompatibilities & Reactivities
- Oxidizers, chlorine, cadmium

### Measurement Methods
- NIOSH 7300, 7301, 7303, 9102; OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation *(See protection)*
- **Skin**: No recommendation  
- **Eyes**: No recommendation  
- **Wash skin**: No recommendation  
- **Remove**: No recommendation  
- **Change**: No recommendation

### First Aid *(See procedures)*
- **Eye**: Irrigate immediately  
- **Skin**: Soap wash promptly  
- **Breathing**: Respiratory support  
- **Swallow**: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 0.5 mg/m³:**
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 1 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

**Up to 2.5 mg/m³:**
(APF = 10) Any supplied-air respirator

**Up to 5 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

**Up to 25 mg/m³:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Garlic breath, sweating; dry mouth, metallic taste; drowsiness; anorexia, nausea, no sweating; dermatitis; in animals: central nervous system, red blood cell changes

**Target Organs** Skin, central nervous system, blood

See also: [INTRODUCTION](#)
### NIOSH Pocket Guide to Chemical Hazards

**Tellurium hexafluoride**

<table>
<thead>
<tr>
<th>CAS</th>
<th>7783-80-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>WY2800000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Tellurium fluoride</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2195 125</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>1 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion</td>
<td>1 ppm = 9.88 mg/m³</td>
</tr>
</tbody>
</table>

**NIOSH REL:** TWA 0.02 ppm (0.2 mg/m³)

**OSHA PEL:** TWA 0.02 ppm (0.2 mg/m³)

**Physical Description**

Colorless gas with a repulsive odor. MW: 241.6

<table>
<thead>
<tr>
<th>BP</th>
<th>Sublimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRZ</td>
<td>-36°F (Sublimes)</td>
</tr>
<tr>
<td>Sol</td>
<td>Decomposes</td>
</tr>
<tr>
<td>VP</td>
<td>&gt;1 atm</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>RGasD</td>
<td>8.34</td>
</tr>
</tbody>
</table>

**Incompatibilities & Reactivities**

Water [Note: Hydrolyzes slowly in water to telluric acid.]

**Measurement Methods**

NIOSH S187 (II-3)

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

**First Aid** *(See procedures)*

- Breathing: Respiratory support
### Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

**Up to 0.2 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 0.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 1 ppm:**
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
- Any appropriate escape-type, self-contained breathing apparatus

---

### Exposure Routes

**inhalation**

### Symptoms

- Headache; dyspnea (breathing difficulty); garlic breath; in animals: pulmonary edema

### Target Organs

- Respiratory system

See also: **INTRODUCTION**
## Temephos

<table>
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<tr>
<th>CAS</th>
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<tbody>
<tr>
<td>RTECS</td>
<td>TF6890000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Abate®; Temefos; O,O,O'O'-Tetramethyl O,O'-thiodi-p-phenylene phosphorothioate</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL | TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL† | TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |
| IDLH      | N.D. |

### Physical Description

- White, crystalline solid or liquid (above 87°F). [insecticide] [Note: Technical grade is a viscous, brown liquid.]
- MW: 466.5
- BP: 248-257°F (Decomposes)
- MLT: 87°F
- Sol: Insoluble
- VP(77°F): 0.0000007 mmHg
- IP: ?
- Sp.Gr: 1.32
- Fl.P: ?
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities

- None reported

### Measurement Methods

- NIOSH 0500, 0600; OSHA PV2056
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid

- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

- Respirator Recommendations: Not available.

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

- Irritation eyes, blurred vision; dizziness; dyspnea (breathing difficulty); salivation; abdominal cramps, nausea, diarrhea, vomiting

### Target Organs

- Eyes, respiratory system, central nervous system, cardiovascular system, blood cholinesterase

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## TEPP

<table>
<thead>
<tr>
<th>CAS</th>
<th>107-49-3</th>
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<tbody>
<tr>
<td>RTECS</td>
<td>UX6825000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Ethyl pyrophosphate, Tetraethyl pyrophosphate, Tetron®

## DOT ID & Guide
- 2783 152 (solid)
- 3018 152 (liquid)

## Exposure Limits
- NIOSH REL: TWA 0.05 mg/m³ [skin]
- OSHA PEL: TWA 0.05 mg/m³ [skin]

## IDLH
- 5 mg/m³

## Conversion
- 1 ppm = 11.87 mg/m³

## Physical Description
- Colorless to amber liquid with a faint, fruity odor. [insecticide] [Note: A solid below 32°F.]
- MW: 290.2
- BP: Decomposes
- FRZ: 32°F
- Sol: Miscible
- VP: 0.0002 mmHg
- IP: ?
- Sp.Gr: 1.19
- Fl.P: NA
- UEL: NA
- LEL: NA

## Incompatibilities & Reactivities
- Noncombustible Liquid
- Strong oxidizers, alkalis, water [Note: Hydrolyzes quickly in water to form pyrophosphoric acid.]

## Measurement Methods
- NIOSH 2504
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

## First Aid
- **Eye:** Irrigate immediately
- **Skin:** Water flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH/OSHA

- **Up to 0.5 mg/m³:**
  - (APF = 10) Any supplied-air respirator

- **Up to 1.25 mg/m³:**
  - (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

- **Up to 2.5 mg/m³:**
  - (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
  - (APF = 50) Any self-contained breathing apparatus with a full facepiece
  - (APF = 50) Any supplied-air respirator with a full facepiece

- **Up to 5 mg/m³:**
  - (APF = 500) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

---

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms

- Eye pain, blurred vision, lacrimation (discharge of tears); rhinorrhea (discharge of thin mucus); headache, chest tightness, cyanosis; anorexia, nausea, vomiting, diarrhea; lassitude (weakness, exhaustion), twitching, paralysis, Cheyne-Stokes respiration, convulsions; low blood pressure, cardiac irregularities; sweating

### Target Organs

- Eyes, respiratory system, central nervous system, cardiovascular system, gastrointestinal tract, blood cholinesterase

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## m-Terphenyl

<table>
<thead>
<tr>
<th>CAS</th>
<th>92-06-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>WZ6470000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- m-Diphenylbenzene;
- 1,3-Diphenylbenzene;
- Isodiphenylbenzene;
- 3-Phenylbiphenyl;
- 1,3-Terphenyl;
- meta-Terphenyl;
- m-Triphenyl

### Exposure Limits
- NIOSH REL: C 5 mg/m³ (0.5 ppm)
- OSHA PEL†: C 9 mg/m³ (1 ppm)
- IDLH: 500 mg/m³

### Conversion
1 ppm = 9.57 mg/m³

### Physical Description
- Yellow solid (needles).
- MW: 230.3
- BP: 689°F
- MLT: 192°F
- Sol: Insoluble
- VP(200°F): 0.01 mmHg
- IP: 8.01
- Sp.Gr: 1.23
- Fl.P(oc): 375°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities
None reported

### Measurement Methods
- NIOSH 5021
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 25 mg/m³:**
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 50 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

**Up to 125 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 250 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 500 mg/m³:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, mucous membrane; thermal skin burns; headache; sore throat; in animals: liver, kidney damage

**Target Organs** Eyes, skin, respiratory system, liver, kidneys

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## o-Terphenyl

<table>
<thead>
<tr>
<th>CAS</th>
<th>84-15-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>WZ6472000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- o-Diphenylbenzene
- 1,2-Diphenylbenzene
- 2-Phenylbiphenyl
- 1,2-Terphenyl
- ortho-Terphenyl
- o-Triphenyl

### Exposure Limits

| NIOSH REL: | C 5 mg/m³ (0.5 ppm) |
| OSHA PEL†: | C 9 mg/m³ (1 ppm) |

### IDLH

- 500 mg/m³

### Conversion

- 1 ppm = 9.42 mg/m³

### Physical Description

- Colorless or light-yellow solid.
- MW: 230.3
- BP: 630°F
- MLT: 136°F
- Sol: Insoluble
- VP(200°F): 0.09 mmHg
- IP: 7.99 eV
- Sp.Gr: 1.1
- Fl.P(oc): 325°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities

- None reported

### Measurement Methods

- NIOSH 5021
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation **(See protection)**

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

### First Aid **(See procedures)**

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

Up to 25 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 50 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

Up to 125 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 250 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.

(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 500 mg/m³:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; thermal skin burns; headache; sore throat; in animals: liver, kidney damage

Target Organs Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION
# p-Terphenyl

**CAS** 92-94-4

**C6H5C6H4C6H5**

**RTECS** WZ6475000

## Synonyms & Trade Names
- p-Diphenylbenzene
- 1,4-Diphenylbenzene
- 4-Phenylbiphenyl
- 1,4-Terphenyl
- para-Terphenyl
- p-Triphenyl

## DOT ID & Guide

## Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: C 5 mg/m³ (0.5 ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: C 9 mg/m³ (1 ppm)</td>
</tr>
</tbody>
</table>

**IDLH**: 500 mg/m³

**Conversion**: 1 ppm = 9.57 mg/m³

## Physical Description

- White or light-yellow solid.
- **MW**: 230.3
- **BP**: 761°F
- **MLT**: 415°F
- **Sol**: Insoluble
- **VP**: Very low
- **IP**: 7.78
- **Sp.Gr**: 1.23
- **Fl.P**: 405°F
- **UEL**: ?
- **LEL**: ?

## Incompatibilities & Reactivities

None reported

## Measurement Methods

- NIOSH 5021
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash, Quick drench

## First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 25 mg/m³:**
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 50 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

**Up to 125 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode.
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 250 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 500 mg/m³:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, mucous membrane; thermal skin burns; headache; sore throat; in animals: liver, kidney damage

**Target Organs** Eyes, skin, respiratory system, liver, kidneys

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## 2,3,7,8-Tetrachloro-dibenzo-p-dioxin

<table>
<thead>
<tr>
<th>CAS</th>
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<tbody>
<tr>
<td>RTECS</td>
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### Synonyms & Trade Names
Dioxin; Dioxine; TCDBD; TCDD; 2,3,7,8-TCDD [Note: Formed during past production of 2,4,5-trichlorophenol, 2,4,5-T & 2(2,4,5-trichlorophenoxy)propionic acid.]

### Exposure Limits

| NIOSH REL: Ca See Appendix A |
| OSHA PEL: none |

### IDLH Ca [N.D.]

### Conversion

<table>
<thead>
<tr>
<th>Physical Description</th>
</tr>
</thead>
</table>
Colorless to white, crystalline solid. [Note: Exposure may occur through contact at previously contaminated worksites.]

| MW: 322.0 |
| BP: Decomposes |
| MLT: 581°F |
| Sol: 0.00000002% |

| VP(77°F): 0.000002 mmHg |
| IP: ? |
| UEL: ? |

### Incompatibilities & Reactivities
UV light (decomposes)

### Measurement Methods
None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated/Daily |
| Remove: When wet or contaminated |
| Change: Daily |
| Provide: Eyewash, Quick drench |

### First Aid (See procedures )

| Eye: Irrigate immediately |
| Skin: Soap flush immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes; allergic dermatitis, chloracne; porphyria; gastrointestinal disturbance; possible reproductive, teratogenic effects; in animals: liver, kidney damage; hemorrhage; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, liver, kidneys, reproductive system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: tumors at many sites]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### 1,1,1,2-Tetrachloro-2,2-difluoroethane

**CAS** 76-11-9

<table>
<thead>
<tr>
<th>Synonyms &amp; Trade Names</th>
<th>RTECS KI1425000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,2-Difluoro-1,1,1,2-tetrachloroethane; Freon® 112a; Halocarbon 112a; Refrigerant 112a</td>
<td>DOT ID &amp; Guide</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 500 ppm (4170 mg/m³)</th>
<th>OSHA PEL: TWA 500 ppm (4170 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH</td>
<td>2000 ppm</td>
<td>Conversion 1 ppm = 8.34 mg/m³</td>
</tr>
</tbody>
</table>

#### Physical Description

Colorless solid with a slight, ether-like odor. [Note: A liquid above 105°F.]

<table>
<thead>
<tr>
<th>MW</th>
<th>203.8</th>
<th>BP: 197°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP:</td>
<td>40 mmHg</td>
<td>IP: ?</td>
</tr>
<tr>
<td>FL.P:</td>
<td>NA</td>
<td>UEL: NA</td>
</tr>
<tr>
<td>Sol:</td>
<td>0.01%</td>
<td>Sp.Gr: 1.65</td>
</tr>
</tbody>
</table>
| Noncombustible Solid

#### Incompatibilities & Reactivities

Chemically-active metals such as potassium, beryllium, powdered aluminum, zinc, calcium, magnesium & sodium; acids

#### Measurement Methods

NIOSH 1016 ; OSHA 7

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection )

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

#### First Aid (See procedures )

Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

**Up to 2000 ppm:**

(APF = 10) Any supplied-air respirator
(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin; central nervous system depression; pulmonary edema; drowsiness; dyspnea (breathing difficulty)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
1,1,2,2-Tetrachloro-1,2-difluoroethane

<table>
<thead>
<tr>
<th>CAS</th>
<th>76-12-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KI1420000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td></td>
</tr>
<tr>
<td>1,2-Difluoro-1,1,2,2-tetrachloroethane; Freon® 112; Halocarbon 112; Refrigerant 112</td>
<td></td>
</tr>
</tbody>
</table>

**Exposure Limits**

<table>
<thead>
<tr>
<th>Exposure Limit</th>
<th>NIOSH REL: TWA 500 ppm (4170 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 500 ppm (4170 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>2000 ppm</td>
</tr>
</tbody>
</table>

**Conversion**

1 ppm = 8.34 mg/m³

**Physical Description**

Colorless solid or liquid (above 77°F) with a slight, ether-like odor.

<table>
<thead>
<tr>
<th>MW</th>
<th>203.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>199°F</td>
</tr>
<tr>
<td>VP</td>
<td>40 mmHg</td>
</tr>
<tr>
<td>FL.P</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
<tr>
<td>Sol(77°F)</td>
<td>0.01%</td>
</tr>
<tr>
<td>BP</td>
<td>199°F</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.65</td>
</tr>
</tbody>
</table>

**Noncombustible Solid**

**Incompatibilities & Reactivities**

Chemically-active metals such as potassium, beryllium, powdered aluminum, zinc, magnesium, calcium & sodium; acids

**Measurement Methods**

NIOSH 1016 ; OSHA 7
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

(See protection )

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

**First Aid**

(See procedures )

Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

**Respirator Recommendations**

NIOSH/OSHA

Up to 2000 ppm:

(APF = 10) Any supplied-air respirator
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**

inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>In animals: irritation eyes, skin; conjunctivitis; pulmonary edema; narcosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### 1,1,1,2-Tetrachloroethane

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>630-20-6</td>
</tr>
<tr>
<td>RTECS</td>
<td>KI8450000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>None</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1702 151</td>
</tr>
</tbody>
</table>

**Exposure Limits**

NIOSH REL: Handle with caution in the workplace. See Appendix C (Chloroethanes)

OSHA PEL: none

**Physical Description**

Yellowish-red liquid.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>167.9</td>
</tr>
<tr>
<td>BP</td>
<td>267°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-94°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.1%</td>
</tr>
<tr>
<td>VP</td>
<td>14 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.54</td>
</tr>
</tbody>
</table>

**Incompatibilities & Reactivities**

Potassium; sodium; dinitrogen tetroxide; potassium hydroxide; nitrogen tetroxide; sodium potassium alloy; 2,4-dinitrophenyl disulfide

**Measurement Methods**

None available

See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: No recommendation

Provide: Eyewash, Quick drench

**First Aid**

Eye: Irrigate immediately

Skin: Soap wash immediately

Breathing: Respiratory support

Swallow: Medical attention immediately

**Important additional information about respirator selection**

Respirator Recommendations: Not available.

**Exposure Routes**

Inhalation, ingestion, skin and/or eye contact

**Symptoms**

Irritation eyes, skin; lassitude (weakness, exhaustion), restlessness, irregular respiration, muscle incoordination; in animals: liver changes

**Target Organs**

Eyes, skin, central nervous system, liver

See also: INTRODUCTION
**1,1,2,2-Tetrachloroethane**

<table>
<thead>
<tr>
<th>CAS</th>
<th>79-34-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>KI8575000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**

Acetylene tetrachloride, Symmetrical tetrachloroethane

**DOT ID & Guide**

1702 151

**Exposure Limits**

NIOSH REL: Ca TWA 1 ppm (7 mg/m³) [skin] See Appendix A See Appendix C (Chloroethanes)

OSHA PEL†: TWA 5 ppm (35 mg/m³) [skin]

**IDLH**

Ca [100 ppm]

**Conversion**

1 ppm = 6.87 mg/m³

**Physical Description**

Colorless to pale-yellow liquid with a pungent, chloroform-like odor.

| MW: 167.9 | BP: 296°F | FRZ: -33°F | Sol: 0.3% |
| VP: 5 mmHg | IP: 11.10 eV | Sp.Gr(77°F): 1.59 |
| Fi.P: NA | UEL: NA | LEL: NA |

Noncombustible Liquid

**Incompatibilities & Reactivities**

Chemically-active metals, strong caustics, fuming sulfuric acid [Note: Degrades slowly when exposed to air.]

**Measurement Methods**

NIOSH 1019 , 2562 ; OSHA 7

See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

(See protection)

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: No recommendation

Provide: Eyewash, Quick drench

**First Aid**

(See procedures)

Eye: Irrigate immediately

Skin: Soap wash promptly

Breathing: Respiratory support

Swallow: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations**

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes**

inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms**

Nausea, vomiting, abdominal pain; tremor fingers; jaundice, hepatitis, liver tenderness; dermatitis; leukocytosis (increased blood leukocytes); kidney damage; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Skin, liver, kidneys, central nervous system, gastrointestinal tract</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Tetrachloroethylene

<table>
<thead>
<tr>
<th>CAS</th>
<th>127-18-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl₂C=CCl₂</td>
<td>RTECS KX3850000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Perchloroethylene, Perchloroethylene, Perk, Tetrachlorethylene

### DOT ID & Guide
- DOT ID & Guide 1897 160

### Exposure Limits
- NIOSH REL: Ca Minimize workplace exposure concentrations. **See Appendix A**
- OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 3-hours)
- IDLH Ca [150 ppm]

### Conversion
- 1 ppm = 6.78 mg/m³

### Physical Description
- Colorless liquid with a mild, chloroform-like odor.
- MW: 165.8
- BP: 250°F
- FRZ: -2°F
- Sol: 0.02%
- VP: 14 mmHg
- IP: 9.32 eV
- Sp.Gr: 1.62
- Fl.P: NA
- UEL: NA
- LEL: NA

### Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

### Incompatibilities & Reactivities
- Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

### Measurement Methods
- NIOSH 1003; OSHA 1001
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th>Target Organs</th>
<th>Eyes, skin, respiratory system, liver, kidneys, central nervous system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer Site</td>
<td>[in animals: liver tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
**Tetrachloronaphthalene**

**CAS** 1335-88-2

**C₁₀H₄Cl₄**  
**RTECS** QK3700000

**Synonyms & Trade Names**  
Halowax®, Nibren wax, Seekay wax

**DOT ID & Guide**

---

**Exposure Limits**

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 2 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL:</td>
<td>TWA 2 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

**IDLH** Unknown

---

**Physical Description**

Colorless to pale-yellow solid with an aromatic odor.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MW:</td>
<td>265.9</td>
<td></td>
</tr>
<tr>
<td>BP:</td>
<td>599-680°F</td>
<td></td>
</tr>
<tr>
<td>MLT:</td>
<td>360°F</td>
<td></td>
</tr>
<tr>
<td>Sol:</td>
<td>Insoluble</td>
<td></td>
</tr>
<tr>
<td>VP:</td>
<td>&lt;1 mmHg</td>
<td></td>
</tr>
<tr>
<td>IP:</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Fl.P(oc):</td>
<td>410°F</td>
<td></td>
</tr>
<tr>
<td>UEL:</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>LEL:</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

**Combustible Solid**

---

**Incompatibilities & Reactivities**

Strong oxidizers

---

**Measurement Methods**

NIOSH S130 (II-2)  
See: NMAM or OSHA Methods

---

**Personal Protection & Sanitation** *(See protection)*

<table>
<thead>
<tr>
<th></th>
<th>First Aid <em>(See procedures)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin: Prevent skin contact</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td>Eyes: Prevent eye contact</td>
<td>Skin: Soap wash immediately</td>
</tr>
<tr>
<td>Wash skin: When contaminated</td>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td>Remove: When wet or contaminated</td>
<td>Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>Change: Daily</td>
<td></td>
</tr>
</tbody>
</table>

**Important additional information about respirator selection**

**Respirator Recommendations** *(See Appendix F)* NIOSH/OSHA

**Up to 20 mg/m³:**

- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. **Click here**
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Acne-form dermatitis; headache, lassitude (weakness, exhaustion), anorexia, dizziness; jaundice, liver injury</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Liver, skin, central nervous system</td>
</tr>
<tr>
<td>See also:</td>
<td><strong>INTRODUCTION</strong></td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Tetraethyl lead (as Pb)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb(C₂H₅)₄</td>
<td>78-00-2</td>
<td>Lead tetraethyl, TEL, Tetraethylplumbane</td>
<td>1649 131</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>CAS</strong> 78-00-2</td>
<td><strong>RTECS</strong> TP4550000</td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 0.075 mg/m³ [skin]</th>
<th>OSHA PEL: TWA 0.075 mg/m³ [skin]</th>
<th>IDLH 40 mg/m³ (as Pb)</th>
</tr>
</thead>
</table>

## Conversion

**Physical Description**

Colorless liquid (unless dyed red, orange, or blue) with a pleasant, sweet odor. [Note: Main usage is in anti-knock additives for gasoline.]

- MW: 323.5
- VP: 0.2 mmHg
- F.P: 200°F

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

## Incompatibilities & Reactivities

Strong oxidizers, sulfuryl chloride, rust, potassium permanganate [Note: Decomposes slowly at room temperature and more rapidly at higher temperatures.]

## Measurement Methods

- NIOSH 2533
- See: NMAM or OSHA Methods

## Personal Protection & Sanitation

- **Skin**: Prevent skin contact (>0.1%)
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated (>0.1%)
- **Remove**: When wet or contaminated (>0.1%)
- **Change**: Daily
- **Provide**: Quick drench (>0.1%)

## First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

**Up to 0.75 mg/m³:**
(APF = 10) Any supplied-air respirator

**Up to 1.875 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 3.75 mg/m³:**
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 40 mg/m³:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Insomnia, lassitude (weakness, exhaustion), anxiety; tremor, hyper-reflexia, spasticity; bradycardia, hypotension, hypothermia, pallor, nausea, anorexia, weight loss; confusion, hallucinations, psychosis, mania, convulsions, coma; eye irritation

**Target Organs** central nervous system, cardiovascular system, kidneys, eyes

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Tetrahydrofuran

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₄H₈O</td>
<td>109-99-9</td>
<td>LU5950000</td>
<td>2056 127</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Diethylene oxide
- 1,4-Epoxybutane
- Tetramethylene oxide
- THF

### Exposure Limits
- NIOSH REL: TWA 200 ppm (590 mg/m³) ST 250 ppm (735 mg/m³)
- OSHA PEL†: TWA 200 ppm (590 mg/m³)

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 ppm [10%LEL]</td>
<td>1 ppm = 2.95 mg/m³</td>
</tr>
</tbody>
</table>

### Physical Description
- Colorless liquid with an ether-like odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>72.1</td>
</tr>
<tr>
<td>BP</td>
<td>151°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-163°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Miscible</td>
</tr>
<tr>
<td>VP</td>
<td>132 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>9.45 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.89</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>6°F</td>
</tr>
<tr>
<td>UEL</td>
<td>11.8%</td>
</tr>
<tr>
<td>LEL</td>
<td>2%</td>
</tr>
</tbody>
</table>

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Strong oxidizers, lithium-aluminum alloys
- [Note: Peroxides may accumulate upon prolonged storage in presence of air.]

### Measurement Methods
- NIOSH 1609, 3800; OSHA 7
- See NMAM or OSHA Methods

### Personal Protection & Sanitation
- (See protection)
  - Skin: Prevent skin contact
  - Eyes: Prevent eye contact
  - Wash skin: When contaminated
  - Remove: When wet (flammable)
  - Change: No recommendation

### First Aid
- (See procedures)
  - Eye: Irrigate immediately
  - Skin: Water flush promptly
  - Breathing: Respiratory support
  - Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations** NIOSH/OSHA

**Up to 2000 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

| Exposure Routes | Inhalation, ingestion, skin and/or eye contact |
| Symptons        | Irritation eyes, upper respiratory system; nausea, dizziness, headache, central nervous system depression |
| Target Organs   | Eyes, respiratory system, central nervous system |

See also: [INTRODUCTION](#)
### Tetramethyl lead (as Pb)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-74-1</td>
<td>TP4725000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Lead tetramethyl
- Tetramethylplumbane
- TML

**Exposure Limits**
- NIOSH REL: TWA 0.075 mg/m³ [skin]
- OSHA PEL: TWA 0.075 mg/m³ [skin]
- IDLH 40 mg/m³ (as Pb)

**Physical Description**
- Colorless liquid (unless dyed red, orange, or blue) with a fruity odor. [Note: Main usage is in anti-knock additives for gasoline.]
- MW: 267.3
- BP: 212°F (Decomposes)
- FRZ: -15°F
- Sol: 0.002%
- VP: 23 mmHg
- IP: 8.50 eV
- Sp.Gr: 2.00
- Fl.P: 100°F
- UEL: ?
- LEL: ?

**Incompatibilities & Reactivities**
- Strong oxidizers such as sulfuryl chloride or potassium permanganate

**Measurement Methods**
- NIOSH 2534
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: Prevent skin contact (>0.1%)
- Eyes: Prevent eye contact
- Wash skin: When contaminated (>0.1%)
- Remove: When wet or contaminated (>0.1%)
- Change: Daily
- Provide: Quick drench (>0.1%)

**First Aid**
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 0.75 mg/m³:
(APF = 10) Any supplied-air respirator

Up to 1.875 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 3.75 mg/m³:
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 40 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Insomnia, bad dreams, restlessness, anxious; hypotension; nausea, anorexia; delirium, mania, convulsions; coma

Target Organs central nervous system, cardiovascular system, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Tetramethyl succinonitrile

*(CH₃)₂C(CN)C(CN)(CH₃)₂*

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3333-52-6</td>
<td>WN4025000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Tetramethyl succinodinitrile, TMSN

### Exposure Limits
- **NIOSH REL**: TWA 3 mg/m³ (0.5 ppm) [skin]
- **OSHA PEL**: TWA 3 mg/m³ (0.5 ppm) [skin]

### IDLH
- 5 ppm

### Conversion
- 1 ppm = 5.57 mg/m³

### Physical Description
- Colorless, odorless solid. [Note: Forms cyanide in the body.]
- **MW**: 136.2
- **BP**: Sublimes
- **MLT**: 338°F (Sublimes)
- **Sol**: Insoluble
- **VP**: ?
- **IP**: ?
- **Sp.Gr**: 1.07
- **UEL**: ?
- **LEL**: ?

### Combustible Solid

### Incompatibilities & Reactivities
- Strong oxidizers

### Measurement Methods
- NIOSH S155 (II-3) ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

### Respirator Recommendations
- **NIOSH/OSHA**
- **Up to 28 mg/m³**:
  - (APF = 10) Any supplied-air respirator
  - (APF = 50) Any self-contained breathing apparatus with a full facepiece
- **Emergency or planned entry into unknown concentrations or IDLH conditions**:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
- **Escape**:
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Headache, nausea; convulsions, coma; liver, kidney, gastrointestinal effects</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Central nervous system, liver, kidneys, gastrointestinal tract</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
**Tetranitromethane**

<table>
<thead>
<tr>
<th>CAS</th>
<th>509-14-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>PB4025000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1510 143</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Tetan, TNM

**Exposure Limits**
- NIOSH REL: TWA 1 ppm (8 mg/m³)
- OSHA PEL: TWA 1 ppm (8 mg/m³)
- IDLH 4 ppm

**Conversion**
1 ppm = 8.02 mg/m³

**Physical Description**
Colorless to pale-yellow liquid or solid (below 57°F) with a pungent odor.

<table>
<thead>
<tr>
<th>MW: 196.0</th>
<th>BP: 259°F</th>
<th>FRZ: 57°F</th>
<th>Sol: Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 8 mmHg</td>
<td>IP: ?</td>
<td>Sp.Gr: 1.62</td>
<td></td>
</tr>
</tbody>
</table>

**Combustible Liquid, but difficult to ignite.**

**Incompatibilities & Reactivities**
- Hydrocarbons, alkalis, metals, oxidizers, aluminum, toluene, cotton [Note: Combustible material wet with tetranitromethane may be highly explosive.]

**Measurement Methods**
- NIOSH 3513
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: Daily
- Provide: Eyewash

**First Aid**
(See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH/OSHA</strong></td>
</tr>
<tr>
<td><strong>Up to 4 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode£</td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern£</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern£</td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern£</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern£</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
</tbody>
</table>

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

| (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode |
| (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus |

**Escape:**

| (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern£ |
| Any appropriate escape-type, self-contained breathing apparatus |

| **Exposure Routes** inhalation, ingestion, skin and/or eye contact |
| **Symptoms** irritation eyes, skin, nose, throat; dizziness, headache; chest pain, dyspnea (breathing difficulty); methemoglobinemia, cyanosis; skin burns |
| **Target Organs** eyes, skin, respiratory system, blood, central nervous system |

See also: [INTRODUCTION](#)
# Tetrasodium pyrophosphate

**CAS:** 7722-88-5  
**RTECS:** UX7350000

### Synonyms & Trade Names

Pyrophosphate, Sodium pyrophosphate, Tetrasodium diphosphate, Tetrasodium pyrophosphate (anhydrous), TSPP

### Exposure Limits

- NIOSH REL: TWA 5 mg/m³
- OSHA PEL†: none
- IDLH N.D.

### Physical Description

Odorless, white powder or granules. [Note: The decahydrate (Na₄P₂O₇ • 10H₂O) is in the form of colorless, transparent crystals.]

- **MW:** 265.9  
- **BP:** Decomposes  
- **MLT:** 1810°F  
- **Sol(77°F):** 7%  
- **VP:** 0 mmHg (approx)  
- **IP:** NA  
- **Sp.Gr:** 2.45  
- **Fl.P:** NA  
- **UEL:** NA  
- **LEL:** NA

### Incompatibilities & Reactivities

Noncombustible Solid  
Strong acids

### Measurement Methods

- NIOSH 0500  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated  
**Remove:** When wet or contaminated  
**Change:** Daily  
**Provide:** Eyewash (solution)

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Water wash promptly  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations:** Not available.

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, nose, throat; dermatitis

### Target Organs

Eyes, skin, respiratory system

See also: **INTRODUCTION**
## NIOSH Pocket Guide to Chemical Hazards

### Tetryl

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>479-45-8</td>
<td>BY6300000</td>
<td></td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- N-Methyl-N,2,4,6-tetranitroaniline; Nitramine; 2,4,6-Tetryl; 2,4,6-Trinitrophenyl-N-methylnitramine

#### Exposure Limits
- NIOSH REL: TWA 1.5 mg/m³ [skin]
- OSHA PEL: TWA 1.5 mg/m³ [skin]
- IDLH: 750 mg/m³

#### Physical Description
- Colorless to yellow, odorless, crystalline solid.
- MW: 287.2
- BP: 356-374°F (Explodes)
- MLT: 268°F
- Sol: 0.02%
- VP: <1 mmHg
- IP: ?
- Fl.P: Explodes
- UEL: ?
- Sp.Gr: 1.57
- LEL: ?

#### Incompatibilities & Reactivities
- Oxidizable materials, hydrazine

#### Measurement Methods
- NIOSH S225 (II-3)
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily

#### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
## Important additional information about respirator selection

**Respirator Recommendations NIOSH/OSHA**

### Up to 7.5 mg/m³:
*(APF = 5)* Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

### Up to 15 mg/m³:
*(APF = 10)* Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*

*(APF = 10)* Any supplied-air respirator*

### Up to 37.5 mg/m³:
*(APF = 25)* Any supplied-air respirator operated in a continuous-flow mode*

*(APF = 25)* Any powered air-purifying respirator with a high-efficiency particulate filter.*

### Up to 75 mg/m³:
*(APF = 50)* Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

*(APF = 50)* Any self-contained breathing apparatus with a full facepiece

*(APF = 50)* Any supplied-air respirator with a full facepiece

### Up to 750 mg/m³:
*(APF = 2000)* Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
*(APF = 10,000)* Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

*(APF = 10,000)* Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
*(APF = 50)* Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

## Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms
- Sensitization dermatitis, itch, erythema (skin redness); edema on nasal folds, cheeks, neck; keratitis (inflammation of the cornea); sneezing; anemia; cough, coryza; irritability; malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion), insomnia; nausea, vomiting; liver, kidney damage

## Target Organs
- Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Thallium (soluble compounds, as Tl)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1707 151 (compounds, n.o. s.)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Synonyms vary depending upon the specific soluble thallium compound.

### Exposure Limits

<table>
<thead>
<tr>
<th></th>
<th>NIOSH REL: TWA 0.1 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: TWA 0.1 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

IDLH 15 mg/m³ (as Tl)

### Physical Description

Appearance and odor vary depending upon the specific soluble thallium compound. Properties vary depending upon the specific soluble thallium compound.

### Incompatibilities & Reactivities

Varies

### Measurement Methods

NIOSH 7300, 7301, 7303, 9102; OSHA ID121

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Water flush promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

**Up to 0.5 mg/m³:**
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 1 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

**Up to 2.5 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 5 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 15 mg/m³:**
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs

**Target Organs** Eyes, respiratory system, central nervous system, liver, kidneys, gastrointestinal tract, body hair

See also: [INTRODUCTION](#)
### 4,4'-Thiobis(6-tert-butyl-m-cresol)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>96-69-5</td>
<td>GP31500000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- 4,4'-Thiobis(3-methyl-6-tert-butylphenol)
- 1,1'-Thiobis(2-methyl-4-hydroxy-5-tert-butylbenzene)

#### Exposure Limits
- NIOSH REL: TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)
- OSHA PEL†: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)

#### Physical Description
- Light-gray to tan powder with a slightly aromatic odor.
- MW: 358.6
- BP: ?
- MLT: 302°F
- Sol: 0.08%
- VP: 0.0000006 mmHg
- IP: ?
- Sp.Gr: 1.10
- Fl.P: 420°F
- UEL: NA
- LEL: NA

#### Incompatibilities & Reactivities
- None reported

#### Measurement Methods
- NIOSH 0500 ; 0600
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

#### First Aid
- Eye: Irrigate immediately
- Breathing: Fresh air
- Swallow: Medical attention immediately

#### Important additional information about respirator selection
- Respirator Recommendations: Not available.

#### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

#### Symptoms
- Irritation eyes, skin, respiratory system

#### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
### Thioglycolic acid

**Chemical Name:** HSCH$_2$COOH  
**CAS Number:** 68-11-1  
**RTECS Number:** AI5950000

### Synonyms & Trade Names
- Acetyl mercaptan
- Mercaptoacetate
- Mercaptoacetic acid
- 2-Mercaptoacetic acid
- 2-Thioglycolic acid
- Thiovanic acid

### DOT ID & Guide
- DOT ID: 1940 153

### Exposure Limits
- **NIOSH REL:** TWA 1 ppm (4 mg/m$^3$) [skin]
- **OSHA PEL†:** none

### Physical Description
- Colorless liquid with a strong, disagreeable odor characteristic of mercaptans. [Note: Olfactory fatigue may occur after short exposures.]

### MW: 92.1  
**BP:** ?  
**FRZ:** 2°F  
**Sol:** Miscible

### VP(64°F): 10 mmHg  
**IP:** ?  
**Sp.Gr:** 1.32

### Fl.P: >230°F  
**UEL:** ?  
**LEL:** 5.9%

### Class III B Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities
- Air, strong oxidizers, bases, active metals (e.g., sodium potassium, magnesium, calcium) [Note: Readily oxidized by air.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact  
**Eyes:** Prevent eye contact  
**Wash skin:** When contaminated  
**Remove:** When wet or contaminated  
**Change:** No recommendation  
**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately  
**Skin:** Water flush immediately  
**Breathing:** Respiratory support  
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; lacrimation (discharge of tears), corneal damage; skin burns, blisters; in animals: lassitude (weakness, exhaustion); gasping respirations; convulsions

**Target Organs** Eyes, skin, respiratory system

See also: **INTRODUCTION**
<table>
<thead>
<tr>
<th><strong>Thionyl chloride</strong></th>
<th><strong>CAS</strong> 7719-09-7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOCl₂</strong></td>
<td><strong>RTECS</strong> XM5150000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Sulfinyl chloride, Sulfur chloride oxide, Sulfurous dichloride, Sulfurous oxychloride, Thionyl dichloride

**DOT ID & Guide**
1836 137

**Exposure Limits**
- NIOSH REL: C 1 ppm (5 mg/m³)
- OSHA PEL†: none

**IDLH** N.D.

**Conversion**
1 ppm = 4.87 mg/m³

**Physical Description**
Colorless to yellow to reddish liquid with a pungent odor like sulfur dioxide. [Note: Fumes form when exposed to moist air.]

**MW**: 119.0  
**BP**: 169°F  
**FRZ**: -156°F  
**Sol**: Reacts

**VP(70°F)**: 100 mmHg  
**IP**: ?  
**Sp.Gr**: 1.64

**Noncombustible Liquid**

**Incompatibilities & Reactivities**
Water, acids, alkalis, ammonia, chloryl perchlorate [Note: Reacts violently with water to form sulfur dioxide & hydrogen chloride.]

**Measurement Methods**
None available
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash, Quick drench

**First Aid** *(See procedures)*
- **Eye**: Irrigate immediately
- **Skin**: Water flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

**Important additional information about respirator selection**
**Respirator Recommendations** Not available.

**Exposure Routes**
inhalation, ingestion, skin and/or eye contact

**Symptoms**
Irritation eyes, skin, mucous membrane; eye, skin burns

**Target Organs**
Eyes, skin, respiratory system

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Thiram

<table>
<thead>
<tr>
<th>CAS 137-26-8</th>
<th>RTECS JO1400000</th>
</tr>
</thead>
</table>

### Chemical Formula

$C_6H_{12}N_2S_4$

### Synonyms & Trade Names

bis(Dimethylthiocarbamoyl) disulfide, Tetramethylthiuram disulfide

### DOT ID & Guide

2771 151

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 5 mg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL: TWA 5 mg/m$^3$</td>
</tr>
</tbody>
</table>

### IDLH

100 mg/m$^3$

### Conversion

[Note: Commercial pesticide products may be dyed blue.]

### Physical Description

Colorless to yellow, crystalline solid with a characteristic odor. 

- **MW:** 240.4
- **BP:** Decomposes
- **MLT:** 312°F
- **Sol:** 0.003%
- **VP:** 0.000008 mmHg
- **IP:** ?
- **Sp.Gr:** 1.29
- **Combustible Solid**
- **UEL:** ?
- **LEL:** ?

### Incompatibilities & Reactivities

Strong oxidizers, strong acids, oxidizable materials

## Measurement Methods

NIOSH 5005

See: NMAM or OSHA Methods

## Personal Protection & Sanitation *(See protection)*

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** Daily

## First Aid *(See procedures)*

- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 50 mg/m³:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 100 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 25) Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; dermatitis; Antabuse-like effects

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
| Tin | CAS 7440-31-5 |
| Sn | RTECS XP7320000 |

**Synonyms & Trade Names**
Metallic tin, Tin flake, Tin metal, Tin powder

**DOT ID & Guide**

**Exposure Limits**

| NIOSH REL* | TWA 2 mg/m³ [*Note: The REL also applies to other inorganic tin compounds (as Sn) except tin oxides.] |
| OSHA PEL* | TWA 2 mg/m³ [*Note: The PEL also applies to other inorganic tin compounds (as Sn) except tin oxides.] |

**IDLH** 100 mg/m³ (as Sn)

**Physical Description**
Gray to almost silver-white, ductile, malleable, lustrous solid.

| MW: 118.7 | BP: 4545°F | MLT: 449°F | Sol: Insoluble |
| VP: 0 mmHg (approx) | IP: NA | | Sp.Gr: 7.28 |
| Fl.P: NA | UEL: NA | LEL: NA |

Noncombustible Solid, but powdered form may ignite.

**Incompatibilities & Reactivities**
Chlorine, turpentine, acids, alkalis

**Measurement Methods**
NIOSH 7300, 7301, 7303; OSHA ID121, ID206
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
Skin: No recommendation
Eyes: No recommendation
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

**First Aid** *(See procedures)*
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations</strong> NIOSH/OSHA</td>
</tr>
<tr>
<td><strong>Up to 10 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 5) Any quarter-mask respirator. <a href="#">Click here</a> for information on selection of N, R, or P filters.*</td>
</tr>
<tr>
<td><strong>Up to 20 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. <a href="#">Click here</a> for information on selection of N, R, or P filters.*</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator*</td>
</tr>
<tr>
<td><strong>Up to 50 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
</tr>
<tr>
<td>(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*</td>
</tr>
<tr>
<td><strong>Up to 100 mg/m³:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong> inhalation, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong> Irritation eyes, skin, respiratory system; in animals: vomiting, diarrhea, paralysis with muscle twitching</td>
</tr>
<tr>
<td><strong>Target Organs</strong> Eyes, skin, respiratory system</td>
</tr>
<tr>
<td>See also: <a href="#">INTRODUCTION</a></td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## Tin (organic compounds, as Sn)

### CAS

### RTECS

### DOT ID & Guide

### Synonyms & Trade Names

Synonyms vary depending upon the specific organic tin compound. [Note: Also see specific listing for Cyhexatin.]

### Exposure Limits

- NIOSH REL*: TWA 0.1 mg/m³ [skin] [*Note: The REL applies to all organic tin compounds except Cyhexatin.]
- OSHA PEL*: TWA 0.1 mg/m³ [*Note: The PEL applies to all organic tin compounds.]

IDLH 25 mg/m³ (as Sn)

### Conversion

### Physical Description

Appearance and odor vary depending upon the specific organic tin compound.

Properties vary depending upon the specific organic tin compound.

### Incompatibilities & Reactivities

Varies

### Measurement Methods

NIOSH 5504
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- Recommendations regarding personal protective clothing vary depending upon the specific compound.
- Recommendations regarding eye protection vary depending upon the specific compound.
- Recommendations regarding washing the skin vary depending upon the specific compound.
- Recommendations regarding the removal of personal protective clothing that becomes wet or contaminated vary depending upon the specific compound.
- Recommendations regarding the daily changing of personal protective clothing vary depending upon the specific compound.
- Recommendations regarding the need for eyewash or quick drench facilities vary depending upon the specific compound.

### First Aid (See procedures )

- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 1 mg/m³:**
- (APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
- (APF = 10) Any supplied-air respirator

**Up to 2.5 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 5 mg/m³:**
- (APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter
- (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 25 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here

**Exposure Routes** Inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; headache, dizziness; psycho-neurologic disturbance; sore throat, cough; abdominal pain, vomiting; urine retention; paresis, focal anesthesia; skin burns, pruritus; in animals: hemolysis; hepatic necrosis; kidney damage

**Target Organs** Eyes, skin, respiratory system, central nervous system, liver, kidneys, urinary tract, blood

See also: INTRODUCTION
## Tin(II) oxide (as Sn)

<table>
<thead>
<tr>
<th>CAS 21651-19-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS XQ3700000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Stannous oxide, Tin protoxide [Note: Also see specific listing for Tin(IV) oxide (as Sn).]

### Exposure Limits
- **NIOSH REL**: TWA 2 mg/m³
- **OSHA PEL†**: none

**IDLH**: N.D.

### Physical Description
Brownish-black powder.

**MW**: 134.7
**BP**: Decomposes
**MLT (600 mmHg)**: 1976°F (Decomposes)
**Sol**: Insoluble
**VP**: 0 mmHg (approx)
**IP**: NA
**Sp.Gr**: 6.3
**UEL**: NA
**LEL**: NA

### Incompatibilities & Reactivities
None reported

### Measurement Methods
- NIOSH 7300, 7301, 7303
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: No recommendation
- **Eyes**: No recommendation
- **Wash skin**: No recommendation
- **Remove**: No recommendation
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Breathing**: Fresh air

### Exposure Routes
Inhalation, skin and/or eye contact

### Symptoms
Stannosis (benign pneumoconiosis): dyspnea (breathing difficulty), decreased pulmonary function

### Target Organs
Respiratory system

See also: **INTRODUCTION**
### Tin(IV) oxide (as Sn)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>18282-10-5</td>
</tr>
<tr>
<td>RTECS</td>
<td>XQ4000000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Stannic dioxide, Stannic oxide, White tin oxide [Note: Also see specific listing for Tin(II) oxide (as Sn).]

**Exposure Limits**
- NIOSH REL: TWA 2 mg/m³
- OSHA PEL†: none
- IDLH: N.D.

**Physical Description**
White or slightly gray powder.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>150.7</td>
</tr>
<tr>
<td>BP</td>
<td>Decomposes</td>
</tr>
<tr>
<td>MLT</td>
<td>2966°F ( Decomposes)</td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP</td>
<td>0 mmHg ( approx)</td>
</tr>
<tr>
<td>IP</td>
<td>NA</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>NA</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Incompatibilities & Reactivities**
- Chlorine trifluoride

**Measurement Methods**
- NIOSH 7300, 7301, 7303
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

**First Aid**
- Eye: Irrigate immediately
- Breathing: Fresh air

**Important additional information about respirator selection**
**Respirator Recommendations**
Not available.

**Exposure Routes**
inhalation, skin and/or eye contact

**Symptoms**
Stannosis (benign pneumoconiosis): dyspnea (breathing difficulty), decreased pulmonary function

**Target Organs**
respiratory system

See also: INTRODUCTION
Titanium dioxide

<table>
<thead>
<tr>
<th>CAS</th>
<th>13463-67-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>XR2275000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Rutile, Titanium oxide, Titanium peroxide

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: Ca</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA</td>
<td>15 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca [5000 mg/m³]</th>
<th>Conversion</th>
</tr>
</thead>
</table>

**Physical Description**
White, odorless powder.

| MW: 79.9 | BP: 4532-5432°F | MLT: 3326-3362°F | Sol: Insoluble |
| VP: 0 mmHg (approx) | IP: NA | Sp.Gr: 4.26 |
| Fl.P: NA | UEL: NA | LEL: NA |

Noncombustible Solid

**Incompatibilities & Reactivities**
None reported

**Measurement Methods**
NIOSH S385 (II-3)
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection )

| Skin: No recommendation |
| Eyes: No recommendation |
| Wash skin: No recommendation |
| Remove: No recommendation |
| Change: Daily |

**First Aid** (See procedures )

| Breathing: Respiratory support |

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation

**Symptoms** Lung fibrosis; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>respiratory system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: lung tumors]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
o-Tolidine  
C₁₄H₁₆N₂  

Synonyms & Trade Names  
4,4'-Diamino-3,3'-dimethylbiphenyl; Diaminoditolyl; 3,3'-Dimethylbenzidine; 3,3'-Dimethyl-4,4'-diphenyldiamine; 3,3'-Tolidine

Exposure Limits  
NIOSH REL: Ca C 0.02 mg/m³ [60-minute] [skin] See Appendix A See Appendix C  
OSHA PEL: See Appendix C

Physical Description  
White to reddish crystals or powder. [Note: Darkens on exposure to air. Often used in paste or wet cake form. Used as a basis for many dyes.]

MW: 212.3  
BP: 572°F  
MLT: 264°F  
Sol: 0.1%

Combustible Solid

Incompatibilities & Reactivities  
Strong oxidizers

Measurement Methods  
NIOSH 5013 ; OSHA 71  
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection )  
Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated/Daily  
Remove: When wet or contaminated  
Change: Daily  
Provide: Eyewash, Quick drench

First Aid (See procedures )  
Eye: Irrigate immediately  
Skin: Soap flush immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately

Important additional information about respirator selection

Respirator Recommendations NIOSH  
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus  
Escape:  
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, nose; in animals: liver, kidney damage; [potential occupational carcinogen]</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, respiratory system, liver, kidneys</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[in animals: liver, bladder &amp; mammary gland tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Toluene

<table>
<thead>
<tr>
<th>CAS</th>
<th>108-88-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>XS5250000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
Methyl benzene, Methyl benzo, Phenyl methane, Toluol

**DOT ID & Guide**
1294 130

### Exposure Limits

| NIOSH REL: TWA 100 ppm (375 mg/m³) ST 150 ppm (560 mg/m³) |
| OSHA PEL†: TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak) |
| IDLH | 500 ppm |

**Conversion** 1 ppm = 3.77 mg/m³

### Physical Description
Colorless liquid with a sweet, pungent, benzene-like odor.

| MW: 92.1 | BP: 232°F | FRZ: -139°F | Sol(74°F): 0.07% |
| VP: 21 mmHg | IP: 8.82 eV | Sp.Gr: 0.87 |
| Fl.P: 40°F | UEL: 7.1% | LEL: 1.1% |

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
Strong oxidizers

### Measurement Methods
NIOSH 1500, 1501, 3800, 4000; OSHA 111
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 500 ppm:**

- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage

**Target Organs** Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Toluenediamine

| CAS          | 25376-45-8  
|--------------|--------------
|              | 95-80-7 (2,4-TDA)  
| RTECS        | XS9445000  
|              | XS9625000 (2,4-TDA)  

### Synonyms & Trade Names

- Diaminotoluene, Methylphenylene diamine, TDA, Toluenediamine isomers, Tolylenediamine [Note: Various isomers of TDA exist.]

### DOT ID & Guide

- 1709 151 (2,4-Toluenediamine)

### Exposure Limits

| NIOSH REL | Ca (all isomers) | See Appendix A  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>none</td>
</tr>
</tbody>
</table>

### IDLH

- Ca [N.D.]

### Conversion

|                  |  
|------------------|---
| MW: 122.2        |  
| BP: 558°F        |  
| MLT: 210°F       |  
| Sp.Gr: 1.05 (Liquid at 212°F) |  
| VP (224°F): 1 mmHg |  
| IP: ?            |  
| UEL: ?           |  
| LEL: ?           |  

### Physical Description

- Colorless to brown, needle-shaped crystals or powder. [Note: Tends to darken on storage & exposure to air. Properties given are for 2,4-TDA.]

### Measurement Methods

- NIOSH 5516 ; OSHA 65
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated/Daily

**Remove:** When wet or contaminated

**Change:** Daily

**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately

**Skin:** Water flush immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Irritation eyes, skin, nose, throat; dermatitis; ataxia, tachycardia, nausea, vomiting, convulsions, respiratory depression; methemoglobinemia, cyanosis, headache, lassitude (weakness, exhaustion), dizziness, bluish skin; liver injury; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, blood, cardiovascular system, liver</td>
</tr>
<tr>
<td>Cancer Site</td>
<td>[in animals: liver, skin &amp; mammary gland tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
## NIOSH Pocket Guide to Chemical Hazards

### Toluene-2,4-diisocyanate

<table>
<thead>
<tr>
<th>CAS</th>
<th>584-84-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>CZ6300000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names

- TDI; 2,4-TDI; 2,4-Toluene diisocyanate

#### DOT ID & Guide

- 2078 156

#### Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Ca [2.5 ppm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>C 0.02 ppm (0.14 mg/m³)</td>
</tr>
</tbody>
</table>

**Conversion** 1 ppm = 7.13 mg/m³

#### Physical Description

- Colorless to pale-yellow solid or liquid (above 71°F) with a sharp, pungent odor.

<table>
<thead>
<tr>
<th>MW</th>
<th>174.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>484°F</td>
</tr>
<tr>
<td>MLT</td>
<td>71°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP(77°F)</td>
<td>0.01 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>?</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>1.22</td>
</tr>
<tr>
<td>Fl.P</td>
<td>260°F</td>
</tr>
<tr>
<td>UEL</td>
<td>9.5%</td>
</tr>
<tr>
<td>LEL</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

#### Incompatibilities & Reactivities

- Strong oxidizers, water, acids, bases & amines (may cause foam & spatter); alcohols [Note: Reacts slowly with water to form carbon dioxide and polyureas.]

#### Measurement Methods

NIOSH 2535, 5521, 5522, 5525; OSHA 18, 33, 42

See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash, Quick drench

#### First Aid (See procedures)

- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations** NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact
### Symptoms
Irritation eyes, skin, nose, throat; choke, paroxysmal cough; chest pain, retrosternal (occurring behind the sternum) soreness; nausea, vomiting, abdominal pain; bronchitis, bronchospasm, pulmonary edema; dyspnea (breathing difficulty), asthma; conjunctivitis, lacrimation (discharge of tears); dermatitis, skin sensitization; [potential occupational carcinogen]

### Target Organs
Eyes, skin, respiratory system

### Cancer Site
[in animals: pancreas, liver, mammary gland, circulatory system & skin tumors]

See also: INTRODUCTION
### m-Toluidine

**Chemical Formula:** CH₃C₆H₄NH₂  
**CAS Number:** 108-44-1  
**RTECS Number:** XU2800000

#### Synonyms & Trade Names
- 3-Amino-1-methylbenzene
- 1-Aminophenylmethane
- m-Aminotoluene
- 3-Methylaniline
- 3-Methylbenzenamine
- 3-Toluidine
- m-Tolylamine

#### DOT ID & Guide
- DOT ID: 1708 153

#### Exposure Limits
- **NIOSH REL:** See Appendix D
- **OSHA PEL†:** none
- **IDLH:** N.D.

#### Physical Description
Colorless to light-yellow liquid with an aromatic, amine-like odor. [Note: Used as a basis for many dyes.]

- **MW:** 107.2
- **BP:** 397°F
- **FRZ:** -23°F
- **Sol:** 2%
- **VP(106°F):** 1 mmHg
- **IP:** 7.50 eV
- **Sp.Gr:** 0.999
- **FL.P:** 187°F
- **UEL:** ?
- **LEL:** ?

#### Class IIIA Combustible Liquid: FL.P. at or above 140°F and below 200°F.

#### Incompatibilities & Reactivities
- Oxidizers, acids

#### Measurement Methods
- NIOSH 2002
- OSHA 73
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

#### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap wash immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

#### Important additional information about respirator selection
- **Respirator Recommendations:** Not available.

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
- Irritation eyes, skin; dermatitis; hematuria (blood in the urine); methemoglobinemia; cyanosis, nausea, vomiting, low blood pressure, convulsions; anemia, lassitude (weakness, exhaustion)

#### Target Organs
- Eyes, skin, blood, cardiovascular system

See also: INTRODUCTION
### o-Toluidine

<table>
<thead>
<tr>
<th>CAS</th>
<th>95-53-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>XU2975000</td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
- o-Aminotoluene
- 2-Aminotoluene
- 1-Methyl-2-aminobenzene
- o-Methylaniline
- 2-Methylaniline
- ortho-Toluidine
- o-Tolylamine

#### DOT ID & Guide
- 1708 153

#### Exposure Limits
- NIOSH REL: Ca [skin] See Appendix A
- OSHA PEL: TWA 5 ppm (22 mg/m³) [skin]
- IDLH Ca [50 ppm]

#### Conversion
- 1 ppm = 4.38 mg/m³

#### Physical Description
Colorless to pale-yellow liquid with an aromatic, aniline-like odor.

| MW: 107.2 | BP: 392°F | FRZ: 6°F | Sol: 2% |
| VP: 0.3 mmHg | IP: 7.44 eV | Sp.Gr: 1.01 |
| Fl.P: 185°F | UEL: ? | LEL: ? |

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

#### Incompatibilities & Reactivities
- Strong oxidizers, nitric acid, bases

#### Measurement Methods
- NIOSH 2002, 2017, 8317; OSHA 73
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

#### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

- **Escape:**
  - (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes; anoxia, headache, cyanosis; lassitude (weakness, exhaustion), dizziness, drowsiness; microhematuria (blood in the urine); eye burns; dermatitis; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, blood, kidneys, liver, cardiovascular system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[bladder cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
**NIOSH Pocket Guide to Chemical Hazards**

### p-Toluidine

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>106-49-0</td>
<td>XU31500000</td>
<td>1708 153</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- 4-Aminotoluene
- 4-Methylaniline
- 4-Methylbenzenamine
- 4-Toluidine
- p-Tolylamine

**Exposure Limits**

- NIOSH REL: Ca See Appendix A
- OSHA PEL†: none
- IDLH Ca [N.D.]

**Physical Description**
White solid with an aromatic odor. [Note: Used as a basis for many dyes.]

| MW: 107.2  | BP: 393°F  | MLT: 111°F | Sol: 0.7% |
| VP(108°F): 1 mmHg | IP: 7.50 eV |  |  |
| FI.P. 188°F | UEL: ? | LEL: ? |  |

**Combustible Solid**

**Incompatibilities & Reactivities**
- Oxidizers, acids

**Measurement Methods**
- NIOSH 2002 ; OSHA 73
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation**

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated/Daily |
| Remove: When wet or contaminated |
| Change: Daily |
| Provide: Eyewash, Quick drench |

**First Aid**

| Eye: Irrigate immediately |
| Skin: Soap wash immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

- At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**

| (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters. | Any appropriate escape-type, self-contained breathing apparatus |

**Exposure Routes**
- Inhalation, skin absorption, ingestion, skin and/or eye contact
| **Symptoms** | Irritation eyes, skin; dermatitis; hematuria (blood in the urine); methemoglobinemia; cyanosis, nausea, vomiting, low blood pressure, convulsions; anemia, lassitude (weakness, exhaustion); [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, blood, cardiovascular system |
| **Cancer Site** | [in animals: liver tumors] |

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Tributyl phosphate

**CAS** 126-73-8  
**RTECS** TC7700000

### Synonyms & Trade Names
- Butyl phosphate, TBP, Tributyl ester of phosphoric acid, Tri-n-butyl phosphate

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 0.2 ppm (2.5 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: TWA 5 mg/m³</td>
</tr>
</tbody>
</table>

| IDLH            | 30 ppm                             |
| Conversion      | 1 ppm = 10.89 mg/m³                |

### Physical Description
- Colorless to pale-yellow, odorless liquid.

- MW: 266.3  
- BP: 552°F (Decomposes)  
- FRZ: -112°F  
- Sol: 0.6%  
- VP(77°F): 0.004 mmHg  
- IP: ?  
- Sp.Gr: 0.98  
- Fl.P(oc): 295°F  
- UEL: ?  
- LEL: ?

**Class IIIB Combustible Liquid:** Fl.P. at or above 200°F.

### Incompatibilities & Reactivities
- Alkalis, oxidizers, water, moist air

### Measurement Methods
- NIOSH 5034  
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet or contaminated  
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately  
- **Skin:** Soap wash promptly  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH

**Up to 2 ppm:**
- (APF = 10) Any supplied-air respirator

**Up to 5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode

**Up to 10 ppm:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 30 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

---

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system, headache; nausea

### Target Organs
- Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
Trichloroacetic acid

**CAS** 76-03-9

**RTECS** AJ7875000

**Synonyms & Trade Names**
TCA, Trichloroethanoic acid

**DOT ID & Guide**
1839 153 (solid)
2564 153 (solution)

**Exposure Limits**

- **NIOSH REL**: TWA 1 ppm (7 mg/m³)
- **OSHA PEL†**: none

**Conversion** 1 ppm = 6.68 mg/m³

**Physical Description**
Colorless to white, crystalline solid with a sharp, pungent odor.

| MW: 163.4 | BP: 388°F | MLT: 136°F | Sol: Miscible |
| VP(124°F): 1 mmHg | IP: ? | Sp.Gr: 1.62 |
| Fi.P: NA | UEL: NA | LEL: NA |

**Noncombustible Solid**

**Incompatibilities & Reactivities**
Moisture, iron, zinc, aluminum, strong oxidizers [Note: Decomposes on heating to form phosgene & hydrogen chloride. Corrosive to metals.]

**Measurement Methods**
OSHA PV2017

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection )

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: Daily
- **Provide**: Eyewash, Quick drench

**First Aid** (See procedures )

- **Eye**: Irrigate immediately
- **Skin**: Water flush immediately
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat, respiratory system; cough, dyspnea (breathing difficulty), delayed pulmonary edema; eye, skin burns; dermatitis; salivation, vomiting, diarrhea

**Target Organs** Eyes, skin, respiratory system, gastrointestinal tract

See also: INTRODUCTION
1,2,4-Trichlorobenzene  

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>120-82-1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td>DC2100000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**  
unsym-Trichlorobenzene; 1,2,4-Trichlorobenzol

**DOT ID & Guide**  
2321 153 (liquid)

<table>
<thead>
<tr>
<th><strong>Exposure Limits</strong></th>
<th><strong>Conversion</strong> 1 ppm = 7.42 mg/m³</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>NIOSH REL</strong></th>
<th>C 5 ppm (40 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>none</td>
</tr>
</tbody>
</table>

**Physical Description**  
Colorless liquid or crystalline solid (below 63°F) with an aromatic odor.

<table>
<thead>
<tr>
<th><strong>MW:</strong> 181.4</th>
<th><strong>BP:</strong> 416°F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VP:</strong> 1 mmHg</td>
<td><strong>FRZ:</strong> 63°F</td>
</tr>
<tr>
<td><strong>Fl.P:</strong> 222°F</td>
<td><strong>Sol:</strong> 0.003%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>UEL(302°F): 6.6%</strong></th>
<th><strong>LEL(302°F): 2.5%</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Incompatibilities &amp; Reactivities</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acids, acid fumes, oxidizers, steam</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Measurement Methods</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH 5517</td>
</tr>
</tbody>
</table>

**Personal Protection & Sanitation**  
(See protection )

| **Skin:** Prevent skin contact |
| **Eyes:** Prevent eye contact |
| **Wash skin:** When contaminated |
| **Remove:** When wet or contaminated |
| **Change:** No recommendation |

**First Aid**  
(See procedures )

| **Eye:** Irrigate immediately |
| **Skin:** Soap wash |
| **Breathing:** Respiratory support |
| **Swallow:** Medical attention immediately |

**Important additional information about respirator selection**

**Respirator Recommendations**  
Not available.

<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation, skin absorption, ingestion, skin and/or eye contact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritation eyes, skin, mucous membrane; in animals: liver, kidney damage; possible teratogenic effects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes, skin, respiratory system, liver, reproductive system</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### 1,1,2-Trichloroethane

**CAS** 79-00-5  
**RTECS** KJ3150000

#### Synonyms & Trade Names
Ethane trichloride, beta-Trichloroethane, Vinyl trichloride

#### Exposure Limits
- **NIOSH REL**: Ca TWA 10 ppm (45 mg/m³) [skin] See Appendix A See Appendix C (Chloroethanes)
- **OSHA PEL**: TWA 10 ppm (45 mg/m³) [skin]

#### IDLH
Ca [100 ppm]

#### Conversion
1 ppm = 5.46 mg/m³

#### Physical Description
Colorless liquid with a sweet, chloroform-like odor.

- **MW**: 133.4  
- **BP**: 237°F  
- **FRZ**: -34°F  
- **Sol**: 0.4%
- **VP**: 19 mmHg  
- **IP**: 11.00 eV  
- **Sp.Gr**: 1.44
- **UEL**: 15.5%  
- **LEL**: 6%

Combustible Liquid, forms dense soot.

#### Incompatibilities & Reactivities
Strong oxidizers & caustics; chemically-active metals (such as aluminum, magnesium powders, sodium & potassium)

#### Measurement Methods
- NIOSH 1003; OSHA 11
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation
- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated
- **Remove**: When wet or contaminated
- **Change**: No recommendation
- **Provide**: Eyewash, Quick drench

#### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately

#### Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
Irritation eyes, nose; central nervous system depression; liver, kidney damage; dermatitis; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, respiratory system, central nervous system, liver, kidneys</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
### Trichloroethylene

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>79-01-6</td>
</tr>
<tr>
<td>RTECS</td>
<td>KX4550000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Ethylene trichloride, TCE, Trichloroethene, Trilene</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1710 160</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: Ca</td>
<td>See Appendix A See Appendix C</td>
</tr>
<tr>
<td>OSHA PEL†:</td>
<td>TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)</td>
</tr>
<tr>
<td>IDLH Ca [1000 ppm]</td>
<td>Conversion 1 ppm = 5.37 mg/m³</td>
</tr>
</tbody>
</table>

#### Physical Description

Colorless liquid (unless dyed blue) with a chloroform-like odor.

- MW: 131.4
- BP: 189°F
- FRZ: -99°F
- Sol(77°F): 0.1%
- Sp.Gr: 1.46
- VP: 58 mmHg
- IP: 9.45 eV
- Fl.P: ?
- UEL(77°F): 10.5%
- LEL(77°F): 8%

#### Incompatibilities & Reactivities

Combustible Liquid, but burns with difficulty.

Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

#### Measurement Methods

- NIOSH 1022, 3800; OSHA 1001
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

#### First Aid

Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

#### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes

- Inhalation
- Skin absorption
- Ingestion
- Skin and/or eye contact

#### Symptoms

Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver &amp; kidney cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Trichloronaphthalene

<table>
<thead>
<tr>
<th>CAS</th>
<th>1321-65-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>QK4025000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Halowax®, Nibren wax, Seekay wax</td>
</tr>
</tbody>
</table>

### Exposure Limits

- NIOSH REL: TWA 5 mg/m³ [skin]
- OSHA PEL: TWA 5 mg/m³ [skin]

### IDLH

- Unknown

### Physical Description

- Colorless to pale-yellow solid with an aromatic odor.
- MW: 231.5
- BP: 579-669°F
- MLT: 199°F
- Sol: Insoluble
- VP: <1 mmHg
- IP: ?
- Sp.Gr: 1.58
- Fl.P(oc): 392°F
- UEL: ?
- LEL: ?

### Incompatibilities & Reactivities

- Combustible Solid
- Strong oxidizers

### Measurement Methods

- NIOSH S128 (II-2)
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated
**Remove:** When wet or contaminated
**Change:** Daily

### First Aid

**Eye:** Irrigate immediately
**Skin:** Soap wash
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

### Respirator Recommendations

**Up to 50 mg/m³:**
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>Inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Anorexia, nausea; dizziness; jaundice, liver injury</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Liver</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## 1,2,3-Trichloropropane

<table>
<thead>
<tr>
<th><strong>Chemical Formula</strong></th>
<th><strong>CAS</strong></th>
<th><strong>RTECS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂CICHCICH₂Cl</td>
<td>96-18-4</td>
<td>TZ9275000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Allyl trichloride
- Glycerol trichlorohydrin
- Glyceryl trichlorohydrin
- Trichlorohydrin

### Exposure Limits

<table>
<thead>
<tr>
<th><strong>NIOSH REL</strong></th>
<th>Ca TWA 10 ppm (60 mg/m³) [skin] See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>TWA 50 ppm (300 mg/m³)</td>
</tr>
</tbody>
</table>

**IDLH Ca [100 ppm]**

**Conversion** 1 ppm = 6.03 mg/m³

### Physical Description
- Colorless liquid with a chloroform-like odor.
- MW: 147.4
- BP: 314°F
- FRZ: 6°F
- Sol: 0.1%
- VP: 3 mmHg
- IP: ?
- Sp.Gr: 1.39
- Fl.P: 160°F
- UEL(302°F): 12.6%
- LEL(248°F): 3.2%

Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.

### Incompatibilities & Reactivities
- Chemically-active metals, strong caustics & oxidizers

### Measurement Methods
- NIOSH 1003 ; OSHA 7
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
(See procedures )
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
  - (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  - (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, nose, throat; central nervous system depression; in animals: liver, kidney injury; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system, central nervous system, liver, kidneys</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: forestomach, liver &amp; mammary gland cancer]</td>
</tr>
<tr>
<td>See also:</td>
<td>INTRODUCTION</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## 1,1,2-Trichloro-1,2,2-trifluoroethane

**CAS** 76-13-1  
**RTECS** KJ4000000

### Synonyms & Trade Names
- Chlorofluorocarbon-113, CFC-113, Freon® 113, Genetron® 113, Halocarbon 113, Refrigerant 113, TTE

### Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA</td>
<td>1000 ppm (7600 mg/m³)</td>
</tr>
<tr>
<td>ST</td>
<td>1250 ppm (9500 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>1000 ppm (7600 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>2000 ppm</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 7.67 mg/m³

### Physical Description

- Colorless to water-white liquid with an odor like carbon tetrachloride at high concentrations. [Note: A gas above 118°F.]
- MW: 187.4  
- BP: 118°F  
- FRZ: -31°F  
- Sol(77°F): 0.02%  
- VP: 285 mmHg  
- IP: 11.99 eV  
- Sp.Gr(77°F): 1.56

### Incompatibilities & Reactivities

Chemically-active metals such as calcium, powdered aluminum, zinc, magnesium & beryllium [Note: Decomposes if in contact with alloys containing >2% magnesium.]

### Measurement Methods

- NIOSH 1020 ; OSHA 113
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- Skin: Prevent skin contact  
- Eyes: Prevent eye contact  
- Wash skin: When contaminated  
- Remove: When wet or contaminated  
- Change: No recommendation

### First Aid

- Eye: Irrigate immediately  
- Skin: Soap wash promptly  
- Breathing: Respiratory support  
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 2000 ppm:**
- (APF = 10) Any supplied-air respirator
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation skin, throat, drowsiness, dermatitis; central nervous system depression; in animals: cardiac arrhythmias, narcosis

**Target Organs** Skin, heart, central nervous system, cardiovascular system

See also: INTRODUCTION
## Triethylamine

**Synonyms & Trade Names**

- TEA

**CAS**

- 121-44-8

**RTECS**

- YE0175000

**DOT ID & Guide**

- 1296 132

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix D</th>
</tr>
</thead>
</table>

| OSHA PEL†: | TWA 25 ppm (100 mg/m³) |

**IDLH** 200 ppm

**Conversion** 1 ppm = 4.14 mg/m³

### Physical Description

- Colorless liquid with a strong, ammonia-like odor.
- MW: 101.2
- BP: 193°F
- FRZ: -175°F
- Sol: 2%
- VP: 54 mmHg
- IP: 7.50 eV
- Sp.Gr: 0.73
- Fl.P: 20°F
- UEL: 8.0%
- LEL: 1.2%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

- Strong oxidizers, strong acids, chlorine, hypochlorite, halogenated compounds

### Measurement Methods

- NIOSH S152 (II-3) ; OSHA PV2060
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin**: Prevent skin contact

**Eyes**: Prevent eye contact

**Wash skin**: When contaminated

**Remove**: When wet (flammable)

**Change**: No recommendation

**Provide**: Eyewash (>1%), Quick drench (>1%)

### First Aid

**Eye**: Irrigate immediately

**Skin**: Soap wash immediately

**Breathing**: Respiratory support

**Swallow**: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations**

<table>
<thead>
<tr>
<th>OSHA</th>
</tr>
</thead>
</table>

**Up to 200 ppm:**

- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th>Exposure Routes</th>
<th>inhalation, skin absorption, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>Irritation eyes, skin, respiratory system; in animals: myocardial, kidney, liver damage</td>
</tr>
<tr>
<td>Target Organs</td>
<td>Eyes, skin, respiratory system, cardiovascular system, liver, kidneys</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Trifluorobromomethane

<table>
<thead>
<tr>
<th>CAS</th>
<th>75-63-8</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Bromotrifluoromethane, Fluorocarbon 1301, Freon® 13B1, Halocarbon 13B1, Halon® 1301, Monobromotrifluoromethane, Refrigerant 13B1, Trifluoromonobromomethane

### DOT ID & Guide
1009 126

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 1000 ppm (6100 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL: TWA 1000 ppm (6100 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>40,000 ppm</td>
</tr>
</tbody>
</table>

### Physical Description
Colorless, odorless gas. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>MW</th>
<th>148.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>-72°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-267°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.03%</td>
</tr>
<tr>
<td>VP</td>
<td>&gt;1 atm</td>
</tr>
<tr>
<td>IP</td>
<td>11.78 eV</td>
</tr>
<tr>
<td>UEL</td>
<td>NA</td>
</tr>
<tr>
<td>LEL</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Nonflammable Gas

### Incompatibilities & Reactivities
Chemically-active metals (such as calcium, powdered aluminum, zinc & magnesium)

### Measurement Methods
NIOSH 1017
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin</th>
<th>Frostbite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>Frostbite</td>
</tr>
<tr>
<td>Wash skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Remove</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Change</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Provide</td>
<td>Frostbite wash</td>
</tr>
</tbody>
</table>

### First Aid

<table>
<thead>
<tr>
<th>Eye</th>
<th>Frostbite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Frostbite</td>
</tr>
<tr>
<td>Breathing</td>
<td>Respiratory support</td>
</tr>
</tbody>
</table>

Conversion: 1 ppm = 6.09 mg/m³
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 10,000 ppm:
(APF = 10) Any supplied-air respirator

Up to 25,000 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 40,000 ppm:
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin and/or eye contact (liquid)

Symptoms Dizziness; cardiac arrhythmias; liquid: frostbite

Target Organs central nervous system, heart

See also: INTRODUCTION
### Trimellitic anhydride

**CAS** 552-30-7  
**RTECS** DC2050000

**Synonyms & Trade Names**  
1,2,4-Benzenetricarboxylic anhydride; 4-Carboxyphthalic anhydride; TMA; TMAN; Trimellic acid anhydride [Note: TMA is also a synonym for Trimethylamine.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.005 ppm (0.04 mg/m³)</th>
<th>Should be handled in the workplace as an extremely toxic substance.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
<td></td>
</tr>
</tbody>
</table>

**IDLH** N.D.  

**Conversion** 1 ppm = 7.86 mg/m³

**Physical Description**  
Colorless solid.

| VP: 0.000004 mmHg | IP: ? | Sp.Gr: ? |
| Fi.P: NA | UEL: NA | LEL: NA |

**Combustible Solid**

**Incompatibilities & Reactivities**  
None reported

**Measurement Methods**  
NIOSH 5036 ; OSHA 98  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation**  
(See protection)

- **Skin:** Prevent skin contact  
- **Eyes:** Prevent eye contact  
- **Wash skin:** When contaminated  
- **Remove:** When wet or contaminated  
- **Change:** Daily

**First Aid**  
(See procedures)

- **Eye:** Irrigate immediately  
- **Skin:** Soap wash  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately

**Important additional information about respirator selection**  
**Respirator Recommendations** Not available.

**Exposure Routes**  
inhalation, ingestion, skin and/or eye contact

**Symptoms**  
Irritation eyes, skin, nose, respiratory system; pulmonary edema, respiratory sensitization; rhinitis, asthma, cough, wheezing, dyspnea (breathing difficulty), malaise (vague feeling of discomfort), fever, muscle aches, sneezing

**Target Organs**  
Eyes, skin, respiratory system

See also: INTRODUCTION
## Trimethylamine

**CAS** 75-50-3  
**RTECS** PA0350000

### Synonyms & Trade Names
- N,N-Dimethylmethanamine; TMA  
  [Note: May be used in an aqueous solution (typically 25%, 30%, or 40% TMA.)]

### DOT ID & Guide
- 1083 118 (anhydrous)  
- 1297 132 (aqueous solution)

### Exposure Limits
- **NIOSH REL:** TWA 10 ppm (24 mg/m³)  
  ST 15 ppm (36 mg/m³)  
- **OSHA PEL†:** none

### IDLH
N.D.

### Conversion
1 ppm = 2.42 mg/m³

### Physical Description
Colorless gas with a fishy, amine odor.  
[Note: A liquid below 37°F. Shipped as a liquefied compressed gas.]

### MW: 59.1  
**BP:** 37°F  
**FRZ:** -179°F  
**Sol**(86°F): 48%

### VP(70°F): 1454 mmHg  
**IP:** 7.82 eV  
**RGasD:** 2.09

### Flammable Gas

### Incompatibilities & Reactivities
- Strong oxidizers (including bromine), ethylene oxide, nitrosating agents (e.g., sodium nitrite), mercury, strong acids  
  [Note: Corrosive to many metals (e.g., zinc, brass, aluminum, copper).]

### Measurement Methods
OSHA PV2060  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
- **Skin:** Prevent skin contact (liquid/solution)/Frostbite  
- **Eyes:** Prevent eye contact (liquid/solution)/Frostbite  
- **Wash skin:** When contaminated (solution)  
- **Remove:** When wet (flammable)  
- **Change:** No recommendation  
- **Provide:** Eyewash (liquid/solution), Quick drench (liquid/solution), Frostbite wash

### First Aid (See procedures )
- **Eye:** Irrigate immediately (liquid/solution)/Frostbite  
- **Skin:** Water flush immediately (liquid/solution)/Frostbite  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately (solution)

### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, ingestion (solution), skin and/or eye contact

### Symptoms
Irritation eyes, skin, nose, throat, respiratory system; cough, dyspnea (breathing difficulty), delayed pulmonary edema; blurred vision, corneal necrosis; skin burns; liquid: frostbite

### Target Organs
Eyes, skin, respiratory system

See also: **INTRODUCTION**
# 1,2,3-Trimethylbenzene

<table>
<thead>
<tr>
<th>CAS</th>
<th>526-73-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>DC33000000</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names

Hemellitol [Note: hemimellitene is a mixture of the 1,2,3-isomer with up to 10% of related aromatics such as the 1,2,4-isomer.]

## Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 25 ppm (125 mg/m³)</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDLH N.D.</td>
<td>Conversion 1 ppm = 4.92 mg/m³</td>
</tr>
</tbody>
</table>

## Physical Description

Clear, colorless liquid with a distinctive, aromatic odor.

<table>
<thead>
<tr>
<th>MW: 120.2</th>
<th>BP: 349°F</th>
<th>FRZ: -14°F</th>
<th>Sol: Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP(62°F): 1 mmHg</td>
<td>IP: 8.48 eV</td>
<td>Sp.Gr: 0.89</td>
<td></td>
</tr>
<tr>
<td>Fl.P: ?</td>
<td>UEL: 6.6%</td>
<td>LEL: 0.8%</td>
<td></td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities

Oxidizers, nitric acid

## Measurement Methods

OSHA PV2091
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

### Skin

- Prevent skin contact
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

### Eyes

- Prevent eye contact

### First Aid

- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately

## Important additional information about respirator selection

### Respirator Recommendations

Not available.

## Exposure Routes

Inhalation, ingestion, skin and/or eye contact

## Symptoms

Irritation eyes, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)

## Target Organs

Eyes, skin, respiratory system, central nervous system, blood

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 1,2,4-Trimethylbenzene

<table>
<thead>
<tr>
<th>CAS</th>
<th>95-63-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>DC3325000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Asymmetrical trimethylbenzene, psi-Cumene, Pseudocumene [Note: hemimellitene is a mixture of the 1,2,3-isomer with up to 10% of related aromatics such as the 1,2,4-isomer.]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 25 ppm (125 mg/m³)</th>
</tr>
</thead>
</table>

| OSHA PEL†          | none                    |

| IDLH N.D.          | Conversion 1 ppm = 4.92 mg/m³ |

### Physical Description
Clear, colorless liquid with a distinctive, aromatic odor.

<table>
<thead>
<tr>
<th>MW: 120.2</th>
<th>BP: 337°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRZ: -77°F</td>
<td>Sol: 0.006%</td>
</tr>
<tr>
<td>IP: 8.27 eV</td>
<td>Sp.Gr: 0.88</td>
</tr>
<tr>
<td>UEL: 6.4%</td>
<td>LEL: 0.9%</td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
Oxidizers, nitric acid

### Measurement Methods
OSHA PV2091
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
**Skin**: Prevent skin contact
**Eyes**: Prevent eye contact
**Wash skin**: When contaminated
**Remove**: When wet or contaminated
**Change**: No recommendation

### First Aid
**Eye**: Irrigate immediately
**Skin**: Soap wash
**Breathing**: Respiratory support
**Swallow**: Medical attention immediately

### Important additional information about respirator selection
**Respirator Recommendations**: Not available.

### Exposure Routes
Inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, fatigue, dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)

### Target Organs
Eyes, skin, respiratory system, central nervous system, blood

See also: **INTRODUCTION**
<table>
<thead>
<tr>
<th><strong>1,3,5-Trimethylbenzene</strong></th>
<th><strong>CAS</strong> 108-67-8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C₆H₃(CH₃)₃</strong></td>
<td><strong>RTECS</strong> OX6825000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong> 2325 129</td>
</tr>
<tr>
<td>Mesitylene, Symmetrical trimethylbenzene, sym-Trimethylbenzene</td>
<td></td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th><strong>NIOSH REL</strong></th>
<th>TWA 25 ppm (125 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OSHA PEL†</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>IDLH</strong></td>
<td>N.D.</td>
</tr>
</tbody>
</table>

### Conversion

1 ppm = 4.92 mg/m³

### Physical Description

Clear, colorless liquid with a distinctive, aromatic odor.

| **MW** | 120.2 |
| **BP** | 329°F |
| **FRZ** | -49°F |
| **Sol** | 0.002% |
| **VP** | 2 mmHg |
| **IP** | 8.39 eV |
| **Sp.Gr** | 0.86 |
| **Fl.P** | 122°F |
| **UEL** | ? |
| **LEL** | ? |

Class II Flammable Liquid

### Incompatibilities & Reactivities

Oxidizers, nitric acid

### Measurement Methods

OSHA PV2091

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

### First Aid

(See procedures)

Eye: Irritate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations** Not available.

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)

### Target Organs

Eyes, skin, respiratory system, central nervous system, blood

See also: INTRODUCTION
### Trimethyl phosphite

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>Conversion</th>
<th>1 ppm = 5.08 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL: TWA 2 ppm (10 mg/m³)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSHA PEL†: none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IDLH N.D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical Description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colorless liquid with a distinctive, pungent odor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VP(77°F): 24 mmHg</td>
<td>IP: ?</td>
<td></td>
</tr>
<tr>
<td>Fl.P: 82°F</td>
<td>UEL: ?</td>
<td>LEL: ?</td>
</tr>
<tr>
<td>Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Incompatibilities & Reactivities
Magnesium perchlorate, water [Note: Reacts (hydrolyzes) with water.]

### Measurement Methods
None available
See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
**Respirator Recommendations** Not available.

### Exposure Routes
inhalation, ingestion, skin and/or eye contact

### Symptoms
Irritation eyes, skin, upper respiratory system; dermatitis; in animals: teratogenic effects

### Target Organs
Eyes, skin, respiratory system, reproductive system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 2,4,6-Trinitrotoluene

<table>
<thead>
<tr>
<th>CAS</th>
<th>118-96-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>XU0175000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>1-Methyl-2,4,6-trinitrobenzene; TNT; Trinitrotoluene; sym-Trinitrotoluene; Trinitrotoluel</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1356 113 (wet)</td>
</tr>
</tbody>
</table>

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 0.5 mg/m³ [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 1.5 mg/m³ [skin]</td>
</tr>
</tbody>
</table>

### IDLH

500 mg/m³

### Physical Description

Colorless to pale-yellow, odorless solid or crushed flakes.

<table>
<thead>
<tr>
<th>MW: 227.1</th>
<th>BP: 464°F (Explodes)</th>
<th>MLT: 176°F</th>
<th>Sol(77°F): 0.01%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP: 0.0002 mmHg</td>
<td>IP: 10.59 eV</td>
<td>Sp.Gr: 1.65</td>
<td></td>
</tr>
<tr>
<td>Fl.P: ? (Explodes)</td>
<td>UEL: ?</td>
<td>LEL: ?</td>
<td></td>
</tr>
</tbody>
</table>

Combustible Solid (Class A Explosive)

### Incompatibilities & Reactivities

Strong oxidizers, ammonia, strong alkalis, combustible materials, heat [Note: Rapid heating will result in detonation.]

### Measurement Methods

OSHA 44
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- **Skin**: Prevent skin contact
- **Eyes**: Prevent eye contact
- **Wash skin**: When contaminated/Daily
- **Remove**: When wet or contaminated
- **Change**: Daily

### First Aid

(See procedures)

- **Eye**: Irrigate immediately
- **Skin**: Soap wash promptly
- **Breathing**: Respiratory support
- **Swallow**: Medical attention immediately
## Respirator Recommendations NIOSH

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Respirator Type</th>
<th>APF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 5 mg/m³</td>
<td>(APF = 10) Any supplied-air respirator*</td>
<td></td>
</tr>
<tr>
<td>Up to 12.5 mg/m³</td>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*</td>
<td></td>
</tr>
<tr>
<td>Up to 25 mg/m³</td>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
<td></td>
</tr>
<tr>
<td>Up to 50 mg/m³</td>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
<td></td>
</tr>
<tr>
<td>Up to 500 mg/m³</td>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
<td></td>
</tr>
</tbody>
</table>

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. [Click here](#)

## Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

## Symptoms
- Irritation skin, mucous membrane; liver damage, jaundice; cyanosis; sneezing; cough, sore throat; peripheral neuropathy, muscle pain; kidney damage; cataract; sensitization dermatitis; leukocytosis (increased blood leukocytes); anemia; cardiac irregularities

## Target Organs
- Eyes, skin, respiratory system, blood, liver, cardiovascular system, central nervous system, kidneys

See also: [INTRODUCTION](#)
**Triorthocresyl phosphate**

(\(\text{CH}_3\text{C}_6\text{H}_{40}\))_3\text{PO}

**CAS** 78-30-8

**RTECS** TD0350000

**Synonyms & Trade Names**
TCP, TOCP, Tri-o-cresyl ester of phosphoric acid, Tri-o-cresyl phosphate

**DOT ID & Guide**
2574 151

**Exposure Limits**
- NIOSH REL: TWA 0.1 mg/m\(^3\) [skin]
- OSHA PEL\(\dagger\): TWA 0.1 mg/m\(^3\)
- IDLH 40 mg/m\(^3\)

**Conversion**

**Physical Description**
- Colorless to pale-yellow, odorless liquid or solid (below 52°F).
- MW: 368.4
- BP: 770°F (Decomposes)
- FRZ: 52°F
- Sol: Slight
- VP(77°F): 0.00002 mmHg
- IP: ?
- Sp.Gr: 1.20
- Fl.P: 437°F
- UEL: ?
- LEL: ?

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

**Incompatibilities & Reactivities**
- Oxidizers

**Measurement Methods**
- NIOSH 5037
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- Skin: Prevent skin contact
- Eyes: No recommendation
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: No recommendation

**First Aid** *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap wash immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

**Respirator Recommendations** NIOSH/OSHA

**Up to 0.5 mg/m³:**
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

**Up to 1 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

**Up to 2.5 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 5 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 40 mg/m³:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Gastrointestinal disturbance; peripheral neuropathy; cramps in calves, paresthesia in feet or hands; weak feet, wrist drop, paralysis

**Target Organs** peripheral nervous system, central nervous system

See also: INTRODUCTION
# Triphenylamine

<table>
<thead>
<tr>
<th>Physical Description</th>
<th>Colorless solid.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW: 245.3</td>
<td>BP: 689°F</td>
</tr>
<tr>
<td>VP: ?</td>
<td>IP: 7.60 eV</td>
</tr>
<tr>
<td>Fl.P: ?</td>
<td>UEL: ?</td>
</tr>
<tr>
<td>Sol: Insoluble</td>
<td>Sp.Gr: 0.77</td>
</tr>
</tbody>
</table>

## Exposure Limits

| NIOSH REL: TWA 5 mg/m³ | OSHA PEL†: none |

## Incompatibilities & Reactivities

None reported

## Measurement Methods

None available
See: NMAM or OSHA Methods

## Personal Protection & Sanitation

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: Daily          |
| Remove: No recommendation |
| Change: Daily             |

## First Aid

| Eye: Irrigate immediately |
| Skin: Soap wash           |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

## Important additional information about respirator selection

Respirator Recommendations Not available.

## Exposure Routes

inhalation, ingestion, skin and/or eye contact

## Symptoms

In animals: irritation skin

## Target Organs

Skin

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

**Triphenyl phosphate**

(C$_6$H$_5$O)$_3$PO  
RTECS TC8400000

**Synonyms & Trade Names**  
Phenyl phosphate, TPP, Triphenyl ester of phosphoric acid

**DOT ID & Guide**

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>TWA 3 mg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL</td>
<td>TWA 3 mg/m$^3$</td>
</tr>
</tbody>
</table>

**IDLH** 1000 mg/m$^3$

**Conversion**

| MW: 326.3 | BP: 776°F |
| VP(380°F): 1 mmHg | IP: ? |
| Fl.P: 428°F | UEL: ? |

**Physical Description**

Colorless, crystalline powder with a phenol-like odor.

**Combustible Solid**

**Incompatibilities & Reactivities**

None reported

**Measurement Methods**

NIOSH 5038  
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

**First Aid** *(See procedures)*

- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 15 mg/m³:**
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 30 mg/m³:**
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

**Up to 75 mg/m³:**
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

**Up to 150 mg/m³:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 1000 mg/m³:**
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

**Exposure Routes** inhalation, ingestion

**Symptoms** Minor changes in blood enzymes; in animals: muscle weakness, paralysis

**Target Organs** Blood, peripheral nervous system

See also: INTRODUCTION
## Tungsten

**CAS** 7440-33-7

**RTECS** YO7175000

**DOT ID & Guide**

### Synonyms & Trade Names
Tungsten metal, Wolfram

### Exposure Limits

| NIOSH REL* | TWA 5 mg/m³ ST 10 mg/m³ | *Note: The REL also applies to other insoluble tungsten compounds (as W). |
| OSHA PEL† | none |

**IDLH** N.D.

### Conversion

### Physical Description
Hard, brittle, steel-gray to tin-white solid.

- **MW**: 183.9
- **BP**: 10,701°F
- **MLT**: 6170°F
- **Sol**: Insoluble
- **IP**: NA
- **Sp.Gr**: 19.3
- **Fl.P**: NA
- **UEL**: NA
- **LEL**: NA

Combustible in the form of finely divided powder; may ignite spontaneously.

### Incompatibilities & Reactivities
Bromine trifluoride, chlorine trifluoride, fluorine, iodine pentafluoride

### Measurement Methods
NIOSH 7074, 7300, 7301; OSHA ID213

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin**: No recommendation
- **Eyes**: No recommendation
- **Wash skin**: No recommendation
- **Remove**: No recommendation
- **Change**: No recommendation

### First Aid

- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Fresh air
- **Swallow**: Medical attention immediately

### Respirator Recommendations

**NIOSH**

**Up to 50 mg/m³**: (APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. Click here for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

(APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions**: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**: (APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. Click here
**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; diffuse pulmonary fibrosis; loss of appetite, nausea, cough; blood changes

**Target Organs** Eyes, skin, respiratory system, blood

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Tungsten carbide (cemented)

<table>
<thead>
<tr>
<th></th>
<th>CAS 1: 11107-01-0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2: 12718-69-3</td>
</tr>
<tr>
<td></td>
<td>3: 37329-49-0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WC/Co/Ni/Ti</th>
<th>RTECS 1: YO7350000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2: YO7525000</td>
</tr>
<tr>
<td></td>
<td>3: YO7700000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
Cemented tungsten carbide, Cemented WC, Hard metal [Note: The tungsten carbide (WC) content is generally 85-95% & the cobalt content is generally 5-15%.] [1: 85% WC, 15% Co 2: 92% WC, 8% Co 3: 78% WC, 14% Co, 8% Ti]

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>See Appendix C</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†:</td>
<td>See Appendix C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description
A mixture of tungsten carbide, cobalt, and sometimes other metals & metal oxides or carbides.

Properties vary depending upon the specific mixture.

### Incompatibilities & Reactivities
Tungsten carbide: Fluorine, chlorine trifluoride, oxides of nitrogen, lead dioxide

### Measurement Methods
None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated/Daily (Ni)
Remove: When wet or contaminated
Change: Daily

### First Aid (See procedures )
Eye: Irrigate immediately
Skin: Soap wash
Breathing: Fresh air
Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH

**Up to 0.25 mg Co/m³:**  
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

**Up to 0.5 mg Co/m³:**  
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*

**Up to 1.25 mg Co/m³:**  
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*

**Up to 2.5 mg Co/m³:**  
(APF = 25) Any supplied-air respirator*  
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

**Up to 20 mg Co/m³:**  
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) NIOSH*  
(APF = 50) Any self-contained breathing apparatus with a full facepiece

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**  
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode  
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**  
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

*Note: Respirator for Tungsten carbide (cemented) containing Nickel.*

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; possible skin sensitization to cobalt, nickel; diffuse pulmonary fibrosis; loss of appetite, nausea, cough; blood changes

**Target Organs** Eyes, skin, respiratory system, blood

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Tungsten (soluble compounds, as W)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Synonyms vary depending upon the specific soluble tungsten compound.

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 1 mg/m³ ST 3 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH N.D.</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description

Appearance and odor vary depending upon the specific soluble tungsten compound.

Properties vary depending upon the specific soluble tungsten compound.

### Incompatibilities & Reactivities

Varies

### Measurement Methods

NIOSH 7074, 7300, 7301; OSHA ID213
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**See protection**

- Recommendations regarding personal protective clothing vary depending upon the specific compound.
- Recommendations regarding eye protection vary depending upon the specific compound.
- Recommendations regarding washing the skin vary depending upon the specific compound.
- Recommendations regarding the removal of personal protective clothing that becomes wet or contaminated vary depending upon the specific compound.
- Recommendations regarding the daily changing of personal protective clothing vary depending upon the specific compound.
- Recommendations regarding the need for eyewash or quick drench facilities vary depending upon the specific compound.

### First Aid

**See procedures**

- Eye: Irrigate immediately
- Skin: Water wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

**Up to 10 mg/m³:**
- \((\text{APF} = 10)\) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. Click here for information on selection of N, R, or P filters.
- \((\text{APF} = 10)\) Any supplied-air respirator

**Up to 25 mg/m³:**
- \((\text{APF} = 25)\) Any supplied-air respirator operated in a continuous-flow mode

**Up to 50 mg/m³:**
- \((\text{APF} = 50)\) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
- \((\text{APF} = 50)\) Any self-contained breathing apparatus with a full facepiece
- \((\text{APF} = 50)\) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- \((\text{APF} = 10,000)\) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- \((\text{APF} = 10,000)\) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- \((\text{APF} = 50)\) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

---

**Exposure Routes** Inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, respiratory system; in animals: central nervous system disturbances; diarrhea; respiratory failure; behavioral, body weight, blood changes

**Target Organs** Eyes, skin, respiratory system, central nervous system, gastrointestinal tract

See also: INTRODUCTION
## Turpentine

<table>
<thead>
<tr>
<th>CAS</th>
<th>8006-64-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>YO8400000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1299 128</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Gumspirits
- Gum turpentine
- Spirits of turpentine
- Steam distilled turpentine
- Sulfate wood turpentine
- Turps
- Wood turpentine

### Exposure Limits
- NIOSH REL: TWA 100 ppm (560 mg/m³)
- OSHA PEL: TWA 100 ppm (560 mg/m³)

### IDLH
800 ppm

### Conversion
1 ppm = 5.56 mg/m³ (approx)

### Physical Description
Colorless liquid with a characteristic odor.
- MW: 136 (approx)
- BP: 309-338°F
- FRZ: -58 to -76°F
- Sol: Insoluble
- VP: 4 mmHg
- IP: ?
- Sp.Gr: 0.86
- Fl.P: 95°F
- UEL: ?
- LEL: 0.8%

### Incompatibilities & Reactivities
Strong oxidizers, chlorine, chromic anhydride, stannic chloride, chromyl chloride

### Measurement Methods
- NIOSH 1551
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
(See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid
(See procedures)
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 800 ppm:**

(\(APF = 25\)) Any supplied-air respirator operated in a continuous-flow mode

(\(APF = 25\)) Any powered, air-purifying respirator with organic vapor cartridge(s)

(\(APF = 50\)) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)

(\(APF = 50\)) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

(\(APF = 50\)) Any self-contained breathing apparatus with a full facepiece

(\(APF = 50\)) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

(\(APF = 10,000\)) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(\(APF = 10,000\)) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(\(APF = 50\)) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; headache, dizziness, convulsions; skin sensitization; hematuria (blood in the urine), proteinuria; kidney damage; abdominal pain, nausea, vomiting, diarrhea; chemical pneumonitis (aspiration liquid)

**Target Organs** Eyes, skin, respiratory system, central nervous system, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## 1-Undecanethiol

<table>
<thead>
<tr>
<th>Chemical Information</th>
<th>CAS 5332-52-5</th>
<th>RTECS</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

- Undecyl mercaptan

### DOT ID & Guide

- DOT ID & Guide 1228 131

### Exposure Limits

- **NIOSH REL:** C 0.5 ppm (3.9 mg/m³) [15-minute]
- **OSHA PEL:** none
- **IDLH:** N.D.

### Conversion

- Conversion 1 ppm = 7.71 mg/m³

### Physical Description

- **Liquid.**
- **MW:** 188.4
- **BP:** 495°F
- **FRZ:** 27°F
- **Sol:** Insoluble
- **VP:** ?
- **IP:** ?
- **Sp.Gr:** 0.84
- **UEL:** ?
- **LEL:** ?

### Incompatibilities & Reactivities

- Oxidizers, reducing agents, strong acids & bases, alkali metals

### Measurement Methods

- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)

- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet (flammable)
- **Change:** No recommendation

### First Aid

(See procedures)

- **Eye:** Irrigate immediately
- **Skin:** Soap wash
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 5 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 12.5 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 25 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, respiratory system; confusion, dizziness, headache, drowsiness, nausea, vomiting, lassitude (weakness, exhaustion), convulsions

### Target Organs
- Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Uranium (insoluble compounds, as U)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>7440-61-1 (metal)</td>
</tr>
<tr>
<td>RTECS</td>
<td>YR3490000 (metal)</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2979 162 (metal, pyrophoric)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Uranium metal: Uranium I
- Synonyms of other insoluble uranium compounds vary depending upon the specific compound.

### Exposure Limits
- **NIOSH REL:** Ca TWA 0.2 mg/m³ ST 0.6 mg/m³ [See Appendix A](#)
- **OSHA PEL†:** TWA 0.25 mg/m³

### Physical Description
- **Metal:** Silver-white, malleable, ductile, lustrous solid. [Note: Weakly radioactive.]
- **MW:** 238.0
- **BP:** 6895°F
- **MLT:** 2097°F
- **Sol:** Insoluble
- **VP:** 0 mmHg (approx)
- **IP:** NA
- **USP:** NA
- **UEL:** NA
- **LEL:** NA
- **Sp.Gr:** 19.05 (metal)

### Incompatibilities & Reactivities
- Carbon dioxide, carbon tetrachloride, nitric acid, fluorine [Note: Complete coverage of uranium metal scrap with oil is essential for prevention of fire.]

### Measurement Methods
- None available
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated/Daily
- **Remove:** When wet or contaminated
- **Change:** Daily
- **Provide:** Eyewash

### First Aid (See procedures)
- **Eye:** Irrigate immediately
- **Skin:** Soap wash promptly
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- **(APF = 50)** Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Dermatitis; kidney damage; blood changes; [potential occupational carcinogen]; in animals: lung, lymph node damage [Potential for cancer is a result of alpha-emitting properties &amp; radioactive decay products (e.g., radon).]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Skin, kidneys, bone marrow, lymphatic system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Uranium (soluble compounds, as U)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
</table>

## Synonyms & Trade Names
Synonyms vary depending upon the specific soluble uranium compound.

## Exposure Limits
- **NIOSH REL**: Ca TWA 0.05 mg/m³ See Appendix A
- **OSHA PEL**: TWA 0.05 mg/m³

<table>
<thead>
<tr>
<th>IDLH Ca [10 mg/m³ (as U)]</th>
<th>Conversion</th>
</tr>
</thead>
</table>

## Physical Description
Appearance and odor vary depending upon the specific soluble uranium compound.

## Incompatibilities & Reactivities
- Uranyl nitrate: combustibles
- Uranium hexafluoride: water

## Measurement Methods
None available
See: NMAM or OSHA Methods

## Personal Protection & Sanitation (See protection )
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated/Daily
- Remove: When wet or contaminated
- Change: Daily
- Provide: Eyewash (UF6), Quick drench

## First Aid (See procedures )
- Eye: Irrigate immediately
- Skin: Water flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

## Important additional information about respirator selection

### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape(Halides):**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

**Escape(Non-halides):**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>inhalation, ingestion, skin and/or eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Lacrimation (discharge of tears), conjunctivitis; shortness breath, cough, chest rales; nausea, vomiting; skin burns; red blood cell, casts in urine; proteinuria; high blood urea nitrogen; [potential occupational carcinogen] [Potential for cancer is a result of alpha-emitting properties &amp; radioactive decay products (e.g., radon).]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>respiratory system, blood, liver, kidneys, lymphatic system, skin, bone marrow</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## n-Valeraldehyde

<table>
<thead>
<tr>
<th>CH₃(CH₂)₃CHO</th>
<th>RTECS YV3600000</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
- Amyl aldehyde
- Pentanal
- Valeral
- Valeraldehyde
- Valeric aldehyde

### DOT ID & Guide
- DOT ID & Guide: 2058 129

### Exposure Limits
- NIOSH REL: TWA 50 ppm (175 mg/m³) See Appendix C (Aldehydes)
- OSHA PEL†: none

### IDLH
- N.D.

### Physical Description
- Colorless liquid with a strong, acrid, pungent odor.
- MW: 86.2
- BP: 217°F
- FRZ: -133°F
- Sol: Slight
- VP: 26 mmHg
- IP: 9.82 eV
- Sp.Gr: 0.81
- Fl.P: 54°F
- UEL: ?
- LEL: ?

### Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- None reported

### Measurement Methods
- NIOSH 2018, 2536; OSHA 85
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid
- Eye: Irrigate immediately
- Skin: Soap flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection
- Respirator Recommendations: Not available.

### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat

### Target Organs
- Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Vanadium dust

<table>
<thead>
<tr>
<th>CAS</th>
<th>1314-62-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>YW24500000</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2862 151</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Divanadium pentoxide dust
- Vanadic anhydride dust
- Vanadium oxide dust
- Vanadium pentaoxide dust

Other synonyms vary depending upon the specific vanadium compound.

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL*</th>
<th>C 0.05 mg V/m³ [15-minute] [*Note: The REL applies to all vanadium compounds except Vanadium metal and Vanadium carbide (see Ferrovanadium dust).]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>C 0.5 mg V₂O₅/m³ (resp)</td>
</tr>
</tbody>
</table>

**IDLH** 35 mg/m³ (as V)

### Physical Description
- Yellow-orange powder or dark-gray, odorless flakes dispersed in air.

**MW:** 181.9  
**BP:** 3182°F (Decomposes)  
**MLT:** 1274°F  
**Sol:** 0.8%  
**VP:** 0 mmHg (approx)  
**IP:** NA  
**Sp.Gr:** 3.36  
**UEL:** NA  
**LEL:** NA

Noncombustible Solid, but may increase intensity of fire when in contact with combustible materials.

### Incompatibilities & Reactivities
- Lithium, chlorine trifluoride

### Measurement Methods
- NIOSH 7300, 7301, 7303, 7504, 9102; OSHA ID185
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation

### First Aid
- **Eye:** Irrigate immediately  
- **Skin:** Soap wash promptly  
- **Breathing:** Respiratory support  
- **Swallow:** Medical attention immediately
## Important additional information about respirator selection

### Respirator Recommendations NIOSH (as V)

**Up to 0.5 mg/m³:**
- (APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

**Up to 1.25 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter*

**Up to 2.5 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 35 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

### Emergency or planned entry into unknown concentrations or IDLH conditions:
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

### Escape:
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

### Exposure Routes
- inhalation, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, throat; green tongue, metallic taste, eczema; cough; fine rales, wheezing, bronchitis, dyspnea (breathing difficulty)

### Target Organs
- Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Vanadium fume

<table>
<thead>
<tr>
<th><strong>CAS</strong></th>
<th>1314-62-1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS</strong></td>
<td>YW2460000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

Divanadium pentoxide fume, Vanadic anhydride fume, Vanadium oxide fume, Vanadium pentaoxide fume

Other synonyms vary depending upon the specific vanadium compound.

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>C 0.05 mg V/m³ [15-minute]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†</td>
<td>C 0.1 mg V₂O₅/m³</td>
</tr>
</tbody>
</table>

**IDLH** 35 mg/m³ (as V)

### Physical Description

Finely divided particulate dispersed in air.

- **MW**: 181.9
- **BP**: 3182°F ( Decomposes )
- **MLT**: 1274°F
- **Sol**: 0.8%
- **VP**: 0 mmHg (approx)
- **IP**: NA
- **Fl.P**: NA
- **UEL**: NA
- **LEL**: NA

Noncombustible Solid

### Incompatibilities & Reactivities

Lithium, chlorine trifluoride

### Measurement Methods

NIOSH 7300, 7301, 7303, 7504; OSHA ID185

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection )

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

### First Aid (See procedures )

- **Breathing**: Respiratory support
### Important additional information about respirator selection

**Respirator Recommendations NIOSH (as V)**

**Up to 0.5 mg/m³:**
- (APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. [Click here](#) for information on selection of N, R, or P filters.*
- (APF = 10) Any supplied-air respirator*

**Up to 1.25 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter*

**Up to 2.5 mg/m³:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 35 mg/m³:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms** irritation eyes, throat; green tongue, metallic taste; cough, fine rales, wheezing, bronchitis, dyspnea (breathing difficulty); eczema

**Target Organs** eyes, skin, respiratory system

See also: [INTRODUCTION](#)
### Vegetable oil mist

**CAS** 68956-68-3  
**RTECS** YX1850000  
**DOT ID & Guide**

#### Synonyms & Trade Names

Vegetable mist

#### Exposure Limits

| NIOSH REL | TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp) |
| OSHA PEL | TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp) |

**IDLH** N.D.  
**Conversion**

#### Physical Description

An oil extracted from the seeds, fruit, or nuts of vegetables or other plant matter.

- **MW:** varies  
- **BP:** ?  
- **FRZ:** ?  
- **Sol:** Insoluble

- **VP:** ?  
- **IP:** ?  
- **Sp.Gr:** 0.91-0.95

- **Fl.P:** 323-540°F  
- **UEL:** ?  
- **LEL:** ?

#### Combustible Liquid

#### Incompatibilities & Reactivities

None reported

#### Measurement Methods

NIOSH: 0500, 0600  
See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

*(See protection)*

- **Skin:** No recommendation  
- **Eyes:** No recommendation  
- **Wash skin:** No recommendation  
- **Remove:** No recommendation  
- **Change:** No recommendation

#### First Aid

*(See procedures)*

- **Eye:** Irrigate immediately  
- **Breathing:** Fresh air

#### Important additional information about respirator selection

**Respirator Recommendations** Not available.

#### Exposure Routes

Inhalation, skin and/or eye contact

#### Symptoms

Irritation eyes, skin, respiratory system; lacrimation (discharge of tears)

#### Target Organs

Eyes, skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Vinyl acetate

**CAS** 108-05-4  
**RTECS** AK0875000

### Synonyms & Trade Names
- 1-Acetoxyethylene
- Ethenyl acetate
- Ethenyl ethanoate
- VAC (Vinyl acetate)
- Vinyl acetate monomer
- Vinyl ethanoate

### DOT ID & Guide
- 1301 129 P

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 4 ppm (15 mg/m³) [15-minute]</td>
<td>none</td>
</tr>
</tbody>
</table>

### IDLH
- N.D.

### Conversion
- 1 ppm = 3.52 mg/m³

### Physical Description
- Colorless liquid with a pleasant, fruity odor. [Note: Raw material for many polyvinyl resins.]
- MW: 86.1  
- BP: 162°F  
- FRZ: -136°F  
- Sol: 2%
- VP: 83 mmHg  
- IP: 9.19 eV  
- Sp.Gr: 0.93
- Fl.P: 18°F  
- UEL: 13.4%  
- LEL: 2.6%

**Class IB Flammable Liquid:** Fl.P. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities
- Acids, bases, silica gel, alumina, oxidizers, azo compounds, ozone [Note: Usually contains a stabilizer (e.g., hydroquinone or diphenylamine) to prevent polymerization.]

### Measurement Methods
- NIOSH 1453  
- OSHA 51

See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contaminated
- **Remove:** When wet or contaminated
- **Change:** No recommendation
- **Provide:** Eyewash, Quick drench

### First Aid
- **Eye:** Irrigate immediately
- **Skin:** Soap flush immediately
- **Breathing:** Respiratory support
- **Swallow:** Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**Up to 40 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*

**Up to 100 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

**Up to 200 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 4000 ppm:**
- (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode*

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, ingestion, skin and/or eye contact

#### Symptoms
- Irritation eyes, skin, nose, throat; hoarseness, cough; loss of smell; eye burns, skin blisters

#### Target Organs
- Eyes, skin, respiratory system

See also: [INTRODUCTION](#)
Vinyl bromide

CH₂=CHBr

Synonyms & Trade Names
Bromoethene, Bromoethylene, Monobromoethylene

CAS 593-60-2

RTECS KU8400000

DOT ID & Guide
1085 116 P (inhibited)

Exposure Limits

NIOSH REL: Ca See Appendix A
OSHA PEL†: none

IDLH Ca [N.D.]

Conversion 1 ppm = 4.38 mg/m³

Physical Description
Colorless gas or liquid (below 60°F) with a pleasant odor. [Note: Shipped as a liquefied compressed gas with 0.1% phenol added to prevent polymerization.]

MW: 107.0
BP: 60°F
FRZ: -219°F
Sol: Insoluble

VP: 1.4 atm
IP: 9.80 eV
RGasD: 3.79
Sp.Gr: 1.49 (Liquid at 60°F)

Incompatibilities & Reactivities
Strong oxidizers (e.g., perchlorates, peroxides, chlorates, permanganates & nitrates.) [Note: May polymerize in sunlight.]

Measurement Methods
NIOSH 1009; OSHA 8
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection)

Skin: Prevent skin contact (liquid)
Eyes: Prevent eye contact (liquid)
Wash skin: When contaminated (liquid)
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)

Eye: Irrigate immediately (liquid)
Skin: Water flush immediately (liquid)
Breathing: Respiratory support
Swallow: Medical attention immediately (liquid)

Important additional information about respirator selection
Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion (liquid), skin and/or eye contact
| **Symptoms** | Irritation eyes, skin; dizziness, confusion, incoordination, narcosis, nausea, vomiting; liquid: frostbite; [potential occupational carcinogen] |
| **Target Organs** | Eyes, skin, central nervous system, liver |
| **Cancer Site** | [in animals: liver & lymph node tumors] |

See also: **INTRODUCTION**
Vinyl chloride

<table>
<thead>
<tr>
<th>CAS 75-01-4</th>
</tr>
</thead>
</table>

**CH₂=CHCl**

**Synonyms & Trade Names**
Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)

**DOT ID & Guide**
1086 116 P (inhibited)

**Exposure Limits**

<table>
<thead>
<tr>
<th>NIOSH REL: Ca See Appendix A</th>
</tr>
</thead>
</table>

| OSHA PEL: [1910.1017] TWA 1 ppm C 5 ppm [15-minute] |

<table>
<thead>
<tr>
<th>IDLH Ca [N.D.]</th>
</tr>
</thead>
</table>

**Conversion**

1 ppm = 2.56 mg/m³

**Physical Description**
Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. [Note: Shipped as a liquefied compressed gas.]

| MW: 62.5 |
| BP: 7°F |
| FRZ: -256°F |
| Sol(77°F): 0.1% |

| VP: 3.3 atm |
| IP: 9.99 eV |
| RGasD: 2.21 |

| Fl.P: NA (Gas) |
| UEL: 33.0% |
| LEL: 3.6% |

**Incompatibilities & Reactivities**
Copper, oxidizers, aluminum, peroxides, iron, steel [Note: Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]

**Measurement Methods**
NIOSH 1007 ; OSHA 4 , 75
See: NMAM or OSHA Methods

**Personal Protection & Sanitation** (See protection)

Skin: Frostbite
Eyes: Frostbite
Wash skin: No recommendation
Remove: When wet (flammable)
Change: No recommendation
Provide: Frostbite wash

**First Aid** (See procedures)

Eye: Frostbite
Skin: Frostbite
Breathing: Respiratory support

**Important additional information about respirator selection**

**Respirator Recommendations** (See Appendix E) NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
<table>
<thead>
<tr>
<th><strong>Exposure Routes</strong></th>
<th>Inhalation, skin, and/or eye contact (liquid)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td>Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
<td>Liver, central nervous system, blood, respiratory system, lymphatic system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[liver cancer]</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION]
## Vinyl cyclohexene dioxide

<table>
<thead>
<tr>
<th>CAS</th>
<th>106-87-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>RN8640000</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names

1-Epoxyethyl-3,4-epoxy-cyclohexane; 4-Vinylcyclohexene diepoxide; 4-Vinyl-1-cyclohexene dioxide

### Exposure Limits

| NIOSH REL: Ca TWA 10 ppm (60 mg/m³) [skin] See Appendix A |
| OSHA PEL†: none |

### Physical Description

Colorless liquid.

| MW: 140.2 | BP: 441°F | FRZ: -164°F | Sol: High |
| VP: 0.1 mmHg | IP: ? | | Sp.Gr: 1.10 |

Class IIIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities

Alcohols, amines, water [Note: Slowly hydrolyzes in water.]

### Measurement Methods

OSHA PV2083
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated
**Remove:** When wet or contaminated
**Change:** No recommendation
**Provide:** Eyewash, Quick drench

### First Aid

**Eye:** Irrigate immediately
**Skin:** Water wash immediately
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

### Important additional information about respirator selection

**Respirator Recommendations NIOSH**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact
### Symptoms
In animals: irritation eyes, skin, respiratory system; testicular atrophy; leukopenia (reduced blood leukocytes), necrosis thymus; skin sensitization; [potential occupational carcinogen]

### Target Organs
Eyes, skin, respiratory system, blood, thymus, reproductive system

### Cancer Site
[in animals: skin tumors]

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Vinyl fluoride

<table>
<thead>
<tr>
<th>CAS</th>
<th>75-02-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂=CHF</td>
<td></td>
</tr>
<tr>
<td>RTECS</td>
<td>YZ7351000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Fluoroethene, Fluoroethylene, Monofluoroethylene, Vinyl fluoride monomer</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1860 116 P (inhibited)</td>
</tr>
</tbody>
</table>

### Exposure Limits

| NIOSH REL: | TWA 1 ppm C 5 ppm [use 1910.1017] |
| OSHA PEL:  | none                              |

| IDLH N.D. | Conversion 1 ppm = 1.89 mg/m³ |

### Physical Description

- Colorless gas with a faint, ethereal odor. [Note: Shipped as a liquefied compressed gas.]

| MW: 46.1 | BP: -98°F | FRZ: -257°F | Sol: Insoluble |
| VP: 25.2 atm | IP: 10.37 eV | RGasD: 1.60 |
| Fl.P: NA (Gas) | UEL: 21.7% | LEL: 2.6% |

### Flammable Gas

### Incompatibilities & Reactivities

None reported [Note: Inhibited with 0.2% terpenes to prevent polymerization.]

### Measurement Methods

None available

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

**Skin:** Frostbite

**Eyes:** Frostbite

Wash skin: No recommendation

Remove: When wet (flammable)

Change: No recommendation

Provide: Frostbite wash

### First Aid

**Eye:** Frostbite

**Skin:** Frostbite

Breathing: Respiratory support
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 10 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 25 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 50 ppm:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Up to 200 ppm:**
- (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin and/or eye contact (liquid)

**Symptoms** Headache, dizziness, confusion, incoordination, narcosis, nausea, vomiting; liquid: frostbite

**Target Organs** central nervous system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Vinylidene chloride

**CAS** 75-35-4  
**RTECS** KV9275000

### Synonyms & Trade Names
- 1,1-DCE; 1,1-Dichloroethene; 1,1-Dichloroethylene; VDC; Vinylidene chloride monomer; Vinylidene dichloride

### DOT ID & Guide
- DOT ID & Guide: 1303 130 P (inhibited)

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: Ca</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL† : none</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Physical Description
Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>96.9</td>
</tr>
<tr>
<td>BP</td>
<td>89°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-189°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.04%</td>
</tr>
<tr>
<td>VP</td>
<td>500 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>10.00 eV</td>
</tr>
<tr>
<td>Fl.P.</td>
<td>-2°F</td>
</tr>
<tr>
<td>UEL</td>
<td>15.5%</td>
</tr>
<tr>
<td>LEL</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

Class IA Flammable Liquid: Fl.P. below 73°F and BP below 100°F.

### Incompatibilities & Reactivities
Aluminum, sunlight, air, copper, heat [Note: Polymerization may occur if exposed to oxidizers, chlorosulfonic acid, nitric acid, or oleum. Inhibitors such as the monomethyl ether of hydroquinone are added to prevent polymerization.]

### Measurement Methods
NIOSH 1015; OSHA 19

See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation
- Provide: Eyewash, Quick drench

### First Aid (See procedures)
- Eye: Irrigate immediately
- Skin: Soap flush immediately
- Breathing: Respiratory support
- Swallow: Medical attention immediately

### Important additional information about respirator selection

#### Respirator Recommendations NIOSH

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system, liver, kidneys</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[in animals: liver &amp; kidney tumors]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# Vinylidene fluoride

**CAS** 75-38-7  
**RTECS** KW0560000

## Synonyms & Trade Names
Difluoro-1,1-ethylene; 1,1-Difluoroethene; 1,1-Difluoroethylene; Halocarbon 1132A; VDF; Vinylidene difluoride

## Exposure Limits
NIOSH REL: TWA 1 ppm C 5 ppm [use 1910.1017]  
OSHA PEL: none

**IDLH** N.D.  
**Conversion** 1 ppm = 2.62 mg/m³

## Physical Description
Colorless gas with a faint, ethereal odor. [Note: Shipped as a liquefied compressed gas.]

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>64.0</td>
</tr>
<tr>
<td>BP</td>
<td>-122°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-227°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Insoluble</td>
</tr>
<tr>
<td>VP</td>
<td>35.2 atm</td>
</tr>
<tr>
<td>IP</td>
<td>10.29 eV</td>
</tr>
<tr>
<td>RGasD</td>
<td>2.21</td>
</tr>
<tr>
<td>Fl.P</td>
<td>NA (Gas)</td>
</tr>
<tr>
<td>UEL</td>
<td>21.3%</td>
</tr>
<tr>
<td>LEL</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

## Incompatibilities & Reactivities
Oxidizers, aluminum chloride [Note: Violent reaction with hydrogen chloride when heated under pressure.]

## Measurement Methods
NIOSH 3800  
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
(See protection)

<table>
<thead>
<tr>
<th>Protection</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Frostbite</td>
</tr>
<tr>
<td>Eyes</td>
<td>Frostbite</td>
</tr>
<tr>
<td>Wash skin</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Remove</td>
<td>When wet (flammable)</td>
</tr>
<tr>
<td>Change</td>
<td>No recommendation</td>
</tr>
<tr>
<td>Provide</td>
<td>Frostbite wash</td>
</tr>
</tbody>
</table>

## First Aid
(See procedures)

<table>
<thead>
<tr>
<th>Protection</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>Frostbite</td>
</tr>
<tr>
<td>Skin</td>
<td>Frostbite</td>
</tr>
<tr>
<td>Breathing</td>
<td>Respiratory support</td>
</tr>
</tbody>
</table>

Authored in PDF format by Industrial Hygiene Services; www.ihresources.com
<table>
<thead>
<tr>
<th>Important additional information about respirator selection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respirator Recommendations NIOSH</strong></td>
</tr>
<tr>
<td><strong>Up to 10 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 10) Any supplied-air respirator</td>
</tr>
<tr>
<td><strong>Up to 25 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)</td>
</tr>
<tr>
<td><strong>Up to 50 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)</td>
</tr>
<tr>
<td>(APF = 50) Any self-contained breathing apparatus with a full facepiece</td>
</tr>
<tr>
<td>(APF = 50) Any supplied-air respirator with a full facepiece</td>
</tr>
<tr>
<td><strong>Up to 200 ppm:</strong></td>
</tr>
<tr>
<td>(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td><strong>Emergency or planned entry into unknown concentrations or IDLH conditions:</strong></td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td><strong>Escape:</strong></td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
<tr>
<td><strong>Exposure Routes</strong></td>
</tr>
<tr>
<td>inhalation, skin and/or eye contact (liquid)</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
</tr>
<tr>
<td>Dizziness, headache, nausea; liquid: frostbite</td>
</tr>
<tr>
<td><strong>Target Organs</strong></td>
</tr>
<tr>
<td>central nervous system</td>
</tr>
</tbody>
</table>

See also: [INTRODUCTION](#)

---

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**NIOSH Pocket Guide to Chemical Hazards**

**Vinyl toluene**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>25013-15-4 (inhibited)</td>
</tr>
<tr>
<td>RTECS</td>
<td>WL5075000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>Ethenylmethylbenzene, Methylstyrene, Tolyethylene</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>2618 130 P (inhibited)</td>
</tr>
<tr>
<td>Exposure Limits</td>
<td>NIOSH REL: TWA 100 ppm (480 mg/m³)</td>
</tr>
<tr>
<td></td>
<td>OSHA PEL: TWA 100 ppm (480 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>400 ppm</td>
</tr>
<tr>
<td>Conversion</td>
<td>1 ppm = 4.83 mg/m³</td>
</tr>
<tr>
<td>Physical Description</td>
<td>Colorless liquid with a strong, disagreeable odor.</td>
</tr>
<tr>
<td>MW</td>
<td>118.2</td>
</tr>
<tr>
<td>BP</td>
<td>339°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-106°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.009%</td>
</tr>
<tr>
<td>VP</td>
<td>1 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>8.20 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.89</td>
</tr>
<tr>
<td>Fl.P</td>
<td>127°F</td>
</tr>
<tr>
<td>UEL</td>
<td>11.0%</td>
</tr>
<tr>
<td>LEL</td>
<td>0.8%</td>
</tr>
<tr>
<td>Class II Combustible Liquid</td>
<td>Fl.P. at or above 100°F and below 140°F.</td>
</tr>
<tr>
<td>Incompatibilities &amp; Reactivities</td>
<td>Oxidizers, peroxides, strong acids, iron or aluminum salts [Note: Usually inhibited with tert-butyl catechol to prevent polymerization.]</td>
</tr>
<tr>
<td>Measurement Methods</td>
<td>NIOSH 1501, OSHA 7</td>
</tr>
<tr>
<td></td>
<td>See: NMAM or OSHA Methods</td>
</tr>
<tr>
<td>Personal Protection &amp; Sanitation (See protection)</td>
<td>Skin: Prevent skin contact</td>
</tr>
<tr>
<td></td>
<td>Eyes: Prevent eye contact</td>
</tr>
<tr>
<td></td>
<td>Wash skin: When contaminated</td>
</tr>
<tr>
<td></td>
<td>Remove: When wet or contaminated</td>
</tr>
<tr>
<td></td>
<td>Change: No recommendation</td>
</tr>
<tr>
<td>First Aid (See procedures)</td>
<td>Eye: Irrigate immediately</td>
</tr>
<tr>
<td></td>
<td>Skin: Soap flush promptly</td>
</tr>
<tr>
<td></td>
<td>Breathing: Respiratory support</td>
</tr>
<tr>
<td></td>
<td>Swallow: Medical attention immediately</td>
</tr>
</tbody>
</table>
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 400 ppm:

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, upper respiratory system; drowsiness; in animals: narcosis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
**VM & P Naphtha**

| **CAS** | 8032-32-4 |
| **RTECS** | OI6180000 |
| **DOT ID & Guide** | 1268 128 (petroleum distillates, n.o.s.) |

**Synonyms & Trade Names**
Ligroin, Painters naphtha, Petroleum ether, Petroleum spirit, Refined solvent naphtha, Varnish makers' & painters' naphtha

**Exposure Limits**
- NIOSH REL: TWA 350 mg/m³ C 1800 mg/m³ [15-minute]
- OSHA PEL†: none

**IDLH**
N.D.

**Physical Description**
Clear to yellowish liquid with a pleasant, aromatic odor.

| MW | 87-114 (approx) |
| VP | 2-20 mmHg |
| Fl.P. | 20-55°F |
| BP | 203-320°F |
| FRZ | ? |
| Sol | Insoluble |
| Sp.Gr(60°F) | 0.73-0.76 |
| UEL | 6.0% |
| LEL | 1.2% |

**Incompatibilities & Reactivities**
None reported [Note: VM&P Naphtha is a refined petroleum solvent predominantly C7-C11 which is typically 55% paraffins, 30% monocycloparaffins, 2% dicycloparaffins & 12% alklybenzenes.]

**Measurement Methods**
- NIOSH 1550 ; OSHA 48
- See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*
- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

**First Aid** *(See procedures)*
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 3500 mg/m³:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 8750 mg/m³:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)

**Up to 17,500 mg/m³:**
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, upper respiratory system; dermatitis; central nervous system depression; chemical pneumonitis (aspiration liquid)

**Target Organs** Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION
**Warfarin**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>81-81-2</td>
<td>GN4550000</td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- 3-(alpha-Acetonyl)-benzyl-4-hydroxycoumarin, 4-Hydroxy-3-(3-oxo-1-phenyl butyl)-2H-1-benzopyran-2-one, WARF

**Exposure Limits**
- NIOSH REL: TWA 0.1 mg/m³
- OSHA PEL: TWA 0.1 mg/m³

**Physical Description**
- Colorless, odorless, crystalline powder. [rodecide]
- MW: 308.3
- BP: Decomposes
- MLT: 322°F
- Sol: 0.002%
- VP(71°F): 0.09 mmHg
- IP: ?
- UEL: ?
- LEL: ?

**Incompatibilities & Reactivities**
- Combustible Solid
- Strong oxidizers

**Measurement Methods**
- NIOSH 5002
- See NMAM or OSHA Methods

**Personal Protection & Sanitation**
- Skin: Prevent skin contact
- Eyes: No recommendation
- Wash skin: When contaminated
- Remove: When wet or contaminated
- Change: Daily

**First Aid**
- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 0.5 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 1 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 2.5 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 5 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 100 mg/m³:
(APF = 1,000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Hematuria (blood in the urine), back pain; hematoma arms, legs; epistaxis (nosebleed), bleeding lips, mucous membrane hemorrhage; abdominal pain, vomiting, fecal blood; petechial rash; abnormal hematologic indices

Target Organs Blood, cardiovascular system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Welding fumes

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS ZC2550000</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Synonyms vary depending upon the specific component of the welding fumes.

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: Ca See Appendix A</th>
<th>OSHA PEL†: none</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>IDLH Ca [N.D.]</th>
<th>Conversion</th>
</tr>
</thead>
</table>

### Physical Description
Fumes generated by the process of joining or cutting pieces of metal by heat, pressure, or both.

Properties vary depending upon the specific component of the welding fumes.

### Incompatibilities & Reactivities
Varies

### Measurement Methods
NIOSH 7300, 7301, 7303

See: NMAM or OSHA Methods

### Personal Protection & Sanitation

<table>
<thead>
<tr>
<th>Skin: No recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes: No recommendation</td>
</tr>
<tr>
<td>Wash skin: No recommendation</td>
</tr>
<tr>
<td>Remove: No recommendation</td>
</tr>
<tr>
<td>Change: No recommendation</td>
</tr>
</tbody>
</table>

**First Aid**

Eye: Irrigate immediately

Skin: Soap wash

Breathing: Respiratory support

### Important additional information about respirator selection

**Respirator Recommendations**

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters. Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
inhalation, skin and/or eye contact
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th>Symptoms vary depending upon the specific component of the welding fumes; metal fume fever: flu-like symptoms, dyspnea (breathing difficulty), cough, muscle pain, fever, chills; interstitial pneumonitis; [potential occupational carcinogen]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Organs</strong></td>
<td>Eyes, skin, respiratory system, central nervous system</td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[lung cancer]</td>
</tr>
</tbody>
</table>

See also: **INTRODUCTION**
# NIOSH Pocket Guide to Chemical Hazards

## Wood dust

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS ZC9850000</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names
Hard wood dust, Soft wood dust, Western red cedar dust

### Exposure Limits
- NIOSH REL: Ca 1 mg/m³  
  [See Appendix A]
- OSHA PEL†: TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)
- IDLH Ca [N.D.]

### Physical Description
Dust from various types of wood.

### MW: varies  BP: NA  MLT: NA  Sol: ?

### VP: 0 mmHg (approx)  IP: NA  Sp.Gr: ?

### Fl.P: NA  UEL: NA  LEL: NA

### Combustible Solid

### Incompatibilities & Reactivities
None reported

### Measurement Methods
NIOSH 0500
See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- **Skin**: No recommendation
- **Eyes**: No recommendation
- **Wash skin**: No recommendation
- **Remove**: No recommendation
- **Change**: No recommendation

### First Aid
- **Eye**: Irrigate immediately
- **Skin**: Soap wash
- **Breathing**: Fresh air

### Important additional information about respirator selection

### Respirator Recommendations NIOSH
- **At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration**:
  (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
  (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
- **Escape**:
  (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters./Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- **Inhalation**, skin and/or eye contact

### Symptoms
- Irritation eyes; epistaxis (nosebleed); dermatitis; respiratory hypersensitivity; granulomatous pneumonitis; asthma, cough, wheezing, sinusitis; prolonged colds; [potential occupational carcinogen]
<table>
<thead>
<tr>
<th><strong>Target Organs</strong></th>
<th>Eyes, skin, respiratory system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Site</strong></td>
<td>[nasal cancer]</td>
</tr>
</tbody>
</table>

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## m-Xylene

<table>
<thead>
<tr>
<th>CAS 108-38-3</th>
</tr>
</thead>
</table>

### Chemical Information

- **Chemical Formula:** C₆H₄(CH₃)₂
- **CAS Number:** 108-38-3
- **RTECS Number:** ZE2275000

### Synonyms & Trade Names

- 1,3-Dimethylbenzene
- meta-Xylene
- m-Xylol

### DOT ID & Guide

- DOT ID: 1307
- Guide: 130

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL: TWA 100 ppm (435 mg/m³) ST 150 ppm (655 mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL†: TWA 100 ppm (435 mg/m³)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>900 ppm</th>
</tr>
</thead>
</table>

### IDLH

- **900 ppm**

### Conversion

- 1 ppm = 4.34 mg/m³

### Physical Description

- Colorless liquid with an aromatic odor.
- **MW:** 106.2
- **BP:** 282°F
- **FRZ:** -54°F
- **Sol:** Slight
- **VP:** 9 mmHg
- **IP:** 8.56 eV
- **Sp.Gr:** 0.86
- **Fl.P:** 82°F
- **UEL:** 7.0%
- **LEL:** 1.1%

### Incompatibilities & Reactivities

- Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.
- Strong oxidizers, strong acids

### Measurement Methods

- NIOSH 1501, 3800
- OSHA 1002
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation (See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

### First Aid (See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 900 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## o-Xylene

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS</th>
<th>Synonyms &amp; Trade Names</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₆H₄(CH₃)₂</td>
<td>95-47-6</td>
<td>1,2-Dimethylbenzene; ortho-Xylene; o-Xylol</td>
<td>1307 130</td>
</tr>
<tr>
<td>RTECS</td>
<td>ZE2450000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Exposure Limits

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>TWA 100 ppm (435 mg/m³) ST 150 ppm (655 mg/m³)</td>
</tr>
<tr>
<td>OSHA PEL†</td>
<td>TWA 100 ppm (435 mg/m³)</td>
</tr>
<tr>
<td>IDLH</td>
<td>900 ppm</td>
</tr>
</tbody>
</table>

## Conversion

1 ppm = 4.34 mg/m³

## Physical Description

Colorless liquid with an aromatic odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>106.2</td>
</tr>
<tr>
<td>BP</td>
<td>292°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-13°F</td>
</tr>
<tr>
<td>Sol</td>
<td>0.02%</td>
</tr>
<tr>
<td>VP</td>
<td>7 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>8.56 eV</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.88</td>
</tr>
<tr>
<td>Fl.P</td>
<td>90°F</td>
</tr>
<tr>
<td>UEL</td>
<td>6.7%</td>
</tr>
<tr>
<td>LEL</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

## Incompatibilities & Reactivities

Strong oxidizers, strong acids

## Measurement Methods

NIOSH 1501, 3800; OSHA 1002

See: NMAM or OSHA Methods

## Personal Protection & Sanitation

### Skin
Prevent skin contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

### Eyes
Prevent eye contact

## First Aid

### Eye
Irrigate immediately

### Skin
Soap wash promptly

### Breathing
Respiratory support

### Swallow
Medical attention immediately
### Important additional information about respirator selection

#### Respirator Recommendations NIOSH/OSHA

**Up to 900 ppm:**

- **(APF = 10)** Any chemical cartridge respirator with organic vapor cartridge(s)*
- **(APF = 25)** Any powered, air-purifying respirator with organic vapor cartridge(s)*
- **(APF = 10)** Any supplied-air respirator*
- **(APF = 50)** Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

- **(APF = 10,000)** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- **(APF = 10,000)** Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

- **(APF = 50)** Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

#### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

#### Symptoms
- Irritation of eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

#### Target Organs
- Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

See also: INTRODUCTION
### p-Xylene

<table>
<thead>
<tr>
<th>CAS</th>
<th>106-42-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTECS</td>
<td>ZE2625000</td>
</tr>
<tr>
<td>Synonyms &amp; Trade Names</td>
<td>1,4-Dimethylbenzene; para-Xylene; p-Xylol</td>
</tr>
<tr>
<td>DOT ID &amp; Guide</td>
<td>1307 130</td>
</tr>
</tbody>
</table>

#### Exposure Limits

<table>
<thead>
<tr>
<th>IDLH</th>
<th>900 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion</td>
<td>1 ppm = 4.41 mg/m³</td>
</tr>
</tbody>
</table>

#### Physical Description

Colorless liquid with an aromatic odor. [Note: A solid below 56°F.]

- MW: 106.2
- BP: 281°F
- FRZ: 56°F
- Sol: 0.02%
- VP: 9 mmHg
- IP: 8.44 eV
- Sp.Gr: 0.86
- Fl.P: 81°F
- UEL: 7.0%
- LEL: 1.1%

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

#### Incompatibilities & Reactivities

Strong oxidizers, strong acids

#### Measurement Methods

- NIOSH 1501, 3800; OSHA 1002
- See: NMAM or OSHA Methods

#### Personal Protection & Sanitation

(See protection)

- Skin: Prevent skin contact
- Eyes: Prevent eye contact
- Wash skin: When contaminated
- Remove: When wet (flammable)
- Change: No recommendation

#### First Aid

(See procedures)

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
### Respirator Recommendations NIOSH/OSHA

**Up to 900 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
- (APF = 10) Any supplied-air respirator*
- (APF = 50) Any self-contained breathing apparatus with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

### Exposure Routes
- Inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
- Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

### Target Organs
- Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

See also: INTRODUCTION
**NIOSH Pocket Guide to Chemical Hazards**

### m-Xylene-alpha,alpha'-diamine

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>1477-55-0</td>
<td>PF8970000</td>
<td></td>
</tr>
</tbody>
</table>

#### Synonyms & Trade Names
1,3-bis(Aminomethyl)benzene; 1,3-Benzenedimethanamine; MXDA; m-Phenylenebis (methylamine); m-Xylylenediamine

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL:</th>
<th>OSHA PEL†:</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 0.1 mg/m³ [skin]</td>
<td>none</td>
</tr>
</tbody>
</table>

#### Conversion

| MW: 136.2 | BP: 477°F | FRZ: 58°F | Sol: Miscible |
| VP(77°F): 0.03 mmHg | IP: ? | Sp.Gr: 1.032 |

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

### Incompatibilities & Reactivities
None reported

### Measurement Methods
OSHA 105
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

| Skin: Prevent skin contact |
| Eyes: Prevent eye contact |
| Wash skin: When contaminated |
| Remove: When wet or contaminated |
| Change: No recommendation |
| Provide: Eyewash, Quick drench |

### First Aid

| Eye: Irrigate immediately |
| Skin: Water flush immediately |
| Breathing: Respiratory support |
| Swallow: Medical attention immediately |

### Exposure Routes
inhalation, skin absorption, ingestion, skin and/or eye contact

### Symptoms
In animals: irritation eyes, skin; liver, kidney, lung damage

### Target Organs
Eyes, skin, respiratory system, liver, kidneys

See also: **INTRODUCTION**
## NIOSH Pocket Guide to Chemical Hazards

### Xyldine

**CAS** 1300-73-8  
**RTECS** ZE8575000

### Synonyms & Trade Names

Aminodimethylbenzene, Aminoxyylene, Dimethylaminobenzene, Dimethylaniline, Xyldine isomers (e.g., 2,4-Dimethylaniline)  
[Note: Dimethylaniline is also used as a synonym for N,N-Dimethylaniline.]

### Exposure Limits

<table>
<thead>
<tr>
<th>Exposure Limits</th>
<th>NIOSH REL: TWA 2 ppm (10 mg/m³) [skin]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSHA PEL†: TWA 5 ppm (25 mg/m³) [skin]</td>
</tr>
<tr>
<td>IDLH</td>
<td>50 ppm</td>
</tr>
</tbody>
</table>

**Conversion**  
1 ppm = 4.96 mg/m³

### Physical Description

Pale-yellow to brown liquid with a weak, aromatic, amine-like odor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW</td>
<td>121.2</td>
</tr>
<tr>
<td>BP</td>
<td>415-439°F</td>
</tr>
<tr>
<td>FRZ</td>
<td>-33°F</td>
</tr>
<tr>
<td>Sol</td>
<td>Slight</td>
</tr>
<tr>
<td>VP</td>
<td>&lt;1 mmHg</td>
</tr>
<tr>
<td>IP</td>
<td>7.65 eV (2,4-) 7.30 eV (2,6-)</td>
</tr>
<tr>
<td>Sp.Gr</td>
<td>0.98</td>
</tr>
<tr>
<td>Fl.P</td>
<td>206°F (2,3-)</td>
</tr>
<tr>
<td>UEL</td>
<td>?</td>
</tr>
<tr>
<td>LEL</td>
<td>1.0% (o-isomer)</td>
</tr>
</tbody>
</table>

Class IIIB Combustible Liquid (2,3-)

### Incompatibilities & Reactivities

Strong oxidizers, hypochlorite salts

### Measurement Methods

NIOSH 2002  
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection )

Skin: Prevent skin contact  
Eyes: Prevent eye contact  
Wash skin: When contaminated  
Remove: When wet or contaminated  
Change: No recommendation  
Provide: Eyewash, Quick drench

### First Aid

(See procedures )

Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH**

**Up to 20 ppm:**
- (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)
- (APF = 10) Any supplied-air respirator

**Up to 50 ppm:**
- (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
- (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)
- (APF = 50) Any self-contained breathing apparatus with a full facepiece
- (APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
- (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
- (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
- (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
- Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Anoxia, cyanosis, methemoglobinemia; lung, liver, kidney damage

**Target Organs** respiratory system, blood, liver, kidneys, cardiovascular system

See also: **INTRODUCTION**
<table>
<thead>
<tr>
<th><strong>Yttrium</strong></th>
<th><strong>CAS</strong> 7440-65-5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Y</strong></td>
<td><strong>RTECS</strong> ZG2980000</td>
</tr>
<tr>
<td><strong>Synonyms &amp; Trade Names</strong></td>
<td><strong>DOT ID &amp; Guide</strong></td>
</tr>
<tr>
<td>Yttrium metal</td>
<td></td>
</tr>
</tbody>
</table>

**Exposure Limits**

- NIOSH REL*: TWA 1 mg/m³ [*Note: The REL also applies to other yttrium compounds (as Y).*]
- OSHA PEL*: TWA 1 mg/m³ [*Note: The PEL also applies to other yttrium compounds (as Y).*]

**IDLH** 500 mg/m³ (as Y)

**Conversion**

**Physical Description**

Dark-gray to black, odorless solid.

- MW: 88.9
- BP: 5301°F
- MLT: 2732°F
- Sol: Soluble in hot H₂O
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 4.47
- Fl.P: NA
- UEL: NA
- LEL: NA

Noncombustible Solid in bulk form.

**Incompatibilities & Reactivities**

Oxidizers

**Measurement Methods**

NIOSH 7300, 7301, 7303, 9102; OSHA ID121

See: NMAM or OSHA Methods

**Personal Protection & Sanitation (See protection )**

- Skin: No recommendation
- Eyes: No recommendation
- Wash skin: No recommendation
- Remove: No recommendation
- Change: No recommendation

**First Aid (See procedures )**

- Eye: Irrigate immediately
- Skin: Soap wash promptly
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 5 mg/m³:
(APF = 5) Any quarter-mask respirator. [Click here](#) for information on selection of N, R, or P filters.

Up to 10 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.[Click here](#) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

Up to 25 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 50 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 500 mg/m³:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes; in animals: pulmonary irritation; eye injury; possible liver damage

Target Organs Eyes, respiratory system, liver

See also: INTRODUCTION
# Zinc chloride fume

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7646-85-7</td>
<td>ZH1400000</td>
<td>2331 154</td>
</tr>
</tbody>
</table>

## Synonyms & Trade Names
- Zinc dichloride fume

## Exposure Limits
- **NIOSH REL**: TWA 1 mg/m³ ST 2 mg/m³
- **OSHA PEL†**: TWA 1 mg/m³
- **IDLH**: 50 mg/m³

## Physical Description
White particulate dispersed in air.

- **MW**: 136.3
- **BP**: 1350°F
- **MLT**: 554°F
- **Sol(70°F)**: 435%
- **VP**: 0 mmHg (approx)
- **IP**: NA
- **FL.P**: NA
- **UEL**: NA
- **LEL**: NA

## Incompatibilities & Reactivities
- Noncombustible Solid
- Potassium

## Measurement Methods
OSHA ID121
See: NMAM or OSHA Methods

## Personal Protection & Sanitation
<table>
<thead>
<tr>
<th>Skin: No recommendation</th>
<th>Eyes: No recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash skin: No recommendation</td>
<td>Remove: No recommendation</td>
</tr>
<tr>
<td>Change: No recommendation</td>
<td><strong>First Aid</strong> (See procedures)</td>
</tr>
</tbody>
</table>

Breathing: Respiratory support
**Important additional information about respirator selection**

**Respirator Recommendations NIOSH/OSHA**

**Up to 10 mg/m³:**

(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. [Click here](#) for information on selection of N, R, or P filters.*

(APF = 10) Any supplied-air respirator*

**Up to 25 mg/m³:**

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.*

**Up to 50 mg/m³:**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#) for information on selection of N, R, or P filters.

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. [Click here](#)

---

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; conjunctivitis; cough, copious sputum; dyspnea (breathing difficulty), chest pain, pulmonary edema, pneumonitis; pulmonary fibrosis, cor pulmonale; fever; cyanosis; tachypnea; skin burns

**Target Organs** Eyes, skin, respiratory system, cardiovascular system

See also: [INTRODUCTION](#)
# NIOSH Pocket Guide to Chemical Hazards

## Zinc oxide

<table>
<thead>
<tr>
<th>CAS</th>
<th>1314-13-2</th>
</tr>
</thead>
</table>

### Synonyms & Trade Names

- Zinc peroxide

### DOT ID & Guide

- ZH4810000
- 1516 143

### Exposure Limits

- **NIOSH REL:** Dust: TWA 5 mg/m³ C 15 mg/m³  
  Fume: TWA 5 mg/m³ ST 10 mg/m³
- **OSHA PEL†:** TWA 5 mg/m³ (fume) TWA 15 mg/m³ (total dust) TWA 5 mg/m³ (resp dust)
- **IDLH:** 500 mg/m³

### Physical Description

- White, odorless solid.
- MW: 81.4
- BP: ?
- MLT: 3587°F
- Sol(64°F): 0.0004%
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 5.61
- FI.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities

- Chlorinated rubber (at 419°F), water [Note: Slowly decomposed by water.]

### Measurement Methods

- NIOSH 7303, 7502; OSHA ID121, ID143
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation

- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

### First Aid

- **Breathing:** Respiratory support

(See protection)  
(See procedures)
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 50 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 125 mg/m³:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.

Up to 250 mg/m³:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 500 mg/m³:
(APF = 100) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation

Symptoms Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function

Target Organs respiratory system

See also: INTRODUCTION
**Zinc stearate**

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>557-05-1</td>
<td>ZH5200000</td>
<td></td>
</tr>
</tbody>
</table>

**Synonyms & Trade Names**
- Dibasic zinc stearate
- Zinc salt of stearic acid
- Zinc distearate

### Exposure Limits

<table>
<thead>
<tr>
<th>NIOSH REL</th>
<th>OSHA PEL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA 10 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
<td>TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDLH</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.D.</td>
<td></td>
</tr>
</tbody>
</table>

**Physical Description**

Soft, white powder with a slight, characteristic odor.

- **MW:** 632.4
- **BP:** ?
- **MLT:** 266°F
- **Sol:** Insoluble
- **VP:** 0 mmHg (approx)
- **IP:** NA
- **Sp.Gr:** 1.10
- **Fl.P(oc):** 530°F
- **UEL:** ?
- **LEL:** ?
- **MEC:** 20 g/m³

**Combustible Solid**

**Incompatibilities & Reactivities**

Oxidizers, dilute acids [Note: Hydrophobic (i.e., repels water).]

**Measurement Methods**

NIOSH 0500 , 0600

See: NMAM or OSHA Methods

**Personal Protection & Sanitation** *(See protection)*

- **Skin:** No recommendation
- **Eyes:** No recommendation
- **Wash skin:** No recommendation
- **Remove:** No recommendation
- **Change:** No recommendation

**First Aid** *(See procedures)*

- **Eye:** Irrigate immediately
- **Skin:** Soap wash
- **Breathing:** Fresh air
- **Swallow:** Medical attention immediately

**Important additional information about respirator selection**

**Respirator Recommendations** Not available.

**Exposure Routes**

inhalation, ingestion, skin and/or eye contact

**Symptoms**

Irritation eyes, skin, upper respiratory system; cough

**Target Organs**

Eyes, skin, respiratory system

See also: INTRODUCTION
## Zirconium compounds (as Zr)

<table>
<thead>
<tr>
<th>CAS</th>
<th>RTECS</th>
<th>DOT ID &amp; Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>7440-67-7 (Metal)</td>
<td>ZH7070000 (Metal)</td>
<td>1358 170 (powder, wet)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1932 135 (scrap)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008 135 (powder, dry)</td>
</tr>
</tbody>
</table>

### Synonyms & Trade Names
- Zirconium metal: Zirconium
- Synonyms of other zirconium compounds vary depending upon the specific compound.

### DOT ID & Guide
- 1358 170 (powder, wet)
- 1932 135 (scrap)
- 2008 135 (powder, dry)

### Exposure Limits
- NIOSH REL*: TWA 5 mg/m³ ST 10 mg/m³ [*Note: The REL applies to all zirconium compounds (as Zr) except Zirconium tetrachloride.]
- OSHA PEL†: TWA 5 mg/m³

### IDLH
- 50 mg/m³ (as Zr)

### Conversion
- TWA 5 mg/m³

### Physical Description
- Metal: Soft, malleable, ductile, solid or gray to gold, amorphous powder.
- MW: 91.2
- BP: 6471°F
- MLT: 3375°F
- Sol: Insoluble
- VP: 0 mmHg (approx)
- IP: NA
- Sp.Gr: 6.51 (Metal)
- Fl.P: NA
- UEL: NA
- LEL: NA

### Incompatibilities & Reactivities
- Potassium nitrate, oxidizers [Note: Fine powder may be stored completely immersed in water.]

### Measurement Methods
- NIOSH 7300, 7301, 9102; OSHA ID121
- See: NMAM or OSHA Methods

### Personal Protection & Sanitation
- Recommendations regarding personal protective clothing vary depending upon the specific compound.
- Recommendations regarding eye protection vary depending upon the specific compound.
- Recommendations regarding washing the skin vary depending upon the specific compound.
- Recommendations regarding the removal of personal protective clothing that becomes wet or contaminated vary depending upon the specific compound.
- Recommendations regarding the daily changing of personal protective clothing vary depending upon the specific compound.
- Recommendations regarding the need for eyewash or quick drench facilities vary depending upon the specific compound.

### First Aid
- Eye: Irrigate immediately
- Skin: Soap wash
- Breathing: Respiratory support
- Swallow: Medical attention immediately
Important additional information about respirator selection

Respirator Recommendations NIOSH/OSHA

Up to 25 mg/m³:
(APF = 5) Any quarter-mask respirator. Click here for information on selection of N, R, or P filters.

Up to 50 mg/m³:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100. Click here for information on selection of N, R, or P filters.
(APF = 25) Any powered air-purifying respirator with a high-efficiency particulate filter.
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. Click here

Exposure Routes inhalation, skin and/or eye contact

Symptoms Skin, lung granulomas; in animals: irritation skin, mucous membrane; X-ray evidence of retention in lungs

Target Organs Skin, respiratory system

See also: INTRODUCTION
# NIOSH Pocket Guide to Chemical Hazards

## Personal Protection and Sanitation Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skin: Prevent skin contact</strong></td>
<td>Wear appropriate personal protective clothing to prevent skin contact.</td>
</tr>
<tr>
<td><strong>Skin: Frostbite</strong></td>
<td>Compressed gases may create low temperatures when they expand rapidly. Leaks and uses that allow rapid expansion may cause a frostbite hazard. Wear appropriate personal protective clothing to prevent the skin from becoming frozen.</td>
</tr>
<tr>
<td><strong>Skin: N.R</strong></td>
<td>No recommendation is made specifying the need for personal protective equipment for the body.</td>
</tr>
<tr>
<td><strong>Eyes: Prevent eye contact</strong></td>
<td>Wear appropriate eye protection to prevent eye contact.</td>
</tr>
<tr>
<td><strong>Eyes: Frostbite</strong></td>
<td>Wear appropriate eye protection to prevent eye contact with the liquid that could result in burns or tissue damage from frostbite.</td>
</tr>
<tr>
<td><strong>Eyes: N.R.</strong></td>
<td>No recommendation is made specifying the need for eye protection.</td>
</tr>
<tr>
<td><strong>Wash skin: When contam</strong></td>
<td>The worker should immediately wash the skin when it becomes contaminated.</td>
</tr>
<tr>
<td><strong>Wash skin: Daily</strong></td>
<td>The worker should wash daily at the end of each work shift, and prior to eating, drinking, smoking, etc.</td>
</tr>
<tr>
<td><strong>Wash skin: N.R.</strong></td>
<td>No recommendation is made specifying the need for washing the substance from the skin (either immediately or at the end of the work shift).</td>
</tr>
<tr>
<td><strong>Remove: When wet or contam</strong></td>
<td>Work clothing that becomes wet or significantly contaminated should be removed and replaced.</td>
</tr>
<tr>
<td><strong>Remove: When wet (flamm)</strong></td>
<td>Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point &lt;100°F).</td>
</tr>
<tr>
<td><strong>Remove: N.R.</strong></td>
<td>No recommendation is made specifying the need for removing clothing that becomes wet or contaminated.</td>
</tr>
<tr>
<td><strong>Change: Daily</strong></td>
<td>Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises.</td>
</tr>
<tr>
<td><strong>Change: N.R.</strong></td>
<td>No recommendation is made specifying the need for the worker to change clothing after the workshift.</td>
</tr>
<tr>
<td><strong>Provide: Eyewash</strong></td>
<td>Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection.</td>
</tr>
<tr>
<td><strong>Provide: Quick drench</strong></td>
<td>Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.]</td>
</tr>
<tr>
<td><strong>Provide: Frostbite wash</strong></td>
<td>Quick drench facilities and/or eyewash fountains should be provided within the immediate work area for emergency use where there is any possibility of exposure to liquids that are extremely cold or rapidly evaporating.</td>
</tr>
<tr>
<td><strong>Liq</strong></td>
<td>Liquid</td>
</tr>
<tr>
<td><strong>Molt</strong></td>
<td>Molten</td>
</tr>
<tr>
<td>Sol</td>
<td>Solid</td>
</tr>
<tr>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Soln</td>
<td>Solution containing the contaminant</td>
</tr>
<tr>
<td>Vap</td>
<td>Vapor</td>
</tr>
</tbody>
</table>
# NIOSH Pocket Guide to Chemical Hazards

## First Aid Procedures

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye: Irrigate immediately</td>
<td>If this chemical contacts the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately.</td>
</tr>
<tr>
<td>Eye: Irrigate promptly</td>
<td>If this chemical contacts the eyes, promptly wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention if any discomfort continues.</td>
</tr>
<tr>
<td>Eye: Frostbite</td>
<td>If eye tissue is frozen, seek medical attention immediately; if tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of water for at least 15 minutes, occasionally lifting the lower and upper eyelids. If irritation, pain, swelling, lacrimation, or photophobia persist, get medical attention as soon as possible.</td>
</tr>
<tr>
<td>Eye: Medical attention</td>
<td>Self-explanatory</td>
</tr>
<tr>
<td>Skin: Blot/brush away</td>
<td>If irritation occurs, gently blot or brush away excess.</td>
</tr>
<tr>
<td>Skin: Dust off solid; water flush</td>
<td>If this solid chemical contacts the skin, dust it off immediately and then flush the contaminated skin with water. If this chemical or liquids containing this chemical penetrate the clothing, promptly remove the clothing and flush the skin with water. Get medical attention immediately.</td>
</tr>
<tr>
<td>Skin: Frostbite</td>
<td>If frostbite has occurred, seek medical attention immediately; do NOT rub the affected areas or flush them with water. In order to prevent further tissue damage, do NOT attempt to remove frozen clothing from frostbitten areas. If frostbite has NOT occurred, immediately and thoroughly wash contaminated skin with soap and water.</td>
</tr>
<tr>
<td>Skin: Molten flush immediately/solid-liquid soap wash immediately</td>
<td>If this molten chemical contacts the skin, immediately flush the skin with large amounts of water. Get medical attention immediately. If this chemical (or liquids containing this chemical) contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical or liquids containing this chemical penetrate the clothing, immediately remove the clothing and wash the skin with soap and water. If irritation persists after washing, get medical attention.</td>
</tr>
<tr>
<td>Skin: Soap flush immediately</td>
<td>If this chemical contacts the skin, immediately flush the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.</td>
</tr>
<tr>
<td>Skin: Soap flush promptly</td>
<td>If this chemical contacts the skin, promptly flush the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.</td>
</tr>
<tr>
<td>Skin: Soap promptly/molten flush immediately</td>
<td>If this solid chemical or a liquid containing this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If irritation persists after washing, get medical attention. If this molten chemical contacts the skin or nonimpervious clothing, immediately flush the affected area with large amounts of water to remove heat. Get medical attention immediately.</td>
</tr>
<tr>
<td>Skin: Soap wash</td>
<td>If this chemical contacts the skin, wash the contaminated skin with soap and water.</td>
</tr>
<tr>
<td>Skin: Soap wash immediately</td>
<td>If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.</td>
</tr>
<tr>
<td>Skin: Soap wash promptly</td>
<td>If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.</td>
</tr>
<tr>
<td>Skin: Water flush</td>
<td>If this chemical contacts the skin, flush the contaminated skin with water. Where there is evidence of skin irritation, get medical attention.</td>
</tr>
<tr>
<td>Skin: Water flush immediately</td>
<td>If this chemical contacts the skin, immediately flush the contaminated skin with water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. Get medical attention promptly.</td>
</tr>
<tr>
<td>Skin: Water flush promptly</td>
<td>If this chemical contacts the skin, flush the contaminated skin with water promptly. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water promptly. If irritation persists after washing, get medical attention.</td>
</tr>
<tr>
<td>Skin: Water wash</td>
<td>If this chemical contacts the skin, wash the contaminated skin with water.</td>
</tr>
<tr>
<td>Skin: Water wash immediately</td>
<td>If this chemical contacts the skin, immediately wash the contaminated skin with water. If this chemical penetrates the clothing, immediately remove the clothing and wash the skin with water. If symptoms occur after washing, get medical attention immediately.</td>
</tr>
<tr>
<td>Skin: Water wash promptly</td>
<td>If this chemical contacts the skin, promptly wash the contaminated skin with water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with water. If irritation persists after washing, get medical attention.</td>
</tr>
<tr>
<td>Breath: Respiratory support</td>
<td>If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.</td>
</tr>
<tr>
<td>Breath: Fresh air</td>
<td>If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. Other measures are usually unnecessary.</td>
</tr>
<tr>
<td>Breath: Fresh air, 100% O₂</td>
<td>If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering 100% oxygen. Keep the affected person warm and at rest. Get medical attention as soon as possible.</td>
</tr>
<tr>
<td>Swallow: Medical attention immediately</td>
<td>If this chemical has been swallowed, get medical attention immediately.</td>
</tr>
</tbody>
</table>