NIOSH POCKET GUIDE TO CHEMICAL HAZARDS

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

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PREFACE

The *NIOSH Pocket Guide to Chemical Hazards* presents information taken from the *NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards*, from National Institute for Occupational Safety and Health (NIOSH) criteria documents and Current Intelligence Bulletins, and from recognized references in the fields of industrial hygiene, occupational medicine, toxicology, and analytical chemistry. The information is presented in tabular form to provide a quick, convenient source of information on general industrial hygiene practices. The information in the *Pocket Guide* includes chemical structures or formulas, identification codes, synonyms, exposure limits, chemical and physical properties, incompatibilities and reactivities, measurement methods, respirator selections, signs and symptoms of exposure, and procedures for emergency treatment.

The information assembled in the original 1978 printing of the *Pocket Guide* was the result of the Standards Completion Program, a joint effort by NIOSH and the Department of Labor to develop supplemental requirements for the approximately 380 workplace environmental exposure standards adopted by the Occupational Safety and Health Administration (OSHA) in 1971.

Listed below are changes that were made for this edition of the *Pocket Guide*:

- This revision of the *Pocket Guide* includes a new layout for the Chemical Listing section, with information arranged in individual tables for each chemical.

- Recommendations for particulate respirators have been revised to incorporate "Part 84" terminology; "Part 11" terminology has been removed from the respirator recommendations. See "Recommendations for Respirator Selection" on page xiv for a more thorough explanation of these changes.

- The Synonym and Trade Name Index has been expanded to include the primary chemical name for each of the 677 chemicals listed in the *Pocket Guide*. This index is now called the Chemical, Synonym, and Trade Name Index (page 383).

- Changes were made to some of the ID Numbers and Guide Numbers to reflect changes that the Department of Transportation made in the *2004 Emergency Response Guidebook* (http://hazmat.dot.gov/pubs/erg/gydebook.htm).

- The other major change to this edition of the *Pocket Guide* is that Appendix E (page 351) has been revised. It now contains OSHA respirator requirements for 28 chemicals or hazardous substances that were identified in the preamble to the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Other minor technical changes have also been made since the February 2004 edition. (For the most current information and updates, consult the electronic version on the NIOSH Web site: http://www.cdc.gov/niosh/npg/npg.html.)

CONTENTS

Preface iv
Acknowledgments vi
Introduction vii
NIOSH Recommendations vii
How to Use This Pocket Guide viii

Table 1 – NIOSH Manual of Analytical Methods xvii
Table 2 – Personal Protection and Sanitation Codes xviii
Table 3 – Symbols, Code Components, and Codes Used for Respirator Selection xx
Table 4 – Selection of N-, R-, or P-Series Particulate Respirators xxv
Table 5 – Abbreviations for Exposure Routes, Symptoms, and Target Organs xxvi
Table 6 – Codes for First Aid Data xxviii

Chemical Listing 1

Appendices 341
Appendix A – NIOSH Potential Occupational Carcinogens 342
Appendix B – Thirteen OSHA-Regulated Carcinogens 344
Appendix C – Supplementary Exposure Limits 345
Appendix D – Substances with No Established RELs 350
Appendix E – OSHA Respirator Requirements for Selected Chemicals 351
Appendix F – Miscellaneous Notes 361
Appendix G – Vacated 1989 OSHA PELs 362

Indices 373
CAS Number Index 374
DOT ID Number Index 379
Chemical, Synonym, and Trade Name Index 383

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The Education and Information Division (EID), National Institute for Occupational Safety and Health (NIOSH), has primary responsibility for the development of the *Pocket Guide*. There have been many people who have contributed to the preparation and development of this document since it was first published in 1978. I would like to express my appreciation to the following people within EID for their efforts: Vern Anderson for general guidance; Guss Hasbani (Constella Group, Inc.) for computer programming and database development that has been vital to the production of this new edition; Heinz Ahlers, Barb Dames, Charles Geraci, Richard Niemeier, David Votaw, Alan Weinrich, and Ralph Zumwalde for policy review; David Case, Laura Delaney, and Rolland Rogers for reformatting and computerization; Vanessa Becks, Anne Hamilton, and Rodger Tatken for editorial review; Clayton Doak, Eileen Kuempel, Leela Murthy, Henryka Nagy, John Palassis, Faye Rice, and David Votaw for assistance in updating and adding information; Lawrence Foster, Vicki Reuss, Lucy Schoolfield, and Ronald Schuler for data acquisition; Kent Hatfield for consultation on toxicology issues; Charlene Maloney for publication dissemination and general guidance; and Oliver F. Cobb and Associates (Carla Brooks, George Brown, Sherri Diana, and Jesse Romans) for answering requests and mailing thousands of copies of the *Pocket Guide*.

The following people, who constitute the *Pocket Guide* Editorial Board, have contributed greatly by providing guidance and review of the content and style of this new edition: Steven Ahrenholz (Division of Surveillance, Hazard Evaluations and Field Studies, DSHEFS), Roland BerryAnn (National Personal Protective Technology Laboratory, NPPTL), Joseph Bowman (Division of Applied Research and Technology, DART), Pamela Drake (Spokane Research Laboratory, SRL), Gerald Joy (Pittsburgh Research Laboratory, PRL), Alan Lunsford (DART), Nancy Nilsen (DSHEFS), Paula Fey O'Connor (DART), Carl Ornot (Office of Administrative and Management Services, OAMS), Jay Snyder (NPPTL), Sidney Soderholm (Health Effects Laboratory Division, HELD), David Sylvain (DSHEFS), Ainsley Weston (HELD), and Anthony Zimmer (DART).

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Also, thanks are due to all of the people who have reviewed and commented on the *Pocket Guide* during its initial development and subsequent revisions.

Michael E. Barsan
(Technical Editor)

INTRODUCTION

The *NIOSH Pocket Guide to Chemical Hazards* provides a concise 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 commonly found in the work environment (e.g., manganese compounds, tellurium compounds, inorganic tin compounds, etc.). The industrial hygiene information found in the *Pocket Guide* assists users to 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) Occupational Safety and Health Standards (29 CFR 1910.1000 – 1052).

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. (For the most current information and updates, consult the electronic version on the NIOSH Web site: http://www.cdc.gov/niosh/npg/npg.html.)

Data Collection and Application

The data collected for this revision were derived 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 standard 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 in order 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] (http://www.cdc.gov/niosh/92-100.html). 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. Individual tables for each chemical present this data in the Chemical Listing section (page 1). To maximize the amount of data provided in the limited space in these tables, 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 field in these chemical tables in the following subsections.

Chemical Name

The chemical name found in the OSHA General Industry Air Contaminants Standard (29 CFR 1910.1000) is listed in the blue box in the top left portion of each chemical table. This name is referred to as the “primary name” in the Chemical, Synonym, and Trade Name Index (page 383).

Structure/Formula

The chemical structure or formula is listed in the field to the right of the chemical name in each chemical table. Carbon-carbon double bonds (-C=C-) and carbon-carbon triple bonds (-C≡C-) have been indicated where applicable.

CAS Number

This section lists the Chemical Abstracts Service (CAS) registry number. The CAS number, in the format xxx-xx-x, is unique for each chemical and allows efficient searching on computerized data bases. A page index for all CAS registry numbers listed is included at the back of the *Pocket Guide* (page 374) to help the user locate a specific substance.

RTECS Number

This section lists the NIOSH Registry of Toxic Effects of Chemical Substances (RTECS®) number, in the format ABxxxxxxx. 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®. For more information visit the MDL Web site (http://www.mdli.com).

The RTECS® entries for chemicals listed in the *Pocket Guide* can be viewed on the NIOSH Web site (http://www.cdc.gov/niosh/npg/npg.html) or on the CD-ROM version of the *Pocket Guide* (see page iii for ordering information).

IDLH

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 (RD_{50}); other short-term exposure guidelines; and the *NIOSH Respirator Selection Logic* (DHHS [NIOSH] Publication No. 2005-100;

http://www.cdc.gov/niosh/docs/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 (http://www.cdc.gov/niosh/idlh/idlh-1.html). 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!

The *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 *Respirator Selection Logic* uses IDLH values as one of several respirator selection criteria. Under the *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 (page 361) contains an explanation of the "Effective" IDLHs used for four chloronaphthalene compounds.

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/m^3 (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.

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 xxxx 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). This information is also available on the CD-ROM and Web site versions of the *Pocket Guide* (http://www.cdc.gov/niosh/npg/npg.html). A page index for all DOT ID numbers listed is provided on page 379 to help the user locate a specific substance; please note however, that many DOT numbers are **not** unique for a specific substance.

Synonyms and Trade Names

This section contains an alphabetical list of common synonyms and trade names for each chemical. A page index for all chemical names, synonyms, and trade names listed in the *Pocket Guide* is included on page 383.

Exposure Limits

The NIOSH recommended exposure limits (**REL**s) 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 [page 342], which contains a brief discussion of potential occupational carcinogens).

The OSHA permissible exposure limits (**PEL**s), 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 962 (11th Cir., 1992) vacated more protective PELs set by OSHA in 1989 for 212 substances, moving them back to PELs

established in 1971. The appeals court also vacated new PELs for 164 substances that were not previously regulated. Enforcement of the court decision began on June 30, 1993. Although OSHA is currently enforcing exposure limits in Tables Z-1, Z-2, and Z-3 of 29 CFR 1910.1000 which were in effect before 1989, violations of the "general duty clause" as contained in Section 5(a) (1) of the Occupational Safety and Health Act may be considered when worker exposures exceed the 1989 PELs for the 164 substances that were not previously regulated. The substances for which OSHA PELs were vacated on June 30, 1993 are indicated by the symbol "†" following OSHA in this section and previous values (the PELs that were vacated) are listed in Appendix G (page 362).

TWA concentrations for OSHA **PEL**s 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 PEL 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 (page 344) contains a brief discussion of substances regulated as carcinogens by OSHA.

Concentrations are given in ppm, mg/m^3, mppcf (millions of particles per cubic foot of air as determined from counting an impinger sample), or $fibers/cm^3$ (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 (page 345) 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 (chromic acid and chromates, chromium(II) and chromium(III) compounds, and chromium metal), coal tar pitch volatiles, coke oven emissions, cotton dust, lead, mineral dusts, NIAX® Catalyst ESN, trichloroethylene, and tungsten carbide (cemented). Appendix D (page 350) contains a brief discussion of substances included in the *Pocket Guide* with no established RELs at this time. Appendix F (page 361) contains information regarding the OSHA PEL for benzene and IDLH values for four chloronaphthalene compounds, and Appendix G (page 362) lists the OSHA PELS that were vacated on June 30, 1993.

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 [http://www.cdc.gov/niosh/nmam]) 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. Table 1 (page xvii) lists the editions, volumes, and supplements of the *NIOSH Manual of Analytical Methods*.

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.

Physical Description

A brief description of the appearance and odor of each substance is provided in the physical description section. 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.

MW..... Molecular weight

BP.....Boiling point at 1 atmosphere, °F

Sol..... Solubility in water at 68°F*, % by weight (i.e., g/100 ml)

Fl.P..... 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 "(oc)" for open cup), °F

IP..... 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.)

Sp.Gr..... Specific gravity at 68°F* referenced to water at 39.2°F (4°C)

RGasD…..... Relative density of gases referenced to air = 1 (indicates how many times a gas is heavier than air at the same temperature)

VP..... Vapor pressure at 68°F*, mm Hg;
"approx" indicates approximately

FRZ..... Freezing point for liquids and gases, °F

MLT..... Melting point for solids, °F

UEL.....Upper explosive (flammable) limit in air, % by volume (at room temperature*)

LEL..... Lower explosive (flammable) limit in air, % by volume (at room temperature*)

MEC.....Minimum explosive concentration, g/m^3 (when available)

*If noted after a specific entry, these properties may be reported at other temperatures.

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:

Class IA flammable liquid..... Fl.P below 73°F and BP below 100°F.
Class IB flammable liquid..... Fl.P below 73°F and BP at or above 100°F.
Class IC flammable liquid..... Fl.P at or above 73°F and below 100°F.
Class II combustible liquid..... Fl.P at or above 100°F and below 140°F.
Class IIIA combustible liquid..... Fl.P at or above 140°F and below 200°F.
Class IIIB combustible liquid..... Fl.P at or above 200°F.

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. Table 2 (page xviii) explains the codes used. Each category is described as follows:

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

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 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/npg/npg.html) and will be incorporated into subsequent editions of the *Pocket Guide.* [Appendix F (page 361) 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. See Table 4 (page xxv) for information concerning the selection of N-, R-, or P-series (Part 84) particulate respirators.

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)]. *(Note: All respirator codes containing "**Ccr**" or "**Ov**" are covered by this 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 (page 342) 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 that are acceptable for use up to the MUC. Codes for the various categories of respirators, and Assigned Protection Factors (APFs) for these respirators, are listed in Table 3 (page xx). Individual respirator classes are separated by diagonal lines (/). More protective respirators may be worn. The symbol "**§**" is followed by the classes of respirators that are acceptable for emergency or planned entry into unknown concentrations or entry into IDLH 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*.

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. A 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), which are available on the Respirator Topic Page on the NIOSH Web site (http://www.cdc.gov/niosh/npptl/topics/respirators).

Incompatibilities and Reactivities

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

Exposure Routes, Symptoms, and Target Organs

The first row for each substance in this section lists the toxicologically important entry routes (**ER**) and whether contact with the skin or eyes is potentially hazardous. The second row lists the potential symptoms of exposure (**SY**) and whether NIOSH considers the substance a potential occupational carcinogen (**[carc]**). The third row lists target organs (**TO**) affected by exposure to the substance (for carcinogens, the types of cancer are listed in brackets). Information in this section reflects human data unless otherwise noted. Abbreviations are defined in Table 5 (page xxvi).

First Aid

This section lists emergency procedures for eye and skin contact, inhalation, and ingestion of the toxic substance. Abbreviations are defined in Table 6 (page xxviii).

Table 1
NIOSH Manual of Analytical Methods

Edition	Volume	Supplement	Publication No.
2	1		77-157-A
2	2		77-157-B
2	3		77-157-C
2	4		78-175
2	5		79-141
2	6		80-125
2	7		82-100
3			84-100
3		1	85-117
3		2	87-117
3		3	89-127
3		4	90-121
4			94-113
4		1	96-135
4		2	98-119
4		3	2003-154

See **Measurement Methods** section on page xii for more information. The *NIOSH Manual of Analytical Methods* is available on the NIOSH Web site (http://www.cdc.gov/niosh/nmam).

Table 2
Personal Protection and Sanitation Codes

Code		Definition
Skin:	Prevent skin contact	Wear appropriate personal protective clothing to prevent skin contact.
	Frostbite	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.
	N.R	No recommendation is made specifying the need for personal protective equipment for the body.
Eyes:	Prevent eye contact	Wear appropriate eye protection to prevent eye contact.
	Frostbite	Wear appropriate eye protection to prevent eye contact with the liquid that could result in burns or tissue damage from frostbite.
	N.R.	No recommendation is made specifying the need for eye protection.
Wash skin:	When contam	The worker should immediately wash the skin when it becomes contaminated.
	Daily	The worker should wash daily at the end of each work shift, and prior to eating, drinking, smoking, etc.
	N.R.	No recommendation is made specifying the need for washing the substance from the skin (either immediately or at the end of the work shift).
Remove:	When wet or contam	Work clothing that becomes wet or significantly contaminated should be removed and replaced.
	When wet (flamm)	Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100°F).
	N.R.	No recommendation is made specifying the need for removing clothing that becomes wet or contaminated.

Table 2 (Continued)
Personal Protection and Sanitation Codes

Code		Definition
Change:	Daily	Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises.
	N.R.	No recommendation is made specifying the need for the worker to change clothing after the workshift.
Provide:	Eyewash	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.
	Quick drench	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.]
	Frostbite wash	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.
Other codes:	Liq	Liquid
	Molt	Molten
	Sol	Solid
	Soln	Solution containing the contaminant
	Vap	Vapor

Table 3
Symbols, Code Components, and Codes Used for Respirator Selection

Symbol	Description
¥	At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration
§	Emergency or planned entry into unknown concentrations or IDLH conditions
*	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
APF	Assigned protection factor

Code Component	Description
95	Particulate respirator or filter that is 95% efficient. See **Table 4** (page xxv) to select N95, R95, or P95.
99	Particulate respirator or filter that is 99% efficient. See **Table 4** (page xxv) to select N99, R99, or P99.
100	Particulate respirator or filter that is 99.97% efficient. See **Table 4** (page xxv) to select N100, R100, or P100.
Ccr	Chemical cartridge respirator
F	Full facepiece
GmF	Air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister
Papr	Powered, air-purifying respirator
Sa	Supplied-air respirator
Scba	Self-contained breathing apparatus
Ag	Acid gas cartridge or canister
Cf	Continuous flow mode
Hie	High-efficiency particulate filter
Ov	Organic vapor cartridge or canister
Pd,Pp	Pressure-demand or other positive-pressure mode
Qm	Quarter-mask respirator
S	Chemical cartridge or canister providing protection against the compound of concern
T	Tight-fitting facepiece
XQ	Except quarter-mask respirator

Table 3 (Continued)
Symbols, Code Components, and Codes Used for Respirator Selection

Code	APF	Description
95F	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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
95XQ	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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
100F	50	Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
100XQ	10	Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
CcrFAg100	50	Any chemical cartridge respirator with a full facepiece and acid gas cartridge(s) in combination with an N100, R100, or P100 filter. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
CcrFOv	50	Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s).
CcrFOv95	10	Any full-facepiece 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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
CcrFOv100	50	Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
CcrFS	50	Any air-purifying full-facepiece respirator equipped with cartridge(s) providing protection against the compound of concern.
CcrFS100	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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
CcrOv	10	Any air-purifying half-mask respirator equipped with organic vapor cartridge(s).

Table 3 (Continued)
Symbols, Code Components, and Codes Used for Respirator Selection

Code	APF	Description
CcrOv95	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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
CcrOv100	10	Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
CcrOvAg	10	Any air-purifying half-mask respirator equipped with organic vapor and acid gas cartridge(s).
CcrS	10	Any air-purifying half-mask respirator equipped with cartridge(s) providing protection against the compound of concern.
GmFAg	50	Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister.
GmFAg100	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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
GmFOv	50	Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister.
GmFOv95	10	Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
GmFOv100	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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
GmFOvAg	50	Any air-purifying, full facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor and acid gas canister.
GmFOvAg100	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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
GmFS	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.

Table 3 (Continued)
Symbols, Code Components, and Codes Used for Respirator Selection

Code	APF	Description
GmFS100	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. See **Table 4** (page xxv) for information on selection of N, R, or P filters.
PaprAg	25	Any powered air-purifying respirator with acid gas cartridge(s).
PaprAgHie	25	Any powered air-purifying respirator with acid gas cartridge(s) in combination with a high-efficiency particulate filter.
PaprHie	25	Any powered air-purifying respirator with a high-efficiency particulate filter.
PaprOv	25	Any powered air-purifying respirator with organic vapor cartridge(s).
PaprOvAg	25	Any powered air-purifying respirator with organic vapor and acid gas cartridge(s).
PaprOvHie	25	Any powered air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.
PaprS	25	Any powered air-purifying respirator with cartridge(s) providing protection against the compound of concern.
PaprTHie	50	Any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.
PaprTOv	50	Any powered air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s).
PaprTOvHie	50	Any powered air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter.
PaprTS	50	Any powered air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern.
Qm	5	Any quarter-mask respirator. See **Table 4** (page xxv) for information on selection of N, R, or P particulate filters.
Sa	10	Any supplied-air respirator.
Sa:Cf	25	Any supplied-air respirator operated in a continuous-flow mode.
Sa:Pd,Pp	1,000	Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode.

Table 3 (Continued)
Symbols, Code Components, and Codes Used for Respirator Selection

Code	APF	Description
SaF	50	Any supplied-air respirator with a full facepiece.
SaF:Pd,Pp	2,000	Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive pressure mode.
SaF:Pd,Pp:AScba	10,000	Any supplied-air respirator that has a full-facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
SaT:Cf	50	Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode.
ScbaE		Any appropriate escape-type, self-contained breathing apparatus.
ScbaF	50	Any self-contained breathing apparatus with a full facepiece.
ScbaF:Pd,Pp	10,000	Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Table 4
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 **N**ot resistant to oil,
> **R** for **R**esistant to oil,
> **P** for oil **P**roof.

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 **Table 3** (page xx) for APFs of respirator classes, and see **Recommendations for Respirator Selection** (page xiv) for more information.

Table 5
Abbreviations for Exposure Routes, Symptoms, and Target Organs

Code	Definition	Code	Definition
abdom	Abdominal	dizz	Dizziness
abnor	Abnormal/Abnormalities	drow	Drowsiness
abs	Skin absorption	dysp	Dyspnea (breathing difficulty)
album	Albuminuria	emphy	Emphysema
anes	Anesthesia	eosin	Eosinophilia
anor	Anorexia	epilep	Epileptiform
anos	Anosmia (loss of the sense of smell)	epis	Epistaxis (nosebleed)
anxi	Anxiety	equi	Equilibrium
arrhy	Arrhythmias	eryt	Erythema (skin redness)
aspir	Aspiration	euph	Euphoria
asphy	Asphyxia	fail	Failure
BP	Blood pressure	fasc	Fasciculation
breath	Breath/breathing	FEV	Forced expiratory volume
bron	Bronchitis	fib	Fibrosis
BUN	Blood urea nitrogen	ftg	Fatigue
[carc]	Potential occupational carcinogen	func	Function
card	Cardiac	GI	Gastrointestinal
chol	Cholinesterase	halu	Hallucinations
cirr	Cirrhosis	head	Headache
CNS	Central nervous system	hema	Hematuria (blood in the urine)
conc	Concentration	hemato	Hematopoietic
con	Skin and/or eye contact	hemorr	Hemorrhage
conf	Confusion	hyperpig	Hyperpigmentation
conj	Conjunctivitis	hypox	Hypoxemia (reduced O_2 in the blood)
constip	Constipation	inco	Incoordination
convuls	Convulsions	incr	Increased
corn	Corneal	inebri	Inebriation
CVS	Cardiovascular system	inflamm	Inflammation
cyan	Cyanosis	ing	Ingestion
decr	Decreased	inh	Inhalation
depres	Depressed/Depression	inj	Injury
derm	Dermatitis	insom	Insomnia
diarr	Diarrhea	irreg	Irregular/Irregularities
dist	Disturbance	irrit	Irritation

Table 5 (Continued)
Abbreviations for Exposure Routes, Symptoms, and Target Organs

Code	Definition	Code	Definition
irrity	Irritability	prot	Proteinuria
jaun	Jaundice	pulm	Pulmonary
kera	Keratitis (inflammation of the cornea)	RBC	Red blood cell
lac	Lacrimation (discharge of tears)	repro	Reproductive
lar	Laryngeal	resp	Respiratory/respiration
lass	Lassitude (weakness, exhaustion)	restless	Restlessness
leucyt	Leukocytosis (increased blood leukocytes)	retster	Retrosternal (occurring behind the sternum)
leupen	Leukopenia (reduced blood leukocytes)	rhin	Rhinorrhea (discharge of thin nasal mucus)
liq	Liquid		
local	Localized	salv	Salivation
low-wgt	Weight loss	sens	Sensitization
mal	Malaise (vague feeling of discomfort)	short	Shortness
malnut	Malnutrition	sneez	Sneezing
methemo	Methemoglobinemia	sol	Solid
muc memb	Mucous membrane	soln	Solution
musc	Muscle	subs	Substernal (occurring beneath the sternum)
narco	Narcosis		
nau	Nausea	sweat	Sweating
nec	Necrosis	swell	Swelling
neph	Nephritis	sys	System
numb	Numb/numbness	tacar	Tachycardia
opac	Opacity	tend	Tenderness
palp	Palpitations	terato	Teratogenic
para	Paralysis	throb	Throbbing
pares	Paresthesia	tight	Tightness
perf	Perforation	twitch	Twitching
peri neur	Peripheral neuropathy	uncon	Unconsciousness
periorb	Periorbital (situated around the eye)	vap	Vapor
phar	Pharyngeal	vesic	Vesiculation
photo	Photophobia (abnormal visual intolerance to light)	vis	Visual
		vomit	Vomiting
pneu	Pneumonitis	weak	Weak/weakness
polyneur	Polyneuropathy	wheez	Wheezing

Table 6
Codes for First Aid Data

Code	Definition
Eye:	
Irr immed	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.
Irr prompt	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.
Frostbite	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.
Medical attention	Get medical attention.
Skin:	
Blot/brush away	If irritation occurs, gently blot or brush away excess.
Dust off solid; water flush	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.
Frostbite	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.
Molten flush immed/ sol-liq soap wash prompt	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.
Soap flush immed	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.
Soap flush prompt	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.

Table 6 (Continued)
Codes for First Aid Data

Code	Definition
Skin (continued):	
Soap prompt/molten flush immed	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.
Soap wash	If this chemical contacts the skin, wash the contaminated skin with soap and water.
Soap wash immed	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.
Soap wash prompt	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.
Water flush	If this chemical contacts the skin, flush the contaminated skin with water. Where there is evidence of skin irritation, get medical attention.
Water flush immed	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.
Water flush prompt	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.
Water wash	If this chemical contacts the skin, wash the contaminated skin with water.
Water wash immed	If this chemical contacts this 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.
Water wash prompt	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.

Table 6 (Continued)
Codes for First Aid Data

Code	Definition
Breath:	
Resp support	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. Keep the affected person warm and at rest. Get medical attention as soon as possible.
Fresh air	If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. Other measures are usually unnecessary.
Fresh air; 100% O_2	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.
Swallow:	
Medical attention immed	If this chemical has been swallowed, get medical attention immediately.

CHEMICAL LISTING

A

Acetaldehyde

Formula:	CAS#:	RTECS#:	IDLH:
CH_3CHO	75-07-0	AB1925000	Ca [2000 ppm]

Conversion: 1 ppm = 1.80 mg/m^3 **DOT:** 1089 129

Synonyms/Trade Names: Acetic aldehyde, Ethanal, Ethyl aldehyde

Exposure Limits:
NIOSH REL: Ca
See Appendix A
See Appendix C (Aldehydes)
OSHA PEL†: TWA 200 ppm (360 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2018, 2538, 3507
OSHA 68

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

Chemical & Physical Properties:
MW: 44.1
BP: 69°F
Sol: Miscible
FI.P: -36°F
IP: 10.22 eV
Sp.Gr: 0.79
VP: 740 mmHg
FRZ: -190°F
UEL: 60%
LEL: 4.0%
Class IA Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids, bases, alcohols, ammonia & amines, phenols, ketones, HCN, H_2S [**Note:** Prolonged contact with air may cause formation of peroxides that may explode and burst containers; easily undergoes polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat; eye, skin burns; derm; conj; cough; CNS depres; delayed pulm edema; in animals: kidney, repro, terato effects; [carc]
TO: Eyes, skin, resp sys, kidneys, CNS, repro sys [in animals: nasal cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Acetic acid

Formula:	CAS#:	RTECS#:	IDLH:
CH_3COOH	64-19-7	AF1225000	50 ppm

Conversion: 1 ppm = 2.46 mg/m^3 **DOT:** 2790 153 (10-80% acid); 2789 132 (>80% acid)

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.]

Exposure Limits:
NIOSH REL: TWA 10 ppm (25 mg/m^3)
ST 15 ppm (37 mg/m^3)
OSHA PEL: TWA 10 ppm (25 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1603
OSHA ID186SG

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.]

Chemical & Physical Properties:
MW: 60.1
BP: 244°F
Sol: Miscible
FI.P: 103°F
IP: 10.66 eV
Sp.Gr: 1.05
VP: 11 mmHg
FRZ: 62°F
UEL(200°F): 19.9%
LEL: 4.0%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (>10%)
Eyes: Prevent eye contact
Wash skin: When contam (>10%)
Remove: When wet or contam (>10%)
Change: N.R.
Provide: Eyewash (>5%)
Quick drench (>50%)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, nose, throat; eye, skin burns; skin sens; dental erosion; black skin, hyperkeratosis; conj, lac; phar edema, chronic bron
TO: Eyes, skin, resp sys, teeth

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Acetic anhydride	**Formula:** $(CH_3CO)_2O$	**CAS#:** 108-24-7	**RTECS#:** AK1925000	**IDLH:** 200 ppm

Conversion: 1 ppm = 4.18 mg/m^3 **DOT:** 1715 137

Synonyms/Trade Names: Acetic acid anhydride, Acetic oxide, Acetyl oxide, Ethanoic anhydride

Exposure Limits:
NIOSH REL: C 5 ppm (20 mg/m^3)
OSHA PEL†: TWA 5 ppm (20 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 3506
OSHA 82, 102

Physical Description: Colorless liquid with a strong, pungent, vinegar-like odor.

Chemical & Physical Properties:
MW: 102.1
BP: 282°F
Sol: 12%
FI.P: 120°F
IP: 10.00 eV
Sp.Gr: 1.08
VP: 4 mmHg
FRZ: -99°F
UEL: 10.3%
LEL: 2.7%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
125 ppm: Sa:Cf£/PaprOv£
200 ppm: CcrFOv/GmFOv/PaprTOv£/ ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Conj, lac, corn edema, opac, photo; nasal, phar irrit; cough, dysp, bron; skin burns, vesic, sens derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Acetone	**Formula:** $(CH_3)_2CO$	**CAS#:** 67-64-1	**RTECS#:** AL3150000	**IDLH:** 2500 ppm [10%LEL]

Conversion: 1 ppm = 2.38 mg/m^3 **DOT:** 1090 127

Synonyms/Trade Names: Dimethyl ketone, Ketone propane, 2-Propanone

Exposure Limits:
NIOSH REL: TWA 250 ppm (590 mg/m^3)
OSHA PEL†: TWA 1000 ppm (2400 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1300, 2555, 3800
OSHA 69

Physical Description: Colorless liquid with a fragrant, mint-like odor.

Chemical & Physical Properties:
MW: 58.1
BP: 133°F
Sol: Miscible
FI.P: 0°F
IP: 9.69 eV
Sp.Gr: 0.79
VP: 180 mmHg
FRZ: -140°F
UEL: 12.8%
LEL: 2.5%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
2500 ppm: CcrOv*/PaprOv*/GmFOv/ Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat; head, dizz, CNS depres; derm
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Acetone cyanohydrin

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3C(OH)CNCH_3$	75-86-5	OD9275000	N.D.

Conversion: 1 ppm = 3.48 mg/m^3 **DOT:** 1541 155 (stabilized)

Synonyms/Trade Names: Cyanohydrin-2-propanone, 2-Cyano-2-propanol, α-Hydroxyisobutyronitrile, 2-Hydroxy-2-methyl-propionitrile, 2-Methyllactonitrile

Exposure Limits:
NIOSH REL: C 1 ppm (4 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 2506

Physical Description: Colorless liquid with a faint odor of bitter almond. [**Note:** Forms cyanide in the body.]

Chemical & Physical Properties:
MW: 85.1
BP: 203°F
Sol: Miscible
Fl.P: 165°F
IP: ?
Sp.Gr(77°F): 0.93
VP: 0.8 mmHg
FRZ: -4°F
UEL: 12.0%
LEL: 2.2%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 ppm: Sa
25 ppm: Sa:Cf
50 ppm: ScbaF/SaF
250 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; dizz, lass, head, conf, convuls; liver, kidney inj; pulm edema, asphy
TO: Eyes, skin, resp sys, CNS, CVS, liver, kidneys, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Acetonitrile

Formula:	CAS#:	RTECS#:	IDLH:
CH_3CN	75-05-8	AL7700000	500 ppm

Conversion: 1 ppm = 1.68 mg/m^3 **DOT:** 1648 127

Synonyms/Trade Names: Cyanomethane, Ethyl nitrile, Methyl cyanide [**Note:** Forms cyanide in the body.]

Exposure Limits:
NIOSH REL: TWA 20 ppm (34 mg/m^3)
OSHA PEL†: TWA 40 ppm (70 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1606

Physical Description: Colorless liquid with an aromatic odor.

Chemical & Physical Properties:
MW: 41.1
BP: 179°F
Sol: Miscible
Fl.P(oc): 42°F
IP: 12.20 eV
Sp.Gr: 0.78
VP: 73 mmHg
FRZ: -49°F
UEL: 16.0%
LEL: 3.0%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
200 ppm: CcrOv/Sa
500 ppm: Sa:Cf/PaprOv/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit nose, throat; asphy; nau, vomit; chest pain; lass; stupor, convuls; in animals: liver, kidney damage
TO: Resp sys, CVS, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

2-Acetylaminofluorene	Formula: $C_{15}H_{13}NO$	CAS#: 53-96-3	RTECS#: AB9450000	IDLH: Ca [N.D.]
Conversion:	**DOT:**			

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

Measurement Methods (see Table 1):
None available

Physical Description: Tan, crystalline powder.

Chemical & Physical Properties:
MW: 223.3
BP: ?
Sol: Insoluble
FI.P: ?
IP:?
Sp.Gr: ?
VP: ?
MLT: 381°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Reduced function of liver, kidneys, bladder, pancreas; [carc]
TO: Liver, bladder, kidneys, pancreas, skin [in animals: tumors of the liver, bladder, lungs, skin & pancreas]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Acetylene	Formula: HC≡CH	CAS#: 74-86-2	RTECS#: AO9600000	IDLH: N.D.
Conversion: 1 ppm = 1.06 mg/m^3	**DOT:** 1001 116			

Synonyms/Trade Names: Ethine, Ethyne [**Note:** A compressed gas used in the welding & cutting of metals.]

Exposure Limits:
NIOSH REL: C 2500 ppm (2662 mg/m^3)
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH
Acetylene Criteria Document

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

Chemical & Physical Properties:
MW: 26.0
BP: Sublimes
Sol: 2%
FI.P: NA (Gas)
IP: 11.40 eV
RGasD: 0.91
VP: 44.2 atm
FRZ: -119°F (Sublimes)
UEL: 100%
LEL: 2.5%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Head, dizz; asphy; liquid: frostbite
TO: CNS, resp sys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Fresh air

Acetylene tetrabromide

Formula:	CAS#:	RTECS#:	IDLH:
$CHBr_2CHBr_2$	79-27-6	KI8225000	8 ppm

Conversion: 1 ppm = 14.14 mg/m^3 **DOT:** 2504 159

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/m^3)

Measurement Methods (see Table 1):
NIOSH 2003

Physical Description: Pale-yellow liquid with a pungent odor similar to camphor or iodoform. [**Note:** A solid below 32°F.]

Chemical & Physical Properties:
MW: 345.7
BP: 474°F (Decomposes)
Sol: 0.07%
Fl.P: NA
IP: ?
Sp.Gr: 2.97
VP: 0.02 mmHg
FRZ: 32°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
8 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong caustics; hot iron; reducing metals such as aluminum, magnesium, and zinc

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose; anor, nau; head; abdom pain; jaun; leucyt; CNS depres
TO: Eyes, resp sys, liver, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Acetylsalicyclic acid

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3COOC_6H_4COOH$	50-78-2	VO0700000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: o-Acetoxybenzoic acid, 2-Acetoxybenzoic acid, Aspirin

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500

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

Chemical & Physical Properties:
MW: 180.2
BP: 284°F (Decomposes)
Sol(77°F): 0.3%
Fl.P: NA
IP: NA
Sp.Gr: 1.35
VP: 0 mmHg (approx)
MLT: 275°F
UEL: NA
LEL: NA
MEC: 40 g/m^3
Combustible Powder; explosion hazard if dispersed in air.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: N.R.
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; incr blood clotting time; nau, vomit; liver, kidney inj
TO: Eyes, skin, resp sys, blood, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Acrolein

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=CHCHO	107-02-8	AS1050000	2 ppm

Conversion: 1 ppm = 2.29 mg/m^3

DOT: 1092 131P (inhibited)

Synonyms/Trade Names: Acraldehyde, Acrylaldehyde, Acrylic aldehyde, Allyl aldehyde, Propenal, 2-Propenal

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.25 mg/m^3)
ST 0.3 ppm (0.8 mg/m^3)
See Appendix C (Aldehydes)
OSHA PEL†: TWA 0.1 ppm (0.25 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2501
OSHA 52

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

Chemical & Physical Properties:
MW: 56.1
BP: 127°F
Sol: 40%
FI.P: -15°F
IP: 10.13 eV
Sp.Gr: 0.84
VP: 210 mmHg
FRZ: -126°F
UEL: 31%
LEL: 2.8%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2 ppm: Sa:Cf*/PaprOv*/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; decr pulm func; delayed pulm edema; chronic resp disease
TO: Eyes, skin, resp sys, heart

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Acrylamide

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=CHCONH$_2$	79-06-1	AS3325000	Ca [60 mg/m^3]

Conversion:

DOT: 2074 153P

Synonyms/Trade Names: Acrylamide monomer, Acrylic amide, Propenamide, 2-Propenamide

Exposure Limits:
NIOSH REL: Ca
TWA 0.03 mg/m^3 [skin]
See Appendix A
OSHA PEL†: TWA 0.3 mg/m^3 [skin]

Measurement Methods (see Table 1):
OSHA 21, PV2004

Physical Description: White crystalline, odorless solid.

Chemical & Physical Properties:
MW: 71.1
BP: 347-572°F (Decomposes)
Sol(86°F): 216%
FI.P: 280°F
IP: 9.50 eV
Sp.Gr: 1.12
VP: 0.007 mmHg
MLT: 184°F
UEL: ?
LEL: ?
Combustible Solid (may also be dissolved in flammable liquids).

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers
[**Note:** May polymerize violently upon melting.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; ataxia, numb limbs, pares; musc weak; absent deep tendon reflex; hand sweat; lass, drow; repro effects; [carc]
TO: Eyes, skin, CNS, PNS, repro sys [in animals: tumors of the lungs, testes, thyroid & adrenal glands]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Acrylic acid

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=CHCOOH	79-10-7	AS4375000	N.D.

Conversion: 1 ppm = 2.95 mg/m^3 **DOT:** 2218 132P (inhibited)

Synonyms/Trade Names: Acroleic acid, Aqueous acrylic acid (technical grade is 94%), Ethylenecarboxylic acid, Glacial acrylic acid (98% in aqueous solution), 2-Propenoic acid

Exposure Limits:
NIOSH REL: TWA 2 ppm (6 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 28, PV2005

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.]

Chemical & Physical Properties:
MW: 72.1
BP: 286°F
Sol: Miscible
Fl.P: 121°F
IP: ?
Sp.Gr: 1.05
VP: 3 mmHg
FRZ: 55°F
UEL: 8.02%
LEL: 2.4%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; eye, skin burns; skin sens; in animals: lung, liver, kidney inj
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Acrylonitrile

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=CHCN	107-13-1	AT5250000	Ca [85 ppm]

Conversion: 1 ppm = 2.17 mg/m^3 **DOT:** 1093 131P (inhibited)

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]

Measurement Methods (see Table 1):
NIOSH 1604
OSHA 37

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

Chemical & Physical Properties:
MW: 53.1
BP: 171°F
Sol: 7%
Fl.P: 30°F
IP: 10.91 eV
Sp.Gr: 0.81
VP: 83 mmHg
FRZ: -116°F
UEL: 17%
LEL: 3.0%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

See Appendix E (page 351)

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; asphy; head; sneez; nau, vomit; lass, dizz; skin vesic; scaling derm; [carc]
TO: Eyes, skin, CVS, liver, kidneys, CNS [brain tumors, lung & bowel cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Adiponitrile	**Formula:** $NC(CH_2)_4CN$	**CAS#:** 111-69-3	**RTECS#:** AV2625000	**IDLH:** N.D.
Conversion: 1 ppm = 4.43 mg/m^3	**DOT:** 2205 153			
Synonyms/Trade Names: 1,4-Dicyanobutane, Hexanedinitrile, Tetramethylene cyanide				
Exposure Limits: **NIOSH REL:** TWA 4 ppm (18 mg/m^3) **OSHA PEL:** none **Physical Description:** Water-white, practically odorless, oily liquid. [**Note:** A solid below 34°F. Forms cyanide in the body.]			**Measurement Methods (see Table 1):** **NIOSH** Nitriles Criteria Document	
Chemical & Physical Properties: **MW:** 108.2 **BP:** 563°F **Sol:** 4.5% **FI.P(oc):** 199°F **IP:** ? **Sp.Gr:** 0.97 **VP:** 0.002 mmHg **FRZ:** 34°F **UEL:** 5.0% **LEL:** 1.7% Class IIIA Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **40 ppm:** Sa **100 ppm:** Sa:Cf **200 ppm:** ScbaF/SaF **250 ppm:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Oxidizers (e.g., perchlorates, nitrates), strong acids (e.g., sulfuric acid) [**Note:** Decomposes above 194°F, forming hydrogen cyanide.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, resp sys; head, dizz, lass, conf, convuls; blurred vision; dysp; abdom pain, nau, vomit **TO:** Eyes, skin, resp sys, CNS, CVS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Aldrin	**Formula:** $C_{12}H_8Cl_6$	**CAS#:** 309-00-2	**RTECS#:** IO2100000	**IDLH:** Ca [25 mg/m^3]
Conversion:	**DOT:** 2761 151			
Synonyms/Trade Names: HHDN, Octalene, 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-endo-1,4-exo-5,8-dimethanonaphthalene				
Exposure Limits: **NIOSH REL:** Ca TWA 0.25 mg/m^3 [skin] See Appendix A **OSHA PEL:** TWA 0.25 mg/m^3 [skin] **Physical Description:** Colorless to dark-brown crystalline solid with a mild chemical odor. [**Note:** Formerly used as an insecticide.]			**Measurement Methods (see Table 1):** **NIOSH** 5502	
Chemical & Physical Properties: **MW:** 364.9 **BP:** Decomposes **Sol:** 0.003% **FI.P:** NA **IP:** ? **Sp.Gr:** 1.60 **VP:** 0.00008 mmHg **MLT:** 219°F **UEL:** NA **LEL:** NA Noncombustible Solid, but may be dissolved in flammable liquids.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam/Daily **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE	
	Incompatibilities and Reactivities: Concentrated mineral acids, active metals, acid catalysts, acid oxidizing agents, phenol			
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Head, dizz; nau, vomit, mal; myoclonic jerks of limbs; clonic, tonic convuls; coma; hema, azotemia; [carc] **TO:** CNS, liver, kidneys, skin [in animals: tumors of the lungs, liver, thyroid & adrenal glands]			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Allyl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=CHCH$_2$OH	107-18-6	BA5075000	20 ppm

Conversion: 1 ppm = 2.38 mg/m^3 **DOT:** 1098 131

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

Exposure Limits:
NIOSH REL: TWA 2 ppm (5 mg/m^3)
ST 4 ppm (10 mg/m^3) [skin]
OSHA PEL†: TWA 2 ppm (5 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1402, 1405

Physical Description: Colorless liquid with a pungent, mustard-like odor.

Chemical & Physical Properties:
MW: 58.1
BP: 205°F
Sol: Miscible
Fl.P: 70°F
IP: 9.63 eV
Sp.Gr: 0.85
VP: 17 mmHg
FRZ: -200°F
UEL: 18.0%
LEL: 2.5%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
20 ppm: Sa:Cf*/PaprOv*/CcrFOv/ GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Eye irrit, tissue damage; irrit upper resp sys, skin; pulm edema
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Allyl chloride

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=CHCH$_2$Cl	107-05-1	UC7350000	250 ppm

Conversion: 1 ppm = 3.13 mg/m^3 **DOT:** 1100 131

Synonyms/Trade Names: 3-Chloropropene, 1-Chloro-2-propene, 3-Chloropropylene

Exposure Limits:
NIOSH REL: TWA 1 ppm (3 mg/m^3)
ST 2 ppm (6 mg/m^3)
OSHA PEL†: TWA 1 ppm (3 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1000
OSHA 7

Physical Description: Colorless, brown, yellow, or purple liquid with a pungent, unpleasant odor.

Chemical & Physical Properties:
MW: 76.5
BP: 113°F
Sol: 0.4%
Fl.P: -25°F
IP: 10.05 eV
Sp.Gr: 0.94
VP: 295 mmHg
MLT: -210°F
UEL: 11.1%
LEL: 2.9%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 ppm: Sa:Cf*
50 ppm: ScbaF/SaF
250 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids, amines, iron & aluminum chlorides, magnesium, zinc

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, muc memb; pulm edema; in animals: liver, kidney inj
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Allyl glycidyl ether

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_{10}O_2$	106-92-3	RR0875000	50 ppm

Conversion: 1 ppm = 4.67 mg/m^3 **DOT:** 2219 129

Synonyms/Trade Names: AGE, 1-Allyloxy-2,3-epoxypropane, Glycidyl allyl ether, [(2-Propenyloxy)methyl] oxirane

Exposure Limits:
NIOSH REL: TWA 5 ppm (22 mg/m^3) [skin]
ST 10 ppm (44 mg/m^3)
OSHA PEL†: C 10 ppm (45 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2545

Physical Description: Colorless liquid with a pleasant odor.

Chemical & Physical Properties:
MW: 114.2
BP: 309°F
Sol: 14%
FI.P: 135°F
IP: ?
Sp.Gr: 0.97
VP: 2 mmHg
FRZ: -148°F [forms glass]
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 ppm: CcrOv/PaprOv/
GmFOv/Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, resp sys; derm; pulm edema; narco; possible hemato, repro effects
TO: Eyes, skin, resp sys, blood, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Allyl propyl disulfide

Formula:	CAS#:	RTECS#:	IDLH:
$H_2C{=}CHCH_2S_2CH_2CH_2CH_3$	2179-59-1	JO0350000	N.D.

Conversion: 1 ppm = 6.07 mg/m^3 **DOT:**

Synonyms/Trade Names: 4,5-Dithia-1-octene, Onion oil, 2-Propenyl propyl disulfide, Propyl allyl disulfide

Exposure Limits:
NIOSH REL: TWA 2 ppm (12 mg/m^3)
ST 3 ppm (18 mg/m^3)
OSHA PEL†: TWA 2 ppm (12 mg/m^3)

Measurement Methods (see Table 1):
OSHA PV2086

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

Chemical & Physical Properties:
MW: 148.3
BP: ?
Sol: Insoluble
FI.P: ?
IP: ?
Sp.Gr(59°F): 0.93
VP: ?
FRZ: 5°F
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, resp sys; lac
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

α-Alumina

Formula:	CAS#:	RTECS#:	IDLH:
Al_2O_3	1344-28-1	BD1200000	N.D.

Conversion:

DOT:

Synonyms/Trade Names: Alumina, Aluminum oxide, Aluminum trioxide [**Note:** α-Alumina is the main component of technical grade alumina. Corundum is natural Al_2O_3. Emery is an impure crystalline variety of Al_2O_3.]

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600
OSHA ID109SG, ID198SG

Physical Description: White, odorless, crystalline powder.

Chemical & Physical Properties:
MW: 101.9
BP: 5396°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 4.0
VP: 0 mmHg (approx)
MLT: 3632°F
UEL: NA
LEL: NA
Noncombustible solid, but dusts may form explosive mixtures in air.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Blot/brush away
Breath: Fresh air
Swallow: Medical attention immed

Aluminum

Formula:	CAS#:	RTECS#:	IDLH:
Al	7429-90-5	BD0330000	N.D.

Conversion:

DOT: 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/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 7013, 7300, 7301, 7303
OSHA ID121

Physical Description: Silvery-white, malleable, ductile, odorless metal.

Chemical & Physical Properties:
MW: 27.0
BP: 4221°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 2.70
VP: 0 mmHg (approx)
MLT: 1220°F
UEL: NA
LEL: NA
Combustible Solid, finely divided dust is easily ignited; may cause explosions.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Aluminum (pyro powders and welding fumes, as Al)	**Formula:**	**CAS#:**	**RTECS#:**	**IDLH:** N.D.
Conversion:	**DOT:** 1383 135 (powder, pyrophoric)			
Synonyms/Trade Names: Synonyms vary depending upon the specific aluminum compound.				
Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 **OSHA PEL†:** none **Physical Description:** Appearance and odor vary depending upon the specific aluminum compound.			**Measurement Methods (see Table 1):** **NIOSH** 7300, 7301, 7303	
Chemical & Physical Properties: Properties vary depending upon the specific aluminum compound.	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Varies				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit skin, resp sys; pulm fib **TO:** Skin, resp sys		**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed		

Aluminum (soluble salts and alkyls, as Al)	**Formula:**	**CAS#:**	**RTECS#:**	**IDLH:** N.D.
Conversion:	**DOT:** 3051 135 (Aluminum alkyls)			
Synonyms/Trade Names: Synonyms vary depending upon the specific aluminum compound.				
Exposure Limits: **NIOSH REL:** TWA 2 mg/m^3 **OSHA PEL†:** none **Physical Description:** Appearance and odor vary depending upon the specific aluminum compound.			**Measurement Methods (see Table 1):** **NIOSH** 7013, 7300, 7301, 7303 **OSHA** ID121	
Chemical & Physical Properties: Properties vary depending upon the specific aluminum compound.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Varies				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit skin, resp sys; skin burns **TO:** Skin, resp sys		**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed		

4-Aminodiphenyl

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_5C_6H_4NH_2$	92-67-1	DU8925000	Ca [N.D.]

Conversion: **DOT:**

Synonyms/Trade Names: 4-Aminobiphenyl, p-Aminobiphenyl, 4-Phenylaniline

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

Measurement Methods (see Table 1):
NIOSH P&CAM269 (II-4)
OSHA 93

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

Chemical & Physical Properties:
MW: 169.2
BP: 576°F
Sol: Slight
FI.P: ?
IP: ?
Sp.Gr: 1.16
VP(227°F): 1 mmHg
MLT: 127°F
UEL: ?
LEL: ?
Combustible Solid, but must be preheated before ignition possible.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Oxidized by air

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, dizz; drow, dysp; ataxia, lass; methemo; urinary burning; acute hemorrhagic cystitis; [carc]
TO: Bladder, skin [bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

2-Aminopyridine

Formula:	CAS#:	RTECS#:	IDLH:
$NH_2C_5H_4N$	504-29-0	US1575000	5 ppm

Conversion: 1 ppm = 3.85 mg/m^3 **DOT:** 2671 153

Synonyms/Trade Names: α-Aminopyridine, α-Pyridylamine

Exposure Limits:
NIOSH REL: TWA 0.5 ppm (2 mg/m^3)
OSHA PEL: TWA 0.5 ppm (2 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S158 (II-4)

Physical Description: White powder, leaflets, or crystals with a characteristic odor.

Chemical & Physical Properties:
MW: 94.1
BP: 411°F
Sol: >100%
FI.P: 154°F
IP: 8.00 eV
Sp.Gr: ?
VP(77°F): 0.8 mmHg
MLT: 137°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 ppm: Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; head, dizz; excitement; nau; high BP; resp distress; lass; convuls; stupor
TO: CNS, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Amitrole

Formula:	CAS#:	RTECS#:	IDLH:
$C_2H_4N_4$	61-82-5	XZ3850000	Ca [N.D.]

Conversion:

DOT:

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/m^3
See Appendix A

OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500
OSHA PV2006

Physical Description: Colorless to white, crystalline powder. [herbicide]
[**Note:** Odorless when pure.]

Chemical & Physical Properties:
MW: 84.1
BP: ?
Sol(77°F): 28%
FI.P: NA
IP: ?
Sp.Gr: 1.14
VP: <0.000008 mmHg
MLT: 318°F
UEL: NA
LEL: NA
Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; dysp, musc spasms, ataxia, anor, salv, incr body temperature; lass, skin dryness, depres (thyroid func suppression)
TO: Eyes, skin, thyroid [in animals: liver, thyroid & pituitary gland tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Ammonia

Formula:	CAS#:	RTECS#:	IDLH:
NH_3	7664-41-7	BO0875000	300 ppm

Conversion: 1 ppm = 0.70 mg/m^3

DOT: 1005 125 (anhydrous); 2672 154 (10-35% solution); 2073 125 (>35-50% solution); 1005 125 (>50% solution)

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

Exposure Limits:
NIOSH REL: TWA 25 ppm (18 mg/m^3)
ST 35 ppm (27 mg/m^3)

OSHA PEL†: TWA 50 ppm (35 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 3800, 6015, 6016
OSHA ID188

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

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

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam (solution)
Remove: When wet or contam (solution)
Change: N.R.
Provide: Eyewash (>10%)
Quick drench (>10%)

Respirator Recommendations (see Tables 3 and 4):
NIOSH
250 ppm: CcrS*/Sa*
300 ppm: Sa:Cf*/PaprS*/CcrFS/GmFS/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

[**Note:** Although NH_3 does not meet the DOT definition of a Flammable Gas (for labeling purposes), it should be treated as one.]

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing (solution), Con (solution/liquid)
SY: Irrit eyes, nose, throat; dysp, wheez, chest pain; pulm edema; pink frothy sputum; skin burns, vesic; liquid: frostbite
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed (solution/liquid)
Skin: Water flush immed (solution/liquid)
Breath: Resp support
Swallow: Medical attention immed (solution)

Ammonium chloride fume

Formula:	CAS#:	RTECS#:	IDLH:
NH_4Cl	12125-02-9	BP4550000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Ammonium chloride, Ammonium muriate fume, Sal ammoniac fume

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3
ST 20 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA ID188

Physical Description: Finely divided, odorless, white particulate dispersed in air.

Chemical & Physical Properties:
MW: 53.5
BP: Sublimes
Sol: 37%
Fl.P: NA
IP: NA
Sp.Gr: 1.53
VP(321°F): 1 mmHg
MLT: 662°F (Sublimes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys; cough, dysp, pulm sens
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support

Ammonium sulfamate

Formula:	CAS#:	RTECS#:	IDLH:
$NH_4OSO_2NH_2$	7773-06-0	WO6125000	1500 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: Ammate herbicide, Ammonium amidosulfonate, AMS, Monoammonium salt of sulfamic acid, Sulfamate

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH S348 (II-5)

Physical Description: Colorless to white crystalline, odorless solid. [herbicide]

Chemical & Physical Properties:
MW: 114.1
BP: 320°F (Decomposes)
Sol: 200%
Fl.P: NA
IP: ?
Sp.Gr: 1.77
VP: 0 mmHg (approx)
MLT: 268°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 mg/m^3: Qm
100 mg/m^3: 95XQ/Sa
250 mg/m^3: Sa:Cf/PaprHie
500 mg/m^3: SaT:Cf/PaprTHie/100F/ScbaF/SaF
1500 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Acids, hot water
[**Note:** Elevated temperatures cause a highly exothermic reaction with water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, nose, throat; cough, dysp
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

n-Amyl acetate	Formula: $CH_3COO[CH_2]_4CH_3$	CAS#: 628-63-7	RTECS#: AJ9250000	IDLH: 1000 ppm
Conversion: 1 ppm = 5.33 mg/m^3	**DOT:** 1104 129			

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/m^3)
OSHA PEL: TWA 100 ppm (525 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1450, 2549
OSHA 7

Physical Description: Colorless liquid with a persistent banana-like odor.

Chemical & Physical Properties:
MW: 130.2
BP: 301°F
Sol: 0.2%
FI.P: 77°F
IP: ?
Sp.Gr: 0.88
VP: 4 mmHg
FRZ: -95°F
UEL: 7.5%
LEL: 1.1%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: CcrOv*/GmFOv/PaprOv*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose; derm; possible CNS depres, narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

sec-Amyl acetate	Formula: $CH_3COOCH(CH_3)C_3H_7$	CAS#: 626-38-0	RTECS#: AJ2100000	IDLH: 1000 ppm
Conversion: 1 ppm = 5.33 mg/m^3	**DOT:** 1104 129			

Synonyms/Trade Names: 1-Methylbutyl acetate, 2-Pentanol acetate, 2-Pentyl ester of acetic acid

Exposure Limits:
NIOSH REL: TWA 125 ppm (650 mg/m^3)
OSHA PEL: TWA 125 ppm (650 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1450, 2549
OSHA 7

Physical Description: Colorless liquid with a mild odor.

Chemical & Physical Properties:
MW: 130.2
BP: 249°F
Sol: Slight
FI.P: 89°F
IP: ?
Sp.Gr: 0.87
VP: 7 mmHg
FRZ: -109°F
UEL: 7.5%
LEL: 1%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: CcrOv*/GmFOv/PaprOv*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; narco; derm; possible kidney, liver inj; possible CNS depres
TO: Eyes, skin, resp sys, kidneys, liver, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Aniline (and homologs)

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_5NH_2$	62-53-3	BW6650000	Ca [100 ppm]

Conversion: 1 ppm = 3.81 mg/m^3 **DOT:** 1547 153

Synonyms/Trade Names: Aminobenzene, Aniline oil, Benzenamine, Phenylamine

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: TWA 5 ppm (19 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2002, 2017, 8317
OSHA PV2079

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

Chemical & Physical Properties:
MW: 93.1
BP: 363°F
Sol: 4%
Fl.P: 158°F
IP: 7.70 eV
Sp.Gr: 1.02
VP: 0.6 mmHg
FRZ: 21°F
UEL: 11%
LEL: 1.3%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, toluene diisocyanate, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, lass, dizz; cyan; ataxia; dysp on effort; tacar; irrit eyes; methemo; cirr; [carc]
TO: Blood, CVS, eyes, liver, kidneys, resp sys [bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

o-Anisidine

Formula:	CAS#:	RTECS#:	IDLH:
$NH_2C_6H_4OCH_3$	90-04-0	BZ5410000	Ca [50 mg/m^3]

Conversion: **DOT:** 2431 153

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/m^3 [skin]
See Appendix A
OSHA PEL: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 2514

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

Chemical & Physical Properties:
MW: 123.2
BP: 437°F
Sol(77°F): 1%
Fl.P(oc): 244°F
IP: 7.44 eV
Sp.Gr: 1.10
VP: <0.1 mmHg
FRZ: 41°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, dizz; cyan; RBC Heinz bodies; [carc]
TO: Blood, kidneys, liver, CVS, CNS [in animals: tumors of the thyroid gland, bladder & kidneys]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

p-Anisidine	Formula: $NH_2C_6H_4OCH_3$	CAS#: 104-94-9	RTECS#: BZ5450000	IDLH: 50 mg/m^3
Conversion:	**DOT:** 2431 153			

Synonyms/Trade Names: para-Aminoanisole, 4-Anisidine, p-Methoxyaniline

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3 [skin]
OSHA PEL: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 2514

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

Chemical & Physical Properties:
MW: 123.2
BP: 475°F
Sol: Moderate
FI.P: ?
IP: 7.44 eV
Sp.Gr: 1.07
VP(77°F): 0.006 mmHg
MLT: 135°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: 95XQ/Sa
12.5 mg/m^3: Sa:Cf/PaprHie
25 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
50 mg/m^3: Sa:Pd,Pp*
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, dizz; cyan; RBC Heinz bodies
TO: Blood, kidneys, liver, CVS, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Antimony	Formula: Sb	CAS#: 7440-36-0	RTECS#: CC4025000	IDLH: 50 mg/m^3 (as Sb)
Conversion:	**DOT:** 1549 157 (inorganic compounds, n.o.s.); 2871 170 (powder); 3141 157 (inorganic liquid compounds, n.o.s.)			

Synonyms/Trade Names: Antimony metal, Antimony powder, Stibium

Exposure Limits:
NIOSH REL*: TWA 0.5 mg/m^3
OSHA PEL*: TWA 0.5 mg/m^3
[***Note:** The REL and PEL also apply to other antimony compounds (as Sb).]

Measurement Methods (see Table 1):
NIOSH 7301, 7303, P&CAM 261 (II-4)
OSHA ID121, ID125G, ID206

Physical Description: Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder.

Chemical & Physical Properties:
MW: 121.8
BP: 2975°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 6.69
VP: 0 mmHg (approx)
MLT: 1166°F
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: 95XQ/Sa
12.5 mg/m^3: Sa:Cf/PaprHie
25 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
50 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

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

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat, mouth; cough; dizz; head; nau, vomit, diarr; stomach cramps; insom; anor; unable to smell properly
TO: Eyes, skin, resp sys, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

ANTU

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_7NHC(NH_2)S$	86-88-4	YT9275000	100 mg/m^3

Conversion: **DOT:** 1651 153

Synonyms/Trade Names: α-Naphthyl thiocarbamide, 1-Naphthyl thiourea, α-Naphthyl thiourea

Exposure Limits:
NIOSH REL: TWA 0.3 mg/m^3
OSHA PEL: TWA 0.3 mg/m^3

Measurement Methods (see Table 1):
NIOSH S276 (II-5)

Physical Description: White crystalline or gray, odorless powder. [rodenticide]

Chemical & Physical Properties:
MW: 202.3
BP: Decomposes
Sol: 0.06%
FI.P: NA
IP: ?
Sp.Gr: ?
VP: Low
MLT: 388°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
3 mg/m^3: CcrOv95/Sa
7.5 mg/m^3: Sa:Cf/PaprOvHie
15 mg/m^3: CcrFOv100/GmFOv100/ PaprTOvHie/SaT:Cf/ScbaF/SaF
100 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, silver nitrate

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing
SY: After ingestion of large doses: vomit, dysp, cyan, coarse pulm rales; liver damage
TO: Resp sys, blood, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Arsenic (inorganic compounds, as As)

Formula:	CAS#:	RTECS#:	IDLH:
As (metal)	7440-38-2 (metal)	CG0525000 (metal)	Ca [5 mg/m^3 (as As)]

Conversion: **DOT:** 1558 152 (metal); 1562 152 (dust)

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.]

Exposure Limits:
NIOSH REL: Ca
C 0.002 mg/m^3 [15-minute]
See Appendix A
OSHA PEL: [1910.1018] TWA 0.010 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102, 7900
OSHA ID105

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

Chemical & Physical Properties:
MW: 74.9
BP: Sublimes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 5.73 (metal)
VP: 0 mmHg (approx)
MLT: 1135°F (Sublimes)
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFAg100/ScbaE

See Appendix E (page 351)

Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame.

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Con, Ing
SY: Ulceration of nasal septum, derm, GI disturbances, peri neur, resp irrit, hyperpig of skin, [carc]
TO: Liver, kidneys, skin, lungs, lymphatic sys [lung & lymphatic cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Arsenic (organic compounds, as As)	Formula:	CAS#:	RTECS#:	IDLH:
				N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Synonyms vary depending upon the specific organic arsenic compound.

Exposure Limits:
NIOSH REL: none
OSHA PEL: TWA 0.5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5022

Physical Description: Appearance and odor vary depending upon the specific organic arsenic compound.

Chemical & Physical Properties:
Properties vary depending upon the specific organic arsenic compound.

Personal Protection/Sanitation (see Table 2):
Recommendations regarding personal protective clothing vary depending upon the specific compound.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit skin, possible derm; resp distress; diarr; kidney damage; musc tremor, convuls; possible GI tract, repro effects; possible liver damage
TO: Skin, resp sys, kidneys, CNS, liver, GI tract, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Arsine	Formula:	CAS#:	RTECS#:	IDLH:
	AsH_3	7784-42-1	CG6475000	Ca [3 ppm]

Conversion: 1 ppm = 3.19 mg/m^3 **DOT:** 2188 119

Synonyms/Trade Names: Arsenic hydride, Arsenic trihydride, Arseniuretted hydrogen, Arsenous hydride, Hydrogen arsenide

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

Measurement Methods (see Table 1):
NIOSH 6001
OSHA ID105

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

Chemical & Physical Properties:
MW: 78.0
BP: -81°F
Sol: 20%
FI.P: NA (Gas)
IP: 9.89 eV
RGasD: 2.69
VP(70°F): 14.9 atm
FRZ: -179°F
UEL: 78%
LEL: 5.1%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Head, mal, lass, dizz; dysp; abdom, back pain; nau, vomit; bronze skin; hema; jaun; peri neur; liquid: frostbite; [carc]
TO: Blood, kidneys, liver [lung & lymphatic cancer]

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Asbestos

Formula:	CAS#:	RTECS#:	IDLH:
Hydrated mineral silicates	1332-21-4	CI6475000	Ca [N.D.]

Conversion: **DOT:** 2212 171 (blue, brown); 2590 171 (white)

Synonyms/Trade Names: Actinolite, Actinolite asbestos, Amosite (cummingtonite-grunerite), Anthophyllite, Anthophyllite asbestos, Chrysotile, Crocidolite (Riebeckite), Tremolite, Tremolite asbestos

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

Measurement Methods (see Table 1):
NIOSH 7400, 7402
OSHA ID160, ID191

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

Chemical & Physical Properties:
MW: Varies
BP: Decomposes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: 1112°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solids

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Asbestosis (chronic exposure): dysp, interstitial fib, restricted pulm function, finger clubbing; irrit eyes; [carc]
TO: Resp sys, eyes [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Asphalt fumes

Formula:	CAS#:	RTECS#:	IDLH:
	8052-42-4	CI9900000	Ca [N.D.]

Conversion: **DOT:** 1999 130 (asphalt)

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

Exposure Limits:
NIOSH REL: Ca
C 5 mg/m^3 [15-minute]
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 5042

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).

Chemical & Physical Properties:
Properties vary depending upon the specific asphalt formulation or mixture.

Asphalt: Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Con
SY: Irrit eyes, resp sys; [carc]
TO: Eyes, resp sys [in animals: skin tumors]

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support

Atrazine	**Formula:** $C_8H_{14}ClN_5$	**CAS#:** 1912-24-9	**RTECS#:** XY5600000	**IDLH:** N.D.
Conversion:	**DOT:** 2763 151 (triazine pesticide)			

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

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5602, 8315

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

Chemical & Physical Properties:
MW: 215.7
BP: Decomposes
Sol: 0.003%
Fl.P: NA
IP: NA
Sp.Gr: 1.19
VP: 0.0000003 mmHg
MLT: 340°F
UEL: NA
LEL: NA
Noncombustible Solid, but may be mixed with flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids, strong bases

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; derm, sens skin; dysp, lass, inco, salv; hypothermia; liver inj
TO: Eyes, skin, resp sys, CNS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Azinphos-methyl	**Formula:** $C_{10}H_{12}O_3PS_2N_3$ [$(CH_3O)_2P(S)SCH_2(N_3C_7H_4O)$]	**CAS#:** 86-50-0	**RTECS#:** TE1925000	**IDLH:** 10 mg/m^3
Conversion:	**DOT:** 2783 152 (organophosphorus pesticide, solid, toxic)			

Synonyms/Trade Names: O,O-Dimethyl-S-4-oxo-1,2,3-benzotriazin-3(4H)-ylmethyl phosphorodithioate; Guthion®; Methyl azinphos

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3 [skin]
OSHA PEL: TWA 0.2 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5600
OSHA PV2087

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

Chemical & Physical Properties:
MW: 317.3
BP: Decomposes
Sol: 0.003%
Fl.P: NA
IP: ?
Sp.Gr: 1.44
VP: 8 x 10^{-9} mmHg
MLT: 163°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2 mg/m^3: CcrOv95/Sa
5 mg/m^3: Sa:Cf/PaprOvHie
10 mg/m^3: CcrFOv100/GmFOv100/PaprTOvHie/SaT:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Miosis; ache eyes; blurred vision, lac, rhin; head; chest tight, wheez, lar spasm; salv; cyan; anor; nau, vomit, diarr; sweat; twitch, para, convuls; low BP, card irreg
TO: Resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

B

Barium chloride (as Ba)

Formula:	CAS#:	RTECS#:	IDLH:
$BaCl_2$	10361-37-2	CQ8750000	50 mg/m^3 (as Ba)

Conversion: **DOT:** 1564 154 (barium compound, n.o.s.)

Synonyms/Trade Names: Barium dichloride

Exposure Limits:
NIOSH REL*: TWA 0.5 mg/m^3
OSHA PEL*: TWA 0.5 mg/m^3
[***Note:** The REL and PEL also apply to other soluble barium compounds (as Ba) except Barium sulfate.]

Measurement Methods (see Table 1):
NIOSH 7056, 7303
OSHA ID121

Physical Description: White, odorless solid.

Chemical & Physical Properties:
MW: 208.2
BP: 2840°F
Sol: 38%
Fl.P: NA
IP: ?
Sp.Gr: 3.86
VP: Low
MLT: 1765°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: 95XQ/Sa
12.5 mg/m^3: Sa:Cf/PaprHie
25 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
50 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Acids, oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; skin burns; gastroenteritis; musc spasm; slow pulse, extrasystoles; hypokalemia
TO: Eyes, skin, resp sys, heart, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Barium nitrate (as Ba)

Formula:	CAS#:	RTECS#:	IDLH:
$Ba(NO_3)_2$	10022-31-8	CQ9625000	50 mg/m^3 (as Ba)

Conversion: **DOT:** 1446 141

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

Exposure Limits:
NIOSH REL*: TWA 0.5 mg/m^3
OSHA PEL*: TWA 0.5 mg/m^3
[***Note:** The REL and PEL also apply to other soluble barium compounds (as Ba) except Barium sulfate.]

Measurement Methods (see Table 1):
NIOSH 7056
OSHA ID121

Physical Description: White, odorless solid.

Chemical & Physical Properties:
MW: 261.4
BP: Decomposes
Sol: 9%
Fl.P: NA
IP: ?
Sp.Gr: 3.24
VP: Low
MLT: 1094°F
UEL: NA
LEL: NA
Noncombustible Solid, but will accelerate the burning of combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: 95XQ/Sa
12.5 mg/m^3: Sa:Cf/PaprHie
25 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
50 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; skin burns; gastroenteritis; musc spasm; slow pulse, extrasystoles; hypokalemia
TO: Eyes, skin, resp sys, heart, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Barium sulfate

Formula:	CAS#:	RTECS#:	IDLH:
$BaSO_4$	7727-43-7	CR0600000	N.D.

Conversion: **DOT:** 1564 154 (barium compound, n.o.s.)

Synonyms/Trade Names: Artificial barite, Barite, Barium salt of sulfuric acid, Barytes (natural)

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: White or yellowish, odorless powder.

Chemical & Physical Properties:
MW: 233.4
BP: 2912°F (Decomposes)
Sol(64°F): 0.0002%
FI.P: NA
IP: NA
Sp.Gr: 4.25-4.5
VP: 0 mmHg (approx)
MLT: 2876°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Phosphorus, aluminum
[**Note:** Aluminum in the presence of heat can cause an explosion.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, nose, upper resp sys; benign pneumoconiosis (baritosis)
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Benomyl

Formula:	CAS#:	RTECS#:	IDLH:
$C_{14}H_{18}N_4O_3$	17804-35-2	DD6475000	N.D.

Conversion: **DOT:** 2757 151 (carbamate pesticide, solid)

Synonyms/Trade Names: Methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600
OSHA PV2107

Physical Description: White crystalline solid with a faint, acrid odor. [fungicide]
[**Note:** Decomposes without melting above 572°F.]

Chemical & Physical Properties:
MW: 290.4
BP: Decomposes
Sol: 0.0004%
FI.P: NA
IP: NA
Sp.Gr: ?
VP: <0.00001 mmHg
MLT: >572°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Heat, strong acids, strong alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; skin sens; possible repro, terato effects
TO: Eyes, skin, resp sys, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Benzene	Formula: C_6H_6	CAS#: 71-43-2	RTECS#: CY1400000	IDLH: Ca [500 ppm]
Conversion: 1 ppm = 3.19 mg/m^3	**DOT:** 1114 130			
Synonyms/Trade Names: Benzol, Phenyl hydride				

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

Measurement Methods (see Table 1):
NIOSH 1500, 1501, 3700, 3800
OSHA 12, 1005

Physical Description: Colorless to light-yellow liquid with an aromatic odor. [**Note:** A solid below 42°F.]

Chemical & Physical Properties:
MW: 78.1
BP: 176°F
Sol: 0.07%
Fl.P: 12°F
IP: 9.24 eV
Sp.Gr: 0.88
VP: 75 mmHg
FRZ: 42°F
UEL: 7.8%
LEL: 1.2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers, many fluorides & perchlorates, nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, resp sys; dizz; head, nau, staggered gait; anor, lass; derm; bone marrow depres; [carc]
TO: Eyes, skin, resp sys, blood, CNS, bone marrow [leukemia]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Benzenethiol	Formula: C_6H_5SH	CAS#: 108-98-5	RTECS#: DC0525000	IDLH: N.D.
Conversion: 1 ppm = 4.51 mg/m^3	**DOT:** 2337 131			
Synonyms/Trade Names: Mercaptobenzene, Phenyl mercaptan, Thiophenol				

Exposure Limits:
NIOSH REL: C 0.1 ppm (0.5 mg/m^3) [15-minute]
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2075

Physical Description: Water-white liquid with an offensive, garlic-like odor. [**Note:** A solid below 5°F.]

Chemical & Physical Properties:
MW: 110.2
BP: 336°F
Sol(77°F): 0.08%
Fl.P: 132°F
IP: 8.33 eV
Sp.Gr: 1.08
VP(65°F): 1 mmHg
FRZ: 5°F
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1 ppm: CcrOv/Sa
2.5 ppm: Sa:Cf/PaprOv
5 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong acids & bases, calcium hypochlorite, alkali metals
[**Note:** Oxidizes on exposure to air.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; derm; cyan; cough, wheez, dysp, pulm edema, pneu; head, dizz, CNS depres; nau, vomit; kidney, liver, spleen damage
TO: Eyes, skin, resp sys, CNS, kidneys, liver, spleen

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Benzidine	**Formula:** $NH_2C_6H_4C_6H_4NH_2$	**CAS#:** 92-87-5	**RTECS#:** DC9625000	**IDLH:** Ca [N.D.]
Conversion:	**DOT:** 1885 153			

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.]

Exposure Limits:
NIOSH REL: Ca
See Appendix A
See Appendix C

OSHA PEL: [1910.1010]
See Appendix B
See Appendix C

Measurement Methods (see Table 1):
NIOSH 5509
OSHA 65

Physical Description: Grayish-yellow, reddish-gray, or white crystalline powder. [**Note:** Darkens on exposure to air and light.]

Chemical & Physical Properties:
MW: 184.3
BP: 752°F
Sol(54°F): 0.04%
Fl.P: ?
IP: ?
Sp.Gr: 1.25
VP: Low
MLT: 239°F
UEL: ?
LEL: ?
Combustible Solid, but difficult to burn.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Red fuming nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Hema; secondary anemia from hemolysis; acute cystitis; acute liver disorders; derm; painful, irreg urination; [carc]
TO: Bladder, skin, kidneys, liver, blood [liver, kidney & bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Benzoyl peroxide	**Formula:** $(C_6H_5CO)_2O_2$	**CAS#:** 94-36-0	**RTECS#:** DM8575000	**IDLH:** 1500 mg/m^3
Conversion:	**DOT:**			

Synonyms/Trade Names: Benzoperoxide, Dibenzoyl peroxide

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5009

Physical Description: Colorless to white crystals or a granular powder with a faint, benzaldehyde-like odor.

Chemical & Physical Properties:
MW: 242.2
BP: Decomposes explosively
Sol: <1%
Fl.P: 176°F
IP: ?
Sp.Gr: 1.33
VP: <1 mmHg
MLT: 217°F
UEL: ?
LEL: ?
Combustible Solid (easily ignited and burns very rapidly).

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: 95XQ*/Sa*
125 mg/m^3: Sa:Cf*/PaprHie*
250 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
1500 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Combustible substances (wood, paper, etc.), acids, alkalis, alcohols, amines, ethers [**Note:** Containers may explode when heated. Extremely explosion-sensitive to shock, heat & friction.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; sens derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

B

Benzyl chloride

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_5CH_2Cl$	100-44-7	XS8925000	10 ppm

Conversion: 1 ppm = 5.18 mg/m^3 **DOT:** 1738 156

Synonyms/Trade Names: Chloromethylbenzene, α-Chlorotoluene

Exposure Limits:
NIOSH REL: C 1 ppm (5 mg/m^3) [15-minute]
OSHA PEL: TWA 1 ppm (5 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless to slightly yellow liquid with a pungent, aromatic odor.

Chemical & Physical Properties:
MW: 126.6
BP: 354°F
Sol: 0.05%
Fl.P: 153°F
IP: ?
Sp.Gr: 1.10
VP: 1 mmHg
FRZ: -38°F
UEL: ?
LEL: 1.1%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 ppm: CcrOvAg*/GmFOvAg/
PaprOvAg*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOvAg/ScbaE

Incompatibilities and Reactivities: Oxidizers, acids, copper, aluminum, magnesium, iron, zinc, tin [**Note:** Can polymerize when in contact with all common metals except nickel & lead. Hydrolyzes in H_2O to benzyl alcohol.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; lass; irrity; head; skin eruption; pulm edema
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Beryllium & beryllium compounds (as Be)

Formula:	CAS#:	RTECS#:	IDLH:
Be (metal)	7440-41-7 (metal)	DS1750000 (metal)	Ca [4 mg/m^3 (as Be)]

Conversion: **DOT:** 1566 154 (compounds); 1567 134 (powder)

Synonyms/Trade Names: **Beryllium metal:** Beryllium
Other synonyms vary depending upon the specific beryllium compound.

Exposure Limits:
NIOSH REL: Ca
Not to exceed 0.0005 mg/m^3
See Appendix A
OSHA PEL: TWA 0.002 mg/m^3
C 0.005 mg/m^3 0.025 mg/m^3 [30-minute maximum peak]

Measurement Methods (see Table 1):
NIOSH 7102, 7300, 7301, 7303, 9102
OSHA ID125G, ID206

Physical Description: Metal: A hard, brittle, gray-white solid.

Chemical & Physical Properties:
MW: 9.0
BP: 4532°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 1.85 (metal)
VP: 0 mmHg (approx)
MLT: 2349°F
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of a powder or dust.

Incompatibilities and Reactivities: Acids, caustics, chlorinated hydrocarbons, oxidizers, molten lithium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Berylliosis (chronic exposure): anor, low-wgt, lass, chest pain, cough, clubbing of fingers, cyan, pulm insufficiency; irrit eyes; derm; [carc]
TO: Eyes, skin, resp sys [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Bismuth telluride, doped with Selenium sulfide (as Bi_2Te_3)	**Formula:**	**CAS#:**	**RTECS#:**	**IDLH:** N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Doped bismuth sesquitelluride, Doped bismuth telluride, Doped bismuth tritelluride, Doped tellurobismuthite [**Note:** Doped with selenium sulfide. Commercial mix may contain 80% Bi_2Te_3, 20% stannous telluride, plus some tellurium.]

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500
OSHA ID121

Physical Description: Gray, crystalline solid that has been enhanced (doped) with a small amount of selenium sulfide (SeS).
[**Note:** Doping alters the conductivity of a semiconductor.]

Chemical & Physical Properties:
Properties are unavailable but should be similar to Bismuth telluride, undoped.

Sp.Gr: ?

Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, moisture

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, upper resp sys; garlic breath; in animals: pulm lesions (nonfibrotic)
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Bismuth telluride, undoped	**Formula:** Bi_2Te_3	**CAS#:** 1304-82-1	**RTECS#:** EB3110000	**IDLH:** N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Bismuth sesquitelluride, Bismuth telluride, Bismuth tritelluride, Tellurobismuthite

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600
OSHA ID121

Physical Description: Gray, crystalline solid.

Chemical & Physical Properties:
MW: 800.8
BP: ?
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 7.7
VP: 0 mmHg (approx)
MLT: 1063°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers (e.g., bromine, chlorine, or fluorine), moisture, nitric acid (decomposes)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, upper resp sys; garlic breath
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

B

Borates, tetra, sodium salts (Anhydrous)	Formula: $Na_2B_4O_7$	CAS#: 1330-43-4	RTECS#: ED4588000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Anhydrous borax, Borax dehydrated, Disodium salt of boric acid, Disodium tetrabromate, Fused borax, Sodium borate (anhydrous), Sodium tetraborate

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
OSHA PEL†: none

Physical Description: White to gray, odorless powder. [herbicide]
[**Note:** Becomes opaque on exposure to air.]

Measurement Methods (see Table 1):
NIOSH 0500
OSHA ID125G

Chemical & Physical Properties:
MW: 201.2
BP: 2867°F (Decomposes)
Sol: 4%
FI.P: NA
IP: NA
Sp.Gr: 2.37
VP: 0 mmHg (approx)
MLT: 1366°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Moisture [**Note:** Forms partial hydrate in moist air.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; derm; epis; cough, dysp
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Borates, tetra, sodium salts (Decahydrate)	Formula: $Na_2B_4O_7{\times}10H_2O$	CAS#: 1303-96-4	RTECS#: VZ2275000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Borax, Borax decahydrate, Sodium borate decahydrate, Sodium tetraborate decahydrate

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Physical Description: White, odorless, crystalline solid. [herbicide]
[**Note:** Becomes anhydrous at 608°F.]

Measurement Methods (see Table 1):
NIOSH 0500
OSHA ID125G

Chemical & Physical Properties:
MW: 381.4
BP: 608°F
Sol: 6%
FI.P: NA
IP: NA
Sp.Gr: 1.73
VP: 0 mmHg (approx)
MLT: 167°F
UEL: NA
LEL: NA
Noncombustible Solid (an inherent fire retardant).

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Zirconium, strong acids, metallic salts

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; derm; epis; cough, dysp
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Borates, tetra, sodium salts (Pentahydrate)	**Formula:** $Na_2B_4O_7 \times 5H_2O$	**CAS#:** 12179-04-3	**RTECS#:** VZ2540000	**IDLH:** N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Borax pentahydrate, Sodium borate pentahydrate, Sodium tetraborate pentahydrate

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500
OSHA ID125G

Physical Description: Colorless or white, odorless crystals or free-flowing powder. [herbicide] [**Note:** Begins to lose water of hydration at 252°F.]

Chemical & Physical Properties:
MW: 291.4
BP: ?
Sol: 3%
FI.P: NA
IP: NA
Sp.Gr: 1.82
VP: 0 mmHg (approx)
MLT: 392°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported
[**Note:** See the reactivities & incompatibilities reported for the related substance Borax decahydrate above.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; derm; epis; cough, dysp
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Boron oxide	**Formula:** B_2O_3	**CAS#:** 1303-86-2	**RTECS#:** ED7900000	**IDLH:** 2000 mg/m^3
Conversion:	**DOT:**			

Synonyms/Trade Names: Boric anhydride, Boric oxide, Boron trioxide

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3
OSHA PEL†: TWA 15 mg/m^3

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Colorless, semitransparent lumps or hard, white, odorless crystals.

Chemical & Physical Properties:
MW: 69.6
BP: 3380°F
Sol: 3%
FI.P: NA
IP: 13.50 eV
Sp.Gr: 2.46
VP: 0 mmHg (approx)
MLT: 842°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 mg/m^3: Qm*
100 mg/m^3: 95XQ*/Sa*
250 mg/m^3: Sa:Cf*/PaprHie*
500 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
2000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Water [**Note:** Reacts slowly with water to form boric acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; cough; conj; skin eryt
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Fresh air
Swallow: Medical attention immed

B

Boron tribromide

Formula:	CAS#:	RTECS#:	IDLH:
BBr_3	10294-33-4	ED7400000	N.D.

Conversion: 1 ppm = 10.25 mg/m^3 **DOT:** 2692 157

Synonyms/Trade Names: Boron bromide, Tribromoborane

Exposure Limits:
NIOSH REL: C 1 ppm (10 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless, fuming liquid with a sharp, irritating odor.

Chemical & Physical Properties:
MW: 250.5
BP: 194°F
Sol: Decomposes
FI.P: NA
IP: 9.70 eV
Sp.Gr(65°F): 2.64
VP(57°F): 40 mmHg
FRZ: -51°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Moisture, water, heat, potassium, sodium, alcohols
[**Note:** Attacks metals, wood & rubber. Reacts with water to form boric acid and hydrogen bromide.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; eye, skin burns; dysp, pulm edema
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Boron trifluoride

Formula:	CAS#:	RTECS#:	IDLH:
BF_3	7637-07-2	ED2275000	25 ppm

Conversion: 1 ppm = 2.77 mg/m^3 **DOT:** 1008 125

Synonyms/Trade Names: Boron fluoride, Trifluoroborane

Exposure Limits:
NIOSH REL: C 1 ppm (3 mg/m^3)
OSHA PEL: C 1 ppm (3 mg/m^3)

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a pungent, suffocating odor.
[**Note:** Forms dense white fumes in moist air. Shipped as a nonliquefied compressed gas.]

Chemical & Physical Properties:
MW: 67.8
BP: -148°F
Sol: 106% (in cold H_2O)
FI.P: NA
IP: 15.50 eV
RGasD: 2.38
VP: >50 atm
FRZ: -196°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 ppm: Sa*
25 ppm: Sa:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Alkali metals, calcium oxide
[**Note:** Hydrolyzes in moist air or hot water to form boric acid, hydrogen fluoride & fluoboric acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, nose, resp sys; epis; eye, skin burns; in animals: pneu; kidney damage
TO: Eyes, skin, resp sys, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support

Bromacil

Formula:	CAS#:	RTECS#:	IDLH:
$C_9H_{13}BrN_2O_2$	314-40-9	YQ9100000	N.D.

Conversion: 1 ppm = 10.68 mg/m^3

DOT:

Synonyms/Trade Names: 5-Bromo-3-sec-butyl-6-methyluracil, 5-Bromo-6-methyl-3-(1-methylpropyl)uracil

Exposure Limits:
NIOSH REL: TWA 1 ppm (10 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Odorless, colorless to white, crystalline solid. [herbicide]
[**Note:** Commercially available as a wettable powder or in liquid formulations.]

Chemical & Physical Properties:
MW: 261.2
BP: Sublimes
Sol(77°F): 0.08%
FI.P: NA
IP: ?
Sp.Gr: 1.55
VP(212°F): 0.0008 mmHg
MLT: 317°F (Sublimes)
UEL: NA
LEL: NA
Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids (decomposes slowly), oxidizers, heat, sparks, open flames

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; in animals: thyroid inj
TO: Eyes, skin, resp sys, thyroid

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Bromine

Formula:	CAS#:	RTECS#:	IDLH:
Br_2	7726-95-6	EF9100000	3 ppm

Conversion: 1 ppm = 6.54 mg/m^3

DOT: 1744 154

Synonyms/Trade Names: Molecular bromine

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.7 mg/m^3)
ST 0.3 ppm (2 mg/m^3)
OSHA PEL†: TWA 0.1 ppm (0.7 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6011
OSHA ID108

Physical Description: Dark reddish-brown, fuming liquid with suffocating, irritating fumes.

Chemical & Physical Properties:
MW: 159.8
BP: 139°F
Sol: 4%
FI.P: NA
IP: 10.55 eV
Sp.Gr: 3.12
VP: 172 mmHg
FRZ: 19°F
UEL: NA
LEL: NA
Noncombustible Liquid, but accelerates the burning of combustibles.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2.5 ppm: Sa:Cf£/PaprS¿£
3 ppm: CcrFS¿/GmFS¿/PaprTS¿£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Dizz, head; lac, epis; cough, feeling of oppression, pulm edema, pneu; abdom pain, diarr; measle-like eruptions; eye, skin burns
TO: Resp sys, eyes, CNS, skin

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

B

Bromine pentafluoride

Formula:	CAS#:	RTECS#:	IDLH:
BrF_5	7789-30-2	EF9350000	N.D.

Conversion: 1 ppm = 7.15 mg/m^3 **DOT:** 1745 144

Synonyms/Trade Names: Bromine fluoride

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.7 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to pale-yellow, fuming liquid with a pungent odor. [**Note:** A colorless gas above 105°F. Shipped as a compressed gas.]

Chemical & Physical Properties:
MW: 174.9
BP: 105°F
Sol: Reacts violently
FI.P: NA
IP: ?
Sp.Gr: 2.48
VP: 328 mmHg
FRZ: -77°F
UEL: NA
LEL: NA
Noncombustible Liquid, but a very powerful oxidizer.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Acids, halogens, arsenic, selenium, sulfur, glass, organic materials, water [**Note:** Reacts with all elements except inert gases, nitrogen & oxygen.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; corn nec; skin burns; cough, dysp, pulm edema; liver, kidney inj
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Bromoform

Formula:	CAS#:	RTECS#:	IDLH:
$CHBr_3$	75-25-2	PB5600000	850 ppm

Conversion: 1 ppm = 10.34 mg/m^3 **DOT:** 2515 159

Synonyms/Trade Names: Methyl tribromide, Tribromomethane

Exposure Limits:
NIOSH REL: TWA 0.5 ppm (5 mg/m^3) [skin]
OSHA PEL: TWA 0.5 ppm (5 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless to yellow liquid with a chloroform-like odor. [**Note:** A solid below 47°F.]

Chemical & Physical Properties:
MW: 252.8
BP: 301°F
Sol: 0.1%
FI.P: NA
IP: 10.48 eV
Sp.Gr: 2.89
VP: 5 mmHg
FRZ: 47°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
12.5 ppm: Sa:Cf£/PaprOv£
25 ppm: CcrFOv/GmFOv/PaprTOv£/ ScbaF/SaF
850 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Lithium, sodium, potassium, calcium, aluminum, zinc, magnesium, strong caustics, acetone [**Note:** Gradually decomposes, acquiring yellow color; air & light accelerate decomposition.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; CNS depres; liver, kidney damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

1,3-Butadiene

Formula: CH_2=CHCH=CH_2 | **CAS#:** 106-99-0 | **RTECS#:** EI9275000 | **IDLH:** Ca [2000 ppm] [10%LEL]

Conversion: 1 ppm = 2.21 mg/m^3 | **DOT:** 1010 116P (inhibited)

Synonyms/Trade Names: Biethylene, Bivinyl, Butadiene, Divinyl, Erythrene, Vinylethylene

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1051] TWA 1 ppm
ST 5 ppm

Measurement Methods (see Table 1):
NIOSH 1024
OSHA 56

Physical Description: Colorless gas with a mild aromatic or gasoline-like odor. [**Note:** A liquid below 24°F. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 54.1
BP: 24°F
Sol: Insoluble
FI.P: NA (Gas)
-105°F (Liquid)
IP: 9.07 eV
RGasD: 1.88
Sp.Gr: 0.65 (Liquid at 24°F)
VP: 2.4 atm
FRZ: -164°F
UEL: 12.0%
LEL: 2.0%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Phenol, chlorine dioxide, copper, crotonaldehyde [**Note:** May contain inhibitors (e.g., tributylcatechol) to prevent self-polymerization. May form explosive peroxides upon exposure to air.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit eyes, nose, throat; drow, dizz; liquid: frostbite; terato, repro effects; [carc]
TO: Eyes, resp sys, CNS, repro sys [hemato cancer]

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

n-Butane

Formula: $CH_3CH_2CH_2CH_3$ | **CAS#:** 106-97-8 | **RTECS#:** EJ4200000 | **IDLH:** N.D.

Conversion: 1 ppm = 2.38 mg/m^3 | **DOT:** 1011 115; 1075 115

Synonyms/Trade Names: normal-Butane, Butyl hydride, Diethyl, Methylethylmethane [**Note:** Also see specific listing for Isobutane.]

Exposure Limits:
NIOSH REL: TWA 800 ppm (1900 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 56

Physical Description: Colorless gas with a gasoline-like or natural gas odor. [**Note:** Shipped as a liquefied compressed gas. A liquid below 31°F.]

Chemical & Physical Properties:
MW: 58.1
BP: 31°F
Sol: Slight
FI.P: NA (Gas)
IP: 10.63 eV
RGasD: 2.11
Sp.Gr: 0.6 (Liquid at 31°F)
VP: 2.05 atm
FRZ: -217°F
UEL: 8.4%
LEL: 1.6%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers (e.g., nitrates and perchlorates), chlorine, fluorine, (nickel carbonyl + oxygen)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Drow, narco, asphy; liquid: frostbite
TO: CNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

B

2-Butanone

Formula: $CH_3COCH_2CH_3$ | **CAS#:** 78-93-3 | **RTECS#:** EL6475000 | **IDLH:** 3000 ppm

Conversion: 1 ppm = 2.95 mg/m^3 | **DOT:** 1193 127

Synonyms/Trade Names: Ethyl methyl ketone, MEK, Methyl acetone, Methyl ethyl ketone

Exposure Limits:
NIOSH REL: TWA 200 ppm (590 mg/m^3)
ST 300 ppm (885 mg/m^3)
OSHA PEL†: TWA 200 ppm (590 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2500, 2555, 3800
OSHA 16, 84, 1004

Physical Description: Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor.

Chemical & Physical Properties:
MW: 72.1
BP: 175°F
Sol: 28%
FI.P: 16°F
IP: 9.54 eV
Sp.Gr: 0.81
VP: 78 mmHg
FRZ: -123°F
UEL(200°F): 11.4%
LEL(200°F): 1.4%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
3000 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, amines, ammonia, inorganic acids, caustics, isocyanates, pyridines

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; head; dizz; vomit; derm
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Fresh air
Swallow: Medical attention immed

2-Butoxyethanol

Formula: $C_4H_9OCH_2CH_2OH$ | **CAS#:** 111-76-2 | **RTECS#:** KJ8575000 | **IDLH:** 700 ppm

Conversion: 1 ppm = 4.83 mg/m^3 | **DOT:** 2369 152

Synonyms/Trade Names: Butyl Cellosolve®, Butyl oxitol, Dowanol® EB, EGBE, Ektasolve EB®, Ethylene glycol monobutyl ether, Jeffersol EB

Exposure Limits:
NIOSH REL: TWA 5 ppm (24 mg/m^3) [skin]
OSHA PEL†: TWA 50 ppm (240 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1403
OSHA 83

Physical Description: Colorless liquid with a mild, ether-like odor.

Chemical & Physical Properties:
MW: 118.2
BP: 339°F
Sol: Miscible
FI.P: 143°F
IP: 10.00 eV
Sp.Gr: 0.90
VP: 0.8 mmHg
FRZ: -107°F
UEL(275°F): 12.7%
LEL(200°F): 1.1%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 ppm: CcrOv*/Sa*
125 ppm: Sa:Cf*/PaprOv*
250 ppm: CcrFOv/GmFOv/PaprTOv*/ScbaF/SaF
700 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong caustics

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; hemolysis, hema; CNS depres, head; vomit
TO: Eyes, skin, resp sys, CNS, hemato sys, blood, kidneys, liver, lymphoid sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

2-Butoxyethanol acetate	Formula: $C_4H_9O(CH_2)_2OCOCH_3$	CAS#: 112-07-2	RTECS#: KJ8925000	IDLH: N.D.
Conversion: 1 ppm = 6.55 mg/m^3	**DOT:**			

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/m^3)
OSHA PEL: none

Measurement Methods (see Table 1):
OSHA 83

Physical Description: Colorless liquid with a pleasant, sweet, fruity odor.

Chemical & Physical Properties:
MW: 160.2
BP: 378°F
Sol: 1.5%
FI.P: 160°F
IP: ?
Sp.Gr: 0.94
VP: 0.3 mmHg
FRZ: -82°F
UEL(275°F): 8.54%
LEL(200°F): 0.88%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 ppm: CcrOv*/Sa*
125 ppm: Sa:Cf*/PaprOv*
250 ppm: CcrFOv/GmFOv/PaprTOv*/ScbaF/SaF
700 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; hemolysis, hema; CNS depres, head; vomit
TO: Eyes, skin, resp sys, CNS, hemato sys, blood, kidneys, liver, lymphoid sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

n-Butyl acetate	Formula: $CH_3COO[CH_2]_3CH_3$	CAS#: 123-86-4	RTECS#: AF7350000	IDLH: 1700 ppm [10%LEL]
Conversion: 1 ppm = 4.75 mg/m^3	**DOT:** 1123 129			

Synonyms/Trade Names: Butyl acetate, n-Butyl ester of acetic acid, Butyl ethanoate

Exposure Limits:
NIOSH REL: TWA 150 ppm (710 mg/m^3)
ST 200 ppm (950 mg/m^3)
OSHA PEL†: TWA 150 ppm (710 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1450
OSHA 7

Physical Description: Colorless liquid with a fruity odor.

Chemical & Physical Properties:
MW: 116.2
BP: 258°F
Sol: 1%
FI.P: 72°F
IP: 10.00 eV
Sp.Gr: 0.88
VP: 10 mmHg
FRZ: -107°F
UEL: 7.6%
LEL: 1.7%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1500 ppm: CcrOv*/Sa*
1700 ppm: Sa:Cf*/PaprOv*/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; head, drow, narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

B

sec-Butyl acetate

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3COOCH(CH_3)CH_2CH_3$	105-46-4	AF7380000	1700 ppm [10%LEL]

Conversion: 1 ppm = 4.75 mg/m^3 **DOT:** 1123 129

Synonyms/Trade Names: sec-Butyl ester of acetic acid, 1-Methylpropyl acetate

Exposure Limits:
NIOSH REL: TWA 200 ppm (950 mg/m^3)
OSHA PEL: TWA 200 ppm (950 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1450
OSHA 7

Physical Description: Colorless liquid with a pleasant, fruity odor.

Chemical & Physical Properties:
MW: 116.2
BP: 234°F
Sol: 0.8%
FI.P: 62°F
IP: 9.91 eV
Sp.Gr: 0.86
VP: 10 mmHg
FRZ: -100°F
UEL: 9.8%
LEL: 1.7%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1700 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes; head; drow; dryness upper resp sys, skin; narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

tert-Butyl acetate

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3COOC(CH_3)_3$	540-88-5	AF7400000	1500 ppm [10%LEL]

Conversion: 1 ppm = 4.75 mg/m^3 **DOT:** 1123 129

Synonyms/Trade Names: tert-Butyl ester of acetic acid

Exposure Limits:
NIOSH REL: TWA 200 ppm (950 mg/m^3)
OSHA PEL: TWA 200 ppm (950 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1450
OSHA 7

Physical Description: Colorless liquid with a fruity odor.

Chemical & Physical Properties:
MW: 116.2
BP: 208°F
Sol: Insoluble
FI.P: 72°F
IP: ?
Sp.Gr: 0.87
VP: ?
FRZ: ?
UEL: ?
LEL: 1.5%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1500 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Itch, inflamm eyes; irrit upper resp tract; head; narco; derm
TO: Resp sys, eyes, skin, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Butyl acrylate	**Formula:** CH_2=CHCOOC_4H_9	**CAS#:** 141-32-2	**RTECS#:** UD3150000	**IDLH:** N.D.
Conversion: 1 ppm = 5.24 mg/m^3	**DOT:** 2348 130P			

Synonyms/Trade Names: n-Butyl acrylate, Butyl ester of acrylic acid, Butyl-2-propenoate

Exposure Limits:
NIOSH REL: TWA 10 ppm (55 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2011

Physical Description: Clear, colorless liquid with a strong, fruity odor. [**Note:** Highly reactive; may contain an inhibitor to prevent spontaneous polymerization.]

Chemical & Physical Properties:
MW: 128.2
BP: 293°F
Sol: 0.1%
Fl.P: 103°F
IP: ?
Sp.Gr: 0.89
VP: 4 mmHg
FRZ: -83°F
UEL: 9.9%
LEL: 1.5%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids & alkalis, amines, halogens, hydrogen compounds, oxidizers, heat, flame, sunlight [**Note:** Polymerizes readily on heating.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, upper resp sys; sens derm; dysp
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

n-Butyl alcohol	**Formula:** $CH_3CH_2CH_2CH_2OH$	**CAS#:** 71-36-3	**RTECS#:** EO1400000	**IDLH:** 1400 ppm [10%LEL]
Conversion: 1 ppm = 3.03 mg/m^3	**DOT:** 1120 129			

Synonyms/Trade Names: 1-Butanol, n-Butanol, Butyl alcohol, 1-Hydroxybutane, n-Propyl carbinol

Exposure Limits:
NIOSH REL: C 50 ppm (150 mg/m^3) [skin]
OSHA PEL†: TWA 100 ppm (300 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1401, 1405
OSHA 7

Physical Description: Colorless liquid with a strong, characteristic, mildly alcoholic odor.

Chemical & Physical Properties:
MW: 74.1
BP: 243°F
Sol: 9%
Fl.P: 84°F
IP: 10.04 eV
Sp.Gr: 0.81
VP: 6 mmHg
FRZ: -129°F
UEL: 11.2%
LEL: 1.4%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1250 ppm: Sa:Cf£/PaprOv£
1400 ppm: CcrFOv/GmFOv/PaprTOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong mineral acids, alkali metals, halogens

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; head, dizz, drow; corn inflamm, blurred vision, lac, photo; derm; possible auditory nerve damage, hearing loss; CNS depres
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

B

sec-Butyl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3CH(OH)CH_2CH_3$	78-92-2	EO1750000	2000 ppm

Conversion: 1 ppm = 3.03 mg/m^3 **DOT:** 1120 129

Synonyms/Trade Names: 2-Butanol, Butylene hydrate, 2-Hydroxybutane, Methyl ethyl carbinol

Exposure Limits:
NIOSH REL: TWA 100 ppm (305 mg/m^3)
ST 150 ppm (455 mg/m^3)
OSHA PEL†: TWA 150 ppm (450 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1401, 1405
OSHA 7

Physical Description: Colorless liquid with a strong, pleasant odor.

Chemical & Physical Properties:
MW: 74.1
BP: 211°F
Sol: 16%
FI.P: 75°F
IP: 10.10 eV
Sp.Gr: 0.81
VP: 12 mmHg
FRZ: -175°F
UEL(212°F): 9.8%
LEL(212°F): 1.7%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1000 ppm: CcrOv*/Sa*
2000 ppm: Sa:Cf*/PaprOv*/CcrFOv/
GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, organic peroxides, perchloric & permonosulfuric acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

tert-Butyl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
$(CH_3)_3COH$	75-65-0	EO1925000	1600 ppm

Conversion: 1 ppm = 3.03 mg/m^3 **DOT:** 1120 129

Synonyms/Trade Names: 2-Methyl-2-propanol, Trimethyl carbinol

Exposure Limits:
NIOSH REL: TWA 100 ppm (300 mg/m^3)
ST 150 ppm (450 mg/m^3)
OSHA PEL†: TWA 100 ppm (300 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1400
OSHA 7

Physical Description: Colorless solid or liquid (above 77°F) with a camphor-like odor. [**Note:** Often used in aqueous solutions.]

Chemical & Physical Properties:
MW: 74.1
BP: 180°F
Sol: Miscible
FI.P: 52°F
IP: 9.70 eV
Sp.Gr: 0.79 (Solid)
VP(77°F): 42 mmHg
FRZ: 78°F
UEL: 8.0%
LEL: 2.4%
Combustible Solid
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1600 ppm: Sa:Cf£/PaprOv£/CcrFOv/
GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong mineral acids, strong hydrochloric acid, oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; drow, narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

n-Butylamine	Formula: $CH_3CH_2CH_2CH_2NH_2$	CAS#: 109-73-9	RTECS#: EO2975000	IDLH: 300 ppm
Conversion: 1 ppm = 2.99 mg/m^3	**DOT:** 1125 132			

Synonyms/Trade Names: 1-Aminobutane, Butylamine

Exposure Limits:
NIOSH REL: C 5 ppm (15 mg/m^3) [skin]
OSHA PEL: C 5 ppm (15 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2012

Physical Description: Colorless liquid with a fishy, ammonia-like odor.

Chemical & Physical Properties:
MW: 73.2
BP: 172°F
Sol: Miscible
FI.P: 10°F
IP: 8.71 eV
Sp.Gr: 0.74
VP: 82 mmHg
FRZ: -58°F
UEL: 9.8%
LEL: 1.7%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 ppm: CcrS*/Sa*
125 ppm: Sa:Cf*/PaprS*
250 ppm: CcrFS/GmFS/PaprTS*/ScbaF/SaF
300 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids
[**Note:** May corrode some metals in presence of water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; head; skin flush, burns
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

tert-Butyl chromate	Formula: $[(CH_3)_3CO]_2CrO_2$	CAS#: 1189-85-1	RTECS#: GB2900000	IDLH: Ca [15 mg/m^3 {as Cr(VI)}]
Conversion:	**DOT:**			

Synonyms/Trade Names: di-tert-Butyl ester of chromic acid

Exposure Limits:
NIOSH REL: Ca
TWA 0.001 mg Cr(VI)/m^3
See Appendix A
See Appendix C
OSHA PEL: C 0.1 mg CrO_3/m^3 [skin]
See Appendix C

Measurement Methods (see Table 1):
NIOSH 7604
OSHA ID103, ID215

Physical Description: Liquid. [**Note:** Solidifies at 32-23°F.]

Chemical & Physical Properties:
MW: 230.3
BP: ?
Sol: ?
FI.P: ?
IP: ?
Sp.Gr: ?
VP: ?
FRZ: 32-23°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Reducing agents, moisture, acids, alcohols, hydrazine, combustible materials

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; eye, skin burns; drow, musc weak; skin ulcers; lung changes; [carc]
TO: Eyes, skin, resp sys, CNS [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

B

n-Butyl glycidyl ether

Formula:	CAS#:	RTECS#:	IDLH:
$C_7H_{14}O_2$	2426-08-6	TX4200000	250 ppm

Conversion: 1 ppm = 5.33 mg/m^3 **DOT:**

Synonyms/Trade Names: BGE; 1,2-Epoxy-3-butoxypropane

Exposure Limits:
NIOSH REL: C 5.6 ppm (30 mg/m^3) [15-minute]
OSHA PEL†: TWA 50 ppm (270 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1616
OSHA 7

Physical Description: Colorless liquid with an irritating odor.

Chemical & Physical Properties:
MW: 130.2
BP: 327°F
Sol: 2%
Fl.P: 130°F
IP: ?
Sp.Gr: 0.91
VP(77°F): 3 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
56 ppm: CcrOv*/Sa*
140 ppm: Sa:Cf*/PaprOv*
250 ppm: CcrFOv/GmFOv/PaprTOv*/ ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong caustics

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; skin sens; narco; possible hemato effects; CNS depres
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

n-Butyl lactate

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3CH(OH)COOC_4H_9$	138-22-7	OD4025000	N.D.

Conversion: 1 ppm = 5.98 mg/m^3 **DOT:** 1993 128 (combustible liquid, n.o.s.)

Synonyms/Trade Names: Butyl ester of 2-hydroxypropanoic acid, Butyl ester of lactic acid, Butyl lactate

Exposure Limits:
NIOSH REL: TWA 5 ppm (25 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Clear, colorless to white liquid with a mild, transient odor.

Chemical & Physical Properties:
MW: 146.2
BP: 370°F
Sol: Slight
Fl.P: 160°F
IP: ?
Sp.Gr: 0.98
VP: 0.4 mmHg
FRZ: -45°F
UEL: ?
LEL: 1.15%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids & bases, strong oxidizers, heat, sparks, open flames

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; drow, head, CNS depres; nau, vomit
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

n-Butyl mercaptan	Formula: $CH_3CH_2CH_2CH_2SH$	CAS#: 109-79-5	RTECS#: EK6300000	IDLH: 500 ppm
Conversion: 1 ppm = 3.69 mg/m^3	**DOT:** 2347 130			

Synonyms/Trade Names: Butanethiol, 1-Butanethiol, n-Butanethiol, 1-Mercaptobutane

Exposure Limits:
NIOSH REL: C 0.5 ppm (1.8 mg/m^3) [15-minute]
OSHA PEL†: TWA 10 ppm (35 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2525, 2542

Physical Description: Colorless liquid with a strong, garlic-, cabbage-, or skunk-like odor.

Chemical & Physical Properties:
MW: 90.2
BP: 209°F
Sol: 0.06%
FI.P: 35°F
IP: 9.15 eV
Sp.Gr: 0.83
VP: 35 mmHg
FRZ: -176°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
500 ppm: Sa:Pd,Pp*
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (such as dry bleaches), acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; musc weak, mal, sweat, nau, vomit, head, conf; in animals: narco, inco, lass; cyan, pulm irrit; liver, kidney damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

o-sec-Butylphenol	Formula: $CH_3CH_2CH(CH_3)C_6H_4OH$	CAS#: 89-72-5	RTECS#: SJ8920000	IDLH: N.D.
Conversion: 1 ppm = 6.14 mg/m^3	**DOT:**			

Synonyms/Trade Names: 2-sec-Butylphenol; 2-(1-Methylpropyl)phenol

Exposure Limits:
NIOSH REL: TWA 5 ppm (30 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid or solid (below 61°F).

Chemical & Physical Properties:
MW: 150.2
BP: 227°F
Sol: Insoluble
FI.P: 225°F
IP: ?
Sp.Gr: 0.89
VP: Low
FRZ: 61°F
UEL: ?
LEL: ?
Class IIB Combustible Liquid
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; skin burns
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

B

p-tert-Butyltoluene

Formula:	CAS#:	RTECS#:	IDLH:
$(CH_3)_3CC_6H_4CH_3$	98-51-1	XS8400000	100 ppm

Conversion: 1 ppm = 6.07 mg/m^3 **DOT:** 2667 152

Synonyms/Trade Names: 4-tert-Butyltoluene, 1-Methyl-4-tert-butylbenzene

Exposure Limits:
NIOSH REL: TWA 10 ppm (60 mg/m^3)
ST 20 ppm (120 mg/m^3)
OSHA PEL†: TWA 10 ppm (60 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1501
OSHA 7

Physical Description: Colorless liquid with a distinct aromatic odor, somewhat like gasoline.

Chemical & Physical Properties:
MW: 148.3
BP: 379°F
Sol: Insoluble
Fl.P: 155°F
IP: 8.28 eV
Sp.Gr: 0.86
VP(77°F): 0.7 mmHg
FRZ: -62°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; dry nose, throat; head; low BP, tacar, abnor CVS stress; CNS, hemato depres; metallic taste; liver, kidney inj
TO: Eyes, skin, resp sys, CVS, CNS, bone marrow, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

n-Butyronitrile

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3CH_2CH_2CN$	109-74-0	ET8750000	N.D.

Conversion: 1 ppm = 2.83 mg/m^3 **DOT:** 2411 131

Synonyms/Trade Names: Butanenitrile, Butyronitrile, 1-Cyanopropane, Propyl cyanide, n-Propyl cyanide

Exposure Limits:
NIOSH REL: TWA 8 ppm (22 mg/m^3)
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 1606 (adapt)

Physical Description: Colorless liquid with a sharp, suffocating odor.
[**Note:** Forms cyanide in the body.]

Chemical & Physical Properties:
MW: 69.1
BP: 244°F
Sol(77°F): 3%
Fl.P: 62°F
IP: 11.67 eV
Sp.Gr: 0.81
VP: 14 mmHg
FRZ: -170°F
UEL: ?
LEL: 1.65%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
80 ppm: CcrOv/Sa
200 ppm: Sa:Cf/PaprOv
400 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
1000 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers & reducing agents, strong acids & bases

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz, lass, conf, convuls; dysp; abdom pain, nau, vomit
TO: Eyes, skin, resp sys, CNS, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Cadmium dust (as Cd)	**Formula:** Cd (metal)	**CAS#:** 7440-43-9 (metal)	**RTECS#:** EU9800000 (metal)	**IDLH:** Ca [9 mg/m^3 (as Cd)]
Conversion:	**DOT:** 2570 154 (cadmium compound)			

Synonyms/Trade Names: **Cadmium metal:** Cadmium
Other synonyms vary depending upon the specific cadmium compound.

Exposure Limits:
NIOSH REL*: Ca
See Appendix A
OSHA PEL*: [1910.1027] TWA 0.005 mg/m^3
[***Note:** The REL and PEL apply to all Cadmium compounds (as Cd).]

Measurement Methods (see Table 1):
NIOSH 7048, 7300, 7301, 7303, 9102
OSHA ID121, ID125G, ID189, ID206

Physical Description: Metal: Silver-white, blue-tinged lustrous, odorless solid.

Chemical & Physical Properties:
MW: 112.4
BP: 1409°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 8.65 (metal)
VP: 0 mmHg (approx)
MLT: 610°F
UEL: NA
LEL: NA
Metal: Noncombustible Solid in bulk form, but will burn in powder form.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers; elemental sulfur, selenium & tellurium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing
SY: Pulm edema, dysp, cough, chest tight, subs pain; head; chills, musc aches; nau, vomit, diarr; anos, emphy, prot, mild anemia; [carc]
TO: Resp sys, kidneys, prostate, blood [prostatic & lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Cadmium fume (as Cd)	**Formula:** CdO/Cd	**CAS#:** 1306-19-0 (CdO)	**RTECS#:** EV1930000 (CdO)	**IDLH:** Ca [9 mg/m^3 (as Cd)]
Conversion:	**DOT:**			

Synonyms/Trade Names: **CdO:** Cadmium monoxide, Cadmium oxide fume **Cd:** Cadmium

Exposure Limits:
NIOSH REL*: Ca
See Appendix A
OSHA PEL*: [1910.1027] TWA 0.005 mg/m^3
[***Note:** The REL and PEL apply to all Cadmium compounds (as Cd).]

Measurement Methods (see Table 1):
NIOSH 7048, 7300, 7301, 7303
OSHA ID121, ID125G, ID189, ID206

Physical Description: Odorless, yellow-brown, finely divided particulate dispersed in air. [**Note:** See listing for Cadmium dust for properties of Cd.]

Chemical & Physical Properties:
MW: 128.4
BP: Decomposes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 8.15 (crystalline form)
6.95 (amorphous form)
VP: 0 mmHg (approx)
MLT: 2599°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Not applicable

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Pulm edema, dysp, cough, chest tight, subs pain; head; chills, musc aches; nau, vomit, diarr; emphy, prot, anos, mild anemia; [carc]
TO: Resp sys, kidneys, blood [prostatic & lung cancer]

First Aid (see Table 6):
Breath: Resp support

C

Calcium arsenate (as As)

Formula: $Ca_3(AsO_4)_2$ | **CAS#:** 7778-44-1 | **RTECS#:** CG0830000 | **IDLH:** Ca [5 mg/m^3 (as As)]

Conversion: **DOT:** 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:
NIOSH REL: Ca
C 0.002 mg/m^3 [15-minute]
See Appendix A
OSHA PEL: [1910.1018] TWA 0.010 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7900
OSHA ID105

Physical Description: Colorless to white, odorless solid. [insecticide/herbicide]

Chemical & Physical Properties:
MW: 398.1
BP: Decomposes
Sol(77°F): 0.01%
FI.P: NA
IP: NA
Sp.Gr: 3.62
VP: 0 mmHg (approx)
MLT: ?
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported
[**Note:** Produces toxic fumes of arsenic when heated to decomposition.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Lass; GI dist; peri neur; skin hyperpig, palmar planter hyperkeratoses; derm; [carc]; in animals: liver damage
TO: Eyes, resp sys, liver, skin, CNS, lymphatic sys [lymphatic & lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Calcium carbonate

Formula: $CaCO_3$ | **CAS#:** 1317-65-3 | **RTECS#:** EV9580000 | **IDLH:** N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Calcium salt of carbonic acid
[**Note:** Occurs in nature as as limestone, chalk, marble, dolomite, aragonite, calcite & oyster shells.]

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 7020, 7303
OSHA ID121

Physical Description: White, odorless powder or colorless crystals.

Chemical & Physical Properties:
MW: 100.1
BP: Decomposes
Sol: 0.001%
FI.P: NA
IP: NA
Sp.Gr: 2.7-2.95
VP: 0 mmHg (approx)
MLT: 1517-2442°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Acids, alum, ammonium salts, mercury & hydrogen, fluorine, magnesium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys; cough
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air

Calcium cyanamide

Formula:	CAS#:	RTECS#:	IDLH:
$CaCN_2$	156-62-7	GS6000000	N.D.

Conversion: **DOT:** 1403 138 (with >0.1% calcium carbide)

Synonyms/Trade Names: Calcium carbimide, Cyanamide, Lime nitrogen, Nitrogen lime
[**Note:** Cyanamide is also a synonym for Hydrogen cyanamide, NH_2CN.]

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Colorless, gray, or black crystals or powder. [fertilizer]
[**Note:** Commercial grades may contain calcium carbide.]

Chemical & Physical Properties:
MW: 80.1
BP: Sublimes
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 2.29
VP: 0 mmHg (approx)
MLT: 2444°F
UEL: NA
LEL: NA
Noncombustible Solid, but a fire risk if it contains calcium carbide.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Water
[**Note:** May polymerize in water or alkaline solutions to dicyanamide. Decomposes in water to form acetylene & ammonia.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz, rapid breath, low BP, nau, vomit; skin burns, sens; cough; Antabuse-like effects
TO: Eyes, skin, resp sys, vasomotor sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Calcium hydroxide

Formula:	CAS#:	RTECS#:	IDLH:
$Ca(OH)_2$	1305-62-0	EW2800000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Calcium hydrate, Caustic lime, Hydrated lime, Slaked lime

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 7020
OSHA ID121

Physical Description: White, odorless powder.
[**Note:** Readily absorbs CO_2 from the air to form calcium carbonate.]

Chemical & Physical Properties:
MW: 74.1
BP: Decomposes
Sol(32°F): 0.2%
Fl.P: NA
IP: NA
Sp.Gr: 2.24
VP: 0 mmHg (approx)
MLT: 1076°F (Decomposes) (Loses H_2O)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Maleic anhydride, phosphorus, nitroethane, nitromethane, nitroparaffins, nitropropane [**Note:** Attacks some metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; eye, skin burns; skin vesic; cough, bron, pneu
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

C

Calcium oxide

Formula:	CAS#:	RTECS#:	IDLH:
CaO	1305-78-8	EW3100000	25 mg/m^3

Conversion: **DOT:** 1910 157

Synonyms/Trade Names: Burned lime, Burnt lime, Lime, Pebble lime, Quick lime, Unslaked lime

Exposure Limits:
NIOSH REL: TWA 2 mg/m^3
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7020, 7303
OSHA ID121

Physical Description: White or gray, odorless lumps or granular powder.

Chemical & Physical Properties:
MW: 56.1
BP: 5162°F
Sol: Reacts
Fl.P: NA
IP: NA
Sp.Gr: 3.34
VP: 0 mmHg (approx)
MLT: 4662°F
UEL: NA
LEL: NA
Noncombustible Solid, but will support combustion by liberation of oxygen.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 mg/m^3: Qm
20 mg/m^3: 95XQ/Sa
25 mg/m^3: Sa:Cf/PaprHie/100F/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Water (liberates heat), fluorine, ethanol
[**Note:** Reacts with water to form calcium hydroxide.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp tract; ulcer, perf nasal septum; pneu; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Calcium silicate

Formula:	CAS#:	RTECS#:	IDLH:
$CaSiO_3$	1344-95-2	VV9150000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Calcium hydrosilicate, Calcium metasilicate, Calcium monosilicate, Calcium salt of silicic acid, Wollastonite (mineral)

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 7020
OSHA ID121

Physical Description: White or cream-colored, free-flowing powder.
[**Note:** The commercial product is prepared from diatomaceous earth & lime.]

Chemical & Physical Properties:
MW: 116.2
BP: ?
Sol: 0.01%
Fl.P: NA
IP: NA
Sp.Gr: 2.9
VP: 0 mmHg (approx)
MLT: 2804°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported
[**Note:** After prolonged contact with water, solution reverts to soluble calcium salts & amorphous silica.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, upper resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air

Calcium sulfate	**Formula:** $CaSO_4$	**CAS#:** 7778-18-9	**RTECS#:** WS6920000	**IDLH:** N.D.
Conversion:	**DOT:**			

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/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Odorless, white powder or colorless, crystalline solid. [**Note:** May have blue, gray, or reddish tinge.]

Chemical & Physical Properties:
MW: 136.1
BP: Decomposes
Sol: 0.3%
FI.P: NA
IP: NA
Sp.Gr: 2.96
VP: 0 mmHg (approx)
MLT: 2840°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Diazomethane, aluminum, phosphorus, water [**Note:** Hygroscopic (i.e., absorbs moisture from the air). Reacts with water to form Gypsum & Plaster of Paris.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, upper resp sys; conj; rhinitis, epis
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air

Camphor (synthetic)	**Formula:** $C_{10}H_{16}O$	**CAS#:** 76-22-2	**RTECS#:** EX1225000	**IDLH:** 200 mg/m^3
Conversion:	**DOT:** 2717 133			

Synonyms/Trade Names: 2-Camphonone, Gum camphor, Laurel camphor, Synthetic camphor

Exposure Limits:
NIOSH REL: TWA 2 mg/m^3
OSHA PEL: TWA 2 mg/m^3

Measurement Methods (see Table 1):
NIOSH 1301, 2553
OSHA 7

Physical Description: Colorless or white crystals with a penetrating, aromatic odor.

Chemical & Physical Properties:
MW: 152.3
BP: 399°F
Sol: Insoluble
FI.P: 150°F
IP: 8.76 eV
Sp.Gr: 0.99
VP: 0.2 mmHg
MLT: 345°F
UEL: 3.5%
LEL: 0.6%
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: Sa:Cf£/PaprOvHie£
100 mg/m^3: CcrFOv100/GmFOv100/PaprTOvHie£/ScbaF/SaF
200 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (especially chromic anhydride & potassium permanganate)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; nau, vomit, diarr; head, dizz, excitement, epilep convuls
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

C

Caprolactam

Formula: $C_2H_{11}NO$ | **CAS#:** 105-60-2 | **RTECS#:** CM3675000 | **IDLH:** N.D.

Conversion: 1 ppm = 4.63 mg/m^3 | **DOT:**

Synonyms/Trade Names: Aminocaproic lactam, epsilon-Caprolactam, Hexahydro-2H-azepin-2-one, 2-Oxohexamethyleneimine

Exposure Limits:
NIOSH REL: Dust: TWA 1 mg/m^3
ST 3 mg/m^3
Vapor: TWA 0.22 ppm (1 mg/m^3)
ST 0.66 ppm (3 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2012

Physical Description: White, crystalline solid or flakes with an unpleasant odor.
[**Note:** Significant vapor concentrations would be expected only at elevated temperatures.]

Chemical & Physical Properties:
MW: 113.2
BP: 515°F
Sol: 53%
FI.P: 282°F
IP: ?
Sp.Gr: 1.01
VP: 0.00000008 mmHg
MLT: 156°F
UEL: 8.0%
LEL: 1.4%
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, (acetic acid + dinitrogen trioxide)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit skin, eyes, resp sys; epis; derm, skin sens; asthma; irrity, conf, dizz, head; abdom cramps, diarr, nau, vomit; liver, kidney inj
TO: Eyes, skin, resp sys, CNS, CVS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Captafol

Formula: $C_{10}H_9Cl_{14}NO_2S$ | **CAS#:** 2425-06-1 | **RTECS#:** GW4900000 | **IDLH:** Ca [N.D.]

Conversion: | **DOT:**

Synonyms/Trade Names: Captofol; Difolatan®; N-((1,1,2,2-Tetrachloroethyl)thio)-4-cyclohexene-1,2-dicarboximide

Exposure Limits:
NIOSH REL: Ca
TWA 0.1 mg/m^3 [skin]
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: White, crystalline solid with a slight, characteristic pungent odor. [fungicide]
[**Note:** Available commercially as a wettable powder or in liquid form.]

Chemical & Physical Properties:
MW: 349.1
BP: Decomposes
Sol: 0.0001%
FI.P: NA
IP: NA
Sp.Gr: ?
VP: 0.000008 mmHg
MLT: 321°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Acids, acid vapors, strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; derm, skin sens; conj; bron, wheez; diarr, vomit; liver, kidney inj; high BP; in animals: terato effects; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys, CVS [in animals: tumors at many sites]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Captan

Formula:	CAS#:	RTECS#:	IDLH:
$C_9H_8Cl_3NO_2S$	133-06-2	GW5075000	Ca [N.D.]

Conversion: **DOT:**

Synonyms/Trade Names: Captane; N-Trichloromethylmercapto-4-cyclohexene-1,2-dicarboximide

Exposure Limits:
NIOSH REL: Ca
TWA 5 mg/m^3
See Appendix A

OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5601, 9202, 9205

Physical Description: Odorless, white, crystalline powder. [fungicide]
[**Note:** Commercial product is a yellow powder with a pungent odor.]

Chemical & Physical Properties:
MW: 300.6
BP: Decomposes
Sol(77°F): 0.0003%
FI.P: ?
IP: NA
Sp.Gr: 1.74
VP: 0 mmHg (approx)
MLT: 352°F (Decomposes)
UEL: ?
LEL: ?
Combustible Solid; may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong alkaline materials (e.g., hydrated lime) [**Note:** Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, upper resp sys; blurred vision; derm, skin sens; dysp; diarr, vomit; [carc]
TO: Eyes, skin, resp sys, GI tract, liver, kidneys [in animals: duodenal tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Carbaryl

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3NHCOOC_{10}H_7$	63-25-2	EC5950000	100 mg/m^3

Conversion: **DOT:** 2757 151

Synonyms/Trade Names: α-Naphthyl N-methyl-carbamate, 1-Naphthyl N-Methyl-carbamate, Sevin®

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5006, 5601
OSHA 63

Physical Description: White or gray, odorless solid. [pesticide]

Chemical & Physical Properties:
MW: 201.2
BP: Decomposes
Sol: 0.01%
FI.P: NA
IP: ?
Sp.Gr: 1.23
VP(77°F): <0.00004 mmHg
MLT: 293°F
UEL: NA
LEL: NA
Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: Sa*
100 mg/m^3: Sa:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strongly alkaline pesticides

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Miosis, blurred vision, tear; rhin, salv; sweat; abdom cramps, nau, vomit, diarr; tremor; cyan; convuls; irrit skin; possible repro effects
TO: Resp sys, CNS, CVS, skin, blood chol, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

C

Carbofuran

Formula:	CAS#:	RTECS#:	IDLH:
$C_{12}H_{15}NO_3$	1563-66-2	FB9450000	N.D.

Conversion: **DOT:** 2757 151

Synonyms/Trade Names: 2,3-Dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate; Furacarb®; Furadan®

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5601

Physical Description: Odorless, white or grayish, crystalline solid. [insecticide]
[**Note:** May be dissolved in a liquid carrier.]

Chemical & Physical Properties:
MW: 221.3
BP: ?
Sol(77°F): 0.07%
Fl.P: NA
IP: NA
Sp.Gr: 1.18
VP(77°F): 0.000003 mmHg
MLT: 304°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Alkaline substances, acid, strong oxidizers (e.g., perchlorates, peroxides, chlorates, nitrates, permanganates)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Miosis, blurred vision; sweat, salv, abdom cramps, diarr, head, nau, vomit; lass, musc twitch, inco, convuls
TO: CNS, PNS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Fresh air
Swallow: Medical attention immed

Carbon black

Formula:	CAS#:	RTECS#:	IDLH:
C	1333-86-4	FF5800000	1750 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: Acetylene black, Channel black, Furnace black, Lamp black, Thermal black

Exposure Limits:
NIOSH REL: TWA 3.5 mg/m^3
Carbon black in presence of polycyclic aromatic hydrocarbons (PAHs):
Ca
TWA 0.1 mg PAHs/m^3
See Appendix A
See Appendix C
OSHA PEL: TWA 3.5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5000
OSHA ID196

Physical Description: Black, odorless solid.

Chemical & Physical Properties:
MW: 12.0
BP: Sublimes
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 1.8-2.1
VP: 0 mmHg (approx)
MLT: Sublimes
UEL: NA
LEL: NA
Combustible Solid that may contain flammable hydrocarbons.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
17.5 mg/m^3: Qm
35 mg/m^3: 95XQ/Sa
87.5 mg/m^3: Sa:Cf/PaprHie
175 mg/m^3: 100F/PaprTHie/ScbaF/SaF
1750 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

In presence of polycyclic aromatic hydrocarbons:
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers such as chlorates, bromates & nitrates

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Cough; irrit eyes; in presence of polycyclic aromatic hydrocarbons: [carc]
TO: Resp sys, eyes [lymphatic cancer (in presence of PAHs)]

First Aid (see Table 6):
Eye: Irr prompt
Breath: Fresh air

Carbon dioxide

Formula:	CAS#:	RTECS#:	IDLH:
CO_2	124-38-9	FF6400000	40,000 ppm

Conversion: 1 ppm = 1.80 mg/m^3

DOT: 1013 120; 1845 120 (dry ice); 2187 120 (liquid)

Synonyms/Trade Names: Carbonic acid gas, Dry ice [**Note:** Normal constituent of air (about 300 ppm)].

Exposure Limits:
NIOSH REL: TWA 5000 ppm (9000 mg/m^3)
ST 30,000 ppm (54,000 mg/m^3)
OSHA PEL†: TWA 5000 ppm (9000 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6603
OSHA ID172

Physical Description: Colorless, odorless gas.
[**Note:** Shipped as a liquefied compressed gas. Solid form is utilized as dry ice.]

Chemical & Physical Properties:
MW: 44.0
BP: Sublimes
Sol(77°F): 0.2%
FI.P: NA
IP: 13.77 eV
RGasD: 1.53
VP: 56.5 atm
MLT: -109°F (Sublimes)
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
40,000 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and 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.

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid/solid)
SY: Head, dizz, restless, pares; dysp; sweat, mal; incr heart rate, card output, BP; coma; asphy; convuls; frostbite (liq, dry ice)
TO: Resp sys, CVS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Carbon disulfide

Formula:	CAS#:	RTECS#:	IDLH:
CS_2	75-15-0	FF6650000	500 ppm

Conversion: 1 ppm = 3.11 mg/m^3

DOT: 1131 131

Synonyms/Trade Names: Carbon bisulfide

Exposure Limits:
NIOSH REL: TWA 1 ppm (3 mg/m^3)
ST 10 ppm (30 mg/m^3) [skin]
OSHA PEL†: TWA 20 ppm
C 30 ppm
100 ppm (30-minute maximum peak)

Measurement Methods (see Table 1):
NIOSH 1600, 3800

Physical Description: Colorless to faint-yellow liquid with a sweet ether-like odor.
[**Note:** Reagent grades are foul smelling.]

Chemical & Physical Properties:
MW: 76.1
BP: 116°F
Sol: 0.3%
FI.P: -22°F
IP: 10.08 eV
Sp.Gr: 1.26
VP: 297 mmHg
FRZ: -169°F
UEL: 50.0%
LEL: 1.3%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 ppm: CcrOv/Sa
25 ppm: Sa:Cf/PaprOv
50 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
500 ppm: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers; chemically-active metals such as sodium, potassium & zinc; azides; rust; halogens; amines
[**Note:** Vapors may be ignited by contact with an ordinary light bulb.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Dizz, head, poor sleep, lass, anxi, anor, low-wgt; psychosis; polyneur; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver inj; eye, skin burns; derm; repro effects
TO: CNS, PNS, CVS, eyes, kidneys, liver, skin, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

C

Carbon monoxide

Formula:	CAS#:	RTECS#:	IDLH:
CO	630-08-0	FG3500000	1200 ppm

Conversion: 1 ppm = 1.15 mg/m^3

DOT: 1016 119; 9202 168 (cryogenic liquid)

Synonyms/Trade Names: Carbon oxide, Flue gas, Monoxide

Exposure Limits:
NIOSH REL: TWA 35 ppm (40 mg/m^3)
C 200 ppm (229 mg/m^3)
OSHA PEL†: TWA 50 ppm (55 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6604
OSHA ID209, ID210

Physical Description: Colorless, odorless gas.
[**Note:** Shipped as a nonliquefied or liquefied compressed gas.]

Chemical & Physical Properties:
MW: 28.0
BP: -313°F
Sol: 2%
FI.P: NA (Gas)
IP: 14.01 eV
RGasD: 0.97
VP: >35 atm
MLT: -337°F
UEL: 74%
LEL: 12.5%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
350 ppm: Sa
875 ppm: Sa:Cf
1200 ppm: GmFS†/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS†/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, bromine trifluoride, chlorine trifluoride, lithium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Head, tachypnea, nau, lass, dizz, conf, halu; cyan; depres S-T segment of electrocardiogram, angina, syncope
TO: CVS, lungs, blood, CNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Carbon tetrabromide

Formula:	CAS#:	RTECS#:	IDLH:
CBr_4	558-13-4	FG4725000	N.D.

Conversion: 1 ppm = 13.57 mg/m^3

DOT: 2516 151

Synonyms/Trade Names: Carbon bromide, Methane tetrabromide, Tetrabromomethane

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (1.4 mg/m^3)
ST 0.3 ppm (4 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to yellow-brown crystals with a slight odor.

Chemical & Physical Properties:
MW: 331.7
BP: 374°F
Sol: 0.02%
FI.P: NA
IP: 10.31 eV
Sp.Gr: 3.42
VP(205°F): 40 mmHg
MLT: 194°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, hexacyclohexyldilead, lithium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; lac; lung, liver, kidney inj; in animals: corn damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Carbon tetrachloride

Formula: CCl_4 | **CAS#:** 56-23-5 | **RTECS#:** FG4900000 | **IDLH:** Ca [200 ppm]

Conversion: 1 ppm = 6.29 mg/m^3 | **DOT:** 1846 151

Synonyms/Trade Names: Carbon chloride, Carbon tet, Freon® 10, Halon® 104, Tetrachloromethane

Exposure Limits:
NIOSH REL: Ca
ST 2 ppm (12.6 mg/m^3) [60-minute]
See Appendix A
OSHA PEL†: TWA 10 ppm
C 25 ppm
200 ppm (5-minute maximum peak in any 4 hours)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless liquid with a characteristic ether-like odor.

Chemical & Physical Properties:
MW: 153.8
BP: 170°F
Sol: 0.05%
FI.P: NA
IP: 11.47 eV
Sp.Gr: 1.59
VP: 91 mmHg
FRZ: -9°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as sodium, potassium & magnesium; fluorine; aluminum [**Note:** Forms highly toxic phosgene gas when exposed to flames or welding arcs.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; CNS depres; nau, vomit; liver, kidney inj; drow, dizz, inco; [carc]
TO: CNS, eyes, lungs, liver, kidneys, skin [in animals: liver cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Carbonyl fluoride

Formula: COF_2 | **CAS#:** 353-50-4 | **RTECS#:** FG6125000 | **IDLH:** N.D.

Conversion: 1 ppm = 2.70 mg/m^3 | **DOT:** 2417 125

Synonyms/Trade Names: Carbon difluoride oxide, Carbon fluoride oxide, Carbon oxyfluoride, Carbonyl difluoride, Fluoroformyl fluoride, Fluorophosgene

Exposure Limits:
NIOSH REL: TWA 2 ppm (5 mg/m^3)
ST 5 ppm (15 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a pungent and very irritating odor. [**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 66.0
BP: -118°F
Sol: Reacts
FI.P: NA
IP: 13.02 eV
RGasD: 2.29
VP: 55.4 atm
FRZ: -173°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Heat, moisture, hexafluoroisopropylideneamino-lithium
[**Note:** Reacts with water to form hydrogen fluoride & carbon dioxide.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, muc memb, resp sys; eye, skin burns; lac; cough, pulm edema, dysp; chronic exposure: GI pain, musc fib, skeletal fluorosis; liquid: frostbite
TO: Eyes, skin, resp sys, bone

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

C

Catechol

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_4(OH)_2$	120-80-9	UX1050000	N.D.

Conversion: 1 ppm = 4.50 mg/m^3 **DOT:**

Synonyms/Trade Names: 1,2-Benzenediol; o-Benzenediol; 1,2-Dihydroxybenzene; o-Dihydroxybenzene; 2-Hydroxyphenol; Pyrocatechol

Exposure Limits:
NIOSH REL: TWA 5 ppm (20 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2014

Physical Description: Colorless, crystalline solid with a faint odor.
[**Note:** Discolors to brown in air & light.]

Chemical & Physical Properties:
MW: 110.1
BP: 474°F
Sol: 44%
FI.P: 261°F
IP: ?
Sp.Gr: 1.34
VP(244°F): 10 mmHg
MLT: 221°F
UEL: ?
LEL: 1.4%
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; skin sens, derm; lac, burns eyes; convuls, incr BP, kidney inj
TO: Eyes, skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Cellulose

Formula:	CAS#:	RTECS#:	IDLH:
$(C_6H_{10}O_5)_n$	9004-34-6	FJ5691460	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Hydroxycellulose, Pyrocellulose

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600, 7404

Physical Description: Odorless, white substance.
[**Note:** The principal fiber cell wall material of vegetable tissues (wood, cotton, flax, grass, etc.).]

Chemical & Physical Properties:
MW: 160,000-560,000
BP: Decomposes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 1.27-1.61
VP: 0 mmHg (approx)
MLT: 500-518°F (Decomposes)
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Water, bromine pentafluoride, sodium nitrate, fluorine, strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, muc memb
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air

Cesium hydroxide	**Formula:** CsOH	**CAS#:** 21351-79-1	**RTECS#:** FK9800000	**IDLH:** N.D.
Conversion:	**DOT:** 2682 157; 2681 154 (solution)			

Synonyms/Trade Names: Cesium hydrate, Cesium hydroxide dimer

Exposure Limits: **NIOSH REL:** TWA 2 mg/m^3 **OSHA PEL†:** none	**Measurement Methods (see Table 1):** None available
Physical Description: Colorless or yellowish, crystalline solid. [**Note:** Hygroscopic (i.e., absorbs moisture from the air).]	

Chemical & Physical Properties: **MW:** 149.9 **BP:** ? **Sol(59°F):** 395% **Fl.P:** NA **IP:** NA **Sp.Gr:** 3.68 **VP:** 0 mmHg (approx) **MLT:** 522°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench	**Respirator Recommendations (see Tables 3 and 4):** Not available.

Incompatibilities and Reactivities: Water, acids, CO_2, 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, upper resp sys; eye, skin burns **TO:** Eyes, skin, resp sys	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed

Chlordane	**Formula:** $C_{10}H_6Cl_8$	**CAS#:** 57-74-9	**RTECS#:** PB9800000	**IDLH:** Ca [100 mg/m^3]
Conversion:	**DOT:** 2996 151			

Synonyms/Trade Names: Chlordan; Chlordano;
1,2,4,5,6,7,8,8-Octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane

Exposure Limits: **NIOSH REL:** Ca TWA 0.5 mg/m^3 [skin] See Appendix A **OSHA PEL:** TWA 0.5 mg/m^3 [skin]	**Measurement Methods (see Table 1):** **NIOSH** 5510 **OSHA** 67
Physical Description: Amber-colored, viscous liquid with a pungent, chlorine-like odor. [insecticide]	

Chemical & Physical Properties: **MW:** 409.8 **BP:** Decomposes **Sol:** 0.0001% **Fl.P:** NA **IP:** ? **Sp.Gr(77°F):** 1.6 **VP:** 0.00001 mmHg **FRZ:** 217-228°F **UEL:** NA **LEL:** NA Noncombustible Liquid, but may be utilized in flammable solutions.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkaline reagents

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Blurred vision; conf; ataxia, delirium; cough; abdom pain, nau, vomit, diarr; irrity, tremor, convuls; anuria; in animals: lung, liver, kidney damage; [carc] **TO:** CNS, eyes, lungs, liver, kidneys [in animals: liver cancer]	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

C

Chlorinated camphene

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_{10}Cl_8$	8001-35-2	XW5250000	Ca [200 mg/m^3]

Conversion: **DOT:** 2761 151

Synonyms/Trade Names: Chlorocamphene, Octachlorocamphene, Polychlorocamphene, Toxaphene

Exposure Limits:
NIOSH REL: Ca [skin]
See Appendix A
OSHA PEL†: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5039

Physical Description: Amber, waxy solid with a mild, piney, chlorine- and camphor-like odor. [insecticide]

Chemical & Physical Properties:
MW: 413.8
BP: Decomposes
Sol: 0.0003%
Fl.P: NA
IP: ?
Sp.Gr: 1.65
VP(77°F): 0.4 mmHg
MLT: 149-194°F
UEL: NA
LEL: NA
Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers [**Note:** Slightly corrosive to metals under moist conditions.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Nau, conf, agitation, tremor, convuls, uncon; dry, red skin; [carc]
TO: CNS, skin [in animals: liver cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Chlorinated diphenyl oxide

Formula:	CAS#:	RTECS#:	IDLH:
$C_{12}H_{10-n}Cl_nO$			5 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: Synonyms depend on the degree of chlorination of diphenyl oxide [$(C_6H_5)_2O$], ranging from monochlorodiphenyl oxide [$(C_6H_4Cl)O(C_6H_5)$] to decachlorodiphenyl oxide [$(C_6Cl_5)O(C_6Cl_5)$].

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3
OSHA PEL: TWA 0.5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5025

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

Chemical & Physical Properties:
Properties vary depending upon the specific compound.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOvAg100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Acne-form derm, liver damage
TO: Skin, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Chlorine

Formula:	CAS#:	RTECS#:	IDLH:
Cl_2	7782-50-5	FO2100000	10 ppm

Conversion: 1 ppm = 2.90 mg/m^3 **DOT:** 1017 124

Synonyms/Trade Names: Molecular chlorine

Exposure Limits:
NIOSH REL: C 0.5 ppm (1.45 mg/m^3) [15-minute]
OSHA PEL†: C 1 ppm (3 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6011
OSHA ID101, ID126SGX

Physical Description: Greenish-yellow gas with a pungent, irritating odor. [**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 70.9
BP: -29°F
Sol: 0.7%
FI.P: NA
IP: 11.48 eV
RGasD: 2.47
VP: 6.8 atm
FRZ: -150°F
UEL: NA
LEL: NA
Nonflammable Gas, but a strong oxidizer.

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrS*/Sa*
10 ppm: Sa:Cf*/PaprS*/CcrFS/GmFS/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Reacts explosively or forms explosive compounds with many common substances such as acetylene, ether, turpentine, ammonia, fuel gas, hydrogen & finely divided metals.

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Burning of eyes, nose, mouth; lac, rhin; cough, choking, subs pain; nau, vomit; head, dizz; syncope; pulm edema; pneu; hypox; derm; liquid: frostbite
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Chlorine dioxide

Formula:	CAS#:	RTECS#:	IDLH:
ClO_2	10049-04-4	FO3000000	5 ppm

Conversion: 1 ppm = 2.76 mg/m^3 **DOT:** 9191 143 (hydrate, frozen)

Synonyms/Trade Names: Chlorine oxide, Chlorine peroxide

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.3 mg/m^3)
ST 0.3 ppm (0.9 mg/m^3)
OSHA PEL†: TWA 0.1 ppm (0.3 mg/m^3)

Measurement Methods (see Table 1):
OSHA ID126SGX, ID202

Physical Description: Yellow to red gas or a red-brown liquid (below 52°F) with an unpleasant odor similar to chlorine and nitric acid.

Chemical & Physical Properties:
MW: 67.5
BP: 52°F
Sol(77°F): 0.3%
FI.P: NA (Gas) ? (Liquid)
IP: 10.36 eV
RGasD: 2.33
Sp.Gr: 1.6 (Liquid at 32°F)
VP: >1 atm
FRZ: -74°F
UEL: ?
LEL: ?
Flammable Gas, Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Eyes: Prevent eye contact (liquid)
Wash skin: When contam (liquid)
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (liquid)
Quick drench (liquid)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 ppm: CcrS/Sa
2.5 ppm: Sa:Cf£/PaprS£
5 ppm: CcrFS/GmFS/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and Reactivities: Organic materials, heat, phosphorus, potassium hydroxide, sulfur, mercury, carbon monoxide [**Note:** Unstable in light. A powerful oxidizer.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing (liquid), Con
SY: Irrit eyes, nose, throat; cough, wheez, bron, pulm edema; chronic bron
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed (liquid)
Skin: Soap wash immed (liquid)
Breath: Resp support
Swallow: Medical attention immed (liquid)

C

Chlorine trifluoride

Formula:	CAS#:	RTECS#:	IDLH:
ClF_3	7790-91-2	FO2800000	20 ppm

Conversion: 1 ppm = 3.78 mg/m^3 **DOT:** 1749 124

Synonyms/Trade Names: Chlorine fluoride, Chlorotrifluoride

Exposure Limits:
NIOSH REL: C 0.1 ppm (0.4 mg/m^3)
OSHA PEL: C 0.1 ppm (0.4 mg/m^3)

Measurement Methods (see Table 1):
None available

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.]

Chemical & Physical Properties:
MW: 92.5
BP: 53°F
Sol: Reacts
FI.P: NA
IP: 13.00 eV
RGasD: 3.21
Sp.Gr: 1.77 (Liquid at 53°F)
VP: 1.4 atm
FRZ: -105°F
UEL: NA
LEL: NA
Nonflammable Gas
Noncombustible Liquid, but contact with organic materials may result in SPONTANEOUS ignition.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam (liquid)
Remove: When wet or contam (liquid)
Change: N.R.
Provide: Eyewash (liquid)
Quick drench (liquid)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2.5 ppm: Sa:Cf£
5 ppm: ScbaF/SaF
20 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Oxidizers, water, acids, combustible materials, sand, glass, metals (corrosive)
[**Note:** Reacts with water to form chlorine & hydrofluoric acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing (liquid), Con
SY: Eye, skin burns (liq or high vap conc); resp irrit; in animals: lac, corn ulcer; pulm edema
TO: Skin, eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed (liquid)

Chloroacetaldehyde

Formula:	CAS#:	RTECS#:	IDLH:
$ClCH_2CHO$	107-20-0	AB2450000	45 ppm

Conversion: 1 ppm = 3.21 mg/m^3 **DOT:** 2232 153

Synonyms/Trade Names: Chloroacetaldehyde (40% aqueous solution), 2-Chloroacetaldehyde, 2-Chloroethanal

Exposure Limits:
NIOSH REL: C 1 ppm (3 mg/m^3)
OSHA PEL: C 1 ppm (3 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2015
OSHA 76

Physical Description: Colorless liquid with an acrid, penetrating odor.
[**Note:** Typically found as a 40% aqueous solution.]

Chemical & Physical Properties:
MW: 78.5
BP: 186°F
Sol: Miscible
FI.P: 190°F (40% solution)
IP: 10.61 eV
Sp.Gr: 1.19 (40% solution)
VP: 100 mmHg
FRZ: -3°F (40% solution)
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 ppm: CcrOv*/Sa*
25 ppm: Sa:Cf*/PaprOv*
45 ppm: CcrFOv/GmFOv/PaprTOv*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit skin, eyes, muc memb; skin burns; eye damage; pulm edema; skin, resp sys sens
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

α-Chloroacetophenone	Formula: $C_6H_5COCH_2Cl$	CAS#: 532-27-4	RTECS#: AM6300000	IDLH: 15 mg/m^3
Conversion: 1 ppm = 6.32 mg/m^3	**DOT:** 1697 153			

Synonyms/Trade Names: 2-Chloroacetophenone, Chloromethyl phenyl ketone, Mace®, Phenacyl chloride, Phenyl chloromethyl ketone, Tear gas

Exposure Limits:
NIOSH REL: TWA 0.3 mg/m^3 (0.05 ppm)
OSHA PEL: TWA 0.3 mg/m^3 (0.05 ppm)

Measurement Methods (see Table 1):
NIOSH P&CAM291 (II-5)

Physical Description: Colorless to gray crystalline solid with a sharp, irritating odor.

Chemical & Physical Properties:
MW: 154.6
BP: 472°F
Sol: Insoluble
FI.P: 244°F
IP: 9.44 eV
Sp.Gr: 1.32
VP: 0.005 mmHg
MLT: 134°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
3 mg/m^3: CcrOv95/Sa
7.5 mg/m^3: Sa:Cf£/PaprOvHie£
15 mg/m^3: CcrFOv100/GmFS100/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS100/ScbaE

Incompatibilities and Reactivities: Water, steam, strong oxidizers [**Note:** Slowly corrodes metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; pulm edema
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Chloroacetyl chloride	Formula: $ClCH_2COCl$	CAS#: 79-04-9	RTECS#: AO6475000	IDLH: N.D.
Conversion: 1 ppm = 4.62 mg/m^3	**DOT:** 1752 156			

Synonyms/Trade Names: Chloroacetic acid chloride, Chloroacetic chloride, Monochloroacetyl chloride

Exposure Limits:
NIOSH REL: TWA 0.05 ppm (0.2 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to yellowish liquid with a strong, pungent odor.

Chemical & Physical Properties:
MW: 112.9
BP: 223°F
Sol: Decomposes
FI.P: NA
IP: 10.30 eV
Sp.Gr: 1.42
VP: 19 mmHg
FRZ: -7°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Water, alcohols, bases, metals (corrosive), amines
[**Note:** Decomposes in water to form chloroacetic acid & hydrogen chloride gas.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; eye, skin burns; cough, wheez, dysp; lac
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

C

Chlorobenzene	Formula: C_6H_5Cl	CAS#: 108-90-7	RTECS#: CZ0175000	IDLH: 1000 ppm
Conversion: 1 ppm = 4.61 mg/m^3	**DOT:** 1134 130			
Synonyms/Trade Names: Benzene chloride, Chlorobenzol, MCB, Monochlorobenzene, Phenyl chloride				
Exposure Limits: **NIOSH REL:** See Appendix D **OSHA PEL:** TWA 75 ppm (350 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1003 **OSHA** 7	
Physical Description: Colorless liquid with an almond-like odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 112.6 **BP:** 270°F **Sol:** 0.05% **FI.P:** 82°F **IP:** 9.07 eV **Sp.Gr:** 1.11 **VP:** 9 mmHg **FRZ:** -50°F **UEL:** 9.6% **LEL:** 1.3% Class IC Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.	**OSHA** **1000 ppm:** Sa:Cf£/PaprOv£/CcrFOv/ GmFOv/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Irrit eyes, skin, nose; drow, inco; CNS depres; in animals: liver, lung, kidney inj **TO:** Eyes, skin, resp sys, CNS, liver	**Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

o-Chlorobenzylidene malononitrile	Formula: $ClC_6H_4CH=C(CN)_2$	CAS#: 2698-41-1	RTECS#: OO3675000	IDLH: 2 mg/m^3
Conversion: 1 ppm = 7.71 mg/m^3	**DOT:** 2810 153			
Synonyms/Trade Names: 2-Chlorobenzalmalonitrile, CS, OCBM				
Exposure Limits: **NIOSH REL:** C 0.05 ppm (0.4 mg/m^3) [skin] **OSHA PEL†:** TWA 0.05 ppm (0.4 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** P&CAM304 (II-5)	
Physical Description: White crystalline solid with a pepper-like odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 188.6 **BP:** 590-599°F **Sol:** Insoluble **FI.P:** ? **IP:** ? **Sp.Gr:** ? **VP:** 0.00003 mmHg **MLT:** 203-205°F **UEL:** ? **LEL:** ? **MEC:** 25 g/m^3 Combustible Solid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam/Daily **Remove:** When wet or contam **Change:** Daily	**NIOSH/OSHA** **2 mg/m^3:** Sa:Cf£/GmFS100/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Abs, Ing, Con **SY:** Pain, burn eyes, lac, conj; eryt eyelids, blepharospasm; irrit throat, cough, chest tight; head; eryt, vesic skin **TO:** Eyes, skin, resp sys	**Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

Chlorobromomethane

Formula: CH_2BrCl | **CAS#:** 74-97-5 | **RTECS#:** PA5250000 | **IDLH:** 2000 ppm

Conversion: 1 ppm = 5.29 mg/m^3 | **DOT:** 1887 160

Synonyms/Trade Names: Bromochloromethane, CB, CBM, Fluorocarbon 1011, Halon® 1011, Methyl chlorobromide

Exposure Limits:
NIOSH REL: TWA 200 ppm (1050 mg/m^3)
OSHA PEL: TWA 200 ppm (1050 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003

Physical Description: Colorless to pale-yellow liquid with a chloroform-like odor. [**Note:** May be used as a fire extinguishing agent.]

Chemical & Physical Properties:
MW: 129.4
BP: 155°F
Sol: Insoluble
FI.P: NA
IP: 10.77 eV
Sp.Gr: 1.93
VP: 115 mmHg
FRZ: -124°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as calcium, powdered aluminum, zinc, and magnesium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, throat; conf, dizz, CNS depres; pulm edema
TO: Eyes, skin, resp sys, liver, kidneys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Chlorodifluoromethane

Formula: $CHClF_2$ | **CAS#:** 75-45-6 | **RTECS#:** PA6390000 | **IDLH:** N.D.

Conversion: 1 ppm = 3.54 mg/m^3 | **DOT:** 1018 126

Synonyms/Trade Names: Difluorochloromethane, Fluorocarbon-22, Freon® 22, Genetron® 22, Monochlorodifluoromethane, Refrigerant 22

Exposure Limits:
NIOSH REL: TWA 1000 ppm (3500 mg/m^3)
ST 1250 ppm (4375 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 1018

Physical Description: Colorless gas with a faint, sweetish odor. [**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 86.5
BP: -41°F
Sol(77°F): 0.3%
FI.P: NA
IP: 12.45 eV
RGasD: 3.11
VP: 9.4 atm
FRZ: -231°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Alkalis, alkaline earth metals (e.g., powdered aluminum, sodium, potassium, zinc)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit resp sys; conf, drow, ringing in ears; heart palp, card arrhy; asphy; liver, kidney, spleen inj; liquid: frostbite
TO: Resp sys, CVS, CNS, liver, kidneys, spleen

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

C

Chlorodiphenyl (42% chlorine)

Formula: $C_6H_4ClC_6H_3Cl_2$ (approx) | **CAS#:** 53469-21-9 | **RTECS#:** TQ1356000 | **IDLH:** Ca [5 mg/m^3]

Conversion: **DOT:** 2315 171

Synonyms/Trade Names: Aroclor® 1242, PCB, Polychlorinated biphenyl

Exposure Limits:
NIOSH REL*: Ca
TWA 0.001 mg/m^3
See Appendix A
[***Note:** The REL also applies to other PCBs.]
OSHA PEL: TWA 1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5503
OSHA PV2089

Physical Description: Colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.

Chemical & Physical Properties:
MW: 258 (approx)
BP: 617-691°F
Sol: Insoluble
Fl.P: NA
IP: ?
Sp.Gr(77°F): 1.39
VP: 0.001 mmHg
FRZ: -2°F
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans & chlorinated dibenzo-p-dioxins.

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; chloracne; liver damage; repro effects; [carc]
TO: Skin, eyes, liver, repro sys [in animals: tumors of the pituitary gland & liver, leukemia]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Chlorodiphenyl (54% chlorine)

Formula: $C_6H_3Cl_2C_6H_2Cl_3$ (approx) | **CAS#:** 11097-69-1 | **RTECS#:** TQ1360000 | **IDLH:** Ca [5 mg/m^3]

Conversion: **DOT:** 2315 171

Synonyms/Trade Names: Aroclor® 1254, PCB, Polychlorinated biphenyl

Exposure Limits:
NIOSH REL*: Ca
TWA 0.001 mg/m^3
See Appendix A
[***Note:** The REL also applies to other PCBs.]
OSHA PEL: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5503
OSHA PV2088

Physical Description: Colorless to pale-yellow, viscous liquid or solid (below 50°F) with a mild, hydrocarbon odor.

Chemical & Physical Properties:
MW: 326 (approx)
BP: 689-734°F
Sol: Insoluble
Fl.P: NA
IP: ?
Sp.Gr(77°F): 1.38
VP: 0.00006 mmHg
FRZ: 50°F
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans, and chlorinated dibenzo-p-dioxins.

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, chloracne; liver damage; repro effects; [carc]
TO: Skin, eyes, liver, repro sys [in animals: tumors of the pituitary gland & liver, leukemia]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Chloroform

Formula:	CAS#:	RTECS#:	IDLH:
$CHCl_3$	67-66-3	FS9100000	Ca [500 ppm]

Conversion: 1 ppm = 4.88 mg/m^3 **DOT:** 1888 151

Synonyms/Trade Names: Methane trichloride, Trichloromethane

Exposure Limits:
NIOSH REL: Ca
ST 2 ppm (9.78 mg/m^3) [60-minute]
See Appendix A
OSHA PEL†: C 50 ppm (240 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003

Physical Description: Colorless liquid with a pleasant odor.

Chemical & Physical Properties:
MW: 119.4
BP: 143°F
Sol(77°F): 0.5%
FI.P: NA
IP: 11.42 eV
Sp.Gr: 1.48
VP: 160 mmHg
FRZ: -82°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong caustics; chemically-active metals such as aluminum or magnesium powder, sodium & potassium; strong oxidizers [**Note:** When heated to decomposition, forms phosgene gas.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; dizz, mental dullness, nau, conf; head, lass; anes; enlarged liver; [carc]
TO: Liver, kidneys, heart, eyes, skin, CNS [in animals: liver & kidney cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

bis-Chloromethyl ether

Formula:	CAS#:	RTECS#:	IDLH:
$(CH_2Cl)_2O$	542-88-1	KN1575000	Ca [N.D.]

Conversion: **DOT:** 2249 131

Synonyms/Trade Names: BCME, bis-CME, Chloromethyl ether, Dichlorodimethyl ether, Dichloromethyl ether, Oxybis(chloromethane)

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1008]
See Appendix B

Measurement Methods (see Table 1):
OSHA 10

Physical Description: Colorless liquid with a suffocating odor.

Chemical & Physical Properties:
MW: 115.0
BP: 223°F
Sol: Reacts
FI.P: <66°F
IP: ?
Sp.Gr: 1.32
VP(72°F): 30 mmHg
FRZ: -43°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet (flamm)
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Acids, water
[**Note:** Reacts with water to form hydrochloric acid & formaldehyde.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb, resp sys; pulm congestion, edema; corn damage, nec; decr pulm function, cough, dysp, wheez; blood-stained sputum, bronchial secretions; [carc]
TO: Eyes, skin, resp sys [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

C

Chloromethyl methyl ether

Formula:	CAS#:	RTECS#:	IDLH:
CH_3OCH_2Cl	107-30-2	KN6650000	Ca [N.D.]

Conversion: **DOT:** 1239 131

Synonyms/Trade Names: Chlorodimethyl ether, Chloromethoxymethane, CMME, Dimethylchloroether, Methylchloromethyl ether

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1006]
See Appendix B

Measurement Methods (see Table 1):
NIOSH P&CAM220 (II-1)
OSHA 10

Physical Description: Colorless liquid with an irritating odor.

Chemical & Physical Properties:
MW: 80.5
BP: 138°F
Sol: Reacts
Fl.P(oc): 32°F
IP: 10.25 eV
Sp.Gr: 1.06
VP(70°F): 192 mmHg
FRZ: -154°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet (flamm)
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Water [**Note:** Reacts with water to form hydrochloric acid & formaldehyde.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; pulm edema, pulm congestion, pneu; skin burns, nec; cough, wheez, pulm congestion; blood stained-sputum; low-wgt; bronchial secretions; [carc]
TO: Eyes, skin, resp sys [in animals: skin & lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

1-Chloro-1-nitropropane

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3CH_2CHClNO_2$	600-25-9	TX5075000	100 ppm

Conversion: 1 ppm = 5.06 mg/m^3 **DOT:**

Synonyms/Trade Names: Korax®, Lanstan®

Exposure Limits:
NIOSH REL: TWA 2 ppm (10 mg/m^3)
OSHA PEL†: TWA 20 ppm (100 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S211 (II-5)

Physical Description: Colorless liquid with an unpleasant odor. [fungicide]

Chemical & Physical Properties:
MW: 123.6
BP: 289°F
Sol: 0.5%
Fl.P(oc): 144°F
IP: 9.90 eV
Sp.Gr: 1.21
VP(77°F): 6 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
20 ppm: Sa*
50 ppm: Sa:Cf*/PaprOv*
100 ppm: CcrFOv/GmFOv/PaprTOv*/ ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes; pulm edema; liver, kidney, heart damage
TO: Resp sys, liver, kidneys, CVS, eyes

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Chloropentafluoroethane

Formula:	CAS#:	RTECS#:	IDLH:
$CClF_2CF_3$	76-15-3	KH7877500	N.D.

Conversion: 1 ppm = 6.32 mg/m^3 **DOT:** 1020 126

Synonyms/Trade Names: Fluorocarbon-115, Freon® 115, Genetron® 115, Halocarbon 115, Monochloropentafluoroethane

Exposure Limits:
NIOSH REL: TWA 1000 ppm (6320 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a slight, ethereal odor.
[**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 154.5
BP: -38°F
Sol(77°F): 0.006%
FI.P: NA
IP: 12.96 eV
RGasD: 5.55
VP(70°F): 7.9 atm
FRZ: -223°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Alkalis, alkaline earth metals (e.g., aluminum powder, sodium, potassium, zinc)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Dysp; dizz, inco, narco; nau, vomit; heart palp, card arrhy, asphy; liquid: frostbite, derm
TO: Skin, CNS, CVS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Chloropicrin

Formula:	CAS#:	RTECS#:	IDLH:
CCl_3NO_2	76-06-2	PB6300000	2 ppm

Conversion: 1 ppm = 6.72 mg/m^3 **DOT:** 1580 154; 1583 154 (mixture, n.o.s.)

Synonyms/Trade Names: Nitrochloroform, Nitrotrichloromethane, Trichloronitromethane

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.7 mg/m^3)
OSHA PEL: TWA 0.1 ppm (0.7 mg/m^3)

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to faint-yellow, oily liquid with an intensely irritating odor. [pesticide]

Chemical & Physical Properties:
MW: 164.4
BP: 234°F
Sol: 0.2%
FI.P: NA
IP: ?
Sp.Gr: 1.66
VP: 18 mmHg
FRZ: -93°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers
[**Note:** The material may explode when heated under confinement.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; lac; cough, pulm edema; nau, vomit
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

C

β-Chloroprene

Formula: CH_2=CClCH=CH_2 | **CAS#:** 126-99-8 | **RTECS#:** EI9625000 | **IDLH:** Ca [300 ppm]

Conversion: 1 ppm = 3.62 mg/m^3 | **DOT:** 1991 131P (inhibited)

Synonyms/Trade Names: 2-Chloro-1,3-butadiene; Chlorobutadiene; Chloroprene

Exposure Limits:
NIOSH REL: Ca
C 1 ppm (3.6 mg/m^3) [15-minute]
See Appendix A
OSHA PEL†: TWA 25 ppm (90 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1002
OSHA 112

Physical Description: Colorless liquid with a pungent, ether-like odor.

Chemical & Physical Properties:
MW: 88.5
BP: 139°F
Sol: Slight
Fl.P: -4°F
IP: 8.79 eV
Sp.Gr: 0.96
VP: 188 mmHg
FRZ: -153°F
UEL: 11.3%
LEL: 1.9%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Peroxides & other oxidizers
[**Note:** Polymerizes at room temperature unless inhibited with antioxidants.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; anxi, irrity; derm; alopecia; repro effects; [carc]
TO: Eyes, skin, resp sys, repro sys [lung & skin cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

o-Chlorostyrene

Formula: ClC_6H_4CH=CH_2 | **CAS#:** 2039-87-4 | **RTECS#:** WL4160000 | **IDLH:** N.D.

Conversion: 1 ppm = 5.67 mg/m^3 | **DOT:**

Synonyms/Trade Names: 2-Chlorostyrene, ortho-Chlorostyrene, 1-Chloro-2-ethenylbenzene

Exposure Limits:
NIOSH REL: TWA 50 ppm (285 mg/m^3)
ST 75 ppm (428 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid.

Chemical & Physical Properties:
MW: 138.6
BP: 372°F
Sol: Insoluble
Fl.P: 138°F
IP: ?
Sp.Gr: 1.10
VP(77°F): 0.96 mmHg
FRZ: -82°F
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, skin; hema, prot, acidosis; enlarged liver, jaun
TO: Eyes, skin, liver, kidneys, CNS, PNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

o-Chlorotoluene

Formula:	CAS#:	RTECS#:	IDLH:
$ClC_6H_4CH_3$	95-49-8	XS9000000	N.D.

Conversion: 1 ppm = 5.18 mg/m^3 **DOT:** 2238 129

Synonyms/Trade Names: 1-Chloro-2-methylbenzene, 2-Chloro-1-methylbenzene, 2-Chlorotoluene, o-Tolyl chloride

Exposure Limits:
NIOSH REL: TWA 50 ppm (250 mg/m^3)
ST 75 ppm (375 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with an aromatic odor.

Chemical & Physical Properties:
MW: 126.6
BP: 320°F
Sol(77°F): 0.009%
Fl.P: 96°F
IP: 8.83 eV
Sp.Gr: 1.08
VP(77°F): 4 mmHg
FRZ: -31°F
UEL: ?
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Acids, alkalis, oxidizers, reducing materials, water

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; derm; drow, inco, anes; cough; liver, kidney inj
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

2-Chloro-6-trichloromethyl pyridine

Formula:	CAS#:	RTECS#:	IDLH:
$ClC_5H_3NCCl_3$	1929-82-4	US7525000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: 2-Chloro-6-(trichloro-methyl)pyridine; Nitrapyrin; N-serve®; 2,2,2,6-Tetrachloro-2-picoline

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
ST 20 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
None available

Physical Description: Colorless or white, crystalline solid with a mild, sweet odor.

Chemical & Physical Properties:
MW: 230.9
BP: ?
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr: ?
VP(73°F): 0.003 mmHg
MLT: 145°F
UEL: ?
LEL: ?
Combustible Solid [Explosive]

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Aluminum, magnesium
[**Note:** Emits oxides of nitrogen and chloride ion when heated to decomposition.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: No adverse effects noted in ingestion studies with animals.
TO: Eyes, skin

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

C

Chlorpyrifos

Formula: $C_9H_{11}Cl_3NO_3PS$ | **CAS#:** 2921-88-2 | **RTECS#:** TF6300000 | **IDLH:** N.D.

Conversion: **DOT:** 2783 152

Synonyms/Trade Names: Chlorpyrifos-ethyl; O,O-Diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate; Dursban®

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3
ST 0.6 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5600 **OSHA** 62

Physical Description: Colorless to white, crystalline solid with a mild, mercaptan-like odor. [pesticide]
[**Note:** Commercial formulations may be combined with combustible liquids.]

Chemical & Physical Properties:
MW: 350.6
BP: 320°F (Decomposes)
Sol: 0.0002%
FI.P: ?
IP: ?
Sp.Gr: 1.40 (Liquid at 110°F)
VP: 0.00002 mmHg
MLT: 108°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids, caustics, amines
[**Note:** Corrosive to copper & brass.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Wheez, lar spasms, salv; bluish lips, skin; miosis, blurred vision; nau, vomit, abdom cramps, diarr
TO: Resp sys, CNS, PNS, plasma chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Chromic acid and chromates

Formula: CrO_3 (acid) | **CAS#:** 1333-82-0 (CrO_3) | **RTECS#:** GB6650000 (CrO_3) | **IDLH:** Ca [15 mg/m^3 {as Cr(VI)}]

Conversion: **DOT:** 1755 154 (acid solution); 1463 141 (acid, solid)

Synonyms/Trade Names: **Chromic acid (CrO_3):** 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/m^3
See Appendix A
See Appendix C
OSHA PEL (as CrO_3): C 0.1 mg/m^3 See Appendix C

Measurement Methods (see Table 1):
NIOSH 7600, 7604, 7605
OSHA ID103, ID215, W4001

Physical Description: CrO_3: Dark-red, odorless flakes or powder.
[**Note:** Often used in an aqueous solution (H_2CrO_4).]

Chemical & Physical Properties:
MW: 100.0
BP: 482°F (Decomposes)
Sol: 63%
FI.P: NA
IP: NA
Sp.Gr: 2.70 (CrO_3)
VP: Very low
MLT: 387°F (Decomposes)
UEL: NA
LEL: NA
CrO_3: Noncombustible Solid, but will accelerate the burning of combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Combustible, organic, or other readily oxidizable materials (paper, wood, sulfur, aluminum, plastics, etc.); corrosive to metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit resp sys; nasal septum perf; liver, kidney damage; leucyt, leupen, eosin; eye inj, conj; skin ulcer, sens derm; [carc]
TO: Blood, resp sys, liver, kidneys, eyes, skin [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Chromium(II) compounds (as Cr)	Formula:	CAS#:	RTECS#:	IDLH: 250 mg/m^3 [as Cr(II)]
Conversion:	**DOT:**			

Synonyms/Trade Names: Synonyms vary depending upon the specific Chromium(II) compound.
[**Note:** Chromium(II) compounds include soluble chromous salts.]

Exposure Limits:	**Measurement Methods (see Table 1):**
NIOSH REL: TWA 0.5 mg/m^3 See Appendix C **OSHA PEL:** TWA 0.5 mg/m^3 See Appendix C	**NIOSH** 7024, 7300, 7301, 7303, 9102 **OSHA** ID121, ID125G

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

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
Properties vary depending upon the specific compound.	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH/OSHA** **2.5 mg/m^3:** Qm* **5 mg/m^3:** 95XQ*/Sa* **12.5 mg/m^3:** Sa:Cf*/PaprHie* **25 mg/m^3:** 100F/PaprTHie*/ScbaF/SaF **250 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):	**First Aid (see Table 6):**
ER: Inh, Ing, Con **SY:** Irrit eyes; sens derm **TO:** Eyes, skin	**Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed

Chromium(III) compounds (as Cr)	Formula:	CAS#:	RTECS#:	IDLH: 25 mg/m^3 [as Cr(III)]
Conversion:	**DOT:**			

Synonyms/Trade Names: Synonyms vary depending upon the specific Chromium(III) compound.
[**Note:** Chromium(III) compounds include soluble chromic salts.]

Exposure Limits:	**Measurement Methods (see Table 1):**
NIOSH REL: TWA 0.5 mg/m^3 See Appendix C **OSHA PEL:** TWA 0.5 mg/m^3 See Appendix C	**NIOSH** 7024, 7300, 7301, 7303, 9102 **OSHA** ID121, ID125G

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

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
Properties vary depending upon the specific compound.	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH/OSHA** **2.5 mg/m^3:** Qm* **5 mg/m^3:** 95XQ*/Sa* **12.5 mg/m^3:** Sa:Cf*/PaprHie* **25 mg/m^3:** 100F/PaprTHie*/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):	**First Aid (see Table 6):**
ER: Inh, Ing, Con **SY:** Irrit eyes; sens derm **TO:** Eyes, skin	**Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed

C

Chromium metal

Formula:	CAS#:	RTECS#:	IDLH:
Cr	7440-47-3	GB4200000	250 mg/m^3 (as Cr)

Conversion: **DOT:**

Synonyms/Trade Names: Chrome, Chromium

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3
See Appendix C
OSHA PEL*: TWA 1 mg/m^3
See Appendix C
[***Note:** The PEL also applies to insoluble chromium salts.]

Measurement Methods (see Table 1):
NIOSH 7024, 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Physical Description: Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.

Chemical & Physical Properties:
MW: 52.0
BP: 4788°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 7.14
VP: 0 mmHg (approx)
MLT: 3452°F
UEL: NA
LEL: NA
Noncombustible Solid in bulk form, but finely divided dust burns rapidly if heated in a flame.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
2.5 mg/m^3: Qm*
5 mg/m^3: 95XQ*/Sa*
12.5 mg/m^3: Sa:Cf*/PaprHie*
25 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
250 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (such as hydrogen peroxide), alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; lung fib (histologic)
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Chromyl chloride

Formula:	CAS#:	RTECS#:	IDLH:
$Cr(OCl)_2$	14977-61-8	GB5775000	Ca [N.D.]

Conversion: **DOT:** 1758 137

Synonyms/Trade Names: Chlorochromic anhydride, Chromic oxychloride, Chromium chloride oxide, Chromium dichloride dioxide, Chromium dioxide dichloride, Chromium dioxychloride, Chromium oxychloride, Dichlorodioxochromium

Exposure Limits:
NIOSH REL: Ca
0.001 mg Cr(VI)/m^3
See Appendix A, See Appendix C
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Deep-red liquid with a musty, burning, acrid odor. [**Note:** Fumes in moist air.]

Chemical & Physical Properties:
MW: 154.9
BP: 243°F
Sol: Reacts
FI.P: NA
IP: 12.60 eV
Sp.Gr(77°F): 1.91
VP: 20 mmHg
FRZ: -142°F
UEL: NA
LEL: NA
Noncombustible Liquid, but a powerful oxidizer.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Water, combustible substances, halides, phosphorus, turpentine [**Note:** Reacts violently in water; forms chromic acid, chromic chloride, hydrochloric acid & chlorine. Corrodes common metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, upper resp sys; eye, skin burns [carc]
TO: Eyes, skin, resp sys [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Clopidol

Formula:	CAS#:	RTECS#:	IDLH:
$C_7H_7Cl_2NO$	2971-90-6	UU7711500	N.D.

Conversion:

DOT:

Synonyms/Trade Names: Coyden®; 3,5-Dichloro-2,6-dimethyl-4-pyridinol

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
ST 20 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: White to light-brown, crystalline solid.

Chemical & Physical Properties:
MW: 192.1
BP: ?
Sol: Insoluble
Fl.P: NA
IP: ?
Sp.Gr: ?
VP: ?
MLT: >608°F
UEL: NA
LEL: NA
Noncombustible Solid, but dust may explode in cloud form.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, nose, throat; cough
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air

Coal dust

Formula:	CAS#:	RTECS#:	IDLH:
		GF8281000	N.D.

Conversion:

DOT: 1361 133

Synonyms/Trade Names: Anthracite coal dust, Bituminous coal dust, Lignite coal dust

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 2.4 mg/m^3 [respirable, <5% SiO_2]
TWA (10 mg/m^3)/(%SiO_2 + 2) [respirable, ≥ 5% SiO_2]
See Appendix C (Mineral Dusts)

Measurement Methods (see Table 1):
NIOSH 0600, 7500

Physical Description: Dark-brown to black solid dispersed in air.

Chemical & Physical Properties:
Properties vary depending upon the specific coal type.

Combustible Solid; slightly explosive when exposed to flame.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Chronic bron, decr pulm func, emphy
TO: Resp sys

First Aid (see Table 6):
Breath: Fresh air

C

Coal tar pitch volatiles	Formula:	CAS#:	RTECS#:	IDLH:
		65996-93-2	GF8655000	Ca [80 mg/m^3]

Conversion: **DOT:** 2713 153 (acridine)

Synonyms/Trade Names: Synonyms vary depending upon the specific compound (e.g., pyrene, phenanthrene, acridine, chrysene, anthracene & benzo(a)pyrene).
[**Note:** NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products.]

Exposure Limits:
NIOSH REL: Ca
TWA 0.1 mg/m^3 (cyclohexane-extractable fraction)
See Appendix A
See Appendix C
OSHA PEL: TWA 0.2 mg/m^3 (benzene-soluble fraction) [1910.1002]
See Appendix C

Measurement Methods (see Table 1):
OSHA 58

Physical Description: Black or dark-brown amorphous residue.

Chemical & Physical Properties:
Properties vary depending upon the specific compound.
Combustible Solids

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Derm, bron, [carc]
TO: Resp sys, skin, bladder, kidneys [lung, kidney & skin cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Cobalt carbonyl (as Co)	Formula:	CAS#:	RTECS#:	IDLH:
	$C_8Co_2O_8$	10210-68-1	GG0300000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: di-mu-Carbonylhexacarbonyldicobalt, Cobalt octacarbonyl, Cobalt tetracarbonyl dimer, Dicobalt carbonyl, Dicobalt Octacarbonyl, Octacarbonyldicobalt

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Orange to dark-brown, crystalline solid.
[**Note:** The pure substance is white.]

Chemical & Physical Properties:
MW: 341.9
BP: 126°F (Decomposes)
Sol: Insoluble
Fl.P: NA
IP: ?
Sp.Gr: 1.87
VP: 0.7 mmHg
MLT: 124°F
UEL: NA
LEL: NA
Noncombustible Solid, but flammable carbon monoxide is emitted during decomposition.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Air
[**Note:** Decomposes on exposure to air or heat; stable in atmosphere of hydrogen & carbon monoxide.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; cough, decr pulm func, wheez, dysp; in animals: liver, kidney inj, pulm edema
TO: Eyes, skin, resp sys, blood, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Cobalt hydrocarbonyl (as Co)	Formula: $HCo(CO)_4$	CAS#: 16842-03-8	RTECS#: GG0900000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Hydrocobalt tetracarbonyl, Tetracarbonylhydridocobalt, Tetracarbonylhydrocobalt

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Gas with an offensive odor.

Chemical & Physical Properties:
MW: 172.0
BP: ?
Sol: 0.05%
FI.P: NA (Gas)
IP: ?
RGasD: 5.93
VP: >1 atm
FRZ: -15°F
UEL: ?
LEL: ?
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Air
[**Note:** Unstable gas that decomposes rapidly in air at room temperature to cobalt carbonyl & hydrogen.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: In animals: irrit resp sys; dysp, cough, decr pulm func, pulm edema
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support

Cobalt metal dust and fume (as Co)	Formula: Co	CAS#: 7440-48-4	RTECS#: GF8750000	IDLH: 20 mg/m^3 (as Co)
Conversion:	**DOT:**			

Synonyms/Trade Names: Cobalt metal dust, Cobalt metal fume

Exposure Limits:
NIOSH REL: TWA 0.05 mg/m^3
OSHA PEL†: TWA 0.1 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7027, 7300, 7301, 7303, 9102
OSHA ID121, ID125G, ID213

Physical Description: Odorless, silver-gray to black solid.

Chemical & Physical Properties:
MW: 58.9
BP: 5612°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 8.92
VP: 0 mmHg (approx)
MLT: 2719°F
UEL: NA
LEL: NA
Noncombustible Solid in bulk form, but finely divided dust will burn at high temperatures.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
0.25 mg/m^3: Qm
0.5 mg/m^3: 95XQ*/Sa*
1.25 mg/m^3: Sa:Cf*/PaprHie*
2.5 mg/m^3: 100F/ScbaF/SaF
20 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, ammonium nitrate

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Cough, dysp, wheez, decr pulm func; low-wgt; derm; diffuse nodular fib; resp hypersensitivity, asthma
TO: Skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Coke oven emissions	Formula:	CAS#:	RTECS#:	IDLH:
			GH0346000	Ca [N.D.]

Conversion: **DOT:**

Synonyms/Trade Names: Synonyms vary depending upon the specific constituent.

Exposure Limits:
NIOSH REL: Ca
TWA 0.2 mg/m^3 (benzene-soluble fraction)
See Appendix A
See Appendix C
OSHA PEL: [1910.1029] TWA 0.150 mg/m^3 (benzene-soluble fraction)

Measurement Methods (see Table 1):
OSHA 58

Physical Description: Emissions released during the carbonization of bituminous coal for the production of coke. [**Note:** See Appendix C for more information.]

Chemical & Physical Properties:
Properties vary depending upon the constituent.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, resp sys; cough, dysp, wheez; [carc]
TO: Skin, resp sys, urinary sys [skin, lung, kidney & bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support

Copper (dusts and mists, as Cu)	Formula:	CAS#:	RTECS#:	IDLH:
	Cu	7440-50-8	GL5325000	100 mg/m^3 (as Cu)

Conversion: **DOT:**

Synonyms/Trade Names: Copper metal dusts, Copper metal fumes

Exposure Limits:
NIOSH REL*: TWA 1 mg/m^3
OSHA PEL*: TWA 1 mg/m^3
[***Note:** The REL and PEL also apply to other copper compounds (as Cu) except copper fume.]

Measurement Methods (see Table 1):
NIOSH 7029, 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Physical Description: Reddish, lustrous, malleable, odorless solid.

Chemical & Physical Properties:
MW: 63.5
BP: 4703°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 8.94
VP: 0 mmHg (approx)
MLT: 1981°F
UEL: NA
LEL: NA
Noncombustible Solid in bulk form, but powdered form may ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: Qm*
10 mg/m^3: 95XQ*/Sa*
25 mg/m^3: Sa:Cf*/PaprHie*
50 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
100 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Oxidizers, alkalis, sodium azide, acetylene

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, pharynx; nasal septum perf; metallic taste; derm; in animals: lung, liver, kidney damage; anemia
TO: Eyes, skin, resp sys, liver, kidneys (incr risk with Wilson's disease)

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Copper fume (as Cu)

Formula: CuO/Cu | **CAS#:** 1317-38-0 (CuO) | **RTECS#:** GL7900000 (CuO) | **IDLH:** 100 mg/m^3 (as Cu)

Conversion: | **DOT:**

Synonyms/Trade Names: **Cu:** Copper fume **CuO:** Black copper oxide fume, Copper monoxide fume, Copper(II) oxide fume, Cupric oxide fume
[**Note:** Also see specific listing for Copper (dusts and mists).]

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3
OSHA PEL: TWA 0.1 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7029, 7300, 7301, 7303
OSHA ID121, ID125G, ID206

Physical Description: Finely divided black particulate dispersed in air.
[**Note:** Exposure may occur in copper & brass plants and during the welding of copper alloys.]

Chemical & Physical Properties:
MW: 79.5
BP: Decomposes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 6.4 (CuO)
VP: 0 mmHg (approx)
MLT: 1879°F (Decomposes)
UEL: NA
LEL: NA
CuO: Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 mg/m^3: 95XQ/Sa
2.5 mg/m^3: Sa:Cf/PaprHie
5 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
100 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: **CuO:** Acetylene, zirconium
[**Note:** See Copper (dusts and mists) for properties of Copper metal.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, upper resp sys; metal fume fever: chills, musc ache, nau, fever, dry throat, cough, lass; metallic or sweet taste; discoloration skin, hair
TO: Eyes, skin, resp sys (incr risk with Wilson's disease)

First Aid (see Table 6):
Breath: Resp support

Cotton dust (raw)

Formula: | **CAS#:** | **RTECS#:** GN2275000 | **IDLH:** 100 mg/m^3

Conversion: | **DOT:** 1365 133 (cotton)

Synonyms/Trade Names: Raw cotton dust

Exposure Limits:
NIOSH REL: TWA <0.200 mg/m^3
See Appendix C
OSHA PEL: [Z-1-A & 1910.1043]
See Appendix C

Measurement Methods (see Table 1):
OSHA [1910.1043]

Physical Description: Colorless, odorless solid.

Chemical & Physical Properties:
MW: ?
BP: Decomposes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: Decomposes
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1 mg/m^3: Qm
2 mg/m^3: 95XQ/Sa
5 mg/m^3: Sa:Cf/PaprHie
10 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
100 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE
See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Byssinosis: chest tight, cough, wheez, dysp; decr FEV; bron; mal; fever, chills, upper resp symptoms after initial exposure
TO: CVS, resp sys

First Aid (see Table 6):
Breath: Fresh air

C

Crag® herbicide

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_3Cl_2OCH_2CH_2OSO_3Na$	136-78-7	KK4900000	500 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: Crag® herbicide No. 1; 2-(2,4-Dichlorophenoxy)ethyl sodium sulfate; Sesone

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH S356 (II-5)

Physical Description: Colorless to white crystalline, odorless solid. [herbicide]

Chemical & Physical Properties:
MW: 309.1
BP: Decomposes
Sol(77°F): 26%
FI.P: NA
IP: ?
Sp.Gr: 1.70
VP: 0.1 mmHg
MLT: 473°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 mg/m^3: Qm
100 mg/m^3: 95XQ/Sa
250 mg/m^3: Sa:Cf/PaprHie
500 mg/m^3: 100F/PaprTHie*/SaT:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; liver, kidney damage; in animals: CNS effects, convuls
TO: Eyes, skin, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash prompt
Breath: Resp support
Swallow: Medical attention immed

m-Cresol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3C_6H_4OH$	108-39-4	GO6125000	250 ppm

Conversion: 1 ppm = 4.43 mg/m^3 **DOT:** 2076 153

Synonyms/Trade Names: meta-Cresol, 3-Cresol, m-Cresylic acid, 1-Hydroxy-3-methylbenzene, 3-Hydroxytoluene, 3-Methyl phenol

Exposure Limits:
NIOSH REL: TWA 2.3 ppm (10 mg/m^3)
OSHA PEL: TWA 5 ppm (22 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2546
OSHA 32

Physical Description: Colorless to yellowish liquid with a sweet, tarry odor. [**Note:** A solid below 54°F.]

Chemical & Physical Properties:
MW: 108.2
BP: 397°F
Sol: 2%
FI.P: 187°F
IP: 8.98 eV
Sp.Gr: 1.03
VP(77°F): 0.14 mmHg
FRZ: 54°F
UEL: ?
LEL(300°F): 1.1%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
23 ppm: CcrOv95/Sa
57.5 ppm: Sa:Cf/PaprOvHie
115 ppm: CcrFOv100/GmFOv100/PaprTOvHie*/SaT:Cf*/ScbaF/SaF
250 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; CNS effects: conf, depres, resp fail; dysp, irreg rapid resp, weak pulse; eye, skin burns; derm; lung, liver, kidney, pancreas damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys, pancreas, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

o-Cresol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3C_6H_4OH$	95-48-7	GO6300000	250 ppm

Conversion: 1 ppm = 4.43 mg/m^3 **DOT:** 2076 153

Synonyms/Trade Names: ortho-Cresol, 2-Cresol, o-Cresylic acid, 1-Hydroxy-2-methylbenzene, 2-Hydroxytoluene, 2-Methyl phenol

Exposure Limits:
NIOSH REL: TWA 2.3 ppm (10 mg/m^3)
OSHA PEL: TWA 5 ppm (22 mg/m^3) [skin]

Physical Description: White crystals with a sweet, tarry odor.
[**Note:** A liquid above 88°F.]

Measurement Methods (see Table 1):
NIOSH 2546
OSHA 32

Chemical & Physical Properties:
MW: 108.2
BP: 376°F
Sol: 2%
Fl.P: 178°F
IP: 8.93 eV
Sp.Gr: 1.05
VP(77°F): 0.29 mmHg
MLT: 88°F
UEL: ?
LEL(300°F): 1.4%
Combustible Solid
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
23 ppm: CcrOv95/Sa
57.5 ppm: Sa:Cf/PaprOvHie
115 ppm: CcrFOv100/GmFOv100/PaprTOvHie*/SaT:Cf*/ScbaF/SaF
250 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; CNS effects: conf, depres, resp fail; dysp, irreg rapid resp, weak pulse; eye, skin burns; derm; lung, liver, kidney, pancreas damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys, pancreas, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

p-Cresol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3C_6H_4OH$	106-44-5	GO6475000	250 ppm

Conversion: 1 ppm = 4.43 mg/m^3 **DOT:** 2076 153

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/m^3)
OSHA PEL: TWA 5 ppm (22 mg/m^3) [skin]

Physical Description: Crystalline solid with a sweet, tarry odor.
[**Note:** A liquid above 95°F.]

Measurement Methods (see Table 1):
NIOSH 2546
OSHA 32

Chemical & Physical Properties:
MW: 108.2
BP: 396°F
Sol: 2%
Fl.P: 187°F
IP: 8.97 eV
Sp.Gr: 1.04
VP(77°F): 0.11 mmHg
MLT: 95°F
UEL: ?
LEL(300°F): 1.1%
Combustible Solid
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
23 ppm: CcrOv95/Sa
57.5 ppm: Sa:Cf/PaprOvHie
115 ppm: CcrFOv100/GmFOv100/PaprTOvHie*/SaT:Cf*/ScbaF/SaF
250 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; CNS effects: conf, depres, resp fail; dysp, irreg rapid resp, weak pulse; eye, skin burns; derm; lung, liver, kidney, pancreas damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys, pancreas, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

C

Crotonaldehyde

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3CH=CHCHO$	4170-30-3	GP9499000	50 ppm

Conversion: 1 ppm = 2.87 mg/m^3

DOT: 1143 131P (inhibited)

Synonyms/Trade Names: 2-Butenal, β-Methyl acrolein, Propylene aldehyde

Exposure Limits:
NIOSH REL: TWA 2 ppm (6 mg/m^3)
See Appendix C (Aldehydes)
OSHA PEL: TWA 2 ppm (6 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 3516
OSHA 81

Physical Description: Water-white liquid with a suffocating odor.
[**Note:** Turns pale-yellow on contact with air.]

Chemical & Physical Properties:
MW: 70.1
BP: 219°F
Sol: 18%
FI.P: 45°F
IP: 9.73 eV
Sp.Gr: 0.87
VP: 19 mmHg
FRZ: -101°F
UEL: 15.5%
LEL: 2.1%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
20 ppm: CcrOv*/Sa*
50 ppm: Sa:Cf*/PaprOv*/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Caustics, ammonia, strong oxidizers, nitric acid, amines
[**Note:** Polymerization may occur at elevated temperatures, such as in fire conditions.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp sys; in animals: dysp, pulm edema, irrit skin
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Crufomate

Formula:	CAS#:	RTECS#:	IDLH:
$C_{12}H_{19}ClNO_3P$	299-86-5	TB3850000	N.D.

Conversion:

DOT:

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

Measurement Methods (see Table 1):
NIOSH 0500
OSHA PV2015

Physical Description: White, crystalline solid in pure form. [pesticide]
[**Note:** Commercial product is a yellow oil.]

Chemical & Physical Properties:
MW: 291.7
BP: Decomposes
Sol: Insoluble
FI.P: ?
IP: ?
Sp.Gr: 1.16
VP(243°F): 0.01 mmHg
MLT: 140°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strongly alkaline & strongly acidic media
[**Note:** Unstable over long periods in aqueous preparations or above 140°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; wheez, dysp; blurred vision, lac; sweat; abdom cramps, diarr, nau, anor
TO: Eyes, skin, resp sys, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Cumene	**Formula:** $C_6H_5CH(CH_3)_2$	**CAS#:** 98-82-8	**RTECS#:** GR8575000	**IDLH:** 900 ppm [10%LEL]
Conversion: 1 ppm = 4.92 mg/m^3	**DOT:** 1918 130			
Synonyms/Trade Names: Cumol, Isopropyl benzene, 2-Phenyl propane				
Exposure Limits: **NIOSH REL:** TWA 50 ppm (245 mg/m^3) [skin] **OSHA PEL:** TWA 50 ppm (245 mg/m^3) [skin]				**Measurement Methods (see Table 1):** **NIOSH** 1501
Physical Description: Colorless liquid with a sharp, penetrating, aromatic odor.				
Chemical & Physical Properties: **MW:** 120.2 **BP:** 306°F **Sol:** Insoluble **Fl.P:** 96°F **IP:** 8.75 eV **Sp.Gr:** 0.86 **VP:** 8 mmHg **FRZ:** -141°F **UEL:** 6.5% **LEL:** 0.9% Class IC Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **500 ppm:** CcrOv*/Sa* **900 ppm:** Sa:Cf*/PaprOv*/CcrFOv/ GmFOv/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Oxidizers, nitric acid, sulfur acid [**Note:** Forms cumene hydroperoxide upon long exposure to air.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, muc memb; derm; head, narco, coma **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Cyanamide	**Formula:** NH_2CN	**CAS#:** 420-04-2	**RTECS#:** GS5950000	**IDLH:** N.D.
Conversion:	**DOT:**			
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/m^3 **OSHA PEL†:** none				**Measurement Methods (see Table 1):** **NIOSH** 0500
Physical Description: Crystalline solid.				
Chemical & Physical Properties: **MW:** 42.1 **BP:** 500°F (Decomposes) **Sol(59°F):** 78% **Fl.P:** 286°F **IP:** 10.65 eV **Sp.Gr:** 1.28 **VP:** ? **MLT:** 113°F **UEL:** ? **LEL:** ? Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Above 104°F: Moisture, acids, or alkalis; 1,2-phenylene diamine salts [**Note:** Polymerization may occur on evaporation of aqueous solutions.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, resp sys; eye, skin burns; miosis, salv, lac, twitch; Antabuse-like effects **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

Cyanogen	Formula: NCCN	CAS#: 460-19-5	RTECS#: GT1925000	IDLH: N.D.
Conversion: 1 ppm = 2.13 mg/m^3	**DOT:** 1026 119			
Synonyms/Trade Names: Carbon nitride, Dicyan, Dicyanogen, Ethanedinitrile, Oxalonitrile				
Exposure Limits: **NIOSH REL:** TWA 10 ppm (20 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **OSHA** PV2104	
Physical Description: Colorless gas with a pungent, almond-like odor. [**Note:** Shipped as a liquefied compressed gas. Forms cyanide in the body.]				
Chemical & Physical Properties: **MW:** 52.0 **BP:** -6°F **Sol:** 1% **FI.P:** NA (Gas) **IP:** 13.57 eV **RGasD:** 1.82 **Sp.Gr:** 0.95 (Liquid at -6°F) **VP(70°F):** 5.1 atm **FRZ:** -18°F **UEL:** 32% **LEL:** 6.6% Flammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** Frostbite **Eyes:** Prevent eye contact/Frostbite **Wash skin:** N.R. **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Frostbite wash		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Acids, water, strong oxidizers (e.g., dichlorine oxide, fluorine) [**Note:** Slowly hydrolyzed in water to form hydrogen cyanide, oxalic acid, or ammonia.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Irrit eyes, nose, upper resp sys; lac; cherry red lips, tachypnea, hypernea, bradycardia; head, convuls; dizz, loss of appetite, low-wgt; liquid: frostbite **TO:** Eyes, resp sys, CNS, CVS			**First Aid (see Table 6):** **Eye:** Frostbite **Skin:** Frostbite **Breath:** Resp support	

Cyanogen chloride	Formula: ClCN	CAS#: 506-77-4	RTECS#: GT2275000	IDLH: N.D.
Conversion: 1 ppm = 2.52 mg/m^3	**DOT:** 1589 125 (inhibited)			
Synonyms/Trade Names: Chlorcyan, Chlorine cyanide, Chlorocyanide, Chlorocyanogen				
Exposure Limits: **NIOSH REL:** C 0.3 ppm (0.6 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
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.]				
Chemical & Physical Properties: **MW:** 61.5 **BP:** 55°F **Sol:** 7% **FI.P:** NA **IP:** 12.49 eV **RGasD:** 2.16 **Sp.Gr:** 1.22 (Liquid at 32°F) **VP:** 1010 mmHg **FRZ:** 20°F **UEL:** NA **LEL:** NA Nonflammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact (liquid) **Eyes:** Prevent eye contact (liquid) **Wash skin:** When contam (liquid) **Remove:** When wet or contam (liquid) **Change:** N.R. **Provide:** Eyewash (liquid) Quick drench (liquid)		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Water, acids, alkalis, ammonia, alcohols [**Note:** Can react very slowly with water to form hydrogen cyanide. May be stabilized to prevent polymerization.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs (liquid), Ing (liquid), Con (liquid) **SY:** Irrit eyes, upper resp sys; cough, delayed pulm edema; lass, head, dizz, conf, nau, vomit; irreg heartbeat; irrit skin (liquid) **TO:** Eyes, skin, resp sys, CNS, CVS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water wash immed (liquid) **Breath:** Resp support **Swallow:** Medical attention immed (liquid)	

Cyclohexane

Formula: C_6H_{12} | **CAS#:** 110-82-7 | **RTECS#:** GU6300000 | **IDLH:** 1300 ppm [10%LEL]

Conversion: 1 ppm = 3.44 mg/m^3 | **DOT:** 1145 128

Synonyms/Trade Names: Benzene hexahydride, Hexahydrobenzene, Hexamethylene, Hexanaphthene

Exposure Limits:
NIOSH REL: TWA 300 ppm (1050 mg/m^3)
OSHA PEL: TWA 300 ppm (1050 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1500
OSHA 7

Physical Description: Colorless liquid with a sweet, chloroform-like odor. [**Note:** A solid below 44°F.]

Chemical & Physical Properties:
MW: 84.2
BP: 177°F
Sol: Insoluble
FI.P: 0°F
IP: 9.88 eV
Sp.Gr: 0.78
VP: 78 mmHg
FRZ: 44°F
UEL: 8%
LEL: 1.3%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1300 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; drow; derm; narco, coma
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Cyclohexanethiol

Formula: $C_6H_{11}SH$ | **CAS#:** 1569-69-3 | **RTECS#:** GV7525000 | **IDLH:** N.D.

Conversion: 1 ppm = 4.75 mg/m^3 | **DOT:** 3054 129

Synonyms/Trade Names: Cyclohexylmercaptan, Cyclohexylthiol

Exposure Limits:
NIOSH REL: C 0.5 ppm (2.4 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a strong, offensive odor.

Chemical & Physical Properties:
MW: 116.2
BP: 316°F
Sol: Insoluble
FI.P: 110°F
IP: ?
Sp.Gr: 0.98
VP: 10 mmHg
FRZ: -181°F
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids, alkali metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz, lass, nau, vomit, convuls; cough, wheez, laryngitis, dysp
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

C

Cyclohexanol

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_{11}OH$	108-93-0	GV7875000	400 ppm

Conversion: 1 ppm = 4.10 mg/m^3 **DOT:** 1993 128 (combustible liquid, n.o.s.)

Synonyms/Trade Names: Anol, Cyclohexyl alcohol, Hexahydrophenol, Hexalin, Hydralin, Hydroxycyclohexane

Exposure Limits:
NIOSH REL: TWA 50 ppm (200 mg/m^3) [skin]
OSHA PEL†: TWA 50 ppm (200 mg/m^3)

Physical Description: Sticky solid or colorless to light-yellow liquid (above 77°F) with a camphor-like odor.

Measurement Methods (see Table 1):
NIOSH 1402, 1405
OSHA 7

Chemical & Physical Properties:
MW: 100.2
BP: 322°F
Sol: 4%
Fl.P: 154°F
IP: 10.00 eV
Sp.Gr: 0.96
VP: 1 mmHg
MLT: 77°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
400 ppm: CcrOv*/PaprOv*/GmFOv/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (such as hydrogen peroxide & nitric acid)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; narco
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash prompt
Breath: Resp support
Swallow: Medical attention immed

Cyclohexanone

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_{10}O$	108-94-1	GW1050000	700 ppm

Conversion: 1 ppm = 4.02 mg/m^3 **DOT:** 1915 127

Synonyms/Trade Names: Anone, Cyclohexyl ketone, Pimelic ketone

Exposure Limits:
NIOSH REL: TWA 25 ppm (100 mg/m^3) [skin]
OSHA PEL†: TWA 50 ppm (200 mg/m^3)

Physical Description: Water-white to pale-yellow liquid with a peppermint- or acetone-like odor.

Measurement Methods (see Table 1):
NIOSH 1300, 2555
OSHA 1

Chemical & Physical Properties:
MW: 98.2
BP: 312°F
Sol: 15%
Fl.P: 146°F
IP: 9.14 eV
Sp.Gr: 0.95
VP: 5 mmHg
FRZ: -49°F
UEL: 9.4%
LEL(212°F): 1.1%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
625 ppm: Sa:Cf£/PaprOv£
700 ppm: CcrFOv/GmFOv/PaprTOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; head; narco, coma; derm; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Cyclohexene

Formula:	CAS#:	RTECS#:	IDLH:
C_6H_{10}	110-83-8	GW2500000	2000 ppm

Conversion: 1 ppm = 3.36 mg/m^3 **DOT:** 2256 130

Synonyms/Trade Names: Benzene tetrahydride, Tetrahydrobenzene

Exposure Limits:
NIOSH REL: TWA 300 ppm (1015 mg/m^3)
OSHA PEL: TWA 300 ppm (1015 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1500
OSHA 7

Physical Description: Colorless liquid with a sweet odor.

Chemical & Physical Properties:
MW: 82.2
BP: 181°F
Sol: Insoluble
FI.P: 11°F
IP: 8.95 eV
Sp.Gr: 0.81
VP: 67 mmHg
FRZ: -154°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: Sa:Cf£/PaprOv£/CcrFOv/ GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers [**Note:** Forms explosive peroxides with oxygen upon storage.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; drow
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Cyclohexylamine

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_{11}NH_2$	108-91-8	GX0700000	N.D.

Conversion: 1 ppm = 4.06 mg/m^3 **DOT:** 2357 132

Synonyms/Trade Names: Aminocyclohexane, Aminohexahydrobenzene, Hexahydroaniline, Hexahydrobenzenamine

Exposure Limits:
NIOSH REL: TWA 10 ppm (40 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2010
OSHA PV2016

Physical Description: Colorless or yellow liquid with a strong, fishy, amine-like odor.

Chemical & Physical Properties:
MW: 99.2
BP: 274°F
Sol: Miscible
FI.P: 88°F
IP: 8.37 eV
Sp.Gr: 0.87
VP: 11 mmHg
FRZ: 0°F
UEL: 9.4%
LEL: 1.5%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, organic compounds, acid anhydrides, acid chlorides, acids, lead [**Note:** Corrosive to copper, aluminum, zinc & galvanized steel.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb, resp sys; eye, skin burns; skin sens; cough, pulm edema; drow, dizz; diarr, nau, vomit
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

C

Cyclonite	Formula: $C_3H_6N_6O_6$	CAS#: 121-82-4	RTECS#: XY9450000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Cyclotrimethylenetrinitramine; Hexahydro-1,3,5-trinitro-s-triazine; RDX; Trimethylenetrinitramine; 1,3,5-Trinitro-1,3,5-triazacyclohexane

Exposure Limits:
NIOSH REL: TWA 1.5 mg/m^3
ST 3 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: White, crystalline powder. [**Note:** A powerful high explosive.]

Chemical & Physical Properties:
MW: 222.2
BP: ?
Sol: Insoluble
Fl.P: Explodes
IP: ?
Sp.Gr: 1.82
VP(230°F): 0.0004 mmHg
MLT: 401°F
UEL: ?
LEL: ?
Combustible Solid [EXPLOSIVE!]

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, combustible materials, heat
[**Note:** Detonates on contact with mercury fulminate.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; head, irrity, lass, tremor, nau, dizz, vomit, insom, convuls
TO: Eyes, skin, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Cyclopentadiene	Formula: C_5H_6	CAS#: 542-92-7	RTECS#: GY1000000	IDLH: 750 ppm
Conversion: 1 ppm = 2.70 mg/m^3	**DOT:**			

Synonyms/Trade Names: 1,3-Cyclopentadiene

Exposure Limits:
NIOSH REL: TWA 75 ppm (200 mg/m^3)
OSHA PEL: TWA 75 ppm (200 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2523

Physical Description: Colorless liquid with an irritating, terpene-like odor.

Chemical & Physical Properties:
MW: 66.1
BP: 107°F
Sol: Insoluble
Fl.P(oc): 77°F
IP: 8.56 eV
Sp.Gr: 0.80
VP: 400 mmHg
FRZ: -121°F
UEL: ?
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
750 ppm: CcrOv/GmFOv/PaprOv/Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, fuming nitric acid, sulfuric acid
[**Note:** Polymerizes to dicyclopentadiene upon standing.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Cyclopentane	**Formula:** C_5H_{10}	**CAS#:** 287-92-3	**RTECS#:** GY2390000	**IDLH:** N.D.
Conversion: 1 ppm = 2.87 mg/m^3	**DOT:** 1146 128			
Synonyms/Trade Names: Pentamethylene				
Exposure Limits: **NIOSH REL:** TWA 600 ppm (1720 mg/m^3) **OSHA PEL†:** none				**Measurement Methods (see Table 1):** None available
Physical Description: Colorless liquid with a mild, sweet odor.				

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
MW: 70.2 **BP:** 121°F **Sol:** Insoluble **FI.P:** -35°F **IP:** 10.52 eV **Sp.Gr:** 0.75 **VP(88°F):** 400 mmHg **FRZ:** -137°F **UEL:** 8.7% **LEL:** 1.1% Class IB Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** Daily **Remove:** When wet (flamm) **Change:** N.R.	Not available.

Incompatibilities and Reactivities: Strong oxidizers (e.g., chlorine, bromine, fluorine)

Exposure Routes, Symptoms, Target Organs (see Table 5):	**First Aid (see Table 6):**
ER: Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat; dizz, euph, inco, nau, vomit, stupor; dry, cracking skin **TO:** Eyes, skin, resp sys, CNS	**Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed

Cyhexatin	**Formula:** $(C_6H_{11})_3SnOH$	**CAS#:** 13121-70-5	**RTECS#:** WH8750000	**IDLH:** 80 mg/m^3 [25 mg/m^3 (as Sn)]
Conversion:	**DOT:**			
Synonyms/Trade Names: TCHH, Tricyclohexylhydroxystannane, Tricyclohexylhydroxytin, Tricyclohexylstannium hydroxide, Tricyclohexyltin hydroxide				
Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 **OSHA PEL†:** TWA 0.32 mg/m^3 [0.1 mg/m^3 (as Sn)]				**Measurement Methods (see Table 1):** **NIOSH** 5504
Physical Description: Colorless to white, nearly odorless, crystalline powder. [insecticide]				

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
MW: 385.2 **BP:** 442°F (Decomposes) **Sol:** Insoluble **FI.P:** NA **IP:** NA **Sp.Gr:** ? **VP:** 0 mmHg (approx) **MLT:** 383°F **UEL:** NA **LEL:** NA	**Skin:** Prevent skin contact **Eyes:** N.R. **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily	**OSHA** **3.2 mg/m^3:** CcrOv95/Sa **8 mg/m^3:** Sa:Cf/PaprOvHie **16 mg/m^3:** CcrFOv100/GmFOv100/ PaprTOvHie/SaT:Cf/ScbaF/SaF **80 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, ultraviolet light

Exposure Routes, Symptoms, Target Organs (see Table 5):	**First Aid (see Table 6):**
ER: Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, resp sys; head, dizz; sore throat, cough; abdom pain, vomit; skin burns, pruritus; in animals: liver, kidney damage **TO:** Eyes, skin, resp sys, liver, kidneys	**Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

D

2,4-D	Formula: $Cl_2C_6H_3OCH_2COOH$	CAS#: 94-75-7	RTECS#: AG6825000	IDLH: 100 mg/m^3
Conversion:	**DOT:** 2765 152			

Synonyms/Trade Names: Dichlorophenoxyacetic acid; 2,4-Dichlorophenoxyacetic acid

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3
OSHA PEL: TWA 10 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5001

Physical Description: White to yellow, crystalline, odorless powder. [herbicide]

Chemical & Physical Properties:
MW: 221.0
BP: Decomposes
Sol: 0.05%
Fl.P: NA
IP: ?
Sp.Gr: 1.57
VP(320°F): 0.4 mmHg
MLT: 280°F
UEL: NA
LEL: NA
Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 mg/m^3: CcrOv95/GmFOv100/ PaprOvHie/Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Lass, stupor, hyporeflexia, musc twitch; convuls; derm; in animals: liver, kidney inj
TO: Skin, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

DDT	Formula: $(C_6H_4Cl)_2CHCCl_3$	CAS#: 50-29-3	RTECS#: KJ3325000	IDLH: Ca [500 mg/m^3]
Conversion:	**DOT:** 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/m^3
See Appendix A
OSHA PEL: TWA 1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S274 (II-3)

Physical Description: Colorless crystals or off-white powder with a slight, aromatic odor. [pesticide]

Chemical & Physical Properties:
MW: 354.5
BP: 230°F (Decomposes)
Sol: Insoluble
Fl.P: 162-171°F
IP: ?
Sp.Gr: 0.99
VP: 0.0000002 mmHg
MLT: 227°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; pares tongue, lips, face; tremor; anxi, dizz, conf, mal, head, lass; convuls; paresis hands; vomit; [carc]
TO: Eyes, skin, CNS, kidneys, liver, PNS [in animals: liver, lung & lymphatic tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Decaborane

Formula:	CAS#:	RTECS#:	IDLH:
$B_{10}H_{14}$	17702-41-9	HD1400000	15 mg/m^3

Conversion: 1 ppm = 5.00 mg/m^3 **DOT:** 1868 134

Synonyms/Trade Names: Decaboron tetradecahydride

Exposure Limits:
NIOSH REL: TWA 0.3 mg/m^3 (0.05 ppm) [skin]
ST 0.9 mg/m^3 (0.15 ppm)
OSHA PEL†: TWA 0.3 mg/m^3 (0.05 ppm) [skin]

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to white crystalline solid with an intense, bitter, chocolate-like odor.

Chemical & Physical Properties:
MW: 122.2
BP: 415°F
Sol: Slight
FI.P: 176°F
IP: 9.88 eV
Sp.Gr: 0.94
VP: 0.2 mmHg
MLT: 211°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
3 mg/m^3: Sa
7.5 mg/m^3: Sa:Cf
15 mg/m^3: SaT:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Oxidizers, water, halogenated compounds (especially carbon tetrachloride) [**Note:** May ignite SPONTANEOUSLY on exposure to air. Decomposes slowly in hot water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Dizz, head, nau, drow; inco, local musc spasm, tremor, convuls; lass; in animals: dysp; lass; liver, kidney damage
TO: CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

1-Decanethiol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3(CH_2)_9SH$	143-10-2		N.D.

Conversion: 1 ppm = 7.13 mg/m^3 **DOT:** 1228 131

Synonyms/Trade Names: Decylmercaptan, n-Decylmercaptan, 1-Mercaptodecane

Exposure Limits:
NIOSH REL: C 0.5 ppm (3.6 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a strong odor.

Chemical & Physical Properties:
MW: 174.4
BP: 465°F
Sol: Insoluble
FI.P: 209°F
IP: ?
Sp.Gr: 0.84
VP: ?
FRZ: -15°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, strong acids & bases, alkali metals, nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; conf, dizz, head, drow, nau, vomit, lass, convuls
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

D

Demeton

Formula: $(C_2H_5O)_2PSOC_2H_4SC_2H_5$ | **CAS#:** 8065-48-3 | **RTECS#:** TF3150000 | **IDLH:** 10 mg/m^3

Conversion: | **DOT:**

Synonyms/Trade Names: O-O-Diethyl-O(and S)-2-(ethylthio)ethyl phosphorothioate mixture, Systox®

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL: TWA 0.1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5514

Physical Description: Amber, oily liquid with a sulfur-like odor. [insecticide]

Chemical & Physical Properties:
MW: 258.3
BP: Decomposes
Sol: 0.01%
FI.P: 113°F
IP: ?
Sp.Gr: 1.12
VP: 0.0003 mmHg
FRZ: <-13°F
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 mg/m^3: Sa
2.5 mg/m^3: Sa:Cf
5 mg/m^3: SaT:Cf/ScbaF/SaF
10 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkalis, water

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; miosis, ache eyes, rhin, head; chest tight, wheez, lar spasm, salv, cyan; anor, nau, vomit, abdom cramps, diarr; local sweat; musc fasc, lass, para; dizz, conf, ataxia; convuls, coma; low BP; card irreg
TO: Eyes, skin, resp sys, CVS, CNS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Diacetone alcohol

Formula: $CH_3COCH_2C(CH_3)_2OH$ | **CAS#:** 123-42-2 | **RTECS#:** SA9100000 | **IDLH:** 1800 ppm [10%LEL]

Conversion: 1 ppm = 4.75 mg/m^3 | **DOT:** 1148 129

Synonyms/Trade Names: Diacetone, 4-Hydroxy-4-methyl-2-pentanone, 2-Methyl-2-pentanol-4-one

Exposure Limits:
NIOSH REL: TWA 50 ppm (240 mg/m^3)
OSHA PEL: TWA 50 ppm (240 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1402, 1405
OSHA 7

Physical Description: Colorless liquid with a faint, minty odor.

Chemical & Physical Properties:
MW: 116.2
BP: 334°F
Sol: Miscible
FI.P: 125°F
IP: ?
Sp.Gr: 0.94
VP: 1 mmHg
FRZ: -47°F
UEL: 6.9%
LEL: 1.8%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1250 ppm: Sa:Cf£/PaprOv£
1800 ppm: CcrFOv/GmFOv/PaprTOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; corn damage; in animals: narco, liver damage
TO: Eyes, skin, resp sys, CNS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

2,4-Diaminoanisole (and its salts)

Formula:	CAS#:	RTECS#:	IDLH:
$(NH_2)_2C_6H_3OCH_3$	615-05-4	BZ8580500	Ca [N.D.]

Conversion: **DOT:**

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)
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
None available

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.]

Chemical & Physical Properties:
MW: 138.2
BP: ?
Sol: ?
Fl.P: ?
IP: ?
Sp.Gr: ?
VP: ?
MLT: 153°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: irrit skin; thyroid, liver changes; terato effects; [carc]
TO: Skin, thyroid, liver, repro sys [in animals: thyroid, liver, skin & lymphatic sys tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

o-Dianisidine

Formula:	CAS#:	RTECS#:	IDLH:
$(NH_2C_6H_3OCH_3)_2$	119-90-4	DD0875000	Ca [N.D.]

Conversion: **DOT:**

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

Measurement Methods (see Table 1):
NIOSH 5013
OSHA 71

Physical Description: Colorless crystals that turn a violet color on standing.
[**Note:** Used as a basis for many dyes.]

Chemical & Physical Properties:
MW: 244.3
BP: ?
Sol: Insoluble
Fl.P: 403°F
IP: ?
Sp.Gr: ?
VP: ?
MLT: 279°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit skin; in animals: kidney, liver damage; thyroid, spleen changes; [carc]
TO: Skin, kidneys, liver, thyroid, liver [in animals: bladder, liver, stomach & mammary gland tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

D

Diazinon®

Formula:	CAS#:	RTECS#:	IDLH:
$C_{12}H_{21}N_2O_3PS$	333-41-5	TF3325000	N.D.

Conversion: **DOT:** 2783 152

Synonyms/Trade Names: Basudin®; Diazide®; O,O-Diethyl-O-2-isopropyl-4-methyl-6-pyrimidinyl-phosphorothioate; Spectracide®

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL†: none

Physical Description: Colorless liquid with a faint ester-like odor. [insecticide] [**Note:** Technical grade is pale to dark brown.]

Measurement Methods (see Table 1):
NIOSH 5600
OSHA 62

Chemical & Physical Properties:
MW: 304.4
BP: Decomposes
Sol: 0.004%
FI.P: 180°F
IP: ?
Sp.Gr: 1.12
VP: 0.0001 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids & alkalis, copper-containing compounds [**Note:** Hydrolyzes slowly in water & dilute acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; miosis, blurred vision; dizz, conf, lass, convuls; dysp; salv, abdom cramps, nau, vomit
TO: Eyes, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Diazomethane

Formula:	CAS#:	RTECS#:	IDLH:
CH_2N_2	334-88-3	PA7000000	2 ppm

Conversion: 1 ppm = 1.72 mg/m^3 **DOT:**

Synonyms/Trade Names: Azimethylene, Azomethylene, Diazirine

Exposure Limits:
NIOSH REL: TWA 0.2 ppm (0.4 mg/m^3)
OSHA PEL: TWA 0.2 ppm (0.4 mg/m^3)

Physical Description: Yellow gas with a musty odor. [**Note:** Shipped as a liquefied compressed gas.]

Measurement Methods (see Table 1):
NIOSH 2515

Chemical & Physical Properties:
MW: 42.1
BP: -9°F
Sol: Reacts
FI.P: NA (Gas)
IP: 9.00 eV
RGasD: 1.45
VP: >1 atm
FRZ: -229°F
UEL: ?
LEL: ?
Flammable Gas [EXPLOSIVE!]

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2 ppm: Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit eyes; cough, short breath; head, lass; flush skin, fever; chest pain, pulm edema, pneu; asthma; liquid: frostbite
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Diborane	Formula: B_2H_6	CAS#: 19287-45-7	RTECS#: HQ9275000	IDLH: 15 ppm
Conversion: 1 ppm = 1.13 mg/m^3	**DOT:** 1911 119			
Synonyms/Trade Names: Boroethane, Boron hydride, Diboron hexahydride				

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.1 mg/m^3)
OSHA PEL: TWA 0.1 ppm (0.1 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6006

Physical Description: Colorless gas with a repulsive, sweet odor.
[**Note:** Usually shipped in pressurized cylinders diluted with hydrogen, argon, nitrogen, or helium.]

Chemical & Physical Properties:
MW: 27.7
BP: -135°F
Sol: Reacts
Fl.P: NA (Gas)
IP: 11.38 eV
RGasD: 0.97
VP(62°F): 39.5 atm
FRZ: -265°F
UEL: 88%
LEL: 0.8%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 ppm: Sa
2.5 ppm: Sa:Cf
5 ppm: SaT:Cf/ScbaF/SaF
15 ppm: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Chest tight, precordial pain, short breath, nonproductive cough, nau; head, dizz, chills, fever, lass, tremor, musc fasc; in animals: liver, kidney damage; pulm edema; hemorr
TO: Resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Breath: Resp support

1,2-Dibromo-3-chloropropane	Formula: $CH_2BrCHBrCH_2Cl$	CAS#: 96-12-8	RTECS#: TX8750000	IDLH: Ca [N.D.]
Conversion: 1 ppm = 9.67 mg/m^3	**DOT:** 2872 159			
Synonyms/Trade Names: 1-Chloro-2,3-dibromopropane; DBCP; Dibromochloropropane				

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1044] TWA 0.001 ppm

Measurement Methods (see Table 1):
None available

Physical Description: Dense yellow or amber liquid with a pungent odor at high concentrations. [pesticide]
[**Note:** A solid below 43°F.]

Chemical & Physical Properties:
MW: 236.4
BP: 384°F
Sol: 0.1%
Fl.P(oc): 170°F
IP: ?
Sp.Gr: 2.05
VP: 0.8 mmHg
FRZ: 43°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Chemically-active metals such as aluminum, magnesium & tin alloys [**Note:** Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; drow; nau, vomit; pulm edema; liver, kidney inj; sterility; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys, spleen, repro sys, digestive sys [in animals: cancer of the nasal cavity, tongue, pharynx, lungs, stomach, adrenal & mammary glands]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

D

2-N-Dibutylaminoethanol

Formula:	CAS#:	RTECS#:	IDLH:
$(C_4H_9)_2NCH_2CH_2OH$	102-81-8	KK3850000	N.D.

Conversion: 1 ppm = 7.09 mg/m^3 **DOT:** 2873 153

Synonyms/Trade Names: Dibutylaminoethanol; 2-Dibutylaminoethanol; 2-Di-N-butylaminoethanol; 2-Di-N-butylaminoethyl alcohol; N,N-Dibutylethanolamine

Exposure Limits:
NIOSH REL: TWA 2 ppm (14 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2007

Physical Description: Colorless liquid with a faint, amine-like odor.

Chemical & Physical Properties:
MW: 173.3
BP: 446°F
Sol: 0.4%
Fl.P: 195°F
IP: ?
Sp.Gr: 0.86
VP: 0.1 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: irrit eyes, skin, nose; derm; skin, corn nec; low-wgt
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

2,6-Di-tert-butyl-p-cresol

Formula:	CAS#:	RTECS#:	IDLH:
$[C(CH_3)_3]_2CH_3C_6H_2OH$	128-37-0	GO7875000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: BHT; Butylated hydroxytoluene; Dibutylated hydroxytoluene; 4-Methyl-2,6-di-tert-butyl phenol

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH P&CAM226 (II-1)
OSHA PV2108

Physical Description: White to pale-yellow, crystalline solid with a slight, phenolic odor. [food preservative]

Chemical & Physical Properties:
MW: 220.4
BP: 509°F
Sol: 0.00004%
Fl.P: 261°F
IP: ?
Sp.Gr: 1.05
VP: 0.01 mmHg
MLT: 158°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; in animals: decr growth rate, incr liver weight
TO: Eyes, skin

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air
Swallow: Medical attention immed

Dibutyl phosphate

Formula:	CAS#:	RTECS#:	IDLH:
$(C_4H_9O)_2(OH)PO$	107-66-4	TB9605000	30 ppm

Conversion: 1 ppm = 8.60 mg/m^3 **DOT:**

Synonyms/Trade Names: Dibutyl acid o-phosphate, Di-n-butyl hydrogen phosphate, Dibutyl phosphoric acid

Exposure Limits:
NIOSH REL: TWA 1 ppm (5 mg/m^3)
ST 2 ppm (10 mg/m^3)
OSHA PEL†: TWA 1 ppm (5 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 5017

Physical Description: Pale-amber, odorless liquid.

Chemical & Physical Properties:
MW: 210.2
BP: 212°F (Decomposes)
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr: 1.06
VP: 1 mmHg (approx)
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 ppm: Sa
25 ppm: Sa:Cf
30 ppm: SaT:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; head
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Dibutyl phthalate

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_4(COOC_4H_9)_2$	84-74-2	TI0875000	4000 mg/m^3

Conversion: 1 ppm = 11.57 mg/m^3 **DOT:**

Synonyms/Trade Names: DBP; Dibutyl-1,2-benzene-dicarboxylate; Di-n-butyl phthalate

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5020
OSHA 104

Physical Description: Colorless to faint-yellow, oily liquid with a slight, aromatic odor.

Chemical & Physical Properties:
MW: 278.3
BP: 644°F
Sol(77°F): 0.001%
Fl.P: 315°F
IP: ?
Sp.Gr: 1.05
VP: 0.00007 mmHg
FRZ: -31°F
UEL: ?
LEL(456°F): 0.5%
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: 95F
125 mg/m^3: Sa:Cf£/PaprHie£
250 mg/m^3: 100F/ScbaF/SaF
4000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids; liquid chlorine

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, upper resp sys, stomach
TO: Eyes, resp sys, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Wash regularly
Breath: Resp support
Swallow: Medical attention immed

D

Dichloroacetylene

Formula: C_2Cl_2 | **CAS#:** 7572-29-4 | **RTECS#:** AP1080000 | **IDLH:** Ca [N.D.]

Conversion: 1 ppm = 3.88 mg/m^3 | **DOT:**

Synonyms/Trade Names: DCA, Dichloroethyne
[**Note:** DCA is a possible decomposition product of trichloroethylene or trichloroethane.]

Exposure Limits:
NIOSH REL: Ca
C 0.1 ppm (0.4 mg/m^3)
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Volatile oil with a disagreeable, sweetish odor.
[**Note:** A gas above 90°F. DCA is not produced commercially.]

Chemical & Physical Properties:
MW: 94.9
BP: 90°F (Explodes)
Sol: ?
FI.P: ?
IP: ?
Sp.Gr: 1.26
VP: ?
FRZ: -58 to -87°F
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, heat, shock

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, loss of appetite, nau, vomit, intense jaw pain, cranial nerve palsy; in animals: kidney, liver, brain inj; low-wgt; [carc]
TO: CNS [in animals: kidney tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

o-Dichlorobenzene

Formula: $C_6H_4Cl_2$ | **CAS#:** 95-50-1 | **RTECS#:** CZ4500000 | **IDLH:** 200 ppm

Conversion: 1 ppm = 6.01 mg/m^3 | **DOT:** 1591 152

Synonyms/Trade Names: o-DCB; 1,2-Dichlorobenzene; ortho-Dichlorobenzene; o-Dichlorobenzol

Exposure Limits:
NIOSH REL: C 50 ppm (300 mg/m^3)
OSHA PEL: C 50 ppm (300 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless to pale-yellow liquid with a pleasant, aromatic odor.
[herbicide]

Chemical & Physical Properties:
MW: 147.0
BP: 357°F
Sol: 0.01%
FI.P: 151°F
IP: 9.06 eV
Sp.Gr: 1.30
VP: 1 mmHg
FRZ: 1°F
UEL: 9.2%
LEL: 2.2%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
200 ppm: CcrFOv/PaprOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, aluminum, chlorides, acids, acid fumes

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose; liver, kidney damage; skin blisters
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

p-Dichlorobenzene	Formula: $C_6H_4Cl_2$	CAS#: 106-46-7	RTECS#: CZ4550000	IDLH: Ca [150 ppm]
Conversion: 1 ppm = 6.01 mg/m^3	**DOT:**			

Synonyms/Trade Names: p-DCB; 1,4-Dichlorobenzene; para-Dichlorobenzene; Dichlorocide

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: TWA 75 ppm (450 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless or white crystalline solid with a mothball-like odor. [insecticide]

Chemical & Physical Properties:
MW: 147.0
BP: 345°F
Sol: 0.008%
Fl.P: 150°F
IP: 8.98 eV
Sp.Gr: 1.25
VP: 1.3 mmHg
MLT: 128°F
UEL: ?
LEL: 2.5%
Combustible Solid, but may take some effort to ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (such as chlorine or permanganate)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Eye irrit, swell periorb; profuse rhinitis; head, anor, nau, vomit; low-wgt, jaun, cirr; in animals: liver, kidney inj; [carc]
TO: Liver, resp sys, eyes, kidneys, skin [in animals: liver & kidney cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

3,3'-Dichlorobenzidine (and its salts)	Formula: $NH_2ClC_6H_3C_6H_3ClNH_2$	CAS#: 91-94-1	RTECS#: DD0525000	IDLH: Ca [N.D.]
Conversion:	**DOT:**			

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:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1007] See Appendix B

Measurement Methods (see Table 1):
NIOSH 5509
OSHA 65

Physical Description: Gray to purple, crystalline solid.

Chemical & Physical Properties:
MW: 253.1
BP: 788°F
Sol(59°F): 0.07%
Fl.P: ?
IP: ?
Sp.Gr: ?
VP: ?
MLT: 271°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Skin sens, derm; head, dizz; caustic burns; frequent urination, dysuria; hema; GI upset; upper resp infection; [carc]
TO: Bladder, liver, lung, skin, GI tract [in animals: liver & bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

D

Dichlorodifluoromethane

Formula:	CAS#:	RTECS#:	IDLH:
CCl_2F_2	75-71-8	PA8200000	15,000 ppm

Conversion: 1 ppm = 4.95 mg/m^3 **DOT:** 1028 126

Synonyms/Trade Names: Difluorodichloromethane, Fluorocarbon 12, Freon® 12, Genetron® 12, Halon® 122, Propellant 12, Refrigerant 12

Exposure Limits:
NIOSH REL: TWA 1000 ppm (4950 mg/m^3)
OSHA PEL: TWA 1000 ppm (4950 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1018

Physical Description: Colorless gas with an ether-like odor at extremely high concentrations. [**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 120.9
BP: -22°F
Sol(77°F): 0.03%
Fl.P: NA
IP: 11.75 eV
RGasD: 4.2
VP: 5.7 atm
FRZ: -252°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10,000 ppm: Sa
15,000 ppm: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Dizz, tremor, asphy, uncon, card arrhy, card arrest; liquid: frostbite
TO: CVS, PNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

1,3-Dichloro-5,5-dimethylhydantoin

Formula:	CAS#:	RTECS#:	IDLH:
$C_5H_6Cl_2N_2O_2$	118-52-5	MU0700000	5 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: Dactin, DDH, Halane

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3
ST 0.4 mg/m^3
OSHA PEL†: TWA 0.2 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: White powder with a chlorine-like odor.

Chemical & Physical Properties:
MW: 197.0
BP: ?
Sol: 0.2%
Fl.P: 346°F
IP: ?
Sp.Gr: 1.5
VP: ?
MLT: 270°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2 mg/m^3: Sa
5 mg/m^3: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS100/ScbaE

Incompatibilities and Reactivities: Water, strong acids, easily oxidized materials such as ammonia salts & sulfides

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, muc memb, resp sys
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

1,1-Dichloroethane

Formula:	CAS#:	RTECS#:	IDLH:
$CHCl_2CH_3$	75-34-3	KI0175000	3000 ppm

Conversion: 1 ppm = 4.05 mg/m^3 **DOT:** 2362 130

Synonyms/Trade Names: Asymmetrical dichloroethane; Ethylidene chloride; 1,1-Ethylidene dichloride

Exposure Limits:
NIOSH REL: TWA 100 ppm (400 mg/m^3)
See Appendix C (Chloroethanes)
OSHA PEL: TWA 100 ppm (400 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless, oily liquid with a chloroform-like odor.

Chemical & Physical Properties:
MW: 99.0
BP: 135°F
Sol: 0.6%
Fl.P: 2°F
IP: 11.06 eV
Sp.Gr: 1.18
VP: 182 mmHg
FRZ: -143°F
UEL: 11.4%
LEL: 5.4%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: Sa
2500 ppm: Sa:Cf
3000 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong caustics

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit skin; CNS depres; liver, kidney, lung damage
TO: Skin, liver, kidneys, lungs, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush prompt
Breath: Resp support
Swallow: Medical attention immed

1,2-Dichloroethylene

Formula:	CAS#:	RTECS#:	IDLH:
ClCH=CHCl	540-59-0	KV9360000	1000 ppm

Conversion: 1 ppm = 3.97 mg/m^3 **DOT:** 1150 130P

Synonyms/Trade Names: Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene

Exposure Limits:
NIOSH REL: TWA 200 ppm (790 mg/m^3)
OSHA PEL: TWA 200 ppm (790 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.

Chemical & Physical Properties:
MW: 97.0
BP: 118-140°F
Sol: 0.4%
Fl.P: 36-39°F
IP: 9.65 eV
Sp.Gr(77°F): 1.27
VP: 180-265 mmHg
FRZ: -57 to -115°F
UEL: 12.8%
LEL: 5.6%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong alkalis, potassium hydroxide, copper [**Note:** Usually contains inhibitors to prevent polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp sys; CNS depres
TO: Eyes, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

D

Dichloroethyl ether

Formula: $(ClCH_2CH_2)_2O$ | **CAS#:** 111-44-4 | **RTECS#:** KN0875000 | **IDLH:** Ca [100 ppm]

Conversion: 1 ppm = 5.85 mg/m^3 | **DOT:** 1916 152

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/m^3)
ST 10 ppm (60 mg/m^3) [skin]
See Appendix A
OSHA PEL†: TWA 15 ppm (90 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1004
OSHA 7

Physical Description: Colorless liquid with a chlorinated solvent-like odor.

Chemical & Physical Properties:
MW: 143.0
BP: 352°F
Sol: 1%
FI.P: 131°F
IP: ?
Sp.Gr: 1.22
VP: 0.7 mmHg
FRZ: -58°F
UEL: ?
LEL: 2.7%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers
[**Note:** Decomposes in presence of moisture to form hydrochloric acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit nose, throat, resp sys; lac; cough; nau, vomit; in animals: pulm edema; liver damage; [carc]
TO: Eyes, resp sys, liver [in animals: liver tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Dichloromonofluoromethane

Formula: $CHCl_2F$ | **CAS#:** 75-43-4 | **RTECS#:** PA8400000 | **IDLH:** 5000 ppm

Conversion: 1 ppm = 4.21 mg/m^3 | **DOT:** 1029 126

Synonyms/Trade Names: Dichlorofluoromethane, Fluorodichloromethane, Freon® 21, Genetron® 21, Halon® 112, Refrigerant 21

Exposure Limits:
NIOSH REL: TWA 10 ppm (40 mg/m^3)
OSHA PEL†: TWA 1000 ppm (4200 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2516

Physical Description: Colorless gas with a slight, ether-like odor.
[**Note:** A liquid below 48°F. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 102.9
BP: 48°F
Sol(86°F): 0.7%
FI.P: NA
IP: 12.39 eV
RGasD: 3.57
VP(70°F): 1.6 atm
FRZ: -211°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
100 ppm: Sa
250 ppm: Sa:Cf
500 ppm: ScbaF/SaF
5000 ppm: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium; acid; acid fumes

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Asphy, card arrhy, card arrest; liquid: frostbite
TO: Resp sys, CVS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

1,1-Dichloro-1-nitroethane	Formula: $CH_3CCl_2NO_2$	CAS#: 594-72-9	RTECS#: KI0500000	IDLH: 25 ppm
Conversion: 1 ppm = 5.89 mg/m^3	**DOT:** 2650 153			

Synonyms/Trade Names: Dichloronitroethane

Exposure Limits:
NIOSH REL: TWA 2 ppm (10 mg/m^3)
OSHA PEL†: C 10 ppm (60 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1601
OSHA 7

Physical Description: Colorless liquid with an unpleasant odor. [fumigant]

Chemical & Physical Properties:
MW: 143.9
BP: 255°F
Sol: 0.3%
FI.P: 136°F
IP: ?
Sp.Gr: 1.43
VP: 15 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
20 ppm: Sa
25 ppm: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers [**Note:** Corrosive to iron in presence of moisture.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, skin; liver, heart, kidney damage; pulm edema, hemorr
TO: Eyes, skin, resp sys, liver, kidneys, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

1,3-Dichloropropene	Formula: $ClHC{=}CHCH_2Cl$	CAS#: 542-75-6	RTECS#: UC8310000	IDLH: Ca [N.D.]
Conversion: 1 ppm = 4.54 mg/m^3	**DOT:** 2047 129			

Synonyms/Trade Names: 3-Chloroallyl chloride; DCP; 1,3-Dichloro-1-propene; 1,3-Dichloropropylene; Telone®

Exposure Limits:
NIOSH REL: Ca
TWA 1 ppm (5 mg/m^3) [skin]
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to straw-colored liquid with a sharp, sweet, irritating, chloroform-like odor. [insecticide] [**Note:** Exists as mixture of cis- & trans-isomers.]

Chemical & Physical Properties:
MW: 111.0
BP: 226°F
Sol: 0.2%
FI.P: 77°F
IP: ?
Sp.Gr: 1.21
VP: 28 mmHg
FRZ: -119°F
UEL: 14.5%
LEL: 5.3%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Aluminum, magnesium, halogens, oxidizers [**Note:** Epichlorohydrin may be added as a stabilizer.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; eye, skin burns; lac; head, dizz; in animals; liver, kidney damage; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys [in animals: cancer of the bladder, liver, lung & forestomach]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

D

2,2-Dichloropropionic acid

Formula:	CAS#:	RTECS#:	IDLH:
CH_3CCl_2COOH	75-99-0	UF0690000	N.D.

Conversion: 1 ppm = 5.85 mg/m^3 **DOT:**

Synonyms/Trade Names: Dalapon; 2,2-Dichloropropanoic acid; α,α-Dichloropropionic acid

Exposure Limits:
NIOSH REL: TWA 1 ppm (6 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2017

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.]

Chemical & Physical Properties:
MW: 143.0
BP: 374°F
Sol: 50%
FI.P: NA
IP: ?
Sp.Gr: 1.40
VP: ?
FRZ: 46°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Metals
[**Note:** Very corrosive to aluminum & copper alloys. Reacts slowly in water to form hydrochloric & pyruvic acids.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; skin burns; lass, loss of appetite, diarr, vomit, slowing of pulse; CNS depres
TO: Eyes, skin, resp sys, GI tract, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Dichlorotetrafluoroethane

Formula:	CAS#:	RTECS#:	IDLH:
$CClF_2CClF_2$	76-14-2	KI1101000	15,000 ppm

Conversion: 1 ppm = 6.99 mg/m^3 **DOT:** 1958 126

Synonyms/Trade Names: 1,2-Dichlorotetrafluoroethane; Freon® 114; Genetron® 114; Halon® 242; Refrigerant 114

Exposure Limits:
NIOSH REL: TWA 1000 ppm (7000 mg/m^3)
OSHA PEL: TWA 1000 ppm (7000 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1018

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.]

Chemical & Physical Properties:
MW: 170.9
BP: 38°F
Sol: 0.01%
FI.P: NA
IP: 12.20 eV
RGasD: 5.93
VP(70°F): 1.9 atm
FRZ: -137°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10,000 ppm: Sa
15,000 ppm: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium; acids; acid fumes

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit resp sys; asphy; card arrhy, card arrest; liquid: frostbite
TO: Resp sys, CVS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Dichlorvos	**Formula:** $(CH_3O)_2P(O)OCH=CCl_2$	**CAS#:** 62-73-7	**RTECS#:** TC0350000	**IDLH:** 100 mg/m^3
Conversion: 1 ppm = 9.04 mg/m^3	**DOT:** 2783 152			
Synonyms/Trade Names: DDVP; 2,2-Dichlorovinyl dimethyl phosphate				
Exposure Limits: **NIOSH REL:** TWA 1 mg/m^3 [skin] **OSHA PEL:** TWA 1 mg/m^3 [skin]				**Measurement Methods (see Table 1):** **NIOSH** P&CAM295 (II-5) **OSHA** 62
Physical Description: Colorless to amber liquid with a mild, chemical odor. [**Note:** Insecticide that may be absorbed on a dry carrier.]				

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
MW: 221.0 **BP:** Decomposes **Sol:** 0.5% **Fl.P:** >175°F **IP:** ? **Sp.Gr(77°F):** 1.42 **VP:** 0.01 mmHg **FRZ:** ? **UEL:** ? **LEL:** ? Class III Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH/OSHA** **10 mg/m^3:** Sa **25 mg/m^3:** Sa:Cf **50 mg/m^3:** SaT:Cf/ScbaF/SaF **100 mg/m^3:** Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong acids, strong alkalis [**Note:** Corrosive to iron & mild steel.]	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin; miosis, ache eyes; rhin; head; chest tight, wheez, lar spasm, salv; cyan; anor, nau, vomit, diarr; sweat; musc fasc, para, dizz, ataxia; convuls; low BP, card irreg **TO:** Eyes, skin, resp sys, CVS, CNS, blood chol	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

Dicrotophos	**Formula:** $C_8H_{16}NO_5P$	**CAS#:** 141-66-2	**RTECS#:** TC3850000	**IDLH:** N.D.
Conversion: 1 ppm = 9.70 mg/m^3	**DOT:**			
Synonyms/Trade Names: Bidrin®, Carbicron®, 2-Dimethyl-cis-2-dimethylcarbamoyl-1-methylvinylphosphate				
Exposure Limits: **NIOSH REL:** TWA 0.25 mg/m^3 [skin] **OSHA PEL†:** none				**Measurement Methods (see Table 1):** **NIOSH** 5600
Physical Description: Yellow-brown liquid with a mild, ester odor. [insecticide]				

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
MW: 237.2 **BP:** 752°F **Sol:** Miscible **Fl.P:** >200°F **IP:** ? **Sp.Gr(59°F):** 1.22 **VP:** 0.0001 mmHg **FRZ:** ? **UEL:** ? **LEL:** ? Class IIIB Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Quick drench	Not available.

Incompatibilities and Reactivities: Metals [**Note:** Corrosive to cast iron, mild steel, brass & stainless steel.]	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Head, nau, dizz, anxi, restless, musc twitch, lass, tremor, inco, vomit, abdom cramps, diarr; salv, sweat, lac, rhinitis; anor, mal **TO:** CNS, blood chol	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water wash immed **Breath:** Resp support **Swallow:** Medical attention immed

D

Dicyclopentadiene

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_{12}$	77-73-6	PC1050000	N.D.

Conversion: 1 ppm = 5.41 mg/m^3 **DOT:** 2048 130

Synonyms/Trade Names: Bicyclopentadiene; DCPD; 1,3-Dicyclopentadiene dimer; 3a,4,7,7a-Tetrahydro-4,7-methanoindene [**Note:** Exists in two stereoisomeric forms.]

Exposure Limits:
NIOSH REL: TWA 5 ppm (30 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2098

Physical Description: Colorless, crystalline solid with a disagreeable, camphor-like odor. [**Note:** A liquid above 90°F.]

Chemical & Physical Properties:
MW: 132.2
BP: 342°F
Sol: 0.02%
Fl.P(oc): 90°F
IP: ?
Sp.Gr: 0.98 (Liquid at 95°F)
VP: 1.4 mmHg
FRZ: 90°F
UEL: 6.3%
LEL: 0.8%
Class IC Flammable Liquid
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; inco, head; sneez, cough; skin blisters; in animals: kidney, lung damage
TO: Eyes, skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Dicyclopentadienyl iron

Formula:	CAS#:	RTECS#:	IDLH:
$(C_5H_5)_2Fe$	102-54-5	LK0700000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: bis(Cyclopentadienyl)iron, Ferrocene, Iron dicyclopentadienyl

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
OSHA ID125G

Physical Description: Orange, crystalline solid with a camphor-like odor.

Chemical & Physical Properties:
MW: 186.1
BP: 480°F
Sol: Insoluble
Fl.P: ?
IP: 6.88 eV
Sp.Gr: ?
VP: ?
MLT: 343°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Ammonium perchlorate, tetranitromethane, mercury(II) nitrate

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Possible irrit eyes, skin, resp sys; in animals: liver, RBC, testicular changes
TO: Eyes, skin, resp sys, liver, blood, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Dieldrin	**Formula:** $C_{12}H_8Cl_6O$	**CAS#:** 60-57-1	**RTECS#:** IO1750000	**IDLH:** Ca [50 mg/m^3]
Conversion:	**DOT:** 2761 151			

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

Exposure Limits:
NIOSH REL: Ca
TWA 0.25 mg/m^3 [skin]
See Appendix A
OSHA PEL: TWA 0.25 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S283 (II-3)

Physical Description: Colorless to light-tan crystals with a mild, chemical odor. [insecticide]

Chemical & Physical Properties:
MW: 380.9
BP: Decomposes
Sol: 0.02%
FI.P: NA
IP: ?
Sp.Gr: 1.75
VP(77°F): 8 x 10^{-7} mmHg
MLT: 349°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, active metals such as sodium, strong acids, phenols

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, dizz; nau, vomit, mal, sweat; myoclonic limb jerks; clonic, tonic convuls; coma; [carc]; in animals: liver, kidney damage
TO: CNS, liver, kidneys, skin [in animals: lung, liver, thyroid & adrenal gland tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Diesel exhaust	**Formula:**	**CAS#:**	**RTECS#:** HZ1755000	**IDLH:** Ca [N.D.]
Conversion:	**DOT:**			

Synonyms/Trade Names: Synonyms vary depending upon the specific diesel exhaust component.

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 2560, 5040

Physical Description: Appearance and odor vary depending upon the specific diesel exhaust component.

Chemical & Physical Properties:
Properties vary depending upon the specific component diesel exhaust component.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Eye irrit, pulm func changes; [carc]
TO: Eyes, resp sys [in animals: lung tumors]

First Aid (see Table 6):
Breath: Resp support

D

Diethanolamine

Formula: $(HOCH_2CH_2)_2NH$ | **CAS#:** 111-42-2 | **RTECS#:** KL2975000 | **IDLH:** N.D.

Conversion: 1 ppm = 4.30 mg/m^3 | **DOT:**

Synonyms/Trade Names: DEA; Di(2-hydroxyethyl)amine; 2,2'-Dihydroxydiethyamine; Diolamine; bis(2-Hydroxyethyl)amine; 2,2'-Iminodiethanol

Exposure Limits:
NIOSH REL: TWA 3 ppm (15 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 3509
OSHA PV2018

Physical Description: Colorless crystals or a syrupy, white liquid (above 82°F) with a mild, ammonia-like odor.

Chemical & Physical Properties:
MW: 105.2
BP: 516°F (Decomposes)
Sol: 95%
Fl.P: 279°F
IP: ?
Sp.Gr: 1.10
VP: <0.01 mmHg
MLT: 82°F
UEL: 9.8%
LEL: 1.6%
Class IIIB Combustible Liquid
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, strong acids, acid anhydrides, halides
[**Note:** Reacts with CO_2 in the air. Hygroscopic (i.e., absorbs moisture from the air). Corrosive to copper, zinc, and galvanized iron.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; eye burns, corn nec; skin burns; lac, cough, sneez
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Diethylamine

Formula: $(C_2H_5)_2NH$ | **CAS#:** 109-89-7 | **RTECS#:** HZ8750000 | **IDLH:** 200 ppm

Conversion: 1 ppm = 2.99 mg/m^3 | **DOT:** 1154 132

Synonyms/Trade Names: Diethamine; N,N-Diethylamine; N-Ethylethanamine

Exposure Limits:
NIOSH REL: TWA 10 ppm (30 mg/m^3)
ST 25 ppm (75 mg/m^3)
OSHA PEL†: TWA 25 ppm (75 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2010
OSHA 41

Physical Description: Colorless liquid with a fishy, ammonia-like odor.

Chemical & Physical Properties:
MW: 73.1
BP: 132°F
Sol: Miscible
Fl.P: -15°F
IP: 8.01 eV
Sp.Gr: 0.71
VP: 192 mmHg
FRZ: -58°F
UEL: 10.1%
LEL: 1.8%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (>0.5%)
Quick drench (liquid)

Respirator Recommendations (see Tables 3 and 4):
NIOSH
200 ppm: Sa:Cf£/PaprS£/CcrFS/GmFS/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, cellulose nitrate

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; in animals; myocardial degeneration
TO: Eyes, skin, resp sys, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

2-Diethylaminoethanol

Formula:	CAS#:	RTECS#:	IDLH:
$(C_2H_5)_2NCH_2CH_2OH$	100-37-8	KK5075000	100 ppm

Conversion: 1 ppm = 4.79 mg/m^3 **DOT:** 2686 132

Synonyms/Trade Names: Diethylaminoethanol; 2-Diethylaminoethyl alcohol; N,N-Diethylethanolamine; Diethyl-(2-hydroxyethyl)amine; 2-Hydroxytriethylamine

Exposure Limits:
NIOSH REL: TWA 10 ppm (50 mg/m^3) [skin]
OSHA PEL: TWA 10 ppm (50 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2007

Physical Description: Colorless liquid with a nauseating, ammonia-like odor.

Chemical & Physical Properties:
MW: 117.2
BP: 325°F
Sol: Miscible
Fl.P: 126°F
IP: ?
Sp.Gr: 0.89
VP: 1 mmHg
FRZ: -94°F
UEL: 11.7%
LEL: 6.7%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash (>5%)
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: CcrOv*/GmFOv/PaprOv*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; nau, vomit
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Diethylenetriamine

Formula:	CAS#:	RTECS#:	IDLH:
$(NH_2CH_2CH_2)_2NH$	111-40-0	IE1225000	N.D.

Conversion: 1 ppm = 4.22 mg/m^3 **DOT:** 2079 154

Synonyms/Trade Names: N-(2-Aminoethyl)-1,2-ethanediamine; bis(2-Aminoethyl)amine; DETA; 2,2'-Diaminodiethylamine

Exposure Limits:
NIOSH REL: TWA 1 ppm (4 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2540
OSHA 60

Physical Description: Colorless to yellow liquid with a strong, ammonia-like odor. [**Note:** Hygroscopic (i.e., absorbs moisture from the air).]

Chemical & Physical Properties:
MW: 103.2
BP: 405°F
Sol: Miscible
Fl.P: 208°F
IP: ?
Sp.Gr: 0.96
VP: 0.4 mmHg
FRZ: -38°F
UEL: 6.7%
LEL: 2%
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, strong acids, cellulose nitrate
[**Note:** May form explosive complexes with silver, cobalt, or chromium compounds. Corrosive to aluminum, copper, brass & zinc.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb, upper resp sys; derm, skin sens; eye, skin nec; cough, dysp, pulm sens
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

D

Diethyl ketone	Formula: $CH_3CH_2COCH_2CH_3$	CAS#: 96-22-0	RTECS#: SA8050000	IDLH: N.D.
Conversion: 1 ppm = 3.53 mg/m^3	**DOT:** 1156 127			
Synonyms/Trade Names: DEK, Dimethylacetone, Ethyl ketone, Metacetone, 3-Pentanone, Propione				
Exposure Limits: **NIOSH REL:** TWA 200 ppm (705 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless liquid with an acetone-like odor.				
Chemical & Physical Properties: **MW:** 86.2 **BP:** 215°F **Sol:** 5% **Fl.P(oc):** 55°F **IP:** 9.32 eV **Sp.Gr:** 0.81 **VP(77°F):** 35 mmHg **FRZ:** -44°F **UEL:** 6.4% **LEL:** 1.6% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** Prevent eye contact **Wash skin:** Daily **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Strong oxidizers, alkalis, mineral acids, (hydrogen peroxide + nitric acid)				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb, resp sys; cough, sneez **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed	

Diethyl phthalate	Formula: $C_6H_4(COOC_2H_5)_2$	CAS#: 84-66-2	RTECS#: TI1050000	IDLH: N.D.
Conversion:	**DOT:**			
Synonyms/Trade Names: DEP, Diethyl ester of phthalic acid, Ethyl phthalate				
Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **OSHA** 104	
Physical Description: Colorless to water-white, oily liquid with a very slight, aromatic odor. [pesticide]				
Chemical & Physical Properties: **MW:** 222.3 **BP:** 563°F **Sol(77°F):** 0.1% **Fl.P(oc):** 322°F **IP:** ? **Sp.Gr:** 1.12 **VP(77°F):** 0.002 mmHg **FRZ:** -41°F **UEL:** ? **LEL(368°F):** 0.7% Class IIIB Combustible Liquid; however, ignition is difficult.	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Strong oxidizers, strong acids, nitric acid, permanganates, water				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat; head, dizz, nau; lac; possible polyneur, vestibular dysfunc; pain, numb, lass, spasms in arms & legs; in animals: repro effects **TO:** Eyes, skin, resp sys, CNS, PNS, repro sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Wash regularly **Breath:** Resp support **Swallow:** Medical attention immed	

Difluorodibromomethane

Formula:	CAS#:	RTECS#:	IDLH:
CBr_2F_2	75-61-6	PA7525000	2000 ppm

Conversion: 1 ppm = 8.58 mg/m^3 **DOT:** 1941 171

Synonyms/Trade Names: Dibromodifluoromethane, Freon® 12B2, Halon® 1202

Exposure Limits:
NIOSH REL: TWA 100 ppm (860 mg/m^3)
OSHA PEL: TWA 100 ppm (860 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1012
OSHA 7

Physical Description: Colorless, heavy liquid or gas (above 76°F) with a characteristic odor.

Chemical & Physical Properties:
MW: 209.8
BP: 76°F
Sol: Insoluble
FI.P: NA
IP: 11.07 eV
Sp.Gr(59°F): 2.29
VP: 620 mmHg
FRZ: -231°F
UEL: NA
LEL: NA
Noncombustible Liquid
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: Sa
2000 ppm: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit resp sys; CNS symptoms; liver damage
TO: Resp sys, CNS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Diglycidyl ether

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_{10}O_3$	2238-07-5	KN2350000	Ca [10 ppm]

Conversion: 1 ppm = 5.33 mg/m^3 **DOT:**

Synonyms/Trade Names: Diallyl ether dioxide; DGE; Di(2,3-epoxypropyl) ether; 2-Epoxypropyl ether; bis(2,3-Epoxypropyl) ether

Exposure Limits:
NIOSH REL: Ca
TWA 0.1 ppm (0.5 mg/m^3)
See Appendix A
OSHA PEL†: C 0.5 ppm (2.8 mg/m^3)

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a strong, irritating odor.

Chemical & Physical Properties:
MW: 130.2
BP: 500°F
Sol: ?
FI.P: 147°F
IP: ?
Sp.Gr: 1.12
VP(77°F): 0.09 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; skin burns; in animals: hemato sys, lung, liver, kidney damage; repro effects; [carc]
TO: Eyes, skin, resp sys, repro sys [in animals: skin tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

D

Diisobutyl ketone

Formula: $[(CH_3)_2CHCH_2]_2CO$ | **CAS#:** 108-83-8 | **RTECS#:** MJ5775000 | **IDLH:** 500 ppm

Conversion: 1 ppm = 5.82 mg/m^3 | **DOT:** 1157 128

Synonyms/Trade Names: DIBK; sym-Diisopropyl acetone; 2,6-Dimethyl-4-heptanone; Isovalerone; Valerone

Exposure Limits:
NIOSH REL: TWA 25 ppm (150 mg/m^3)
OSHA PEL†: TWA 50 ppm (290 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1300, 2555
OSHA 7

Physical Description: Colorless liquid with a mild, sweet odor.

Chemical & Physical Properties:
MW: 142.3
BP: 334°F
Sol: 0.05%
FI.P: 120°F
IP: 9.04 eV
Sp.Gr: 0.81
VP: 2 mmHg
FRZ: -43°F
UEL(200°F): 7.1%
LEL(200°F): 0.8%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
500 ppm: Sa:Cf£/PaprOv£/CcrFOv/ GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; head, dizz; derm; liver, kidney damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Diisopropylamine

Formula: $[(CH_3)_2CH]_2NH$ | **CAS#:** 108-18-9 | **RTECS#:** IM4025000 | **IDLH:** 200 ppm

Conversion: 1 ppm = 4.14 mg/m^3 | **DOT:** 1158 132

Synonyms/Trade Names: DIPA, N-(1-Methylethyl)-2-propanamine

Exposure Limits:
NIOSH REL: TWA 5 ppm (20 mg/m^3) [skin]
OSHA PEL: TWA 5 ppm (20 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH S141 (II-4)

Physical Description: Colorless liquid with an ammonia- or fish-like odor.

Chemical & Physical Properties:
MW: 101.2
BP: 183°F
Sol: Miscible
FI.P: 20°F
IP: 7.73 eV
Sp.Gr: 0.72
VP: 70 mmHg
FRZ: -141°F
UEL: 7.1%
LEL: 1.1%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact (>5%)
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (>5%)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
125 ppm: Sa:Cf£/PaprOv£
200 ppm: CcrFOv/GmFOv/PaprTOv£/ ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; nau, vomit; head; vis dist
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Dimethyl acetamide	**Formula:** $CH_3CON(CH_3)_2$	**CAS#:** 127-19-5	**RTECS#:** AB7700000	**IDLH:** 300 ppm
Conversion: 1 ppm = 3.56 mg/m^3	**DOT:**			
Synonyms/Trade Names: N,N-Dimethyl acetamide; DMAC				

Exposure Limits:
NIOSH REL: TWA 10 ppm (35 mg/m^3) [skin]
OSHA PEL: TWA 10 ppm (35 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2004

Physical Description: Colorless liquid with a weak, ammonia- or fish-like odor.

Chemical & Physical Properties:
MW: 87.1
BP: 329°F
Sol: Miscible
Fl.P(oc): 158°F
IP: 8.81 eV
Sp.Gr: 0.94
VP: 2 mmHg
FRZ: -4°F
UEL(320°F): 11.5%
LEL(212°F): 1.8%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: Sa
250 ppm: Sa:Cf
300 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Carbon tetrachloride, other halogenated compounds when in contact with iron, oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit skin; jaun, liver damage; depres, drow, halu, delusions
TO: Skin, liver, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Dimethylamine	**Formula:** $(CH_3)_2NH$	**CAS#:** 124-40-3	**RTECS#:** IP8750000	**IDLH:** 500 ppm
Conversion: 1 ppm = 1.85 mg/m^3	**DOT:** 1032 118 (anhydrous); 1160 132 (solution)			
Synonyms/Trade Names: Dimethylamine (anhydrous), N-Methylmethanamine				

Exposure Limits:
NIOSH REL: TWA 10 ppm (18 mg/m^3)
OSHA PEL: TWA 10 ppm (18 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2010
OSHA 34

Physical Description: Colorless gas with an ammonia- or fish-like odor.
[**Note:** A liquid below 44°F. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 45.1
BP: 44°F
Sol(140°F): 24%
Fl.P: NA (Gas) 20°F (Liquid)
IP: 8.24 eV
RGasD: 1.56
Sp.Gr: 0.67 (Liquid at 44°F)
VP: 1.7 atm
FRZ: -134°F
UEL: 14.4%
LEL: 2.8%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Frostbite
Eyes: Prevent eye contact (liquid)
Frostbite
Wash skin: When contam (liquid)
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (liquid)
Quick drench (liquid)
Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
250 ppm: Sa:Cf£
500 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, chlorine, mercury, acraldehyde, fluorides, maleic anhydride, aluminum, brass, copper, zinc

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit nose, throat; sneez, cough, dysp; pulm edema; conj; derm; liquid: frostbite
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed (liquid)/Frostbite
Skin: Water flush immed (liquid)/Frostbite
Breath: Resp support

4-Dimethylaminoazobenzene	Formula: $C_6H_5NNC_6H_4N(CH_3)_2$	CAS#: 60-11-7	RTECS#: BX7350000	IDLH: Ca [N.D.]
Conversion:	DOT:			

Synonyms/Trade Names: Butter yellow; DAB; p-Dimethylaminoazobenzene; N,N-Dimethyl-4-aminoazobenzene; Methyl yellow

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1015] See Appendix B

Measurement Methods (see Table 1):
NIOSH P&CAM284 (II-4)

Physical Description: Yellow, leaf-shaped crystals.

Chemical & Physical Properties:
MW: 225.3
BP: Sublimes
Sol: 0.001%
Fl.P: ?
IP: ?
Sp.Gr: ?
VP: 0.0000003 mmHg (est.)
MLT: 237°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Enlarged liver; liver, kidney dist; contact derm; cough, wheez, dysp; bloody sputum; bronchial secretions; frequent urination, hema, dysuria; [carc]
TO: Skin, resp sys, liver, kidneys, bladder [in animals: liver & bladder tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

bis(2-(Dimethylamino)ethyl)ether	Formula: $C_8H_{20}N_2O$	CAS#: 3033-62-3	RTECS#: KR9460000	IDLH: N.D.
Conversion:	DOT:			

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%).]

Exposure Limits:
NIOSH REL: See Appendix C (NIAX® Catalyst ESN)
OSHA PEL: See Appendix C (NIAX® Catalyst ESN)

Measurement Methods (see Table 1):
None available

Physical Description: Liquid.

Chemical & Physical Properties:
MW: 160.3
BP: 372°F
Sol: ?
Fl.P: ?
IP: ?
Sp.Gr: ?
VP: ?
FRZ: ?
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Possible urinary dist, neurological disorders; in animals: irrit eyes, skin
TO: Eyes, skin, urinary tract, PNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Dimethylaminopropionitrile	**Formula:** $(CH_3)_2NCH_2CH_2CN$	**CAS#:** 1738-25-6	**RTECS#:** UG1575000	**IDLH:** N.D.
Conversion:	**DOT:**			

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)

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid.

Chemical & Physical Properties:
MW: 98.2
BP: 342°F
Sol: Miscible
Fl.P: 147°F
IP: ?
Sp.Gr(86°F): 0.86
VP(135°F): 10 mmHg
FRZ: -48°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers
[**Note:** Emits toxic oxides of nitrogen and cyanide fumes when heated to decomposition.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; urinary dist; neurological disorders; pins & needles in hands & feet; musc weak, lass, nau, vomit; decr nerve conduction in lower legs
TO: Eyes, skin, CNS, urinary tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

N,N-Dimethylaniline	**Formula:** $C_6H_5N(CH_3)_2$	**CAS#:** 121-69-7	**RTECS#:** BX4725000	**IDLH:** 100 ppm
Conversion: 1 ppm = 4.96 mg/m^3	**DOT:** 2253 153			

Synonyms/Trade Names: N,N-Dimethylbenzeneamine; N,N-Dimethylphenylamine
[**Note:** Also known as Dimethylaniline which is a correct synonym for Xylidine.]

Exposure Limits:
NIOSH REL: TWA 5 ppm (25 mg/m^3)
ST 10 ppm (50 mg/m^3) [skin]
OSHA PEL†: TWA 5 ppm (25 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2002
OSHA PV2064

Physical Description: Pale yellow, oily liquid with an amine-like odor. [**Note:** A solid below 36°F.]

Chemical & Physical Properties:
MW: 121.2
BP: 378°F
Sol: 2%
Fl.P: 142°F
IP: 7.14 eV
Sp.Gr: 0.96
VP: 1 mmHg
FRZ: 36°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 ppm: Sa
100 ppm: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, benzoyl peroxide

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Anoxia symptoms: cyan, lass, dizz, ataxia; methemo
TO: Blood, kidneys, liver, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

D

Dimethyl carbamoyl chloride	Formula: $(CH_3)_2NCOCl$	CAS#: 79-44-7	RTECS#: FD4200000	IDLH: Ca [N.D.]
Conversion:	**DOT:** 2262 156			

Synonyms/Trade Names: Chloroformic acid dimethylamide; Dimethylcarbamic chloride; N,N-Dimethylcarbamoyl chloride; DMCC

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Clear, colorless liquid.

Chemical & Physical Properties:
MW: 107.6
BP: 329°F
Sol: Reacts
Fl.P: 155°F
IP: ?
Sp.Gr: 1.17
VP: ?
FRZ: -27°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Acids, water
[**Note:** Rapidly hydrolyzes in water to dimethylamine, carbon dioxide, and hydrogen chloride.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat, resp sys; eye, skin burns; cough, wheez, larnygitis, dysp; head, nau, vomit; liver inj; [carc]
TO: Eyes, skin, resp sys, liver [in animals: nasal cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Dimethyl-1,2-dibromo-2,2-dichlorethyl phosphate	Formula: $(CH_3O)_2P(O)OCHBrCBrCl_2$	CAS#: 300-76-5	RTECS#: TB9450000	IDLH: 200 mg/m^3
Conversion:	**DOT:**			

Synonyms/Trade Names: Dibrom®; 1,2-Dibromo-2,2-dichloroethyl dimethyl phosphate; Naled

Exposure Limits:
NIOSH REL: TWA 3 mg/m^3 [skin]
OSHA PEL†: TWA 3 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to white solid or straw-colored liquid (above 80°F) with a slightly pungent odor. [insecticide]

Chemical & Physical Properties:
MW: 380.8
BP: Decomposes
Sol: Insoluble
Fl.P: NA
IP: ?
Sp.Gr(77°F): 1.96
VP: 0.0002 mmHg
MLT: 80°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
30 mg/m^3: 95XQ/Sa
75 mg/m^3: Sa:Cf/PaprHie
150 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
200 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids, sunlight, water
[**Note:** Corrosive to metals. Hydrolyzed in presence of water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; miosis, lac; head; chest tight, wheez, lar spasm; salv; cyan; anor, nau, vomit, abdom cramp, diarr; lass, twitch, para; dizz, ataxia, convuls; low BP; card irreg
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Dimethylformamide	**Formula:** $HCON(CH_3)_2$	**CAS#:** 68-12-2	**RTECS#:** LQ2100000	**IDLH:** 500 ppm
Conversion: 1 ppm = 2.99 mg/m^3	**DOT:** 2265 129			
Synonyms/Trade Names: Dimethyl formamide; N,N-Dimethylformamide; DMF				

Exposure Limits:
NIOSH REL: TWA 10 ppm (30 mg/m^3) [skin]
OSHA PEL: TWA 10 ppm (30 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2004
OSHA 66

Physical Description: Colorless to pale-yellow liquid with a faint, amine-like odor.

Chemical & Physical Properties:
MW: 73.1
BP: 307°F
Sol: Miscible
Fl.P: 136°F
IP: 9.12 eV
Sp.Gr: 0.95
VP: 3 mmHg
FRZ: -78°F
UEL: 15.2%
LEL(212°F): 2.2%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
100 ppm: Sa*
250 ppm: Sa:Cf*
500 ppm: SaT:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Carbon tetrachloride; other halogenated compounds when in contact with iron; strong oxidizers; alkyl aluminums; inorganic nitrates

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; nau, vomit, colic; liver damage, enlarged liver; high BP; face flush; derm; in animals: kidney, heart damage
TO: Eyes, skin, resp sys, liver, kidneys, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

1,1-Dimethylhydrazine	**Formula:** $(CH_3)_2NNH_2$	**CAS#:** 57-14-7	**RTECS#:** MV2450000	**IDLH:** Ca [15 ppm]
Conversion: 1 ppm = 2.46 mg/m^3	**DOT:** 1163 131			
Synonyms/Trade Names: Dimazine, DMH, UDMH, Unsymmetrical dimethylhydrazine				

Exposure Limits:
NIOSH REL: Ca
C 0.06 ppm (0.15 mg/m^3) [2-hr]
See Appendix A
OSHA PEL: TWA 0.5 ppm (1 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 3515

Physical Description: Colorless liquid with an ammonia- or fish-like odor.

Chemical & Physical Properties:
MW: 60.1
BP: 147°F
Sol: Miscible
Fl.P: 5°F
IP: 8.05 eV
Sp.Gr: 0.79
VP: 103 mmHg
FRZ: -72°F
UEL: 95%
LEL: 2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Oxidizers, halogens, metallic mercury, fuming nitric acid, hydrogen peroxide [**Note:** May ignite SPONTANEOUSLY in contact with oxidizers.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; choking, chest pain, dysp; drow; nau; anoxia; convuls; liver inj; [carc]
TO: CNS, liver, GI tract, blood, resp sys, eyes, skin [in animals: tumors of the lungs, liver, blood vessels & intestines]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Dimethylphthalate

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_4(COOCH_3)_2$	131-11-3	TI1575000	2000 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: Dimethyl ester of 1,2-benzenedicarboxylic acid; DMP

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
OSHA 104

Physical Description: Colorless, oily liquid with a slight, aromatic odor. [**Note:** A solid below 42°F.]

Chemical & Physical Properties:
MW: 194.2
BP: 543°F
Sol: 0.4%
Fl.P: 295°F
IP: 9.64 eV
Sp.Gr: 1.19
VP: 0.01 mmHg
FRZ: 42°F
UEL: ?
LEL(358°F): 0.9%
Class IIIB Combustible Liquid; however, ignition is difficult.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: 95F
125 mg/m^3: Sa:Cf£/PaprHie£
250 mg/m^3: 100F/ScbaF/SaF
2000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, upper resp sys; stomach pain
TO: Eyes, resp sys, GI tract

First Aid (see Table 6):
Eye: Irr prompt
Skin: Wash regularly
Breath: Resp support
Swallow: Medical attention immed

Dimethyl sulfate

Formula:	CAS#:	RTECS#:	IDLH:
$(CH_3)_2SO_4$	77-78-1	WS8225000	Ca [7 ppm]

Conversion: 1 ppm = 5.16 mg/m^3 **DOT:** 1595 156

Synonyms/Trade Names: Dimethyl ester of sulfuric acid, Dimethylsulfate, Methyl sulfate

Exposure Limits:
NIOSH REL: Ca
TWA 0.1 ppm (0.5 mg/m^3) [skin]
See Appendix A
OSHA PEL†: TWA 1 ppm (5 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2524

Physical Description: Colorless, oily liquid with a faint, onion-like odor.

Chemical & Physical Properties:
MW: 126.1
BP: 370°F (Decomposes)
Sol(64°F): 3%
Fl.P: 182°F
IP: ?
Sp.Gr: 1.33
VP: 0.1 mmHg
FRZ: -25°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, ammonia solutions
[**Note:** Decomposes in water to sulfuric acid; corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose; head; dizz; conj; photo; periorb edema; dysphonia, aphonia, dysphagia, productive cough; chest pain; dysp, cyan; vomit, diarr; dysuria; analgesia; fever; prot, hema; eye, skin burns; delirium; [carc]
TO: Eyes, skin, resp sys, liver, kidneys, CNS [in animals: nasal & lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Dinitolmide	**Formula:** $(NO_2)_2C_6H_2(CH_3)CONH_2$	**CAS#:** 148-01-6	**RTECS#:** XS4200000	**IDLH:** N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: 3,5-Dinitro-o-toluamide; 2-Methyl-3,5-dinitrobenzamide; Zoalene

Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 **OSHA PEL†:** none	**Measurement Methods (see Table 1):** **NIOSH** 0500
Physical Description: Yellowish, crystalline solid.	

Chemical & Physical Properties: **MW:** 225.2 **BP:** ? **Sol:** Slight **FI.P:** NA **IP:** ? **Sp.Gr:** ? **VP:** ? **MLT:** 351°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily	**Respirator Recommendations (see Tables 3 and 4):** Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Contact eczema; in animals: methemo, liver changes **TO:** Skin, liver, blood	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

m-Dinitrobenzene	**Formula:** $C_6H_4(NO_2)_2$	**CAS#:** 99-65-0	**RTECS#:** CZ7350000	**IDLH:** 50 mg/m^3
Conversion:	**DOT:** 1597 152			

Synonyms/Trade Names: meta-Dinitrobenzene; 1,3-Dinitrobenzene

Exposure Limits: **NIOSH REL:** TWA 1 mg/m^3 [skin] **OSHA PEL:** TWA 1 mg/m^3 [skin]	**Measurement Methods (see Table 1):** **NIOSH** S214 (II-4)
Physical Description: Pale-white or yellow solid.	

Chemical & Physical Properties: **MW:** 168.1 **BP:** 572°F **Sol:** 0.02% **FI.P:** 302°F **IP:** 10.43 eV **Sp.Gr:** 1.58 **VP:** ? **MLT:** 192°F **UEL:** ? **LEL:** ? Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Quick drench	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **5 mg/m^3:** Qm **10 mg/m^3:** 95XQ/Sa **25 mg/m^3:** Sa:Cf/PaprHie **50 mg/m^3:** 100F/SaT:Cf/PaprTHie/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Anoxia, cyan; vis dist, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage **TO:** Eyes, skin, blood, liver, CVS, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

D

o-Dinitrobenzene	Formula: $C_6H_4(NO_2)_2$	CAS#: 528-29-0	RTECS#: CZ7450000	IDLH: 50 mg/m^3
Conversion:	**DOT:** 1597 152			
Synonyms/Trade Names: ortho-Dinitrobenzene; 1,2-Dinitrobenzene				

Exposure Limits: **NIOSH REL:** TWA 1 mg/m^3 [skin] **OSHA PEL:** TWA 1 mg/m^3 [skin]	**Measurement Methods (see Table 1):** **NIOSH** S214 (II-4)
Physical Description: Pale-white or yellow solid.	

Chemical & Physical Properties: **MW:** 168.1 **BP:** 606°F **Sol:** 0.05% **FI.P:** 302°F **IP:** 10.71 eV **Sp.Gr:** 1.57 **VP:** ? **MLT:** 244°F **UEL:** ? **LEL:** ? Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Quick drench	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **5 mg/m^3:** Qm **10 mg/m^3:** 95XQ/Sa **25 mg/m^3:** Sa:Cf/PaprHie **50 mg/m^3:** 100F/SaT:Cf/PaprTHie/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Anoxia, cyan; vis dist, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage **TO:** Eyes, skin, blood, liver, CVS, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

p-Dinitrobenzene	Formula: $C_6H_4(NO_2)_2$	CAS#: 100-25-4	RTECS#: CZ7525000	IDLH: 50 mg/m^3
Conversion:	**DOT:** 1597 152			
Synonyms/Trade Names: para-Dinitrobenzene; 1,4-Dinitrobenzene				

Exposure Limits: **NIOSH REL:** TWA 1 mg/m^3 [skin] **OSHA PEL:** TWA 1 mg/m^3 [skin]	**Measurement Methods (see Table 1):** **NIOSH** S214 (II-4)
Physical Description: Pale-white or yellow solid.	

Chemical & Physical Properties: **MW:** 168.1 **BP:** 570°F **Sol:** 0.01% **FI.P:** ? **IP:** 10.50 eV **Sp.Gr:** 1.63 **VP:** ? **MLT:** 343°F **UEL:** ? **LEL:** ? Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Quick drench	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **5 mg/m^3:** Qm **10 mg/m^3:** 95XQ/Sa **25 mg/m^3:** Sa:Cf/PaprHie **50 mg/m^3:** 100F/SaT:Cf/PaprTHie/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Anoxia, cyan; vis dist, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage **TO:** Eyes, skin, blood, liver, CVS, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

Dinitro-o-cresol

Formula: $CH_3C_6H_2OH(NO_2)_2$ | **CAS#:** 534-52-1 | **RTECS#:** GO9625000 | **IDLH:** 5 mg/m^3

Conversion: **DOT:** 1598 153

Synonyms/Trade Names: 4,6-Dinitro-o-cresol; 3,5-Dinitro-2-hydroxytoluene; 4,6-Dinitro-2-methyl phenol; DNC; DNOC

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3 [skin]
OSHA PEL: TWA 0.2 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S166 (II-5)

Physical Description: Yellow, odorless solid. [insecticide]

Chemical & Physical Properties:
MW: 198.1
BP: 594°F
Sol: 0.01%
Fl.P: NA
IP: ?
Sp.Gr: 1.1 (estimated)
VP: 0.00005 mmHg
MLT: 190°F
UEL: NA
LEL: NA
MEC: 30 g/m^3
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2 mg/m^3: 95F
5 mg/m^3: 100F/Sa:Cf£/PaprHie£/ ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Sense of well being; head, fever, lass, profuse sweat, excess thirst, tacar, hyperpnea, cough, short breath, coma
TO: CVS, endocrine sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Dinitrotoluene

Formula: $CH_3C_6H_3(NO_2)_2$ | **CAS#:** 25321-14-6 | **RTECS#:** XT1300000 | **IDLH:** Ca [50 mg/m^3]

Conversion: **DOT:** 1600 152 (molten); 2038 152 (solid)

Synonyms/Trade Names: Dinitrotoluol, DNT, Methyldinitrobenzene [**Note:** Various isomers of DNT exist.]

Exposure Limits:
NIOSH REL: Ca
TWA 1.5 mg/m^3 [skin]
See Appendix A
OSHA PEL: TWA 1.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
OSHA 44

Physical Description: Orange-yellow crystalline solid with a characteristic odor. [**Note:** Often shipped molten.]

Chemical & Physical Properties:
MW: 182.2
BP: 572°F
Sol: Insoluble
Fl.P: 404°F
IP: ?
Sp.Gr: 1.32
VP: 1 mmHg
MLT: 158°F
UEL: ?
LEL: ?
Combustible Solid, but difficult to ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, caustics, metals such as tin & zinc
[**Note:** Commercial grades will decompose at 482°F, with self-sustaining decomposition at 536°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Anoxia, cyan; anemia, jaun; repro effects; [carc]
TO: Blood, liver, CVS, repro sys [in animals: liver, skin & kidney tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

D

Di-sec octyl phthalate

Formula:	CAS#:	RTECS#:	IDLH:
$C_{24}H_{38}O_4$	117-81-7	TI0350000	Ca [5000 mg/m^3]

Conversion: **DOT:**

Synonyms/Trade Names: DEHP, Di(2-ethylhexyl)phthalate, DOP, bis-(2-Ethylhexyl)phthalate, Octyl phthalate

Exposure Limits:
NIOSH REL: Ca
TWA 5 mg/m^3
ST 10 mg/m^3
See Appendix A
OSHA PEL†: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5020

Physical Description: Colorless, oily liquid with a slight odor.

Chemical & Physical Properties:
MW: 390.5
BP: 727°F
Sol(75°F): 0.00003%
Fl.P(oc): 420°F
IP: ?
Sp.Gr: 0.99
VP: <0.01 mmHg
FRZ: -58°F
UEL: ?
LEL(474°F): 0.3%
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, acids & alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, muc memb; in animals: liver damage; terato effects; [carc]
TO: Eyes, resp sys, CNS, liver, repro sys, GI tract [in animals: liver tumors]

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support
Swallow: Medical attention immed

Dioxane

Formula:	CAS#:	RTECS#:	IDLH:
$C_4H_8O_2$	123-91-1	JG8225000	Ca [500 ppm]

Conversion: 1 ppm = 3.60 mg/m^3 **DOT:** 1165 127

Synonyms/Trade Names: Diethylene dioxide; Diethylene ether; Dioxan; p-Dioxane; 1,4-Dioxane

Exposure Limits:
NIOSH REL: Ca
C 1 ppm (3.6 mg/m^3) [30-minute]
See Appendix A
OSHA PEL†: TWA 100 ppm (360 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1602
OSHA 7

Physical Description: Colorless liquid or solid (below 53°F) with a mild, ether-like odor.

Chemical & Physical Properties:
MW: 88.1
BP: 214°F
Sol: Miscible
Fl.P: 55°F
IP: 9.13 eV
Sp.Gr: 1.03
VP: 29 mmHg
FRZ: 53°F
UEL: 22%
LEL: 2.0%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, decaborane, triethynyl aluminum

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; drow, head; nau, vomit; liver damage; kidney failure; [carc]
TO: Eyes, skin, resp sys, liver, kidneys [in animals: lung, liver & nasal cavity tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash prompt
Breath: Resp support
Swallow: Medical attention immed

Dioxathion

Formula: $C_4H_6O_2[SPS(OC_2H_5)_2]_2$ | **CAS#:** 78-34-2 | **RTECS#:** TE3350000 | **IDLH:** N.D.

Conversion: | **DOT:**

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®

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Viscous, brown, tan, or dark-amber liquid. [insecticide] [**Note:** Technical product is a mixture of cis- & trans-isomers.]

Chemical & Physical Properties:
MW: 456.6
BP: ?
Sol: Insoluble
Fl.P: NA
IP: ?
Sp.Gr(79°F): 1.26
VP: ?
FRZ: -4°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Alkalis, iron or tin surfaces, heat

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; head, dizz, lass; rhin, chest tight; miosis; nau, vomit, abdom cramps, diarr, salv; musc fasc; conf, drow
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Diphenyl

Formula: $C_6H_5C_6H_5$ | **CAS#:** 92-52-4 | **RTECS#:** DU8050000 | **IDLH:** 100 mg/m^3

Conversion: 1 ppm = 6.31 mg/m^3 | **DOT:**

Synonyms/Trade Names: Biphenyl, Phenyl benzene

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3 (0.2 ppm)
OSHA PEL: TWA 1 mg/m^3 (0.2 ppm)

Measurement Methods (see Table 1):
NIOSH 2530
OSHA PV2022

Physical Description: Colorless to pale-yellow solid with a pleasant, characteristic odor. [fungicide]

Chemical & Physical Properties:
MW: 154.2
BP: 489°F
Sol: Insoluble
Fl.P: 235°F
IP: 7.95 eV
Sp.Gr: 1.04
VP: 0.005 mmHg
MLT: 156°F
UEL(311°F): 5.8%
LEL(232°F): 0.6%
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash (molt)
Quick drench (molt)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 mg/m^3: CcrOv95/Sa
25 mg/m^3: Sa:Cf*/PaprOvHie*
50 mg/m^3: CcrFOv100/GmFOv100/ PaprTOvHie*/ScbaF/SaF
100 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, throat; head, nau, lass, numb limbs; liver damage
TO: Eyes, resp sys, liver, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

D

Diphenylamine

Formula: $(C_6H_5)_2NH$ | **CAS#:** 122-39-4 | **RTECS#:** JJ7800000 | **IDLH:** N.D.

Conversion: | **DOT:**

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:
NIOSH REL: TWA 10 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 22, 78

Physical Description: Colorless, tan, amber, or brown crystalline solid with a pleasant, floral odor. [fungicide]

Chemical & Physical Properties:
MW: 169.2
BP: 576°F
Sol: 0.03%
Fl.P: 307°F
IP: 7.40 eV
Sp.Gr: 1.16
VP(227°F): 1 mmHg
MLT: 127°F
UEL: ?
LEL: ?
Combustible Solid; explosive if a cloud of dust is exposed to a source of ignition.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, hexachloromelamine, trichloromelamine

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; eczema; tacar, hypertension; cough, sneez; methemo; incr BP, heart rate; prot, hema, bladder inj; in animals: terato effects
TO: Eyes, skin, resp sys, CVS, blood, bladder, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Dipropylene glycol methyl ether

Formula: $CH_3OC_3H_6OC_3H_6OH$ | **CAS#:** 34590-94-8 | **RTECS#:** JM1575000 | **IDLH:** 600 ppm

Conversion: 1 ppm = 6.06 mg/m^3 | **DOT:**

Synonyms/Trade Names: Dipropylene glycol monomethyl ether, Dowanol® 50B

Exposure Limits:
NIOSH REL: TWA 100 ppm (600 mg/m^3)
ST 150 ppm (900 mg/m^3) [skin]
OSHA PEL†: TWA 100 ppm (600 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2554, S69 (II-2)

Physical Description: Colorless liquid with a mild, ether-like odor.

Chemical & Physical Properties:
MW: 148.2
BP: 408°F
Sol: Miscible
Fl.P: 180°F
IP: ?
Sp.Gr: 0.95
VP: 0.5 mmHg
FRZ: -112°F
UEL: 3.0%
LEL(392°F): 1.1%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
600 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; lass, dizz, head
TO: Eyes, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash prompt
Breath: Resp support
Swallow: Medical attention immed

Dipropyl ketone

Formula: $(CH_3CH_2CH_2)_2CO$ | **CAS#:** 123-19-3 | **RTECS#:** MJ5600000 | **IDLH:** N.D.

Conversion: 1 ppm = 4.67 mg/m^3 | **DOT:** 2710 128

Synonyms/Trade Names: Butyrone, DPK, 4-Heptanone, Heptan-4-one, Propyl ketone

Exposure Limits:
NIOSH REL: TWA 50 ppm (235 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 7

Physical Description: Colorless liquid with a pleasant odor.

Chemical & Physical Properties:
MW: 114.2
BP: 291°F
Sol: Insoluble
FI.P: 120°F
IP: 9.10 eV
Sp.Gr: 0.82
VP: 5 mmHg
FRZ: -27°F
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; CNS depres, dizz, drow, decr breath; in animals: liver inj; narco
TO: Eyes, skin, CNS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Diquat (Diquat dibromide)

Formula: $C_{12}H_{12}N_2Br_2$ | **CAS#:** 85-00-7 | **RTECS#:** JM5690000 | **IDLH:** N.D.

Conversion: | **DOT:** 2781 151 (solid); 2782 131 (liquid)

Synonyms/Trade Names: Diquat dibromide; 1,1'-Ethylene-2,2'-bipyridyllium dibromide
[**Note:** Diquat is a cation ($C_{12}H_{12}N_2^{++}$; 1,1'-Ethylene-2,2-bipyridyllium ion). Various diquat salts are commercially available.]

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Dibromide salt: Yellow crystals. [herbicide]
[**Note:** Commercial product may be found in a liquid concentrate or a solution.]

Chemical & Physical Properties:
MW: 344.1
BP: Decomposes
Sol: 70%
FI.P: ?
IP: ?
Sp.Gr: 1.22-1.27
VP: <0.00001 mmHg
MLT: 635°F
UEL: ?
LEL: ?
Combustible Solid, but does not readily ignite and burns with difficulty.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Alkalis, UV light, basic solutions
[**Note:** Concentrated diquat solutions corrode aluminum.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb, resp sys; rhin, epis; skin burns; nau, vomit, diarr, mal; kidney, liver inj; cough, chest pain, dysp, pulm edema; tremor, convuls; delayed healing of wounds
TO: Eyes, skin, resp sys, kidneys, liver, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

D

Disulfiram

Formula:	CAS#:	RTECS#:	IDLH:
$[(C_2H_5)_2NCS]_2S_2$	97-77-8	JO1225000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Antabuse®, bis(Diethylthiocarbamoyl) disulfide, Ro-Sulfiram®, TETD, Tetraethylthiuram disulfide

Exposure Limits:
NIOSH REL: TWA 2 mg/m^3
[Precautions should be taken to avoid concurrent exposure to ethylene dibromide.]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: White, yellowish, or light-gray powder with a slight odor. [fungicide]

Chemical & Physical Properties:
MW: 296.6
BP: ?
Sol: 0.02%
Fl.P: NA
IP: ?
Sp.Gr: 1.30
VP: ?
MLT: 158°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; sens derm; lass, tremor, restless, head, dizz; metallic taste; peri neur; liver damage
TO: Eyes, skin, resp sys, CNS, PNS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Disulfoton

Formula:	CAS#:	RTECS#:	IDLH:
$C_8H_{19}O_2PS_3$	298-04-4	TD9275000	N.D.

Conversion: **DOT:** 2783 152

Synonyms/Trade Names: O,O-Diethyl S-2-(ethylthio)-ethyl phosphorodithioate; Di-Syston®; Thiodemeton

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5600

Physical Description: Oily, colorless to yellow liquid with a characteristic, sulfur odor. [insecticide] [**Note:** Technical product is a brown liquid.]

Chemical & Physical Properties:
MW: 274.4
BP: ?
Sol(73°F): 0.003%
Fl.P: >180°F
IP: ?
Sp.Gr: 1.14
VP: 0.0002 mmHg
FRZ: >-13°F
UEL: ?
LEL: ?
Combustible Liquid, but will not ignite easily.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; nau, vomit, abdom cramps, diarr, salv; head, dizz, lass; rhin, chest tight; blurred vision, miosis; card irreg; musc fasc; dysp; eye, skin burns
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Diuron	**Formula:** $C_6H_3Cl_2NHCON(CH_3)_2$	**CAS#:** 330-54-1	**RTECS#:** YS8925000	**IDLH:** N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: 3-(3,4-Dichlorophenyl)-1,1-dimethylurea; Direx®; Karmex®

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5601
OSHA PV2097

Physical Description: White, odorless, crystalline solid. [herbicide]

Chemical & Physical Properties:
MW: 233.1
BP: 356°F (Decomposes)
Sol: 0.004%
Fl.P: NA
IP:?
Sp.Gr: ?
VP: 0.000000002 mmHg
MLT: 316°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; in animals: anemia, methemo
TO: Eyes, skin, resp sys, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Divinyl benzene	**Formula:** $C_6H_4(HC=CH_2)_2$	**CAS#:** 1321-74-0 (mixed isomers)	**RTECS#:** CZ9370000	**IDLH:** N.D.
Conversion: 1 ppm = 5.33 mg/m^3	**DOT:** 2049 130			

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:
NIOSH REL: TWA 10 ppm (50 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 89

Physical Description: Pale, straw-colored liquid.

Chemical & Physical Properties:
MW: 130.2
BP: 392°F
Sol: 0.005%
Fl.P(oc): 169°F
IP: ?
Sp.Gr: 0.93
VP: 0.7 mmHg
FRZ: -88°F
UEL: 6.2%
LEL: 1.1%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; skin burns; in animals: CNS depres
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

E

1-Dodecanethiol

Formula: $CH_3(CH_2)_{11}SH$ | **CAS#:** 112-55-0 | **RTECS#:** JR3155000 | **IDLH:** N.D.

Conversion: 1 ppm = 8.28 mg/m^3 | **DOT:** 1228 131

Synonyms/Trade Names: Dodecyl mercaptan, 1-Dodecyl mercaptan, n-Dodecyl mercaptan, Lauryl mercaptan, n-Lauryl mercaptan, 1-Mercaptododecane

Exposure Limits:
NIOSH REL: C 0.5 ppm (4.1 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless, water-white, or pale-yellow, oily liquid with a mild, skunk-like odor. [**Note:** A solid below 15°F.]

Chemical & Physical Properties:
MW: 202.4
BP: 441-478°F
Sol: Insoluble
Fl.P(oc): 190°F
IP: ?
Sp.Gr: 0.85
VP(77°F): 3 mmHg
FRZ: 15°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers & acids, strong bases, reducing agents, alkali metals, water, steam

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; cough; dizz, dysp, lass, conf, cyan; abdom pain, nau; skin sens
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Emery

Formula: Al_2O_3 | **CAS#:** 1302-74-5 (corundum) | **RTECS#:** GN2310000 (corundum) | **IDLH:** N.D.

Conversion: | **DOT:**

Synonyms/Trade Names: Aluminum oxide, Aluminum trioxide, Corundum, Impure corundum, Natural aluminum oxide [**Note:** Emery is an impure variety of Al_2O_3 which may contain small impurities of iron, magnesium & silica Corundum is natural Al_2O_3.]

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Odorless, white, crystalline powder.

Chemical & Physical Properties:
See α-Alumina for physical & chemical properties.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities:

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air
Swallow: Medical attention immed

Endosulfan

Formula:	CAS#:	RTECS#:	IDLH:
$C_9H_6Cl_6O_3S$	115-29-7	RB9275000	N.D.

Conversion: **DOT:** 2761 151

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/m^3 [skin] **OSHA PEL†:** none

Measurement Methods (see Table 1):
OSHA PV2023

Physical Description: Brown crystals with a slight, sulfur dioxide odor. [insecticide] [**Note:** Technical product is a tan, waxy, isomer mixture.]

Chemical & Physical Properties:
MW: 406.9
BP: Decomposes
Sol: 0.00001%
FI.P: NA
IP: ?
Sp.Gr: 1.74
VP(77°F): 0.00001 mmHg
MLT: 223°F
UEL: NA
LEL: NA Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit skin; nau, conf, agitation, flushing, dry mouth, tremor, convuls, head; in animals: kidney, liver inj; decr testis weight
TO: Skin, CNS, liver, kidneys, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Endrin

Formula:	CAS#:	RTECS#:	IDLH:
$C_{12}H_8Cl_6O$	72-20-8	IO1575000	2 mg/m^3

Conversion: **DOT:** 2761 151

Synonyms/Trade Names: Hexadrin®, 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

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL: TWA 0.1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5519

Physical Description: Colorless to tan, crystalline solid with a mild, chemical odor. [insecticide]

Chemical & Physical Properties:
MW: 380.9
BP: Decomposes
Sol: Insoluble
FI.P: NA
IP: ?
Sp.Gr: 1.70
VP: Low
MLT: 392°F (Decomposes)
UEL: NA
LEL: NA Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 mg/m^3: CcrOv95/Sa
2 mg/m^3: Sa:Cf/PaprOvHie/CcrFOv100/GmFOv100/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, parathion [**Note:** May emit hydrogen chloride & phosgene when heated or burned.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Epilep convuls; stupor, head, dizz; abdom discomfort, nau, vomit; insom; aggressiveness, conf; drow, lass; anor; in animals: liver damage
TO: CNS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

E

Enflurane

Formula:	CAS#:	RTECS#:	IDLH:
CHF_2OCF_2CHClF	13838-16-9	KN6800000	N.D.

Conversion: 1 ppm = 7.55 mg/m^3 **DOT:**

Synonyms/Trade Names: 2-Chloro-1-(difluoromethoxy)-1,1,2-trifluoroethane; 2-Chloro-1,1,2-trifluoroethyl difluoromethyl ether; Ethrane®

Exposure Limits:
NIOSH REL*: C 2 ppm (15.1 mg/m^3) [60-minute]
[***Note:** REL for exposure to waste anesthetic gas.]
OSHA PEL: none

Measurement Methods (see Table 1):
OSHA 29, 103

Physical Description: Clear, colorless liquid with a mild, sweet odor. [inhalation anesthetic]

Chemical & Physical Properties:
MW: 184.5
BP: 134°F
Sol: Low
FI.P: NA
IP: ?
Sp.Gr(77°F): 1.52
VP: 175 mmHg
FRZ: ?
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes; CNS depres, analgesia, anes, convuls, resp depres
TO: Eyes, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Epichlorohydrin

Formula:	CAS#:	RTECS#:	IDLH:
C_3H_5OCl	106-89-8	TX4900000	Ca [75 ppm]

Conversion: 1 ppm = 3.78 mg/m^3 **DOT:** 2023 131P

Synonyms/Trade Names: 1-Chloro-2,3-epoxypropane; 2-Chloropropylene oxide; γ-Chloropropylene oxide

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: TWA 5 ppm (19 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1010
OSHA 7

Physical Description: Colorless liquid with a slightly irritating, chloroform-like odor.

Chemical & Physical Properties:
MW: 92.5
BP: 242°F
Sol: 7%
FI.P: 93°F
IP: 10.60 eV
Sp.Gr: 1.18
VP: 13 mmHg
FRZ: -54°F
UEL: 21.0%
LEL: 3.8%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOvAg/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, certain salts, caustics, zinc, aluminum, water [**Note:** May polymerize in presence of strong acids and bases, particularly when hot.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin with deep pain; nau, vomit; abdom pain; resp distress, cough; cyan; repro effects; [carc]
TO: Eyes, skin, resp sys, kidneys, liver, repro sys [in animals: nasal cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

EPN	Formula: $C_{14}H_{14}O_4NSP$	CAS#: 2104-64-5	RTECS#: TB1925000	IDLH: 5 mg/m^3
Conversion:	**DOT:**			

Synonyms/Trade Names: Ethyl p-nitrophenyl benzenethionophosphonate, O-Ethyl O-(4-nitrophenyl) phenylphosphonothioate

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3 [skin]
OSHA PEL: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5012

Physical Description: Yellow solid with an aromatic odor. [pesticide]
[**Note:** A brown liquid above 97°F.]

Chemical & Physical Properties:
MW: 323.3
BP: ?
Sol: Insoluble
FI.P: NA
IP: ?
Sp.Gr(77°F): 1.27
VP(212°F): 0.0003 mmHg
MLT: 97°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; miosis, lac; rhin; head; chest tight, wheez, lar spasm; salv; cyan; anor, nau, abdom cramps, diarr; para, convuls; low BP, card irreg
TO: Eyes, skin, resp sys, CVS, CNS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Ethanolamine	Formula: $NH_2CH_2CH_2OH$	CAS#: 141-43-5	RTECS#: KJ5775000	IDLH: 30 ppm
Conversion: 1 ppm = 2.50 mg/m^3	**DOT:** 2491 153			

Synonyms/Trade Names: 2-Aminoethanol, β-Aminoethyl alcohol, Ethylolamine, 2-Hydroxyethylamine, Monoethanolamine

Exposure Limits:
NIOSH REL: TWA 3 ppm (8 mg/m^3)
ST 6 ppm (15 mg/m^3)
OSHA PEL†: TWA 3 ppm (6 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2007

Physical Description: Colorless, viscous liquid or solid (below 51°F) with an unpleasant, ammonia-like odor.

Chemical & Physical Properties:
MW: 61.1
BP: 339°F
Sol: Miscible
FI.P: 186°F
IP: 8.96 eV
Sp.Gr: 1.02
VP: 0.4 mmHg
FRZ: 51°F
UEL: 23.5%
LEL(284°F): 3.0%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
30 ppm: CcrS*/GmFS/PaprS*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, iron
[**Note:** May attack copper, brass, and rubber.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; drow
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

E

Ethion

Formula:	CAS#:	RTECS#:	IDLH:
$[(C_2H_5O)_2P(S)S]_2CH_2$	563-12-2	TE4550000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: O,O,O',O'-Tetraethyl S,S'-methylene di(phosphorodithioate)

Exposure Limits:
NIOSH REL: 0.4 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5600

Physical Description: Colorless to amber-colored, odorless liquid. [insecticide]
[**Note:** A solid below 10°F. The technical product has a very disagreeable odor.]

Chemical & Physical Properties:
MW: 384.5
BP: >302°F (Decomposes)
Sol: 0.0001%
FI.P: 349°F
IP: ?
Sp.Gr: 1.22
VP: 0.0000015 mmHg
FRZ: 10°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Acids, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; nau, vomit, abdom cramps, diarr, salv; head, dizz, lass; rhin, chest tight; blurred vision, miosis; card irreg; musc fasc; dysp
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

2-Ethoxyethanol

Formula:	CAS#:	RTECS#:	IDLH:
$C_2H_5OCH_2CH_2OH$	110-80-5	KK8050000	500 ppm

Conversion: 1 ppm = 3.69 mg/m^3 **DOT:** 1171 127

Synonyms/Trade Names: Cellosolve®, EGEE, Ethylene glycol monoethyl ether

Exposure Limits:
NIOSH REL: TWA 0.5 ppm (1.8 mg/m^3) [skin]
OSHA PEL: TWA 200 ppm (740 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1403
OSHA 53, 79

Physical Description: Colorless liquid with a sweet, pleasant, ether-like odor.

Chemical & Physical Properties:
MW: 90.1
BP: 275°F
Sol: Miscible
FI.P: 110°F
IP: ?
Sp.Gr: 0.93
VP: 4 mmHg
FRZ: -130°F
UEL(200°F): 15.6%
LEL(200°F): 1.7%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: Sa*
12.5 ppm: Sa:Cf*
25 ppm: ScbaF/SaF
500 ppm: Sa:Pd,Pp*
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: irrit eyes, resp sys; blood changes; liver, kidney, lung damage; repro, terato effects
TO: Eyes, resp sys, blood, kidneys, liver, repro sys, hemato sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

2-Ethoxyethyl acetate	Formula: $CH_3COOCH_2CH_2OC_2H_5$	CAS#: 111-15-9	RTECS#: KK8225000	IDLH: 500 ppm
Conversion: 1 ppm = 5.41 mg/m^3	DOT: 1172 129			

Synonyms/Trade Names: Cellosolve® acetate, EGEEA, Ethylene glycol monoethyl ether acetate, Glycol monoethyl ether acetate

Exposure Limits:
NIOSH REL: TWA 0.5 ppm (2.7 mg/m^3) [skin]
OSHA PEL: TWA 100 ppm (540 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1450
OSHA 53

Physical Description: Colorless liquid with a mild odor.

Chemical & Physical Properties:
MW: 132.2
BP: 313°F
Sol: 23%
FI.P: 124°F
IP: ?
Sp.Gr: 0.98
VP: 2 mmHg
FRZ: -79°F
UEL: ?
LEL: 1.7%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv*/Sa*
12.5 ppm: Sa:Cf*/PaprOv*
25 ppm: CcrFOv/GmFOv/PaprTOv*/ScbaF/SaF
500 ppm: Sa:Pd,Pp*
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose; vomit; kidney damage; para; in animals: repro, terato effects
TO: Eyes, resp sys, GI tract, repro sys, hemato sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Ethyl acetate	Formula: $CH_3COOC_2H_5$	CAS#: 141-78-6	RTECS#: AH5425000	IDLH: 2000 ppm [10%LEL]
Conversion: 1 ppm = 3.60 mg/m^3	DOT: 1173 129			

Synonyms/Trade Names: Acetic ester, Acetic ether, Ethyl ester of acetic acid, Ethyl ethanoate

Exposure Limits:
NIOSH REL: TWA 400 ppm (1400 mg/m^3)
OSHA PEL: TWA 400 ppm (1400 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1457
OSHA 7

Physical Description: Colorless liquid with an ether-like, fruity odor.

Chemical & Physical Properties:
MW: 88.1
BP: 171°F
Sol(77°F): 10%
FI.P: 24°F
IP: 10.01 eV
Sp.Gr: 0.90
VP: 73 mmHg
FRZ: -117°F
UEL: 11.5%
LEL: 2.0%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; narco; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Ethyl acrylate

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=$CHCOOC_2H_5$	140-88-5	AT0700000	Ca [300 ppm]

Conversion: 1 ppm = 4.09 mg/m^3

DOT: 1917 129P (inhibited)

Synonyms/Trade Names: Ethyl acrylate (inhibited), Ethyl ester of acrylic acid, Ethyl propenoate

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: TWA 25 ppm (100 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1450
OSHA 92

Physical Description: Colorless liquid with an acrid odor.

Chemical & Physical Properties:
MW: 100.1
BP: 211°F
Sol: 2%
Fl.P: 48°F
IP: 10.30 eV
Sp.Gr: 0.92
VP: 29 mmHg
FRZ: -96°F
UEL: 14%
LEL: 1.4%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, peroxides, polymerizers, strong alkalis, moisture, chlorosulfonic acid [**Note:** Polymerizes readily unless an inhibitor such as hydroquinone is added.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; [carc]
TO: Eyes, skin, resp sys [in animals: tumors of the forestomach]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Ethyl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
CH_3CH_2OH	64-17-5	KQ6300000	3300 ppm [10%LEL]

Conversion: 1 ppm = 1.89 mg/m^3

DOT: 1170 127

Synonyms/Trade Names: Alcohol, Cologne spirit, Ethanol, EtOH, Grain alcohol

Exposure Limits:
NIOSH REL: TWA 1000 ppm (1900 mg/m^3)
OSHA PEL: TWA 1000 ppm (1900 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1400
OSHA 100

Physical Description: Clear, colorless liquid with a weak, ethereal, vinous odor.

Chemical & Physical Properties:
MW: 46.1
BP: 173°F
Sol: Miscible
Fl.P: 55°F
IP: 10.47 eV
Sp.Gr: 0.79
VP: 44 mmHg
FRZ: -173°F
UEL: 19%
LEL: 3.3%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
3300 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and Reactivities: Strong oxidizers, potassium dioxide, bromine pentafluoride, acetyl bromide, acetyl chloride, platinum, sodium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; head, drow, lass, narco; cough; liver damage; anemia; repro, terato effects
TO: Eyes, skin, resp sys, CNS, liver, blood, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Fresh air
Swallow: Medical attention immed

Ethylamine	**Formula:** $CH_3CH_2NH_2$	**CAS#:** 75-04-7	**RTECS#:** KH2100000	**IDLH:** 600 ppm
Conversion: 1 ppm = 1.85 mg/m^3	**DOT:** 1036 118			
Synonyms/Trade Names: Aminoethane, Ethylamine (anhydrous), Monoethylamine				
Exposure Limits: **NIOSH REL:** TWA 10 ppm (18 mg/m^3) **OSHA PEL:** TWA 10 ppm (18 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** S144 (II-3) **OSHA** 36	
Physical Description: Colorless gas or water-white liquid (below 62°F) with an ammonia-like odor. [**Note:** Shipped as a liquefied compressed gas.]				

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
MW: 45.1 **BP:** 62°F **Sol:** Miscible **FI.P:** 1°F **IP:** 8.86 eV **RGasD:** 1.61 **Sp.Gr:** 0.69 (Liquid) **VP:** 874 mmHg **FRZ:** -114°F **UEL:** 14.0% **LEL:** 3.5% Flammable Gas	**Skin:** Prevent skin contact (liquid) **Eyes:** Prevent eye contact (liquid) **Wash skin:** When contam (liquid) **Remove:** When wet or contam (liquid) **Change:** N.R. **Provide:** Eyewash (liquid) Quick drench (liquid)	**NIOSH/OSHA** **250 ppm:** Sa:Cf£/PaprS£ **500 ppm:** CcrFS/GmFS/ScbaF/SaF **600 ppm:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS/ScbaE

Incompatibilities and Reactivities: Strong acids; strong oxidizers; copper, tin & zinc in presence of moisture; cellulose nitrate; chlorine; hypochlorites	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs (liquid), Ing (liquid), Con (liquid) **SY:** Irrit eyes, skin, resp sys; skin burns, derm **TO:** Eyes, skin, resp sys	**First Aid (see Table 6):** **Eye:** Irr immed (liquid) **Skin:** Water flush immed (liquid) **Breath:** Resp support **Swallow:** Medical attention immed (liquid)

Ethyl benzene	**Formula:** $CH_3CH_2C_6H_5$	**CAS#:** 100-41-4	**RTECS#:** DA0700000	**IDLH:** 800 ppm [10%LEL]
Conversion: 1 ppm = 4.34 mg/m^3	**DOT:** 1175 130			
Synonyms/Trade Names: Ethylbenzol, Phenylethane				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (435 mg/m^3) ST 125 ppm (545 mg/m^3) **OSHA PEL†:** TWA 100 ppm (435 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1501 **OSHA** 7, 1002	
Physical Description: Colorless liquid with an aromatic odor.				

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
MW: 106.2 **BP:** 277°F **Sol:** 0.01% **FI.P:** 55°F **IP:** 8.76 eV **Sp.Gr:** 0.87 **VP:** 7 mmHg **FRZ:** -139°F **UEL:** 6.7% **LEL:** 0.8% Class IB Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.	**NIOSH/OSHA** **800 ppm:** CcrOv*/GmFOv/PaprOv*/Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; head; derm; narco, coma **TO:** Eyes, skin, resp sys, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed

E

Ethyl bromide	Formula: CH_3CH_2Br	CAS#: 74-96-4	RTECS#: KH6475000	IDLH: 2000 ppm
Conversion: 1 ppm = 4.46 mg/m^3	**DOT:** 1891 131			
Synonyms/Trade Names: Bromoethane, Monobromoethane				
Exposure Limits: **NIOSH REL:** See Appendix D **OSHA PEL†:** TWA 200 ppm (890 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1011 **OSHA** 7	
Physical Description: Colorless to yellow liquid with an ether-like odor. [**Note:** A gas above 101°F.]				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 109.0 **BP:** 101°F **Sol:** 0.9% **Fl.P:** <4°F **IP:** 10.29 eV **Sp.Gr:** 1.46 **VP:** 375 mmHg **FRZ:** -182°F **UEL:** 8.0% **LEL:** 6.8% Class IB Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.	**OSHA** **2000 ppm:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc & magnesium

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Irrit eyes, skin, resp sys; CNS depres; pulm edema; liver, kidney disease; card arrhy, card arrest **TO:** Eyes, skin, resp sys, liver, kidneys, CVS, CNS	**Eye:** Irr immed **Skin:** Soap flush prompt **Breath:** Resp support **Swallow:** Medical attention immed

Ethyl butyl ketone	Formula: $CH_3CH_2CO[CH_2]_3CH_3$	CAS#: 106-35-4	RTECS#: MJ5250000	IDLH: 1000 ppm
Conversion: 1 ppm = 4.67 mg/m^3	**DOT:** 1224 127			
Synonyms/Trade Names: Butyl ethyl ketone, 3-Heptanone				
Exposure Limits: **NIOSH REL:** TWA 50 ppm (230 mg/m^3) **OSHA PEL:** TWA 50 ppm (230 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1301, 2553 **OSHA** 7	
Physical Description: Colorless liquid with a powerful, fruity odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 114.2 **BP:** 298°F **Sol:** 1% **Fl.P(oc):** 115°F **IP:** 9.02 eV **Sp.Gr:** 0.82 **VP:** 4 mmHg **FRZ:** -38°F **UEL:** ? **LEL:** ? Class II Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH/OSHA** **500 ppm:** CcrOv*/Sa* **1000 ppm:** Sa:Cf*/PaprOv*/CcrFOv/ GmFOv/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, acetaldehyde, perchloric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; head, narco, coma; derm **TO:** Eyes, skin, resp sys, CNS	**Eye:** Irr immed **Skin:** Water flush **Breath:** Resp support **Swallow:** Medical attention immed

Ethyl chloride

Formula:	CAS#:	RTECS#:	IDLH:
CH_3CH_2Cl	75-00-3	KH7525000	3800 ppm [10%LEL]

Conversion: 1 ppm = 2.64 mg/m^3 **DOT:** 1037 115

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/m^3)

Measurement Methods (see Table 1):
NIOSH 2519

Physical Description: Colorless gas or liquid (below 54°F) with a pungent, ether-like odor. [**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 64.5
BP: 54°F
Sol: 0.6%
FI.P: NA (Gas)
-58°F (Liquid)
IP: 10.97 eV
RGasD: 2.23
Sp.Gr: 0.92 (Liquid at 32°F)
VP: 1000 mmHg
FRZ: -218°F
UEL: 15.4%
LEL: 3.8%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Eyes: Prevent eye contact (liquid)
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
3800 ppm: Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs (liquid), Ing (liquid), Con
SY: Inco, inebri; abdom cramps; card arrhy, card arrest; liver, kidney damage
TO: Liver, kidneys, resp sys, CVS, CNS

First Aid (see Table 6):
Eye: Irr immed (liquid)
Skin: Water flush prompt (liquid)
Breath: Resp support
Swallow: Medical attention immed (liquid)

Ethylene chlorohydrin

Formula:	CAS#:	RTECS#:	IDLH:
CH_2ClCH_2OH	107-07-3	KK0875000	7 ppm

Conversion: 1 ppm = 3.29 mg/m^3 **DOT:** 1135 131

Synonyms/Trade Names: 2-Chloroethanol, 2-Chloroethyl alcohol, Ethylene chlorhydrin

Exposure Limits:
NIOSH REL: C 1 ppm (3 mg/m^3) [skin]
OSHA PEL†: TWA 5 ppm (16 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2513
OSHA 7

Physical Description: Colorless liquid with a faint, ether-like odor.

Chemical & Physical Properties:
MW: 80.5
BP: 262°F
Sol: Miscible
FI.P: 140°F
IP: 10.90 eV
Sp.Gr: 1.20
VP: 5 mmHg
FRZ: -90°F
UEL: 15.9%
LEL: 4.9%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
7 ppm: Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong caustics, water or steam

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit muc memb; nau, vomit; dizz, inco; numb; vis dist; head; thirst; delirium; low BP; collapse, shock, coma; liver, kidney damage
TO: Resp sys, liver, kidneys, CNS, CVS, eyes

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

E

Ethylenediamine

Formula:	CAS#:	RTECS#:	IDLH:
$NH_2CH_2CH_2NH_2$	107-15-3	KH8575000	1000 ppm

Conversion: 1 ppm = 2.46 mg/m^3 **DOT:** 1604 132

Synonyms/Trade Names: 1,2-Diaminoethane; 1,2-Ethanediamine; Ethylenediamine (anhydrous)

Exposure Limits:
NIOSH REL: TWA 10 ppm (25 mg/m^3)
OSHA PEL: TWA 10 ppm (25 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2540
OSHA 60

Physical Description: Colorless, viscous liquid with an ammonia-like odor. [fungicide] [**Note:** A solid below 47°F.]

Chemical & Physical Properties:
MW: 60.1
BP: 241°F
Sol: Miscible
FI.P: 93°F
IP: 8.60 eV
Sp.Gr: 0.91
VP: 11 mmHg
FRZ: 47°F
UEL(212°F): 12%
LEL(212°F): 2.5%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (>5%)
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
250 ppm: Sa:Cf£/PaprS£
500 ppm: CcrFS/GmFS/PaprTS£/ ScbaF/SaF
1000 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong acids & oxidizers, carbon tetrachloride & other chlorinated organic compounds, carbon disulfide [**Note:** Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit nose, resp sys; sens derm; asthma; liver, kidney damage
TO: Skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Ethylene dibromide

Formula:	CAS#:	RTECS#:	IDLH:
$BrCH_2CH_2Br$	106-93-4	KH9275000	Ca [100 ppm]

Conversion: 1 ppm = 7.69 mg/m^3 **DOT:** 1605 154

Synonyms/Trade Names: 1,2-Dibromoethane; Ethylene bromide; Glycol dibromide

Exposure Limits:
NIOSH REL: Ca
TWA 0.045 ppm
C 0.13 ppm [15-minute]
See Appendix A
OSHA PEL: TWA 20 ppm
C 30 ppm
50 ppm [5-minute maximum peak]

Measurement Methods (see Table 1):
NIOSH 1008
OSHA 2

Physical Description: Colorless liquid or solid (below 50°F) with a sweet odor. [fumigant]

Chemical & Physical Properties:
MW: 187.9
BP: 268°F
Sol: 0.4%
FI.P: NA
IP: 9.45 eV
Sp.Gr: 2.17
VP: 12 mmHg
FRZ: 50°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as sodium, potassium, calcium, hot aluminum & magnesium; liquid ammonia; strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; derm with vesic; liver, heart, spleen, kidney damage; repro effects; [carc]
TO: Eyes, skin, resp sys, liver, kidneys, repro sys [in animals: skin & lung tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Ethylene dichloride	**Formula:** $ClCH_2CH_2Cl$	**CAS#:** 107-06-2	**RTECS#:** KI0525000	**IDLH:** Ca [50 ppm]
Conversion: 1 ppm = 4.05 mg/m^3	**DOT:** 1184 131			
Synonyms/Trade Names: 1,2-Dichloroethane; Ethylene chloride; Glycol dichloride				

Exposure Limits:
NIOSH REL: Ca
TWA 1 ppm (4 mg/m^3)
ST 2 ppm (8 mg/m^3)
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]

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 3

Physical Description: Colorless liquid with a pleasant, chloroform-like odor. [**Note:** Decomposes slowly, becomes acidic & darkens in color.]

Chemical & Physical Properties:
MW: 99.0
BP: 182°F
Sol: 0.9%
FI.P: 56°F
IP: 11.05 eV
Sp.Gr: 1.24
VP: 64 mmHg
FRZ: -32°F
UEL: 16%
LEL: 6.2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Abs, Con
SY: Irrit eyes, corn opac; CNS depres; nau, vomit; derm; liver, kidney, CVS damage; [carc]
TO: Eyes, skin, kidneys, liver, CNS, CVS [in animals: forestomach, mammary gland & circulatory sys cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Ethylene glycol	**Formula:** $HOCH_2CH_2OH$	**CAS#:** 107-21-1	**RTECS#:** KW2975000	**IDLH:** N.D.
Conversion:	**DOT:**			
Synonyms/Trade Names: 1,2-Dihydroxyethane; 1,2-Ethanediol; Glycol; Glycol alcohol; Monoethylene glycol				

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5523
OSHA PV2024

Physical Description: Clear, colorless, syrupy, odorless liquid. [antifreeze] [**Note:** A solid below 9°F.]

Chemical & Physical Properties:
MW: 62.1
BP: 388°F
Sol: Miscible
FI.P: 232°F
IP: ?
Sp.Gr: 1.11
VP: 0.06 mmHg
FRZ: 9°F
UEL: 15.3%
LEL: 3.2%
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, chromium trioxide, potassium permanganate, sodium peroxide
[**Note:** Hygroscopic (i.e., absorbs moisture from the air).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; nau, vomit, abdom pain, lass; dizz, stupor, convuls, CNS depres; skin sens
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

E

Ethylene glycol dinitrate

Formula: $O_2NOCH_2CH_2ONO_2$ | **CAS#:** 628-96-6 | **RTECS#:** KW5600000 | **IDLH:** 75 mg/m^3

Conversion: 1 ppm = 6.22 mg/m^3 | **DOT:**

Synonyms/Trade Names: EGDN; 1,2-Ethanediol dinitrate; Ethylene dinitrate; Ethylene nitrate; Glycol dinitrate; Nitroglycol

Exposure Limits:
NIOSH REL: ST 0.1 mg/m^3 [skin]
OSHA PEL†: C 0.2 ppm (1 mg/m^3) [skin]

Physical Description: Colorless to yellow, oily, odorless liquid. [**Note:** An explosive ingredient (60-80%) in dynamite along with nitroglycerine (40-20%).]

Measurement Methods (see Table 1):
NIOSH 2507
OSHA 43

Chemical & Physical Properties:
MW: 152.1
BP: 387°F
Sol: Insoluble
Fl.P: 419°F
IP: ?
Sp.Gr: 1.49
VP: 0.05 mmHg
FRZ: -8°F
UEL: ?
LEL: ?
Explosive Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1 mg/m^3: Sa*
2.5 mg/m^3: Sa:Cf*
5 mg/m^3: SaT:Cf*/ScbaF/SaF
75 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Acids, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Throb head; dizz; nau, vomit, abdom pain; hypotension, flush, palp, angina; methemo; delirium, CNS depres; irrit skin; in animals: anemia; liver, kidney damage
TO: Skin, CVS, blood, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Ethyleneimine

Formula: C_2H_5N | **CAS#:** 151-56-4 | **RTECS#:** KX5075000 | **IDLH:** Ca [100 ppm]

Conversion: 1 ppm = 1.76 mg/m^3 | **DOT:** 1185 131P (inhibited)

Synonyms/Trade Names: Aminoethylene, Azirane, Aziridine, Dimethyleneimine, Dimethylenimine, Ethylenimine, Ethylimine

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1012] See Appendix B

Physical Description: Colorless liquid with an ammonia-like odor. [**Note:** Usually contains inhibitors to prevent polymerization.]

Measurement Methods (see Table 1):
NIOSH 3514

Chemical & Physical Properties:
MW: 43.1
BP: 133°F
Sol: Miscible
Fl.P: 12°F
IP: 9.20 eV
Sp.Gr: 0.83
VP: 160 mmHg
FRZ: -97°F
UEL: 54.8%
LEL: 3.3%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Polymerizes explosively in presence of acids [**Note:** Explosive silver derivatives may be formed with silver alloys (e.g., silver solder).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; nau, vomit; head, dizz; pulm edema; liver, kidney damage; eye burns; skin sens; [carc]
TO: Eyes, skin, resp sys, liver, kidneys [in animals: lung & liver tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Ethylene oxide

Formula: C_2H_4O | **CAS#:** 75-21-8 | **RTECS#:** KX2450000 | **IDLH:** Ca [800 ppm]

Conversion: 1 ppm = 1.80 mg/m^3 | **DOT:** 1040 119P

Synonyms/Trade Names: Dimethylene oxide; 1,2-Epoxy ethane; Oxirane

Exposure Limits:
NIOSH REL: Ca
TWA <0.1 ppm (0.18 mg/m^3)
C 5 ppm (9 mg/m^3) [10-min/day]
See Appendix A
OSHA PEL: [1910.1047] TWA 1 ppm
5 ppm [15-minute Excursion]

Measurement Methods (see Table 1):
NIOSH 1614, 3800
OSHA 30, 49, 50

Physical Description: Colorless gas or liquid (below 51°F) with an ether-like odor.

Chemical & Physical Properties:
MW: 44.1
BP: 51°F
Sol: Miscible
FI.P: NA (Gas)
-20°F (Liquid)
IP: 10.56 eV
RGasD: 1.49
Sp.Gr: 0.82 (Liquid at 50°F)
VP: 1.46 atm
FRZ: -171°F
UEL: 100%
LEL: 3.0%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Eyes: Prevent eye contact (liquid)
Wash skin: When contam (liquid)
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench (liquid)

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: GmFS†/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS†/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong acids, alkalis & oxidizers; chlorides of iron, aluminum & tin; oxides of iron & aluminum; water

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, (liquid), Con
SY: Irrit eyes, skin, nose, throat; peculiar taste; head; nau, vomit, diarr; dysp, cyan, pulm edema; drow, lass, inco; EKG abnor; eye, skin burns (liq or high vap conc); liquid: frostbite; repro effects; [carc]; in animals: convuls; liver, kidney damage
TO: Eyes, skin, resp sys, liver, CNS, blood, kidneys, repro sys [peritoneal cancer, leukemia]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed (liquid)

Ethylene thiourea

Formula: $C_3H_6N_2S$ | **CAS#:** 96-45-7 | **RTECS#:** NI9625000 | **IDLH:** Ca [N.D.]

Conversion: | **DOT:**

Synonyms/Trade Names: 1,3-Ethylene-2-thiourea; N,N-Ethylenethiourea; ETU; 2-Imidazolidine-2-thione

Exposure Limits:
NIOSH REL: Ca **OSHA PEL:** none
Use encapsulated form.
See Appendix A

Measurement Methods (see Table 1):
NIOSH 5011
OSHA 95

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.]

Chemical & Physical Properties:
MW: 102.2
BP: 446-595°F
Sol(86°F): 2%
FI.P: 486°F
IP: 8.15 eV
Sp.Gr: ?
VP: 16 mmHg
MLT: 392°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Acrolein

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes; in animals: thickening of the skin; goiter; terato effects; [carc]
TO: Eyes, skin, thyroid, repro sys [in animals: liver, thyroid & lymphatic sys tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

E

Ethyl ether

Formula:	CAS#:	RTECS#:	IDLH:
$C_2H_5OC_2H_5$	60-29-7	KI5775000	1900 ppm [10%LEL]

Conversion: 1 ppm = 3.03 mg/m^3 **DOT:** 1155 127

Synonyms/Trade Names: Diethyl ether, Diethyl oxide, Ethyl oxide, Ether, Solvent ether

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 400 ppm (1200 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1610
OSHA 7

Physical Description: Colorless liquid with a pungent, sweetish odor.
[**Note:** A gas above 94°F.]

Chemical & Physical Properties:
MW: 74.1
BP: 94°F
Sol: 8%
Fl.P: -49°F
IP: 9.53 eV
Sp.Gr: 0.71
VP: 440 mmHg
FRZ: -177°F
UEL: 36.0%
LEL: 1.9%
Class IA Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
1900 ppm: CcrOv*/GmFOv/PaprOv*/ Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, halogens, sulfur, sulfur compounds
[**Note:** Tends to form explosive peroxides under influence of air and light.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; dizz, drow, head, excited, narco; nau, vomit
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash prompt
Breath: Resp support
Swallow: Medical attention immed

Ethyl formate

Formula:	CAS#:	RTECS#:	IDLH:
CH_3CH_2OCHO	109-94-4	LQ8400000	1500 ppm

Conversion: 1 ppm = 3.03 mg/m^3 **DOT:** 1190 129

Synonyms/Trade Names: Ethyl ester of formic acid, Ethyl methanoate

Exposure Limits:
NIOSH REL: TWA 100 ppm (300 mg/m^3)
OSHA PEL: TWA 100 ppm (300 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1452
OSHA 7

Physical Description: Colorless liquid with a fruity odor.

Chemical & Physical Properties:
MW: 74.1
BP: 130°F
Sol(64°F): 9%
Fl.P: -4°F
IP: 10.61 eV
Sp.Gr: 0.92
VP: 200 mmHg
FRZ: -113°F
UEL: 16.0%
LEL: 2.8%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1500 ppm: Sa:Cf£/PaprOv£/CcrFOv/ GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids
[**Note:** Decomposes slowly in water to form ethyl alcohol and formic acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, upper resp sys; in animals: narco
TO: Eyes, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Ethylidene norbornene	Formula: C_9H_{12}	CAS#: 16219-75-3	RTECS#: RB9450000	IDLH: N.D.
Conversion: 1 ppm = 4.92 mg/m^3	**DOT:**			

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/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to white liquid with a turpentine-like odor.

Chemical & Physical Properties:
MW: 120.2
BP: 298°F
Sol: ?
Fl.P(oc): 101°F
IP: ?
Sp.Gr: 0.90
VP: 4 mmHg
FRZ: -112°F
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxygen
[**Note:** ENB should be stored in a nitrogen atmosphere since it reacts with oxygen.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; head; cough, dysp; nau, vomit; olfactory, taste changes; chemical pneu (aspir liquid); in animals: liver, kidney, urogenital inj; bone marrow effects
TO: Eyes, skin, resp sys, CNS, liver, kidneys, urogenital system, bone marrow

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Ethyl mercaptan	Formula: CH_3CH_2SH	CAS#: 75-08-1	RTECS#: KI9625000	IDLH: 500 ppm
Conversion: 1 ppm = 2.54 mg/m^3	**DOT:** 2363 129			

Synonyms/Trade Names: Ethanethiol, Ethyl sulfhydrate, Mercaptoethane

Exposure Limits:
NIOSH REL: C 0.5 ppm (1.3 mg/m^3) [15-minute]
OSHA PEL†: C 10 ppm (25 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2542

Physical Description: Colorless liquid with a strong, skunk-like odor.
[**Note:** A gas above 95°F.]

Chemical & Physical Properties:
MW: 62.1
BP: 95°F
Sol: 0.7%
Fl.P: -55°F
IP: 9.29 eV
Sp.Gr: 0.84
VP: 442 mmHg
FRZ: -228°F
UEL: 18.0%
LEL: 2.8%
Class IA Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/SaT:Cf/PaprTOv/ScbaF/SaF
500 ppm: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers [**Note:** Reacts violently with calcium hypochlorite.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit muc memb; head, nau; in animals: inco, lass; liver, kidney damage; cyan; narco
TO: Eyes, resp sys, liver, kidneys, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

N-Ethylmorpholine

Formula:	CAS#:	RTECS#:	IDLH:
$C_4H_8ONCH_2CH_3$	100-74-3	QE4025000	100 ppm

Conversion: 1 ppm = 4.71 mg/m^3 **DOT:**

Synonyms/Trade Names: 4-Ethylmorpholine

Exposure Limits:
NIOSH REL: TWA 5 ppm (23 mg/m^3) [skin]
OSHA PEL†: TWA 20 ppm (94 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH S146 (II-3)

Physical Description: Colorless liquid with an ammonia-like odor.

Chemical & Physical Properties:
MW: 115.2
BP: 281°F
Sol: Miscible
Fl.P(oc): 90°F
IP: ?
Sp.Gr: 0.90
VP: 6 mmHg
FRZ: -81°F
UEL: ?
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (>15%)
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 ppm: CcrOv*/Sa*
100 ppm: Sa:Cf*/PaprOv*/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong acids, strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; vis dist: corn edema, blue-gray vision, colored haloes
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Ethyl silicate

Formula:	CAS#:	RTECS#:	IDLH:
$(C_2H_5)_4SiO_4$	78-10-4	VV9450000	700 ppm

Conversion: 1 ppm = 8.52 mg/m^3 **DOT:** 1292 129

Synonyms/Trade Names: Ethyl orthosilicate, Ethyl silicate (condensed), Tetraethoxysilane, Tetraethyl orthosilicate, Tetraethyl silicate

Exposure Limits:
NIOSH REL: TWA 10 ppm (85 mg/m^3)
OSHA PEL†: TWA 100 ppm (850 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S264 (II-3)

Physical Description: Colorless liquid with a sharp, alcohol-like odor.

Chemical & Physical Properties:
MW: 208.3
BP: 336°F
Sol: Reacts
Fl.P: 99°F
IP: 9.77 eV
Sp.Gr: 0.93
VP: 1 mmHg
FRZ: -117°F
UEL: ?
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
100 ppm: Sa*
250 ppm: Sa:Cf*
500 ppm: ScbaF/SaF
700 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, water
[**Note:** Reacts with water to form a silicone adhesive (a milky-white mass).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose; in animals: lac; dysp, pulm edema; tremor, narco; liver, kidney damage; anemia
TO: Eyes, resp sys, liver, kidneys, blood, skin

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Fenamiphos	**Formula:** $C_{13}H_{22}NO_3PS$	**CAS#:** 22224-92-6	**RTECS#:** TB3675000	**IDLH:** N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Ethyl 3-methyl-4-(methylthio)phenyl-(1-methylethyl)phosphoramidate, Nemacur®, Phenamiphos

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5600

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).]

Chemical & Physical Properties:
MW: 303.4
BP: ?
Sol: 0.03%
Fl.P: ?
IP: ?
Sp.Gr: 1.14
VP: 0.00005 mmHg
MLT: 121°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported [**Note:** May hydrolyze under alkaline conditions.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Nau, vomit, abdom cramps, diarr, salv; head, dizz, lass; rhin, chest tight; blurred vision, miosis; card irreg; musc fasc; dysp
TO: Resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Fensulfothion	**Formula:** $C_{11}H_{17}O_4PS_2$	**CAS#:** 115-90-2	**RTECS#:** TF3850000	**IDLH:** N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Dasanit®; O,O-Diethyl O-(p-methylsulfinyl)phenyl)phosphorothioate; Terracur P®

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Brown liquid or yellow oil. [pesticide]

Chemical & Physical Properties:
MW: 308.4
BP: ?
Sol(77°F): 0.2%
Fl.P: ?
IP: ?
Sp.Gr: 1.20
VP: ?
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit skin; nau, vomit, abdom cramps, diarr, salv; head, dizz, lass; rhin, chest tight; blurred vision, miosis; card irreg; musc fasc; dys
TO: Skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

F

Fenthion

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_{15}O_3PS$	55-38-9	TF9625000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Baytex; Entex; O,O-Dimethyl O-3-methyl-4-methylthiophenyl phosphorothioate

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to brown liquid with a slight, garlic-like odor. [insecticide]

Chemical & Physical Properties:
MW: 278.3
BP: ?
Sol: 0.006%
Fl.P: NA
IP: ?
Sp.Gr: 1.25
VP: 0.0003 mmHg
FRZ: 43°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Nau, vomit, abdom cramps, diarr, salv; head, dizz, lass; rhin, chest tight; blurred vision, miosis; card irregularities; musc fasc; dysp
TO: Resp sys, CNS, CVS, plasma chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Ferbam

Formula:	CAS#:	RTECS#:	IDLH:
$[(CH_3)_2NCS_2]_3Fe$	14484-64-1	NO8750000	800 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: tris(Dimethyldithiocarbamato)iron, Ferric dimethyl dithiocarbamate

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3
OSHA PEL†: TWA 15 mg/m^3

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Dark brown to black, odorless solid. [fungicide]

Chemical & Physical Properties:
MW: 416.5
BP: Decomposes
Sol: 0.01%
Fl.P: ?
IP: 7.72 eV
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: >356°F (Decomposes)
UEL: ?
LEL: ?
MEC: 55 g/m^3
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 mg/m^3: Qm
100 mg/m^3: 95XQ*/Sa*
250 mg/m^3: Sa:Cf*/PaprHie*
500 mg/m^3: 100F/SaT:Cf*/PaprTHie*/ScbaF/SaF
800 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, moisture

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp tract; derm; GI dist
TO: Eyes, skin, resp sys, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Ferrovanadium dust

Formula: FeV | **CAS#:** 12604-58-9 | **RTECS#:** LK2900000 | **IDLH:** 500 mg/m^3

Conversion: | **DOT:**

Synonyms/Trade Names: Ferrovanadium

Exposure Limits:
NIOSH REL*: TWA 1 mg/m^3
ST 3 mg/m^3
[***Note:** The REL also applies to Vanadium metal and Vanadium carbide.]
OSHA PEL†: TWA 1 mg/m^3

Measurement Methods (see Table 1):
OSHA ID121, ID125G

Physical Description: Dark, odorless particulate dispersed in air.
[**Note:** Ferrovanadium metal is an alloy usually containing 50-80% vanadium.]

Chemical & Physical Properties:
MW: 106.8
BP: ?
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: 2696-2768°F
UEL: NA
LEL: NA
MEC: 1.3 g/m^3
Metal: Noncombustible Solid, but dust may be an explosion hazard.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: Qm*
10 mg/m^3: 95XQ*/Sa*
25 mg/m^3: Sa:Cf*/PaprHie*
50 mg/m^3: 100F/SaT:Cf*/PaprTHie*/ScbaF/SaF
500 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, resp sys; in animals: bron, pneu
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support

Fibrous glass dust

Formula: | **CAS#:** | **RTECS#:** LK3651000 | **IDLH:** N.D.

Conversion: | **DOT:**

Synonyms/Trade Names: Fiber glas®, Fiberglass, Glass fibers, Glass wool
[**Note:** Usually produced from borosilicate & low alkali silicate glasses.]

Exposure Limits:
NIOSH REL: TWA 3 fibers/cm^3 (fibers ≤ 3.5 µm in diameter & ≤ 10 µm in length)
TWA 5 mg/m^3 (total)
OSHA PEL: TWA 15 mg/m3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 7400

Physical Description: Typically, glass filaments >3 µm in diameter or glass "wool" with diameters down to 0.05 µm & >1 µm in length.

Chemical & Physical Properties:
MW: NA
BP: NA
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 2.5
VP: 0 mmHg (approx)
MLT: ?
UEL: NA
LEL: NA
Noncombustible Fibers

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5X REL: Qm
10X REL: 95XQ/Sa
25X REL: Sa:Cf/PaprHie
50X REL: 100F/PaprTHie/ScbaF/SaF
1000X REL: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, nose, throat; dysp
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Fluorine	Formula: F_2	CAS#: 7782-41-4	RTECS#: LM6475000	IDLH: 25 ppm
Conversion: 1 ppm = 1.55 mg/m^3	**DOT:** 1045 124; 9192 167 (cryogenic liquid)			
Synonyms/Trade Names: Fluorine-19				
Exposure Limits: **NIOSH REL:** TWA 0.1 ppm (0.2 mg/m^3) **OSHA PEL:** TWA 0.1 ppm (0.2 mg/m^3)			**Measurement Methods (see Table 1):** None available	
Physical Description: Pale-yellow to greenish gas with a pungent, irritating odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 38.0 **BP:** -307°F **Sol:** Reacts **Fl.P:** NA **IP:** 15.70 eV **RGasD:** 1.31 **VP:** >1 atm **FRZ:** -363°F **UEL:** NA **LEL:** NA Nonflammable Gas, but an extremely strong oxidizer.	**Skin:** Prevent skin contact (liquid) **Eyes:** Prevent eye contact (liquid) **Wash skin:** When contam (liquid) **Remove:** When wet or contam (liquid) **Change:** N.R. **Provide:** Eyewash (liquid) Quick drench (liquid)	**NIOSH/OSHA** **1 ppm**: Sa* **2.5 ppm:** Sa:Cf* **5 ppm:** ScbaF/SaF **25 ppm:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS¿/ScbaE

Incompatibilities and 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 H_2O to form hydrofluoric acid.]	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Irrit eyes, nose, resp sys; lar spasm, wheez; pulm edema; eye, skin burns; in animals: liver, kidney damage **TO:** Eyes, skin, resp sys, liver, kidneys	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support

Fluorotrichloromethane	Formula: CCl_3F	CAS#: 75-69-4	RTECS#: PB6125000	IDLH: 2000 ppm
Conversion: 1 ppm = 5.62 mg/m^3	**DOT:**			
Synonyms/Trade Names: Freon® 11, Monofluorotrichloromethane, Refrigerant 11, Trichlorofluoromethane, Trichloromonofluoromethane				
Exposure Limits: **NIOSH REL:** C 1000 ppm (5600 mg/m^3) **OSHA PEL†:** TWA 1000 ppm (5600 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1006	
Physical Description: Colorless to water-white, nearly odorless liquid or gas (above 75°F).				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 137.4 **BP:** 75°F **Sol(75°F):** 0.1% **Fl.P:** NA **IP:** 11.77 eV **RGasD:** 4.74 **Sp.Gr:** 1.47 (Liquid at 75°F) **VP:** 690 mmHg **FRZ:** -168°F **UEL:** NA **LEL:** NA Noncombustible Liquid Nonflammable Gas	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** N.R. **Remove:** When wet or contam **Change:** N.R. **Provide:** Eyewash Quick drench	**NIOSH/OSHA** **2000 ppm:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE
	Incompatibilities and Reactivities: Chemically-active metals such as sodium, potassium, calcium, powdered aluminum, zinc, magnesium & lithium shavings; granular barium	

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Inco, tremor; derm; card arrhy, card arrest; asphy; liquid: frostbite **TO:** Skin, resp sys, CVS	**Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed

Fluoroxene

Formula:	CAS#:	RTECS#:	IDLH:
$CF_3CH_2OCH=CH_2$	406-90-6	KO4250000	N.D.

Conversion: 1 ppm = 5.16 mg/m^3 **DOT:**

Synonyms/Trade Names: 2,2,2-Trifluoroethoxyethene; 2,2,2-Trifluoroethyl vinyl ether

Exposure Limits:
NIOSH REL*: C 2 ppm (10.3 mg/m^3) [60-minute]
[***Note:** REL for exposure to waste anesthetic gas.]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Liquid. [inhalation anesthetic] [**Note:** A gas above 109°F.]

Chemical & Physical Properties:
MW: 126.1
BP: 109°F
Sol: ?
FI.P: ?
IP: ?
Sp.Gr: 1.14
VP: 286 mmHg
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid
[Potentially EXPLOSIVE!]

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes; CNS depres, analgesia, anes, convuls, resp depres
TO: Eyes, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Fonofos

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_{15}OPS_2$	944-22-9	TA5950000	N.D.

Conversion: 1 ppm = 10.07 mg/m^3 **DOT:**

Synonyms/Trade Names: Dyfonate®, Dyphonate, O-Ethyl-S-phenyl ethylphosphorothioate, Fonophos

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5600
OSHA PV2027

Physical Description: Light-yellow liquid with an aromatic odor. [insecticide]

Chemical & Physical Properties:
MW: 246.3
BP: ?
Sol: 0.001%
FI.P: >201°F
IP: ?
Sp.Gr: 1.15
VP(77°F): 0.0002 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Nau, vomit, abdom cramps, diarr, salv; head, dizz, lass; rhin, chest tight; blurred vision, miosis; card irreg; musc fasc; dysp
TO: Resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

F

Formaldehyde

Formula:	CAS#:	RTECS#:	IDLH:
HCHO	50-00-0	LP8925000	Ca [20 ppm]

Conversion: 1 ppm = 1.23 mg/m^3 **DOT:**

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

Measurement Methods (see Table 1):
NIOSH 2016, 2541, 3500, 3800
OSHA ID205, 52

Physical Description: Nearly colorless gas with a pungent, suffocating odor. [**Note:** Often used in an aqueous solution (see specific listing for Formalin).]

Chemical & Physical Properties:
MW: 30.0
BP: -6°F
Sol: Miscible
Fl.P: NA (Gas)
IP: 10.88 eV
RGasD: 1.04
VP: >1 atm
FRZ: -134°F
UEL: 73%
LEL: 7.0%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers, alkalis & acids; phenols; urea [**Note:** Pure formaldehyde has a tendency to polymerize. Reacts with HCl to form bis-Chloromethyl ether.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, nose, throat, resp sys; lac; cough; wheez; [carc]
TO: Eyes, resp sys [nasal cancer]

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support

Formalin (as formaldehyde)

Formula:	CAS#:	RTECS#:	IDLH:
			Ca [20 ppm]

Conversion: **DOT:** 1198 132; 2209 132

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.]

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

Measurement Methods (see Table 1):
NIOSH 2016, 2541, 3500, 3800
OSHA ID205, 52

Physical Description: Colorless liquid with a pungent odor.

Chemical & Physical Properties:
MW: Varies
BP: 214°F
Sol: Miscible
Fl.P: 185°F
IP: ?
Sp.Gr(77°F): 1.08
VP: 1 mmHg
FRZ: ?
UEL: 73%
LEL: 7%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers, alkalis & acids; phenols; urea; oxides; isocyanates; caustics; anhydrides

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat, resp sys; lac; cough; wheez, derm; [carc]
TO: Eyes, skin, resp sys [nasal cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Formamide

Formula:	CAS#:	RTECS#:	IDLH:
$HCONH_2$	75-12-7	LQ0525000	N.D.

Conversion: 1 ppm = 1.85 mg/m^3 **DOT:**

Synonyms/Trade Names: Carbamaldehyde, Methanamide

Exposure Limits:
NIOSH REL: TWA 10 ppm (15 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless, oily liquid. [**Note:** A solid below 37°F.]

Chemical & Physical Properties:
MW: 45.1
BP: 411°F (Decomposes)
Sol: Miscible
Fl.P(oc): 310°F
IP: 10.20 eV
Sp.Gr: 1.13
VP(86°F): 0.1 mmHg
FRZ: 37°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, iodine, pyridine, sulfur trioxide, copper, brass, lead
[**Note:** Hygroscopic (i.e., absorbs moisture from the air).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; drow, lass; nau; acidosis; skin eruptions; in animals: repro effects
TO: Eyes, skin, resp sys, CNS, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash
Breath: Resp support
Swallow: Medical attention immed

Formic acid

Formula:	CAS#:	RTECS#:	IDLH:
HCOOH	64-18-6	LQ4900000	30 ppm

Conversion: 1 ppm = 1.88 mg/m^3 **DOT:** 1779 153

Synonyms/Trade Names: Formic acid (85-95% in aqueous solution); Hydrogen carboxylic acid; Methanoic acid

Exposure Limits:
NIOSH REL: TWA 5 ppm (9 mg/m^3)
OSHA PEL: TWA 5 ppm (9 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2011
OSHA ID186SG

Physical Description: Colorless liquid with a pungent, penetrating odor.
[**Note:** Often used in an aqueous solution.]

Chemical & Physical Properties:
MW: 46.0
BP: 224°F (90% solution)
Sol: Miscible
Fl.P(oc): 122°F (90% solution)
IP: 11.05 eV
Sp.Gr: 1.22 (90% solution)
VP: 35 mmHg
FRZ: 20°F (90% solution)
UEL: 57% (90% solution)
LEL: 18% (90% solution)
Class II Combustible Liquid (90% solution)

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
30 ppm: Sa*/ScbaF
§: ScbaF:Pd,Pp/
SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong caustics, concentrated sulfuric acid
[**Note:** Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes; skin, throat; skin burns, derm; lac; rhin; cough, dysp; nau
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

F

Furfural

Formula:	CAS#:	RTECS#:	IDLH:
$C_5H_4O_2$	98-01-1	LT7000000	100 ppm

Conversion: 1 ppm = 3.93 mg/m^3

DOT: 1199 132P

Synonyms/Trade Names: Fural, 2-Furancarboxaldehyde, Furfuraldehyde, 2-Furfuraldehyde

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 5 ppm (20 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2529
OSHA 72

Physical Description: Colorless to amber liquid with an almond-like odor.
[**Note:** Darkens in light and air.]

Chemical & Physical Properties:
MW: 96.1
BP: 323°F
Sol: 8%
Fl.P: 140°F
IP: 9.21 eV
Sp.Gr: 1.16
VP: 2 mmHg
FRZ: -34°F
UEL: 19.3%
LEL: 2.1%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
50 ppm: CcrOv*/Sa*
100 ppm: Sa:Cf*/CcrFOv/PaprOv*/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong acids, oxidizers, strong alkalis
[**Note:** May polymerize on contact with strong acids or strong alkalis.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, upper resp sys; head; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Furfuryl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
$C_5H_6O_2$	98-00-0	LU9100000	75 ppm

Conversion: 1 ppm = 4.01 mg/m^3

DOT: 2874 153

Synonyms/Trade Names: 2-Furylmethanol, 2-Hydroxymethylfuran

Exposure Limits:
NIOSH REL: TWA 10 ppm (40 mg/m^3) [skin]
ST 15 ppm (60 mg/m^3)
OSHA PEL†: TWA 50 ppm (200 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2505

Physical Description: Colorless to amber liquid with a faint, burning odor.
[**Note:** Darkens on exposure to light.]

Chemical & Physical Properties:
MW: 98.1
BP: 338°F
Sol: Miscible
Fl.P: 149°F
IP: ?
Sp.Gr: 1.13
VP(77°F): 0.6 mmHg
FRZ: 6°F
UEL: 16.3%
LEL: 1.8%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
75 ppm: CcrOv*/GmFOv/PaprOv*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers & acids
[**Note:** Contact with organic acids may lead to polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, muc memb; dizz; nau, diarr; diuresis; resp, body temperature depres; vomit; derm
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Gasoline

Formula: | **CAS#:** 8006-61-9 | **RTECS#:** LX3300000 | **IDLH:** Ca [N.D.]

Conversion: 1 ppm = 4.5 mg/m^3 (approx) | **DOT:** 1203 128

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

Measurement Methods (see Table 1):
OSHA PV2028

Physical Description: Clear liquid with a characteristic odor.

Chemical & Physical Properties:
MW: 110 (approx)
BP: 102°F
Sol: Insoluble
Fl.P: -45°F
IP: ?
Sp.Gr(60°F): 0.72-0.76
VP: 38-300 mmHg
FRZ: ?
UEL: 7.6%
LEL: 1.4%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers such as peroxides, nitric acid & perchlorates

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; derm; head, lass, blurred vision, dizz, slurred speech, conf, convuls; chemical pneu (aspir liquid); possible liver, kidney damage; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys [in animals: liver & kidney cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Germanium tetrahydride

Formula: GeH_4 | **CAS#:** 7782-65-2 | **RTECS#:** LY4900000 | **IDLH:** N.D.

Conversion: 1 ppm = 3.13 mg/m^3 | **DOT:** 2192 119

Synonyms/Trade Names: Germane, Germanium hydride, Germanomethane, Monogermane
[**Note:** Used chiefly for the production of high purity germanium for use in semiconductors.]

Exposure Limits:
NIOSH REL: TWA 0.2 ppm (0.6 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a pungent odor.
[**Note:** Shipped as a compressed gas.]

Chemical & Physical Properties:
MW: 76.6
BP: -127°F
Sol: Insoluble
Fl.P: NA (Gas)
IP: 11.34 eV
RGasD: 2.65
VP: >1 atm
FRZ: -267°F
UEL: ?
LEL: ?
Flammable Gas (may ignite SPONTANEOUSLY in air).

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Bromine

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Mal, head, dizz, fainting; dysp; nau, vomit; kidney inj; hemolytic effects
TO: CNS, kidneys, blood

First Aid (see Table 6):
Breath: Resp support

Glutaraldehyde

Formula: $OCH(CH_2)_3CHO$ | **CAS#:** 111-30-8 | **RTECS#:** MA2450000 | **IDLH:** N.D.

Conversion: 1 ppm = 4.09 mg/m^3 | **DOT:**

Synonyms/Trade Names: Glutaric dialdehyde; 1,5-Pentanedial

Exposure Limits:
NIOSH REL: C 0.2 ppm (0.8 mg/m^3)
See Appendix C (Aldehydes)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2532
OSHA 64

Physical Description: Colorless liquid with a pungent odor.

Chemical & Physical Properties:
MW: 100.1
BP: 212°F
Sol: Miscible
Fl.P: NA
IP: ?
Sp.Gr: 1.10
VP: 17 mmHg
FRZ: 7°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, strong bases [**Note:** Alkaline solutions of glutaraldehyde (i.e., activated glutaraldehyde) react with alcohol, ketones, amines, hydrazines & proteins.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; derm, sens skin; cough, asthma; nau, vomit
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Glycerin (mist)

Formula: $HOCH_2CH(OH)CH_2OH$ | **CAS#:** 56-81-5 | **RTECS#:** MA8050000 | **IDLH:** N.D.

Conversion: | **DOT:**

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/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

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.]

Chemical & Physical Properties:
MW: 92.1
BP: 554°F (Decomposes)
Sol: Miscible
Fl.P: 320°F
IP: ?
Sp.Gr: 1.26
VP(122°F): 0.003 mmHg
MLT: 64°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers (e.g., chromium trioxide, potassium chlorate, potassium permanganate) [**Note:** Hygroscopic (i.e., absorbs moisture from the air).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys; head, nau, vomit; kidney inj
TO: Eyes, skin, resp sys, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash
Breath: Fresh air

Glycidol

Formula:	CAS#:	RTECS#:	IDLH:
$C_3H_6O_2$	556-52-5	UB4375000	150 ppm

Conversion: 1 ppm = 3.03 mg/m^3 **DOT:**

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/m^3)
OSHA PEL†: TWA 50 ppm (150 mg/m^3)

Physical Description: Colorless liquid.

Measurement Methods (see Table 1):
NIOSH 1608
OSHA 7

Chemical & Physical Properties:
MW: 74.1
BP: 320°F (Decomposes)
Sol: Miscible
FI.P: 162°F
IP: ?
Sp.Gr: 1.12
VP(77°F): 0.9 mmHg
FRZ: -49°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
150 ppm: Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, nitrates

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash prompt
Breath: Resp support
Swallow: Medical attention immed

Glycolonitrile

Formula:	CAS#:	RTECS#:	IDLH:
$HOCH_2CN$	107-16-4	AM0350000	N.D.

Conversion: 1 ppm = 2.34 mg/m^3 **DOT:**

Synonyms/Trade Names: Cyanomethanol, Formaldehyde cyanohydrin, Glycolic nitrile, Glyconitrile, Hydroxyacetonitrile

Exposure Limits:
NIOSH REL: C 2 ppm (5 mg/m^3) [15-minute]
OSHA PEL: none

Physical Description: Colorless, odorless, oily liquid.
[**Note:** Forms cyanide in the body.]

Measurement Methods (see Table 1):
None available

Chemical & Physical Properties:
MW: 57.1
BP: 361°F (Decomposes)
Sol: Soluble
FI.P: ?
IP: ?
Sp.Gr(66°F): 1.10
VP(145°F): 1 mmHg
FRZ: <-98°F
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
20 ppm: Sa
50 ppm: Sa:Cf
100 ppm: ScbaF/SaF
250 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Traces of alkalis (promote violent polymerization)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz, lass, conf, convuls; dysp; abdom pain, nau, vomit
TO: Eyes, skin, resp sys, CNS, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Grain dust (oat, wheat, barley)	Formula:	CAS#:	RTECS#:	IDLH:
			MD7900000	N.D.
Conversion:	**DOT:**			

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/m^3
OSHA PEL: TWA 10 mg/m^3

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Mixture of grain and all the other substances associated with its cultivation & harvesting.

Chemical & Physical Properties:
Properties depend upon the specific component of the grain dust.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, upper resp sys; cough, dysp, wheez, asthma, bron, chronic obstructive pulm disease; conj, derm, rhinitis, grain fever
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Graphite (natural)	Formula:	CAS#:	RTECS#:	IDLH:
	C	7782-42-5	MD9659600	1250 mg/m^3
Conversion:	**DOT:**			

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/m^3 (resp)
OSHA PEL†: TWA 15 mppcf

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Steel gray to black, greasy feeling, odorless solid.

Chemical & Physical Properties:
MW: 12.0
BP: Sublimes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 2.0-2.25
VP: 0 mmHg (approx)
MLT: 6602°F (Sublimes)
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
12.5 mg/m^3: Qm
25 mg/m^3: 95XQ/Sa
62.5 mg/m^3: PaprHie/Sa:Cf
125 mg/m^3: 100F/PaprTHie/SaT:Cf/ScbaF/SaF
1250 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Very strong oxidizers such as fluorine, chlorine trifluoride & potassium peroxide

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Cough, dysp, black sputum, decr pulm func, lung fib
TO: Resp sys, CVS

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Graphite (synthetic)	Formula: C	CAS#: 7440-44-0 (synthetic)	RTECS#: FF5250100 (synthetic)	IDLH: N.D.
Conversion:	DOT:			

Synonyms/Trade Names: Acheson graphite, Artificial graphite
[**Note:** Also see specific listing for Graphite (natural).]

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Steel gray to black, greasy feeling, odorless solid.

Chemical & Physical Properties:
MW: 12.0
BP: Sublimes
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 1.5-1.8
VP: 0 mmHg (approx)
MLT: 6602°F (Sublimes)
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Very strong oxidizers such as fluorine, chlorine trifluoride & potassium peroxide

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Cough, dysp, black sputum, decr pulm func, lung fib
TO: Resp sys, CVS

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Gypsum	Formula: $CaSO_4 \times 2H_2O$	CAS#: 13397-24-5	RTECS#: MG2360000	IDLH: N.D.
Conversion:	DOT:			

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/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: White or nearly white, odorless, crystalline solid.

Chemical & Physical Properties:
MW: 172.2
BP: ?
Sol(77°F): 0.2%
FI.P: NA
IP: NA
Sp.Gr: 2.32
VP: 0 mmHg (approx)
MLT: 262-325°F (Loses H_2O)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Aluminum (at high temperatures), diazomethane

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, muc memb, upper resp sys; cough, sneez, rhin
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Hafnium

Formula:	CAS#:	RTECS#:	IDLH:
Hf	7440-58-6	MG4600000	50 mg/m^3 (as Hf)

Conversion: **DOT:** 1326 170 (powder, wet); 2545 135 (powder, dry)

Synonyms/Trade Names: Celtium, Elemental hafnium, Hafnium metal

Exposure Limits:
NIOSH REL*: TWA 0.5 mg/m^3
OSHA PEL*: TWA 0.5 mg/m^3
[***Note:** The REL and PEL also apply to other hafnium compounds (as Hf).]

Measurement Methods (see Table 1):
NIOSH S194 (II-5)
OSHA ID121

Physical Description: Highly lustrous, ductile, grayish solid.

Chemical & Physical Properties:
MW: 178.5
BP: 8316°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 13.31
VP: 0 mmHg (approx)
MLT: 4041°F
UEL: NA
LEL: NA

Explosive in powder form (either dry or with <25% water); finely divided powder can be ignited by static electricity or even SPONTANEOUSLY.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2.5 mg/m^3: Qm
5 mg/m^3: 95XQ/Sa
12.5 mg/m^3: Sa:Cf*/PaprHie*
25 mg/m^3: 100F/SaT:Cf*/PaprTHie*/ScbaF/SaF
50 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, chlorine

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, skin, muc memb; liver damage
TO: Eyes, skin, muc memb, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Halothane

Formula:	CAS#:	RTECS#:	IDLH:
$CF_3CHBrCl$	151-67-7	KH6550000	N.D.

Conversion: 1 ppm = 8.07 mg/m^3 **DOT:**

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

Exposure Limits:
NIOSH REL*: C 2 ppm (16.2 mg/m^3) [60-minute]
[***Note:** REL for exposure to waste anesthetic gas.]
OSHA PEL: none

Measurement Methods (see Table 1):
OSHA 29

Physical Description: Clear, colorless liquid with a sweetish, pleasant odor. [inhalation anesthetic]

Chemical & Physical Properties:
MW: 197.4
BP: 122°F
Sol: 0.3%
Fl.P: NA
IP: ?
Sp.Gr: 1.87
VP: 243 mmHg
FRZ: -180°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: May attack rubber & some plastics; sensitive to light.
[**Note:** Light causes decomposition. May be stabilized with 0.01% thymol.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; conf, drow, dizz, nau, analgesia, anes; card arrhy; liver, kidney damage; decr audio-visual performance; in animals: repro effects
TO: Eyes, skin, resp sys, CVS, CNS, liver, kidneys, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Heptachlor

Formula: $C_{10}H_5Cl_7$ | **CAS#:** 76-44-8 | **RTECS#:** PC0700000 | **IDLH:** Ca [35 mg/m^3]

Conversion: **DOT:** 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:
NIOSH REL: Ca
TWA 0.5 mg/m^3 [skin]
See Appendix A
OSHA PEL: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S287 (II-5)
OSHA PV2029

Physical Description: White to light-tan crystals with a camphor-like odor. [insecticide]

Chemical & Physical Properties:
MW: 373.4
BP: 293°F (Decomposes)
Sol: 0.0006%
FI.P: NA
IP: ?
Sp.Gr: 1.66
VP(77°F): 0.0003 mmHg
MLT: 203°F
UEL: NA
LEL: NA
Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Iron, rust

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: tremor, convuls; liver damage; [carc]
TO: CNS,liver [in animals: liver cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

n-Heptane

Formula: $CH_3[CH_2]_5CH_3$ | **CAS#:** 142-82-5 | **RTECS#:** MI7700000 | **IDLH:** 750 ppm

Conversion: 1 ppm = 4.10 mg/m^3 **DOT:** 1206 128

Synonyms/Trade Names: Heptane, normal-Heptane

Exposure Limits:
NIOSH REL: TWA 85 ppm (350 mg/m^3)
C 440 ppm (1800 mg/m^3) [15-minute]
OSHA PEL†: TWA 500 ppm (2000 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1500
OSHA 7

Physical Description: Colorless liquid with a gasoline-like odor.

Chemical & Physical Properties:
MW: 100.2
BP: 209°F
Sol: 0.0003%
FI.P: 25°F
IP: 9.90 eV
Sp.Gr: 0.68
VP(72°F): 40 mmHg
FRZ: -131°F
UEL: 6.7%
LEL: 1.05%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent eye contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
750 ppm: CcrOv/GmFOv/PaprOv/Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Dizz, stupor, inco; loss of appetite, nau; derm; chemical pneu (aspir liquid); uncon
TO: Skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

1-Heptanethiol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3[CH_2]_6SH$	1639-09-4	MJ1400000	N.D.

Conversion: 1 ppm = 5.41 mg/m^3 **DOT:** 1228 131

Synonyms/Trade Names: Heptyl mercaptan, n-Heptyl mercaptan

Exposure Limits:
NIOSH REL: C 0.5 ppm (2.7 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a strong odor.

Chemical & Physical Properties:
MW: 132.3
BP: 351°F
Sol: Insoluble
Fl.P: 115°F
IP: ?
Sp.Gr: 0.84
VP: ?
FRZ: -46°F
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids & bases, alkali metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; lass, cyan, incr respiration, nau, drow, head, vomit
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Hexachlorobutadiene

Formula:	CAS#:	RTECS#:	IDLH:
$Cl_2C{=}CClCCl{=}CCl_2$	87-68-3	EJ07000	Ca [N.D.]

Conversion: 1 ppm = 10.66 mg/m^3 **DOT:** 2279 151

Synonyms/Trade Names: HCBD; Hexachloro-1,3-butadiene; 1,3-Hexachlorobutadiene; Perchlorobutadiene

Exposure Limits:
NIOSH REL: Ca
TWA 0.02 ppm (0.24 mg/m^3) [skin]
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2543

Physical Description: Clear, colorless liquid with a mild, turpentine-like odor.

Chemical & Physical Properties:
MW: 260.7
BP: 419°F
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr: 1.55
VP: 0.2 mmHg
FRZ: -6°F
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: irrit eyes, skin, resp sys; kidney damage; [carc]
TO: Eyes, skin, resp sys, kidneys [in animals: kidney tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Hexachlorocyclopentadiene	Formula: C_5Cl_6	CAS#: 77-47-4	RTECS#: GY1225000	IDLH: N.D.
Conversion: 1 ppm = 11.16 mg/m^3	**DOT:** 2646 151			
Synonyms/Trade Names: HCPD; Hexachloro-1,3-cyclopentadiene; 1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene; Perchlorocyclopentadiene				
Exposure Limits: **NIOSH REL:** TWA 0.01 ppm (0.1 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **NIOSH** 2518	
Physical Description: Pale-yellow to amber-colored liquid with a pungent, unpleasant odor. [**Note:** A solid below 16°F.]				
Chemical & Physical Properties: **MW:** 272.8 **BP:** 462°F **Sol(77°F):** 0.0002% (Reacts) **FI.P:** NA **IP:** ? **Sp.Gr:** 1.71 **VP(77°F):** 0.08 mmHg **FRZ:** 16°F **UEL:** NA **LEL:** NA Noncombustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R. **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and 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.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, resp sys; eye, skin burns; lac; sneez, cough, dysp, salv, pulm edema; nau, vomit, diarr; in animals: liver, kidney inj **TO:** Eyes, skin, resp sys, liver, kidneys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

Hexachloroethane	Formula: Cl_3CCCl_3	CAS#: 67-72-1	RTECS#: KI4025000	IDLH: Ca [300 ppm]
Conversion: 1 ppm = 9.68 mg/m^3	**DOT:**			
Synonyms/Trade Names: Carbon hexachloride, Ethane hexachloride, Perchloroethane				
Exposure Limits: **NIOSH REL:** Ca TWA 1 ppm (10 mg/m^3) [skin] See Appendix A See Appendix C (Chloroethanes) **OSHA PEL:** TWA 1 ppm (10 mg/m^3) [skin]			**Measurement Methods (see Table 1):** **NIOSH** 1003 **OSHA** 7	
Physical Description: Colorless crystals with a camphor-like odor.				
Chemical & Physical Properties: **MW:** 236.7 **BP:** Sublimes **Sol(72°F):** 0.005% **FI.P:** NA **IP:** 11.22 eV **Sp.Gr:** 2.09 **VP:** 0.2 mmHg **MLT:** 368°F (Sublimes) **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam/Daily **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
	Incompatibilities and Reactivities: Alkalis; metals such as zinc, cadmium, aluminum, hot iron & mercury			
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, muc memb; in animals: kidney damage; [carc] **TO:** Eyes, skin, resp sys, kidneys [in animals: liver cancer]			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Hexachloronaphthalene	Formula: $C_{10}H_2Cl_6$	CAS#: 1335-87-1	RTECS#: QJ7350000	IDLH: 2 mg/m^3
Conversion:	**DOT:**			
Synonyms/Trade Names: Halowax® 1014				

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3 [skin]
OSHA PEL: TWA 0.2 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S100 (II-2)

Physical Description: White to light-yellow solid with an aromatic odor.

Chemical & Physical Properties:
MW: 334.9
BP: 650-730°F
Sol: Insoluble
FI.P: NA
IP: ?
Sp.Gr: 1.78
VP: <1 mmHg
MLT: 279°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2 mg/m^3: Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Acne-form derm, nau, conf, jaun, coma
TO: Skin, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

1-Hexadecanethiol	Formula: $CH_3[CH_2]_{15}SH$	CAS#: 2917-26-2	RTECS#:	IDLH: N.D.
Conversion: 1 ppm = 10.59 mg/m^3	**DOT:** 1228 131 (liquid)			
Synonyms/Trade Names: Cetyl mercaptan, Hexadecanethiol-1, n-Hexadecanethiol, Hexadecyl mercaptan				

Exposure Limits:
NIOSH REL: C 0.5 ppm (5.3 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid or solid (below 64-68°F) with a strong odor.

Chemical & Physical Properties:
MW: 258.5
BP: ?
Sol: Insoluble
FI.P: 215°F
IP: ?
Sp.Gr: 0.85
VP: 0.1 mmHg
FRZ: 64-68°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, strong acids & bases, alkali metals, reducing agents

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz, lass, cyan, nau, convuls
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Hexafluoroacetone

Formula:	CAS#:	RTECS#:	IDLH:
$(CF_3)_2CO$	684-16-2	UC2450000	N.D.

Conversion: 1 ppm = 6.79 mg/m^3 **DOT:** 2420 125

Synonyms/Trade Names: Hexafluoro-2-propanone; 1,1,1,3,3,3-Hexafluoro-2-propanone; HFA; Perfluoroacetone

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.7 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a musty odor.
[**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 166.0
BP: -18°F
Sol: Reacts
FI.P: NA
IP: 11.81 eV
RGasD: 5.76
VP: 5.8 atm
FRZ: -188°F
UEL: NA
LEL: NA
Nonflammable Gas, but highly reactive with water & other substances, releasing heat.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact/Frostbite
Eyes: Prevent eye contact/Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Water, acids
[**Note:** Hygroscopic (i.e., absorbs moisture from the air); reacts with moisture to form a highly acidic sesquihydrate.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Con
SY: Irrit eyes, skin, muc memb, resp sys; pulm edema; liquid: frostbite; in animals: terato, repro effects; kidney inj
TO: Eyes, skin, resp sys, kidneys, repro sys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Hexamethylene diisocyanate

Formula:	CAS#:	RTECS#:	IDLH:
$OCN[CH_2]_6NCO$	822-06-0	MO1740000	N.D.

Conversion: 1 ppm = 6.88 mg/m^3 **DOT:** 2281 156

Synonyms/Trade Names: 1,6-Diisocyanatohexane; HDI; Hexamethylene-1,6-diisocyanate; 1,6-Hexamethylene diisocyanate; HMDI

Exposure Limits:
NIOSH REL: TWA 0.005 ppm (0.035 mg/m^3)
C 0.020 ppm (0.140 mg/m^3) [10-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 5521, 5522, 5525
OSHA 42

Physical Description: Clear, colorless to slightly yellow liquid with a sharp, pungent odor.

Chemical & Physical Properties:
MW: 168.2
BP: 415°F
Sol: Low (Reacts)
FI.P: 284°F
IP:?
Sp.Gr(77°F): 1.04
VP(77°F): 0.5 mmHg
FRZ: -89°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
0.05 ppm: Sa*
0.125 ppm: Sa:Cf*
0.25 ppm: ScbaF/SaF
1 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; cough, dysp, bron, wheez, pulm edema, asthma; corn damage, skin blisters
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

H

Hexamethyl phosphoramide

Formula: $[(CH_3)_2N]_3PO$ | **CAS#:** 680-31-9 | **RTECS#:** TD0875000 | **IDLH:** Ca [N.D.]

Conversion: | **DOT:**

Synonyms/Trade Names: Hexamethylphosphoric triamide, Hexamethylphosphorotriamide, HMPA, Tris(dimethylamino)phosphine oxide

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Clear, colorless liquid with an aromatic or mild, amine-like odor. [**Note:** A solid below 43°F.]

Chemical & Physical Properties:
MW: 179.2
BP: 451°F
Sol: Miscible
FI.P: 220°F
IP: ?
Sp.Gr: 1.03
VP: 0.03 mmHg
FRZ: 43°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, strong acids, chemically-active metals (e.g., potassium, sodium, magnesium, zinc)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; dysp; abdom pain; [carc]
TO: Eyes, skin, resp sys, CNS, GI tract [in animals: cancer of the nasal cavity]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

n-Hexane

Formula: $CH_3[CH_2]_4CH_3$ | **CAS#:** 110-54-3 | **RTECS#:** MN9275000 | **IDLH:** 1100 ppm [10%LEL]

Conversion: 1 ppm = 3.53 mg/m^3 | **DOT:** 1208 128

Synonyms/Trade Names: Hexane, Hexyl hydride, normal-Hexane

Exposure Limits:
NIOSH REL: TWA 50 ppm (180 mg/m^3)
OSHA PEL†: TWA 500 ppm (1800 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1500, 3800
OSHA 7

Physical Description: Colorless liquid with a gasoline-like odor.

Chemical & Physical Properties:
MW: 86.2
BP: 156°F
Sol: 0.002%
FI.P: -7°F
IP: 10.18 eV
Sp.Gr: 0.66
VP: 124 mmHg
FRZ: -219°F
UEL: 7.5%
LEL: 1.1%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
500 ppm: Sa*
1100 ppm: Sa:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose; nau, head; peri neur: numb extremities, musc weak; derm; dizz; chemical pneu (aspir liquid)
TO: Eyes, skin, resp sys, CNS, PNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Hexane isomers (excluding n-Hexane)	Formula: C_6H_{14}	CAS#:	RTECS#:	IDLH: N.D.
Conversion: 1 ppm = 3.53 mg/m^3	**DOT:** 1208 128			

Synonyms/Trade Names: Diethylmethylmethane; Diisopropyl; 2,2-Dimethylbutane; 2,3-Dimethylbutane; Isohexane; 2-Methylpentane; 3-Methylpentane [**Note:** Also see specific listing for n-Hexane.]

Exposure Limits:
NIOSH REL: TWA 100 ppm (350 mg/m^3)
C 510 ppm (1800 mg/m^3) [15-minute]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Clear liquids with mild, gasoline-like odors.
[**Note:** Includes all the isomers of hexane except n-hexane.]

Chemical & Physical Properties:
MW: 86.2
BP: 122-145°F
Sol: Insoluble
FI.P: -54 to 19°F
IP: ?
Sp.Gr: 0.65-0.66
VP: ?
FRZ: -245 to -148°F
UEL: ?
LEL: ?
Class IB Flammable Liquids

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1000 ppm: Sa*
2500 ppm: Sa:Cf*
5000 ppm: SaT:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz; nau; chemical pneu (aspir liquid); derm
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

n-Hexanethiol	Formula: $CH_3[CH_2]_5SH$	CAS#: 111-31-9	RTECS#: MO4550000	IDLH: N.D.
Conversion: 1 ppm = 4.83 mg/m^3	**DOT:** 1228 131			

Synonyms/Trade Names: 1-Hexanethiol, Hexyl mercaptan, n-Hexyl mercaptan, n-Hexylthiol

Exposure Limits:
NIOSH REL: C 0.5 ppm (2.7 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with an unpleasant odor.

Chemical & Physical Properties:
MW: 118.2
BP: 304°F
Sol: Insoluble
FI.P: 68°F
IP: ?
Sp.Gr: 0.84
VP: ?
FRZ: -113°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids & bases, alkali metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; lass, cyan, incr respiration, nau, drow, head, vomit
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

2-Hexanone	Formula: $CH_3CO[CH_2]_3CH_3$	CAS#: 591-78-6	RTECS#: MP1400000	IDLH: 1600 ppm
Conversion: 1 ppm = 4.10 mg/m^3	**DOT:**			

Synonyms/Trade Names: Butyl methyl ketone, MBK, Methyl butyl ketone, Methyl n-butyl ketone

Exposure Limits:
NIOSH REL: TWA 1 ppm (4 mg/m^3)
OSHA PEL†: TWA 100 ppm (410 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1300, 2555
OSHA PV2031

Physical Description: Colorless liquid with an acetone-like odor.

Chemical & Physical Properties:
MW: 100.2
BP: 262°F
Sol: 2%
FI.P: 77°F
IP: 9.34 eV
Sp.Gr: 0.81
VP: 11 mmHg
FRZ: -71°F
UEL: 8%
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 ppm: Sa
25 ppm: Sa:Cf
50 ppm: SaT:Cf/ScbaF/SaF
1600 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose; peri neur: lass, pares; derm; head, drow
TO: Eyes, skin, resp sys, CNS, PNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Hexone	Formula: $CH_3COCH_2CH(CH_3)_2$	CAS#: 108-10-1	RTECS#: SA9275000	IDLH: 500 ppm
Conversion: 1 ppm = 4.10 mg/m^3	**DOT:** 1245 127			

Synonyms/Trade Names: Isobutyl methyl ketone, Methyl isobutyl ketone, 4-Methyl 2-pentanone, MIBK

Exposure Limits:
NIOSH REL: TWA 50 ppm (205 mg/m^3)
ST 75 ppm (300 mg/m^3)
OSHA PEL†: TWA 100 ppm (410 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1300, 2555
OSHA 1004

Physical Description: Colorless liquid with a pleasant odor.

Chemical & Physical Properties:
MW: 100.2
BP: 242°F
Sol: 2%
FI.P: 64°F
IP: 9.30 eV
Sp.Gr: 0.80
VP: 16 mmHg
FRZ: -120°F
UEL(200°F): 8.0%
LEL(200°F): 1.2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
500 ppm: CcrOv*/GmFOv/PaprTOv*/ Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, potassium tert-butoxide

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; head, narco, coma; derm; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

sec-Hexyl acetate	Formula: $C_8H_{16}O_2$	CAS#: 108-84-9	RTECS#: SA7525000	IDLH: 500 ppm
Conversion: 1 ppm = 5.90 mg/m^3	**DOT:** 1233 130			
Synonyms/Trade Names: 1,3-Dimethylbutyl acetate; Methylisoamyl acetate				
Exposure Limits: **NIOSH REL:** TWA 50 ppm (300 mg/m^3) **OSHA PEL:** TWA 50 ppm (300 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1450 **OSHA** 7	
Physical Description: Colorless liquid with a mild, pleasant, fruity odor.				
Chemical & Physical Properties: **MW:** 144.2 **BP:** 297°F **Sol:** 0.08% **FI.P:** 113°F **IP:** ? **Sp.Gr:** 0.86 **VP:** 3 mmHg **FRZ:** -83°F **UEL:** ? **LEL:** ? Class II Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **500 ppm:** CcrOv*/GmFOv/PaprOv*/ Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat; head; in animals: narco **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Hexylene glycol	Formula: $(CH_3)_2COHCH_2CHOHCH_3$	CAS#: 107-41-5	RTECS#: SA0810000	IDLH: N.D.
Conversion: 1 ppm = 4.83 mg/m^3	**DOT:**			
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: **NIOSH REL:** C 25 ppm (125 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **OSHA** PV2101	
Physical Description: Colorless liquid with a mild, sweetish odor.				
Chemical & Physical Properties: **MW:** 118.2 **BP:** 388°F **Sol:** Miscible **FI.P:** 209°F **IP:** ? **Sp.Gr:** 0.92 **VP:** 0.05 mmHg **FRZ:** -58°F (Sets to glass) **UEL(est):** 7.4% **LEL(calc):** 1.3% Class IIIB Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R. **Provide:** Eyewash		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Strong oxidizers, strong acids [**Note:** Hygroscopic (i.e., absorbs moisture from the air).]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, resp sys; head, dizz, nau, inco, CNS depres; derm, skin sens **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Hydrazine

Formula:	CAS#:	RTECS#:	IDLH:
H_2NNH_2	302-01-2	MU7175000	Ca [50 ppm]

Conversion: 1 ppm = 1.31 mg/m^3

DOT: 2029 132 (anhydrous); 3293 152 (≤ 37% solution); 2030 153 (37-64% solution); 2029 132 (>64% solution)

Synonyms/Trade Names: Diamine, Hydrazine (anhydrous), Hydrazine base

Exposure Limits:
NIOSH REL: Ca
C 0.03 ppm (0.04 mg/m^3) [2-hour]
See Appendix A
OSHA PEL†: TWA 1 ppm (1.3 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 3503
OSHA 20, 108

Physical Description: Colorless, fuming, oily liquid with an ammonia-like odor. [**Note:** A solid below 36°F.]

Chemical & Physical Properties:
MW: 32.1
BP: 236°F
Sol: Miscible
Fl.P: 99°F
IP: 8.93 eV
Sp.Gr: 1.01
VP: 10 mmHg
FRZ: 36°F
UEL: 98%
LEL: 2.9%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; temporary blindness; dizz, nau; derm; eye, skin burns; in animals: bron, pulm edema; liver, kidney damage; convuls; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys [in animals: tumors of the lungs, liver, blood vessels & intestine]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Hydrogenated terphenyls

Formula:	CAS#:	RTECS#:	IDLH:
$(C_6H_n)_3$	61788-32-7	WZ6535000	N.D.

Conversion: 1 ppm = 12.19 mg/m^3 (40% hydrogenated)

DOT:

Synonyms/Trade Names: Hydrogenated diphenylbenzenes, Hydrogenated phenylbiphenyls, Hydrogenated triphenyls [**Note:** Complex mixture of terphenyl isomers that are partially hydrogenated.]

Exposure Limits:
NIOSH REL: TWA 0.5 ppm (5 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Clear, oily, pale-yellow liquids with a faint odor. [plasticizer/heat-transfer media]

Chemical & Physical Properties:
MW: 298 (40% hydrogenated)
BP: 644°F (40% hydrogenated)
Sol: Insoluble
Fl.P: 315°F (40% hydrogenated)
IP: ?
Sp.Gr(77°F): 1.003-1.009 (40% hydrogenated)
VP: ?
FRZ: ?
UEL: ?
LEL: ?
Class IIIB Combustible Liquids

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported [**Note:** When heated, irritating vapors will be released.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; liver, kidney, hemato damage
TO: Eyes, skin, resp sys, liver, kidneys, hemato sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Hydrogen bromide	Formula: HBr	CAS#: 10035-10-6	RTECS#: MW3850000	IDLH: 30 ppm
Conversion: 1 ppm = 3.31 mg/m^3	**DOT:** 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/m^3) **OSHA PEL†:** TWA 3 ppm (10 mg/m^3)				**Measurement Methods (see Table 1):** **NIOSH** 7903 **OSHA** ID165SG
Physical Description: Colorless gas with a sharp, irritating odor. [**Note:** Shipped as a liquefied compressed gas. Often used in an aqueous solution.]				
Chemical & Physical Properties: **MW:** 80.9 **BP:** -88°F **Sol:** 49% **FI.P:** NA **IP:** 11.62 eV **RGasD:** 2.81 **VP:** 20 atm **FRZ:** -124°F **UEL:** NA **LEL:** NA Nonflammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact (solution)/Frostbite **Eyes:** Prevent eye contact (solution)/Frostbite **Wash skin:** When contam (solution) **Remove:** When wet or contam (solution) **Change:** N.R. **Provide:** Eyewash (liquid) Quick drench (solution) Frostbite wash		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **30 ppm:** Sa:Cf£/PaprAg£/GmFAg/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFAg/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers, strong caustics, moisture, copper, brass, zinc [**Note:** Hydrobromic acid is highly corrosive to most metals.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing (solution), Con **SY:** Irrit eyes, skin, nose, throat; solution: eye, skin burns; liquid: frostbite **TO:** Eyes, skin, resp sys		**First Aid (see Table 6):** **Eye:** Irr immed (solution)/Frostbite **Skin:** Water flush immed (solution)/Frostbite **Breath:** Resp support **Swallow:** Medical attention immed (solution)		

Hydrogen chloride	Formula: HCl	CAS#: 7647-01-0	RTECS#: MW4025000	IDLH: 50 ppm
Conversion: 1 ppm = 1.49 mg/m^3	**DOT:** 1050 125 (anhydrous); 1789 157 (solution)			
Synonyms/Trade Names: Anhydrous hydrogen chloride; Aqueous hydrogen chloride (i.e., Hydrochloric acid, Muriatic acid) [**Note:** Often used in an aqueous solution.]				
Exposure Limits: **NIOSH REL:** C 5 ppm (7 mg/m^3) **OSHA PEL:** C 5 ppm (7 mg/m^3)				**Measurement Methods (see Table 1):** **NIOSH** 7903 **OSHA** ID174SG
Physical Description: Colorless to slightly yellow gas with a pungent, irritating odor. [**Note:** Shipped as a liquefied compressed gas.]				
Chemical & Physical Properties: **MW:** 36.5 **BP:** -121°F **Sol(86°F):** 67% **FI.P:** NA **IP:** 12.74 eV **RGasD:** 1.27 **VP:** 40.5 atm **FRZ:** -174°F **UEL:** NA **LEL:** NA Nonflammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact (solution)/Frostbite **Eyes:** Prevent eye contact/Frostbite **Wash skin:** When contam (solution) **Remove:** When wet or contam (solution) **Change:** N.R. **Provide:** Eyewash (solution) Quick drench (solution) Frostbite wash		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **50 ppm:** CcrS*/GmFS/PaprS*/Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFAg/ScbaE	
Incompatibilities and Reactivities: Hydroxides, amines, alkalis, copper, brass, zinc [**Note:** Hydrochloric acid is highly corrosive to most metals.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing (solution), Con **SY:** Irrit nose, throat, larynx; cough, choking; derm; solution: eye, skin burns; liquid: frostbite; in animals: lar spasm; pulm edema **TO:** Eyes, skin, resp sys		**First Aid (see Table 6):** **Eye:** Irr immed (solution)/Frostbite **Skin:** Water flush immed (solution)/Frostbite **Breath:** Resp support **Swallow:** Medical attention immed (solution)		

Hydrogen cyanide

Formula:	CAS#:	RTECS#:	IDLH:
HCN	74-90-8	MW6825000	50 ppm

Conversion: 1 ppm = 1.10 mg/m^3

DOT: 1051 117 (>20% solution); 1051 117 (anhydrous); 1613 154 (20% solution)

Synonyms/Trade Names: Formonitrile, Hydrocyanic acid, Prussic acid

Exposure Limits:
NIOSH REL: ST 4.7 ppm (5 mg/m^3) [skin]
OSHA PEL†: TWA 10 ppm (11 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 6010, 6017

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.]

Chemical & Physical Properties:
MW: 27.0
BP: 78°F (96%)
Sol: Miscible
FI.P: 0°F (96%)
IP: 13.60 eV
Sp.Gr: 0.69
VP: 630 mmHg
FRZ: 7°F (96%)
UEL: 40.0%
LEL: 5.6%
Class IA Flammable Liquid
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
47 ppm: Sa
50 ppm: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Amines, oxidizers, acids, sodium hydroxide, calcium hydroxide, sodium carbonate, caustics, ammonia [**Note:** Can polymerize at 122-140°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Asphy; lass, head, conf; nau, vomit; incr rate and depth of respiration or respiration slow and gasping; thyroid, blood changes
TO: CNS, CVS, thyroid, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Hydrogen fluoride

Formula:	CAS#:	RTECS#:	IDLH:
HF	7664-39-3	MW7875000	30 ppm

Conversion: 1 ppm = 0.82 mg/m^3

DOT: 1052 125 (anhydrous); 1790 157 (solution)

Synonyms/Trade Names: Anhydrous hydrogen fluoride; Aqueous hydrogen fluoride (i.e., Hydrofluoric acid); HF-A

Exposure Limits:
NIOSH REL: TWA 3 ppm (2.5 mg/m^3)
C 6 ppm (5 mg/m^3) [15-minute]
OSHA PEL†: TWA 3 ppm

Measurement Methods (see Table 1):
NIOSH 3800, 7902, 7903, 7906
OSHA ID110

Physical Description: Colorless gas or fuming liquid (below 67°F) with a strong, irritating odor. [**Note:** Shipped in cylinders.]

Chemical & Physical Properties:
MW: 20.0
BP: 67°F
Sol: Miscible
FI.P: NA
IP: 15.98 eV
RGasD: 1.86
Sp.Gr: 1.00 (Liquid at 67°F)
VP: 783 mmHg
FRZ: -118°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Eyes: Prevent eye contact (liquid)
Wash skin: When contam (liquid)
Remove: When wet or contam (liquid)
Change: N.R.
Provide: Eyewash (liquid)
Quick drench (liquid)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
30 ppm: CcrS*/PaprS*/GmFS/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Metals, water or steam
[**Note:** Corrosive to metals. Will attack glass and concrete.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs (liquid), Ing (solution), Con
SY: Irrit eyes, skin, nose, throat; pulm edema; eye, skin burns; rhinitis; bron; bone changes
TO: Eyes, skin, resp sys, bones

First Aid (see Table 6):
Eye: Irr immed (solution/liquid)
Skin: Water flush immed (solution/liquid)
Breath: Resp support
Swallow: Medical attention immed (solution)

Hydrogen peroxide	Formula: H_2O_2	CAS#: 7722-84-1	RTECS#: MX0900000	IDLH: 75 ppm
Conversion: 1 ppm = 1.39 mg/m^3	**DOT:** 2984 140 (8-20% solution); 2014 140 (20-60% solution); 2015 143 (>60% solution)			

Synonyms/Trade Names: High-strength hydrogen peroxide, Hydrogen dioxide, Hydrogen peroxide (aqueous), Hydroperoxide, Peroxide

Exposure Limits:	Measurement Methods (see Table 1):
NIOSH REL: TWA 1 ppm (1.4 mg/m^3) **OSHA PEL:** TWA 1 ppm (1.4 mg/m^3)	**OSHA** ID126SG

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.]

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 34.0 **BP:** 286°F **Sol:** Miscible **Fl.P:** NA **IP:** 10.54 eV **Sp.Gr:** 1.39 VP(86°F): 5 mmHg **FRZ:** 12°F **UEL:** NA **LEL:** NA Noncombustible Liquid, but a powerful oxidizer.	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R. **Provide:** Eyewash Quick drench	**NIOSH/OSHA** **10 ppm:** Sa* **25 ppm:** Sa:Cf* **50 ppm:** ScbaF/SaF **75 ppm:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS/ScbaE

Incompatibilities and Reactivities: Oxidizable materials, iron, copper, brass, bronze, chromium, zinc, lead, silver, manganese [**Note:** Contact with combustible material may result in SPONTANEOUS combustion.]

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Irrit eyes, nose, throat; corn ulcer; eryt, vesic skin; bleaching hair **TO:** Eyes, skin, resp sys	**Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed

Hydrogen selenide	Formula: H_2Se	CAS#: 7783-07-5	RTECS#: MX1050000	IDLH: 1 ppm
Conversion: 1 ppm = 3.31 mg/m^3	**DOT:** 2202 117 (anhydrous)			

Synonyms/Trade Names: Selenium dihydride, Selenium hydride

Exposure Limits:	Measurement Methods (see Table 1):
NIOSH REL: TWA 0.05 ppm (0.2 mg/m^3) **OSHA PEL:** TWA 0.05 ppm (0.2 mg/m^3)	None available

Physical Description: Colorless gas with an odor resembling decayed horseradish.
[**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 81.0 **BP:** -42°F **Sol(73°F):** 0.9% **Fl.P:** NA (Gas) **IP:** 9.88 eV **RGasD:** 2.80 **VP(70°F):** 9.5 atm **FRZ:** -87°F **UEL:** ? **LEL:** ? Flammable Gas	**Skin:** Frostbite **Eyes:** Frostbite **Wash skin:** N.R. **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Frostbite wash	**NIOSH/OSHA** **0.5 ppm:** Sa **1 ppm**: Sa:Cf*/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS¿/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids, water, halogenated hydrocarbons

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Con **SY:** Irrit eyes, nose, throat; nau, vomit, diarr; metallic taste, garlic breath; dizz, lass; liquid: frostbite; in animals: pneu; liver damage **TO:** Eyes, resp sys, liver	**Eye:** Frostbite **Skin:** Frostbite **Breath:** Resp support

Hydrogen sulfide

Formula:	CAS#:	RTECS#:	IDLH:
H_2S	7783-06-4	MX1225000	100 ppm

Conversion: 1 ppm = 1.40 mg/m^3

DOT: 1053 117

Synonyms/Trade Names: Hydrosulfuric acid, Sewer gas, Sulfuretted hydrogen

Exposure Limits:
NIOSH REL: C 10 ppm (15 mg/m^3) [10-minute]
OSHA PEL†: C 20 ppm
50 ppm [10-minute maximum peak]

Measurement Methods (see Table 1):
NIOSH 6013
OSHA ID141

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 H_2S. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 34.1
BP: -77°F
Sol: 0.4%
FI.P: NA (Gas)
IP: 10.46 eV
RGasD: 1.19
VP: 17.6 atm
FRZ: -122°F
UEL: 44.0%
LEL: 4.0%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
100 ppm: PaprS/GmFS/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong nitric acid, metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, resp sys; apnea, coma, convuls; conj, eye pain, lac, photo, corn vesic; dizz, head, lass, irrity, insom; GI dist; liquid: frostbite
TO: Eyes, resp sys, CNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Hydroquinone

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_4(OH)_2$	123-31-9	MX3500000	50 mg/m^3

Conversion:

DOT: 2662 153

Synonyms/Trade Names: p-Benzenediol; 1,4-Benzenediol; Dihydroxybenzene; 1,4-Dihydroxybenzene; Quinol

Exposure Limits:
NIOSH REL: C 2 mg/m^3 [15-minute]
OSHA PEL: TWA 2 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5004
OSHA PV2094

Physical Description: Light-tan, light-gray, or colorless crystals.

Chemical & Physical Properties:
MW: 110.1
BP: 545°F
Sol: 7%
FI.P: 329°F (Molten)
IP: 7.95 eV
Sp.Gr: 1.33
VP: 0.00001 mmHg
MLT: 338°F
UEL: ?
LEL: ?
Combustible Solid; dust cloud may explode if ignited in an enclosed area.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash (>7%)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: PaprHie£/100F/SaT:Cf£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes; conj; kera; CNS excitement; colored urine, nau, dizz, suffocation, rapid breath; musc twitch, delirium; collapse; skin irrit, sens, derm
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

2-Hydroxypropyl acrylate	Formula: CH_2=CHCOOCH$_2$CHOHCH$_3$	CAS#: 999-61-1	RTECS#: AT1925000	IDLH: N.D.
Conversion: 1 ppm = 5.33 mg/m^3	**DOT:**			
Synonyms/Trade Names: HPA, β-Hydroxypropyl acrylate, Propylene glycol monoacrylate				
Exposure Limits: **NIOSH REL:** TWA 0.5 ppm (3 mg/m^3) [skin] **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Clear to light-yellow liquid wiith a sweetish, solvent odor.				
Chemical & Physical Properties: **MW:** 130.2 **BP:** 376°F **Sol:** ? **Fl.P:** 149°F **IP:** ? **Sp.Gr:** 1.05 **VP:** ? **FRZ:** ? **UEL:** ? **LEL:** 1.8% Class IIIA Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R. **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Water [**Note:** Can become unstable at high temperatures & pressures or may react with water with some release of energy, but not violently.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, resp sys; eye, skin burns; cough, dysp **TO:** Eyes, skin, resp sys		**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap flush immed **Breath:** Resp support **Swallow:** Medical attention immed		

Indene	Formula: C_9H_8	CAS#: 95-13-6	RTECS#: NK8225000	IDLH: N.D.
Conversion: 1 ppm = 4.75 mg/m^3	**DOT:**			
Synonyms/Trade Names: Indonaphthene				
Exposure Limits: **NIOSH REL:** TWA 10 ppm (45 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless liquid. [**Note:** A solid below 29°F.]				
Chemical & Physical Properties: **MW:** 116.2 **BP:** 359°F **Sol:** Insoluble **Fl.P:** 173°F **IP:** 8.81 eV **Sp.Gr:** 0.997 **VP:** ? **FRZ:** 29°F **UEL:** ? **LEL:** ? Class IIIA Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** Daily **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: None reported [**Note:** Polymerizes & oxidizes on standing. It has exploded during nitration with (H_2SO_4 + HNO_3).]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** In animals: irrit eyes, skin, muc memb; derm, skin sens; chemical pneu (aspir liquid); liver, kidney, spleen inj **TO:** Eyes, skin, resp sys, liver, kidneys, spleen		**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed		

Indium	Formula: In	CAS#: 7440-74-6	RTECS#: NL1050000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Indium metal

Exposure Limits:
NIOSH REL*: TWA 0.1 mg/m^3
[***Note:** The REL also applies to other indium compounds (as In).]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 7303, P&CAM173 (II-5)
OSHA ID121

Physical Description: Ductile, shiny, silver-white metal that is softer than lead.

Chemical & Physical Properties:
MW: 114.8
BP: 3767°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 7.31
VP: 0 mmHg (approx)
MLT: 314°F
UEL: NA
LEL: NA
Noncombustible Solid in bulk form, but may ignite in powdered or dust form.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: (Dinitrogen tetraoxide + acetonitrile), mercury(II) bromide (at 662°F), sulfur (mixtures ignite when heated) [**Note:** oxidizes readily at higher temperatures.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; possible liver, kidney, heart, blood effects; pulm edema
TO: Eyes, skin, resp sys, liver, kidneys, heart, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Iodine	Formula: I_2	CAS#: 7553-56-2	RTECS#: NN1575000	IDLH: 2 ppm
Conversion: 1 ppm = 10.38 mg/m^3	**DOT:**			

Synonyms/Trade Names: Iodine crystals, Molecular iodine

Exposure Limits:
NIOSH REL: C 0.1 ppm (1 mg/m^3)
OSHA PEL: C 0.1 ppm (1 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6005
OSHA ID212

Physical Description: Violet solid with a sharp, characteristic odor.

Chemical & Physical Properties:
MW: 253.8
BP: 365°F
Sol: 0.01%
Fl.P: NA
IP: 9.31 eV
Sp.Gr: 4.93
VP(77°F): 0.3 mmHg
MLT: 236°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash (>7%)
Quick drench (>7%)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 ppm: Sa*
2 ppm: Sa:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFAg100/ScbaE

Incompatibilities and Reactivities: Ammonia, acetylene, acetaldehyde, powdered aluminum, active metals, liquid chlorine

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; lac; head; chest tight; skin burns, rash; cutaneous hypersensitivity
TO: Eyes, skin, resp sys, CNS, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Iodoform	Formula: CHI_3	CAS#: 75-47-8	RTECS#: PB7000000	IDLH: N.D.
Conversion: 1 ppm = 16.10 mg/m^3	**DOT:**			
Synonyms/Trade Names: Triiodomethane				
Exposure Limits: **NIOSH REL:** TWA 0.6 ppm (10 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Yellow to greenish-yellow powder or crystalline solid with a pungent, disagreeable odor. [antiseptic for external use]				
Chemical & Physical Properties: **MW:** 393.7 **BP:** 410°F (Decomposes) **Sol:** 0.01% **Fl.P:** NA **IP:** ? **Sp.Gr:** 4.01 **VP:** ? **MLT:** 246°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Strong oxidizers, lithium, metallic salts (e.g., mercuric oxide, silver nitrate), strong bases, calomel, tannin				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin; lass, dizz, nau, inco, CNS depres; dysp; liver, kidney, heart damage; vis dist **TO:** Eyes, skin, resp sys, liver, kidneys, heart			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Iron oxide dust and fume (as Fe)	Formula: Fe_2O_3	CAS#: 1309-37-1	RTECS#: NO7400000 NO7525000 (fume)	IDLH: 2500 mg/m^3 (as Fe)
Conversion:	**DOT:** 1376 135 (spent)			
Synonyms/Trade Names: Ferric oxide, Iron(III) oxide				
Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 **OSHA PEL:** TWA 10 mg/m^3			**Measurement Methods (see Table 1):** **NIOSH** 7300, 7301, 7303, 9102 **OSHA** ID121, ID125G	
Physical Description: Reddish-brown solid. [**Note:** Exposure to fume may occur during the arc-welding of iron.]				
Chemical & Physical Properties: **MW:** 159.7 **BP:** ? **Sol:** Insoluble **Fl.P:** NA **IP:** NA **Sp.Gr:** 5.24 **VP:** 0 mmHg (approx) **MLT:** 2664°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **50 mg/m^3:** 95XQ/Sa **125 mg/m^3:** Sa:Cf/PaprHie **250 mg/m^3:** 100F/SaT:Cf/PaprTHie/ScbaF/SaF **2500 mg/m^3:** Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: Calcium hypochlorite				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh **SY:** Benign pneumoconiosis with X-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis) **TO:** Resp sys			**First Aid (see Table 6):** **Breath:** Resp support	

Iron pentacarbonyl (as Fe)	Formula: $Fe(CO)_5$	CAS#: 13463-40-6	RTECS#: NO4900000	IDLH: N.D.
Conversion: 1 ppm = 2.28 mg/m^3 (as Fe)	**DOT:** 1994 131			
Synonyms/Trade Names: Iron carbonyl, Pentacarbonyl iron				
Exposure Limits: **NIOSH REL:** TWA 0.1 ppm (0.23 mg/m^3) ST 0.2 ppm (0.45 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless to yellow to dark-red, oily liquid.				
Chemical & Physical Properties: **MW:** 195.9 **BP(749 mmHg):** 217°F **Sol:** Insoluble **Fl.P:** 5°F **IP:** ? **Sp.Gr:** 1.46-1.52 **VP(87°F):** 40 mmHg **FRZ:** -6°F **UEL:** ? **LEL:** ? Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Quick drench		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Oxidizers, nitrogen oxide, (zinc + cobalt halides) [**Note:** Pyrophoric (i.e., ignites spontaneously in air). Decomposed by light or air, releasing carbon monoxide.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, muc memb, resp sys; head, dizz, nau, vomit; fever, cyan, cough, dysp; liver, kidney, lung inj; degenerative changes in CNS **TO:** Eyes, resp sys, CNS, liver, kidneys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

Iron salts (soluble, as Fe)	Formula:	CAS#:	RTECS#:	IDLH: N.D.
Conversion:	**DOT:**			
Synonyms/Trade Names: **$FeSO_4$:** Ferrous sulfate, Iron(II) sulfate; **$FeCl_2$:** Ferrous chloride, Iron(II) chloride; **$Fe(NO_3)_3$:** Ferric nitrate, Iron(III) nitrate; **$Fe(SO_4)_3$:** Ferric sulfate, Iron(III) sulfate; **$FeCl_3$:** Ferric chloride, Iron (III) chloride				
Exposure Limits: **NIOSH REL:** TWA 1 mg/m^3 **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **NIOSH** 7300, 7301, 7303, 9102 **OSHA** ID121, ID125G	
Physical Description: Appearance and odor vary depending upon the specific soluble iron salt.				
Chemical & Physical Properties: Properties vary depending upon the specific soluble iron salt. Noncombustible Solids	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** Daily **Remove:** N.R. **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Varies				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; abdom pain, diarr, vomit; possible liver damage **TO:** Eyes, skin, resp sys, liver, GI tract			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed	

Isoamyl acetate	Formula: $CH_3COOCH_2CH_2CH(CH_3)_2$	CAS#: 123-92-2	RTECS#: NS9800000	IDLH: 1000 ppm
Conversion: 1 ppm = 5.33 mg/m^3	**DOT:** 1104 129			
Synonyms/Trade Names: Banana oil, Isopentyl acetate, 3-Methyl-1-butanol acetate, 3-Methylbutyl ester of acetic acid, 3-Methylbutyl ethanoate				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (525 mg/m^3) **OSHA PEL:** TWA 100 ppm (525 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1450 **OSHA** 7	
Physical Description: Colorless liquid with a banana-like odor.				
Chemical & Physical Properties: **MW:** 130.2 **BP:** 288°F **Sol:** 0.3% **Fl.P:** 77°F **IP:** ? **Sp.Gr:** 0.87 **VP:** 4 mmHg **FRZ:** -109°F **UEL:** 7.5% **LEL(212°F):** 1.0% Class IC Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **1000 ppm:** CcrOv/PaprOv/GmFOv/ Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat; derm; in animals: narco **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Isoamyl alcohol (primary)	Formula: $(CH_3)_2CHCH_2CH_2OH$	CAS#: 123-51-3	RTECS#: EL5425000	IDLH: 500 ppm
Conversion: 1 ppm = 3.61 mg/m^3	**DOT:** 1105 129			
Synonyms/Trade Names: Fermentation amyl alcohol, Fusel oil, Isobutyl carbinol, Isopentyl alcohol, 3-Methyl-1-butanol, Primary isoamyl alcohol				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (360 mg/m^3) ST 125 ppm (450 mg/m^3) **OSHA PEL†:** TWA 100 ppm (360 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1402, 1405	
Physical Description: Colorless liquid with a disagreeable odor.				
Chemical & Physical Properties: **MW:** 88.2 **BP:** 270°F **Sol(57°F):** 2% **Fl.P:** 109°F **IP:** ? **Sp.Gr(57°F):** 0.81 **VP:** 28 mmHg **FRZ:** -179°F **UEL(212°F):** 9.0% **LEL:** 1.2% Class II Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **500 ppm:** Sa:Cf£/CcrFOv/GmFOv/ PaprOv£/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat; head, dizz; cough, dysp, nau, vomit, diarr; skin cracking; in animals: narco **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Isoamyl alcohol (secondary)

Formula: $(CH_3)_2CHCH(OH)CH_3$ | **CAS#:** 6032-29-7 | **RTECS#:** SA4900000 | **IDLH:** 500 ppm

Conversion: 1 ppm = 3.61 mg/m^3 | **DOT:** 1105 129

Synonyms/Trade Names: 3-Methyl-2-butanol, Secondary isoamyl alcohol

Exposure Limits:
NIOSH REL: TWA 100 ppm (360 mg/m^3)
ST 125 ppm (450 mg/m^3)
OSHA PEL†: TWA 100 ppm (360 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1402

Physical Description: Colorless liquid with a disagreeable odor.

Chemical & Physical Properties:
MW: 88.2
BP: 234°F
Sol: ?
Fl.P(oc): 95°F
IP: ?
Sp.Gr: 0.82
VP: 1 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
500 ppm: Sa:Cf£/CcrFOv/GmFOv/PaprOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; head, dizz; cough, dysp, nau, vomit, diarr; skin cracking; in animals: narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Isobutane

Formula: $CH_3CH(CH_3)_2$ | **CAS#:** 75-28-5 | **RTECS#:** TZ4300000 | **IDLH:** N.D.

Conversion: 1 ppm = 2.38 mg/m^3 | **DOT:** 1075 115; 1969 115

Synonyms/Trade Names: 2-Methylpropane [**Note:** Also see specific listing for n-Butane.]

Exposure Limits:
NIOSH REL: TWA 800 ppm (1900 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a gasoline-like or natural gas odor.
[**Note:** Shipped as a liquefied compressed gas. A liquid below 11°F.]

Chemical & Physical Properties:
MW: 58.1
BP: 11°F
Sol: Slight
Fl.P: NA (Gas)
IP: 10.74 eV
RGasD: 2.06
VP(70°F): 3.1 atm
FRZ: -255°F
UEL: 8.4%
LEL: 1.6%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers (e.g., nitrates & perchlorates), chlorine, fluorine, (nickel carbonyl + oxygen)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Drow, narco, asphy; liquid: frostbite
TO: CNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Isobutyl acetate

Formula: $CH_3COOCH_2CH(CH_3)_2$ | **CAS#:** 110-19-0 | **RTECS#:** AI4025000 | **IDLH:** 1300 ppm [10%LEL]

Conversion: 1 ppm = 4.75 mg/m^3 | **DOT:** 1213 129

Synonyms/Trade Names: Isobutyl ester of acetic acid, 2-Methylpropyl acetate, 2-Methylpropyl ester of acetic acid, β-Methylpropyl ethanoate

Exposure Limits:
NIOSH REL: TWA 150 ppm (700 mg/m^3)
OSHA PEL: TWA 150 ppm (700 mg/m^3)

Physical Description: Colorless liquid with a fruity, floral odor.

Measurement Methods (see Table 1):
NIOSH 1450
OSHA 7

Chemical & Physical Properties:
MW: 116.2
BP: 243°F
Sol(77°F): 0.6%
FI.P: 64°F
IP: 9.97 eV
Sp.Gr: 0.87
VP: 13 mmHg
FRZ: -145°F
UEL: 10.5%
LEL: 1.3%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1300 ppm: Sa:Cf£/CcrFOv/GmFOv/PaprOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; head, drow, anes; in animals: narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Isobutyl alcohol

Formula: $(CH_3)_2CHCH_2OH$ | **CAS#:** 78-83-1 | **RTECS#:** NP9625000 | **IDLH:** 1600 ppm

Conversion: 1 ppm = 3.03 mg/m^3 | **DOT:** 1212 129

Synonyms/Trade Names: IBA, Isobutanol, Isopropylcarbinol, 2-Methyl-1-propanol

Exposure Limits:
NIOSH REL: TWA 50 ppm (150 mg/m^3)
OSHA PEL†: TWA 100 ppm (300 mg/m^3)

Physical Description: Colorless, oily liquid with a sweet, musty odor.

Measurement Methods (see Table 1):
NIOSH 1401, 1405
OSHA 7

Chemical & Physical Properties:
MW: 74.1
BP: 227°F
Sol: 10%
FI.P: 82°F
IP: 10.12 eV
Sp.Gr: 0.80
VP: 9 mmHg
FRZ: -162°F
UEL(202°F): 10.6%
LEL(123°F): 1.7%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
500 ppm: CcrOv*/Sa*
1250 ppm: Sa:Cf*/PaprOv*
1600 ppm: CcrFOv/GmFOv/PaprTOv*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, throat; head, drow; skin cracking; in animals: narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Isobutyronitrile

Formula:	CAS#:	RTECS#:	IDLH:
$(CH_3)_2CHCN$	78-82-0	TZ4900000	N.D.

Conversion: 1 ppm = 2.83 mg/m^3 **DOT:** 2284 131

Synonyms/Trade Names: Isopropyl cyanide, 2-Methylpropanenitrile, 2-Methylpropionitrile

Exposure Limits:
NIOSH REL: TWA 8 ppm (22 mg/m^3)
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 1606 (adapt)

Physical Description: Colorless liquid with an almond-like odor.
[**Note:** Forms cyanide in the body.]

Chemical & Physical Properties:
MW: 69.1
BP: 219°F
Sol: Slight
Fl.P: 47°F
IP: ?
Sp.Gr: 0.76
VP(130°F): 100 mmHg
FRZ: -97°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
80 ppm: CcrOv/Sa
200 ppm: Sa:Cf/PaprOv
400 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
1000 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids & bases

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; head, dizz, lass, conf, convuls; dysp; abdom pain, nau, vomit
TO: Eyes, skin, resp sys, CNS, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Isooctyl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
$C_7H_{15}CH_2OH$	26952-21-6	NS7700000	N.D.

Conversion: 1 ppm = 5.33 mg/m^3 **DOT:**

Synonyms/Trade Names: Isooctanol, Oxooctyl alcohol [**Note:** A mixture of closely related isomeric, primary alcohols with branched chains such as 2-Ethylhexanol, $CH_3(CH_2)_3CH(CH_2CH_3)CH_2OH$.]

Exposure Limits:
NIOSH REL: TWA 50 ppm (270 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2033

Physical Description: Clear, colorless liquid.

Chemical & Physical Properties:
MW: 130.3
BP: 367°F
Sol: Insoluble
Fl.P(oc): 180°F
IP: ?
Sp.Gr: 0.83
VP: 0.4 mmHg
FRZ: <-105°F
UEL(est.): 5.7%
LEL(calc.): 0.9%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; eye, skin burns
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Isophorone	Formula: $C_9H_{14}O$	CAS#: 78-59-1	RTECS#: GW7700000	IDLH: 200 ppm
Conversion: 1 ppm = 5.65 mg/m^3	**DOT:** 1993 128 (combustible liquid, n.o.s.)			
Synonyms/Trade Names: Isoacetophorone; 3,5,5-Trimethyl-2-cyclohexenone; 3,5,5-Trimethyl-2-cyclo-hexen-1-one				

Exposure Limits: **NIOSH REL:** TWA 4 ppm (23 mg/m^3) **OSHA PEL†:** TWA 25 ppm (140 mg/m^3) **Physical Description:** Colorless to white liquid with a peppermint-like odor.	**Measurement Methods (see Table 1):** **NIOSH** 2508, 2556 **OSHA** 7

Chemical & Physical Properties: **MW:** 138.2 **BP:** 419°F **Sol:** 1% **FI.P:** 184°F **IP:** 9.07 eV **Sp.Gr:** 0.92 **VP:** 0.3 mmHg **FRZ:** 17°F **UEL:** 3.8% **LEL:** 0.8% Class IIIA Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R. **Provide:** Eyewash	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **40 ppm:** CcrOv*/Sa* **100 ppm:** Sa:Cf*/PaprOv* **200 ppm:** CcrFOv/GmFOv/PaprTOv*/ SaT:Cf*/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, strong alkalis, amines

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, nose, throat; head, nau, dizz, lass, mal, narco; derm; in animals: kidney, liver damage **TO:** Eyes, skin, resp sys, CNS, liver, kidneys	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

Isophorone diisocyanate	Formula: $C_{12}H_{18}N_2O_2$	CAS#: 4098-71-9	RTECS#: NQ9370000	IDLH: N.D.
Conversion: 1 ppm = 9.09 mg/m^3	**DOT:** 2290 156			
Synonyms/Trade Names: IPDI; 3-Isocyanatomethyl-3,5,5-trimethylcyclohexyl-isocyanate; Isophorone diamine diisocyanate				

Exposure Limits: **NIOSH REL:** TWA 0.005 ppm (0.045 mg/m^3) [skin] ST 0.02 ppm (0.180 mg/m^3) **OSHA PEL†:** none **Physical Description:** Colorless to slightly yellow liquid with a pungent odor.	**Measurement Methods (see Table 1):** **NIOSH** 5525 **OSHA** PV2034

Chemical & Physical Properties: **MW:** 222.3 **BP:** ? **Sol:** Decomposes **FI.P:** 311°F **IP:** ? **Sp.Gr:** 1.06 **VP:** 0.0003 mmHg **FRZ:** -76°F **UEL:** ? **LEL:** ? Class IIIB Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Quick drench	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **0.05 ppm:** Sa* **0.125 ppm:** Sa:Cf* **0.25 ppm:** ScbaF/SaF **1 ppm**: SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Water, alcohols, phenols, amines, mercaptans, amides, urethanes, ureas [**Note:** Reacts with water to form carbon dioxide.]

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, resp sys; chest tight, dysp, cough, sore throat; bron, wheez, pulm edema; possible resp sens, asthma **TO:** Eyes, skin, resp sys	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed

2-Isopropoxyethanol	Formula: $(CH_3)_2CHOCH_2CH_2OH$	CAS#: 109-59-1	RTECS#: KL5075000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Ethylene glycol isopropyl ether, β-Hydroxyethyl isopropyl ether, Isopropyl Cellosolve®, Isopropyl glycol

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a mild, ethereal odor.

Chemical & Physical Properties:
MW: 104.2
BP: 283°F
Sol: Miscible
Fl.P(oc): 92°F
IP: ?
Sp.Gr: 0.90
VP: 3 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: irrit eyes, skin; hema, anemia, pulm edema
TO: Eyes, skin, resp sys, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Isopropyl acetate	Formula: $CH_3COOCH(CH_3)_2$	CAS#: 108-21-4	RTECS#: AI4930000	IDLH: 1800 ppm
Conversion: 1 ppm = 4.18 mg/m^3	**DOT:** 1220 129			

Synonyms/Trade Names: Isopropyl ester of acetic acid, 1-Methylethyl ester of acetic acid, 2-Propyl acetate

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 250 ppm (950 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1454, 1460
OSHA 7

Physical Description: Colorless liquid with a fruity odor.

Chemical & Physical Properties:
MW: 102.2
BP: 194°F
Sol: 3%
Fl.P: 36°F
IP: 9.95 eV
Sp.Gr: 0.87
VP: 42 mmHg
FRZ: -92°F
UEL: 8%
LEL(100°F): 1.8%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
1800 ppm: Sa:Cf£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; derm; in animals: narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Isopropyl alcohol	Formula: $(CH_3)_2CHOH$	CAS#: 67-63-0	RTECS#: NT8050000	IDLH: 2000 ppm [10%LEL]
Conversion: 1 ppm = 2.46 mg/m^3	**DOT:** 1219 129			
Synonyms/Trade Names: Dimethyl carbinol, IPA, Isopropanol, 2-Propanol, sec-Propyl alcohol, Rubbing alcohol				

Exposure Limits:
NIOSH REL: TWA 400 ppm (980 mg/m^3)
ST 500 ppm (1225 mg/m^3)
OSHA PEL†: TWA 400 ppm (980 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1400
OSHA 109

Physical Description: Colorless liquid with the odor of rubbing alcohol.

Chemical & Physical Properties:
MW: 60.1
BP: 181°F
Sol: Miscible
Fl.P: 53°F
IP: 10.10 eV
Sp.Gr: 0.79
VP: 33 mmHg
FRZ: -127°F
UEL(200°F): 12.7%
LEL: 2.0%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: Sa:Cf£/CcrFOv/GmFOv/
PaprOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acetaldehyde, chlorine, ethylene oxide, acids, isocyanates

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat; drow, dizz, head; dry cracking skin; in animals: narco
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

Isopropylamine	Formula: $(CH_3)_2CHNH_2$	CAS#: 75-31-0	RTECS#: NT8400000	IDLH: 750 ppm
Conversion: 1 ppm = 2.42 mg/m^3	**DOT:** 1221 132			
Synonyms/Trade Names: 2-Aminopropane, Monoisopropylamine, 2-Propylamine, sec-Propylamine				

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 5 ppm (12 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S147 (II-3)

Physical Description: Colorless liquid with an ammonia-like odor.
[**Note:** A gas above 91°F.]

Chemical & Physical Properties:
MW: 59.1
BP: 91°F
Sol: Miscible
Fl.P(oc): -35°F
IP: 8.72 eV
Sp.Gr: 0.69
VP: 460 mmHg
FRZ: -150°F
UEL: ?
LEL: ?
Class IA Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
OSHA
125 ppm: Sa:Cf£/PaprS£
250 ppm: CcrFS/GmFS/PaprTS£/
ScbaF/SaF
750 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong acids, strong oxidizers, aldehydes, ketones, epoxides

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; pulm edema; vis dist; eye, skin burns; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

N-Isopropylaniline	Formula: $C_6H_5NHCH(CH_3)_2$	CAS#: 768-52-5	RTECS#: BY4190000	IDLH: N.D.
Conversion: 1 ppm = 5.53 mg/m^3	DOT:			
Synonyms/Trade Names: N-IPA, Isopropylaniline, N-(1-Methylethyl)-benzenamine, N-Phenylisopropylamine				
Exposure Limits: NIOSH REL: TWA 2 ppm (10 mg/m^3) [skin] OSHA PEL†: none			Measurement Methods (see Table 1): OSHA 78	
Physical Description: Clear, yellowish liquid with a sweet, aromatic odor.				
Chemical & Physical Properties: MW: 135.2 BP: 397°F Sol: ? Fl.P(oc): 190°F IP: ? Sp.Gr(60°F): 0.93 VP(77°F): 0.03 mmHg FRZ: -58°F UEL: ? LEL: ? Class IIIB Combustible Liquid	Personal Protection/Sanitation (see Table 2): Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam Remove: When wet or contam Change: N.R. Provide: Quick drench		Respirator Recommendations (see Tables 3 and 4): Not available.	
Incompatibilities and Reactivities: None reported				
Exposure Routes, Symptoms, Target Organs (see Table 5): ER: Inh, Abs, Ing, Con SY: Irrit eyes, skin; head, lass, dizz; cyan; ataxia; dysp on effort; tacar; methemo TO: Eyes, skin, resp sys, blood, CVS, liver, kidneys	First Aid (see Table 6): Eye: Irr immed Skin: Soap wash prompt Breath: Resp support Swallow: Medical attention immed			

Isopropyl ether	Formula: $(CH_3)_2CHOCH(CH_3)_2$	CAS#: 108-20-3	RTECS#: TZ5425000	IDLH: 1400 ppm [10%LEL]
Conversion: 1 ppm = 4.18 mg/m^3	DOT: 1159 127			
Synonyms/Trade Names: Diisopropyl ether, Diisopropyl oxide, 2-Isopropoxy propane				
Exposure Limits: NIOSH REL: TWA 500 ppm (2100 mg/m^3) OSHA PEL: TWA 500 ppm (2100 mg/m^3)			Measurement Methods (see Table 1): NIOSH 1618 OSHA 7	
Physical Description: Colorless liquid with a sharp, sweet, ether-like odor.				
Chemical & Physical Properties: MW: 102.2 BP: 154°F Sol: 0.2% Fl.P: -18°F IP: 9.20 eV Sp.Gr: 0.73 VP: 119 mmHg FRZ: -76°F UEL: 7.9% LEL: 1.4% Class IB Flammable Liquid	Personal Protection/Sanitation (see Table 2): Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam Remove: When wet (flamm) Change: N.R.		Respirator Recommendations (see Tables 3 and 4): NIOSH/OSHA 1400 ppm: CcrOv*/PaprOv*/GmFOv/Sa*/ScbaF §: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba Escape: GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers, acids [Note: Unstable peroxides may form on long contact with air.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): ER: Inh, Ing, Con SY: Irrit eyes, skin, nose; resp discomfort; derm; in animals: drow, dizz, uncon, narco TO: Eyes, skin, resp sys, CNS	First Aid (see Table 6): Eye: Irr immed Skin: Soap wash prompt Breath: Resp support Swallow: Medical attention immed			

Isopropyl glycidyl ether

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_{12}O_2$	4016-14-2	TZ3500000	400 ppm

Conversion: 1 ppm = 4.75 mg/m^3 **DOT:**

Synonyms/Trade Names: 1,2-Epoxy-3-isopropoxypropane; IGE; Isopropoxymethyl oxirane

Exposure Limits:
NIOSH REL: C 50 ppm (240 mg/m^3) [15-minute]
OSHA PEL†: TWA 50 ppm (240 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1620
OSHA 7

Physical Description: Colorless liquid.

Chemical & Physical Properties:
MW: 116.2
BP: 279°F
Sol: 19%
FI.P: 92°F
IP: ?
Sp.Gr: 0.92
VP(77°F): 9 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
400 ppm: Sa:Cf£/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong caustics
[**Note:** May form explosive peroxides upon exposure to air or light.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; skin sens; possible hemato, repro effects
TO: Eyes, skin, resp sys, blood, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Kaolin

Formula:	CAS#:	RTECS#:	IDLH:
	1332-58-7	GF1670500	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: China clay, Clay, Hydrated aluminum silicate, Hydrite, Porcelain clay
[**Note:** Main constituent of Kaolin is Kaolinite ($Al_2Si_2O_5(OH)_4$).]

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: White to yellowish or grayish powder.
[**Note:** When moistened, darkens & develops a clay-like odor.]

Chemical & Physical Properties:
MW: varies
BP: ?
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 1.8-2.6
VP: 0 mmHg (approx)
MLT: ?
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Chronic pulm fib, stomach granuloma
TO: Resp sys, stomach

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Kepone

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}Cl_{10}O$	143-50-0	PC8575000	Ca [N.D.]

Conversion: **DOT:**

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:
NIOSH REL: Ca
TWA 0.001 mg/m^3
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 5508

Physical Description: Tan to white, crystalline, odorless solid. [insecticide]

Chemical & Physical Properties:
MW: 490.6
BP: Sublimes
Sol(212°F): 0.5%
Fl.P: NA
IP: ?
Sp.Gr: ?
VP(77°F): 3 x 10^{-7} mmHg
MLT: 662°F (Sublimes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Acids, acid fumes

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, anxi, tremor; liver, kidney damage; vis dist; ataxia, chest pain, skin eryt; testicular atrophy, low sperm count; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys, repro sys [in animal: liver cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Kerosene

Formula:	CAS#:	RTECS#:	IDLH:
	8008-20-6	OA5500000	N.D.

Conversion: **DOT:** 1223 128

Synonyms/Trade Names: Fuel Oil No. 1, Range oil
[**Note:** A refined petroleum solvent (predominantly C_9-C_{16}), which typically is 25% normal paraffins, 11% branched paraffins, 30% monocycloparaffins, 12% dicycloparaffins, 1% tricycloparaffins, 16% mononuclear aromatics, and 5% dinuclear aromatics.]

Exposure Limits:
NIOSH REL: TWA 100 mg/m^3
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 1550

Physical Description: Colorless to yellowish, oily liquid with a strong, characteristic odor.

Chemical & Physical Properties:
MW: 170 (approx)
BP: 347-617°F
Sol: Insoluble
Fl.P: 100-162°F
IP: ?
Sp.Gr: 0.81
VP(100°F): 5 mmHg
FRZ: -50°F
UEL: 5%
LEL: 0.7%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1000 mg/m^3: CcrOv/Sa
2500 mg/m^3: Sa:Cf/PaprOv
5000 mg/m^3: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; burning sensation in chest; head, nau, lass, restless, inco, conf, drow; vomit, diarr; derm; chemical pneu (aspir liquid)
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Ketene	**Formula:** CH_2=CO	**CAS#:** 463-51-4	**RTECS#:** OA7700000	**IDLH:** 5 ppm
Conversion: 1 ppm = 1.72 mg/m^3	**DOT:**			
Synonyms/Trade Names: Carbomethene, Ethenone, Keto-ethylene				

Exposure Limits:
NIOSH REL: TWA 0.5 ppm (0.9 mg/m^3)
ST 1.5 ppm (3 mg/m^3)
OSHA PEL†: TWA 0.5 ppm (0.9 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S92 (II-2)

Physical Description: Colorless gas with a penetrating odor.

Chemical & Physical Properties:
MW: 42.0
BP: -69°F
Sol: Reacts
Fl.P: NA (Gas)
IP: 9.61 eV
RGasD: 1.45
VP: >1 atm
FRZ: -238°F
UEL: ?
LEL: ?
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 ppm: Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Water, alcohols, ammonia
[**Note:** Readily polymerizes. Reacts with water to form acetic acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, nose, throat, resp sys; pulm edema
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Breath: Resp support

L

Lead	**Formula:** Pb	**CAS#:** 7439-92-1	**RTECS#:** OF7525000	**IDLH:** 100 mg/m^3 (as Pb)
Conversion:	**DOT:**			
Synonyms/Trade Names: Lead metal, Plumbum				

Exposure Limits:
NIOSH REL*: TWA 0.050 mg/m^3
See Appendix C
OSHA PEL*: [1910.1025] TWA 0.050 mg/m^3
See Appendix C
[***Note:** The REL and PEL also apply to other lead compounds (as Pb) -- see Appendix C.]

Measurement Methods (see Table 1):
NIOSH 7082, 7105, 7300, 7301, 7303, 7700, 7701, 7702, 9102, 9105
OSHA ID121, ID125G, ID206

Physical Description: A heavy, ductile, soft, gray solid.

Chemical & Physical Properties:
MW: 207.2
BP: 3164°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 11.34
VP: 0 mmHg (approx)
MLT: 621°F
UEL: NA
LEL: NA
Noncombustible Solid in bulk form.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.5 mg/m^3: 100XQ/Sa
1.25 mg/m^3: Sa:Cf/PaprHie
2.5 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
50 mg/m^3: Sa:Pd,Pp
100 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers, hydrogen peroxide, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Lass, insom; facial pallor; anor, low-wgt, malnut; constip, abdom pain, colic; anemia; gingival lead line; tremor; para wrist, ankles; encephalopathy; kidney disease; irrit eyes; hypotension
TO: Eyes, GI tract, CNS, kidneys, blood, gingival tissue

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush prompt
Breath: Resp support
Swallow: Medical attention immed

Limestone

Formula: $CaCO_3$ | **CAS#:** 1317-65-3 | **RTECS#:** | **IDLH:** N.D.

Conversion: | **DOT:**

Synonyms/Trade Names: Calcium carbonate, Natural calcium carbonate
[**Note:** Calcite & aragonite are commercially important natural calcium carbonates.]

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Odorless, white to tan powder.

Chemical & Physical Properties:
MW: 100.1
BP: Decomposes
Sol: 0.001%
Fl.P: NA
IP: NA
Sp.Gr: 2.7-2.9
VP: 0 mmHg (approx)
MLT: 1517-2442°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Fluorine, magnesium, acids, alum, ammonium salts

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, muc memb; cough, sneez, rhin; lac
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air

Lindane

Formula: $C_6H_6Cl_6$ | **CAS#:** 58-89-9 | **RTECS#:** GV4900000 | **IDLH:** 50 mg/m^3

Conversion: | **DOT:** 2761 151

Synonyms/Trade Names: BHC; HCH; γ-Hexachlorocyclohexane; gamma isomer of 1,2,3,4,5,6-Hexachlorocyclohexane

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3 [skin]
OSHA PEL: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5502

Physical Description: White to yellow, crystalline powder with a slight, musty odor. [pesticide]

Chemical & Physical Properties:
MW: 290.8
BP: 614°F
Sol: 0.001%
Fl.P: NA
IP: ?
Sp.Gr: 1.85
VP: 0.00001 mmHg
MLT: 235°F
UEL: NA
LEL: NA
Noncombustible Solid, but may be dissolved in flammable liquids.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: CcrOv95/Sa
12.5 mg/m^3: Sa:Cf*/PaprOvHie*
25 mg/m^3: CcrFOv100/GmFOv100/PaprTOvHie*/ScbaF/SaF
50 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Corrosive to metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; head; nau; clonic convuls; resp difficulty; cyan; aplastic anemia; musc spasm; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, CNS, blood, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Lithium hydride	Formula: LiH	CAS#: 7580-67-8	RTECS#: OJ6300000	IDLH: 0.5 mg/m^3
Conversion:	**DOT:** 1414 138; 2805 138 (fused, solid)			

Synonyms/Trade Names: Lithium monohydride

Exposure Limits: **NIOSH REL:** TWA 0.025 mg/m^3 **OSHA PEL:** TWA 0.025 mg/m^3	**Measurement Methods (see Table 1):** **OSHA** ID121
Physical Description: Odorless, off-white to gray, translucent, crystalline mass or white powder.	

Chemical & Physical Properties: **MW:** 7.95 **BP:** Decomposes **Sol:** Reacts **Fl.P:** NA **IP:** NA **Sp.Gr:** 0.78 **VP:** 0 mmHg (approx) **MLT:** 1256°F **UEL:** NA **LEL:** NA Combustible Solid that can form airborne dust clouds which may explode on contact with flame, heat, or oxidizers.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** Brush (DO NOT WASH) **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench (>0.5 mg/m^3)	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.25 mg/m^3:** 100XQ/Sa **0.5 mg/m^3:** Sa:Cf*/100F/PaprHie*/ ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin; eye, skin burns; mouth, esophagus burns (if ingested); nau; musc twitches; mental conf; blurred vision **TO:** Eyes, skin, resp sys, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Brush (DO NOT WASH) **Breath:** Resp support **Swallow:** Medical attention immed

L

L.P.G.	Formula: $C_3H_8/C_3H_6/C_4H_{10}/C_4H_8$	CAS#: 68476-85-7	RTECS#: SE7545000	IDLH: 2000 ppm [10%LEL]
Conversion: 1 ppm = 1.72-2.37 mg/m^3	**DOT:** 1075 115			

Synonyms/Trade Names: Bottled gas, Compressed petroleum gas, Liquefied hydrocarbon gas, Liquefied petroleum gas, LPG [**Note:** A fuel mixture of propane, propylene, butanes & butylenes.]

Exposure Limits: **NIOSH REL:** TWA 1000 ppm (1800 mg/m^3) **OSHA PEL:** TWA 1000 ppm (1800 mg/m^3)	**Measurement Methods (see Table 1):** **NIOSH** S93 (II-2)
Physical Description: Colorless, noncorrosive, odorless gas when pure. [**Note:** A foul-smelling odorant is usually added. Shipped as a liquefied compressed gas.]	

Chemical & Physical Properties: **MW:** 42-58 **BP:** >-44°F **Sol:** Insoluble **Fl.P:** NA (Gas) **IP:** 10.95 eV **RGasD:** 1.45-2.00 **VP:** >1 atm **FRZ:** ? **UEL:** 9.5% (Propane) 8.5% (Butane) **LEL:** 2.1% (Propane) 1.9% (Butane) Flammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** Frostbite **Eyes:** Frostbite **Wash skin:** N.R. **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Frostbite wash	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **2000 ppm:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** ScbaE

Incompatibilities and Reactivities: Strong oxidizers, chlorine dioxide

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con (liquid) **SY:** Dizz, drow, asphy; liquid: frostbite **TO:** Resp sys, CNS	**First Aid (see Table 6):** **Eye:** Irr immed (liquid) **Skin:** Water flush immed (liquid) **Breath:** Resp support

Magnesite

Formula:	CAS#:	RTECS#:	IDLH:
$MgCO_3$	546-93-0	OM2470000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Carbonate magnesium, Hydromagnesite, Magnesium carbonate, Magnesium(II) carbonate [**Note:** Magnesite is a naturally-occurring form of magnesium carbonate.]

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: White, odorless, crystalline powder.

Chemical & Physical Properties:
MW: 84.3
BP: Decomposes
Sol: 0.01%
Fl.P: NA
IP: NA
Sp.Gr: 2.96
VP: 0 mmHg (approx)
MLT: 662°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Acids, formaldehyde

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys; cough
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Magnesium oxide fume

Formula:	CAS#:	RTECS#:	IDLH:
MgO	1309-48-4	OM3850000	750 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: Magnesia fume

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 15 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303
OSHA ID121

Physical Description: Finely divided white particulate dispersed in air.
[**Note:** Exposure may occur when magnesium is burned, thermally cut, or welded upon.]

Chemical & Physical Properties:
MW: 40.3
BP: 6512°F
Sol(86°F): 0.009%
Fl.P: NA
IP: NA
Sp.Gr: 3.58
VP: 0 mmHg (approx)
MLT: 5072°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
150 mg/m^3: 95XQ/Sa
375 mg/m^3: Sa:Cf/PaprHie
750 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Chlorine trifluoride, phosphorus pentachloride

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, nose; metal fume fever: cough, chest pain, flu-like fever
TO: Eyes, resp sys

First Aid (see Table 6):
Breath: Resp support

Malathion

Formula: $C_{10}H_{19}O_6PS_2$ | **CAS#:** 121-75-5 | **RTECS#:** WM8400000 | **IDLH:** 250 mg/m^3

Conversion: **DOT:** 2783 152

Synonyms/Trade Names: S-[1,2-bis(ethoxycarbonyl) ethyl]O,O-dimethyl-phosphorodithioate; Diethyl (dimethoxyphosphinothioylthio) succinate

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 [skin]
OSHA PEL†: TWA 15 mg/m^3 [skin]

Physical Description: Deep-brown to yellow liquid with a garlic-like odor. [insecticide] [**Note:** A solid below 37°F.]

Measurement Methods (see Table 1):
NIOSH 5600
OSHA 62

Chemical & Physical Properties:
MW: 330.4
BP: 140°F (Decomposes)
Sol: 0.02%
Fl.P(oc): >325°F
IP: ?
Sp.Gr: 1.21
VP: 0.00004 mmHg
FRZ: 37°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid, but may be difficult to ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
100 mg/m^3: CcrOv95/Sa
250 mg/m^3: Sa:Cf*/CcrFOv100/GmFOv100/PaprOvHie*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, magnesium, alkaline pesticides [**Note:** Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; miosis, aching eyes, blurred vision, lac; salv; anor, nau, vomit, abdom cramps, diarr, dizz, conf, ataxia; rhin, head; chest tight, wheez, lar spasm
TO: Eyes, skin, resp sys, liver, blood chol, CNS, CVS, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Maleic anhydride

Formula: $C_4H_2O_3$ | **CAS#:** 108-31-6 | **RTECS#:** ON3675000 | **IDLH:** 10 mg/m^3

Conversion: 1 ppm = 4.01 mg/m^3 **DOT:** 2215 156

Synonyms/Trade Names: cis-Butenedioic anhydride; 2,5-Furanedione; Maleic acid anhydride; Toxilic anhydride

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3 (0.25 ppm)
OSHA PEL: TWA 1 mg/m^3 (0.25 ppm)

Physical Description: Colorless needles, white lumps, or pellets with an irritating, choking odor.

Measurement Methods (see Table 1):
NIOSH 3512
OSHA 25, 86

Chemical & Physical Properties:
MW: 98.1
BP: 396°F
Sol: Reacts
Fl.P: 218°F
IP: 9.90 eV
Sp.Gr: 1.48
VP: 0.2 mmHg
MLT: 127°F
UEL: 7.1%
LEL: 1.4%
Combustible Solid, but may be difficult to ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 mg/m^3: Sa:Cf£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, water, alkalis, metals, caustics, and amines above 150°F
[**Note:** Reacts slowly with water (hydrolyzes) to form maleic acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit nose, upper resp sys; conj; photo, double vision; bronchial asthma; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Malonaldehyde

Formula: $CHOCH_2CHO$ | **CAS#:** 542-78-9 | **RTECS#:** TX6475000 | **IDLH:** Ca [N.D.]

Conversion: | **DOT:**

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:
NIOSH REL: Ca
See Appendix A
See Appendix C (Aldehydes)
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Solid (needles).

Chemical & Physical Properties:
MW: 72.1
BP: ?
Sol: ?
Fl.P: ?
IP: ?
Sp.Gr: ?
VP: ?
MLT: 161°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Proteins
[**Note:** Pure compound is stable under neutral conditions, but not under acidic conditions.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; CNS depres; [carc]
TO: Eyes, skin, resp sys, CNS [in animals: thyroid gland tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Malononitrile

Formula: $NCCH_2CN$ | **CAS#:** 109-77-3 | **RTECS#:** OO3150000 | **IDLH:** N.D.

Conversion: 1 ppm = 2.70 mg/m^3 | **DOT:** 2647 153

Synonyms/Trade Names: Cyanoacetonitrile, Dicyanomethane, Malonic dinitrile

Exposure Limits:
NIOSH REL: TWA 3 ppm (8 mg/m^3)
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH Nitriles Criteria Document

Physical Description: White powder or colorless crystals.
[**Note:** Melts above 90°F. Forms cyanide in the body.]

Chemical & Physical Properties:
MW: 66.1
BP: 426°F
Sol: 13%
Fl.P(oc): 266°F
IP: 12.88 eV
Sp.Gr: 1.19
VP: ?
MLT: 90°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
80 mg/m^3: Sa
200 mg/m^3: Sa:Cf
400 mg/m^3: ScbaF/SaF
667 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong bases [**Note:** May polymerize violently on prolonged heating at 265°F, or in contact with strong bases at lower temperatures.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; head, dizz, lass, conf, convuls; dysp; abdom pain, nau, vomit
TO: Eyes, skin, resp sys, CNS, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Manganese compounds and fume (as Mn)

Formula: Mn (metal) | **CAS#:** 7439-96-5 (metal) | **RTECS#:** OO9275000 (metal) | **IDLH:** 500 mg/m^3 (as Mn)

Conversion: | **DOT:**

Synonyms/Trade Names: **Manganese metal:** Colloidal manganese, Manganese-55
Synonyms of other compounds vary depending upon the specific manganese compound.

Exposure Limits:
NIOSH REL*: TWA 1 mg/m^3
ST 3 mg/m^3
[***Note:** Also see specific listings for Manganese cyclopentadienyl tricarbonyl, Methyl cyclopentadienyl manganese tricarbonyl, and Manganese tetroxide.]
OSHA PEL*: C 5 mg/m^3
[***Note:** Also see specific listings for Manganese cyclopentadienyl tricarbonyl and Methyl cyclopentadienyl manganese tricarbonyl.]

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Physical Description: A lustrous, brittle, silvery solid.

Chemical & Physical Properties:
MW: 54.9
BP: 3564°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 7.20 (metal)
VP: 0 mmHg (approx)
MLT: 2271°F
UEL: NA
LEL: NA
Metal: Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 mg/m^3: 95XQ/Sa
25 mg/m^3: Sa:Cf/PaprHie
50 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
500 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Oxidizers
[**Note:** Will react with water or steam to produce hydrogen.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing
SY: Parkinson's; asthenia, insom, mental conf; metal fume fever: dry throat, cough, chest tight, dysp, rales, flu-like fever; low-back pain; vomit; mal; lass; kidney damage
TO: Resp sys, CNS, blood, kidneys

First Aid (see Table 6):
Breath: Resp support
Swallow: Medical attention immed

M

Manganese cyclopentadienyl tricarbonyl (as Mn)

Formula: $C_5H_5Mn(CO)_3$ | **CAS#:** 12079-65-1 | **RTECS#:** OO9720000 | **IDLH:** N.D.

Conversion: | **DOT:**

Synonyms/Trade Names: Cyclopentadienylmanganese tricarbonyl, Cyclopentadienyl tricarbonyl manganese, MCT

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL†: C 5 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Yellow, crystalline solid with a characteristic odor.
[**Note:** An antiknock additive for gasoline. May be found in an oil & gaseous solution.]

Chemical & Physical Properties:
MW: 204.1
BP: Sublimes
Sol: Slight
FI.P: ?
IP: ?
Sp.Gr: ?
VP: ?
MLT: 167°F (Sublimes)
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxygen

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: irrit skin; pulm edema; convuls; CNS, resp sys, kidney changes; decr resistance to infection
TO: Skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Manganese tetroxide (as Mn)

Formula:	CAS#:	RTECS#:	IDLH:
Mn_3O_4	1317-35-7	OP0895000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Manganese oxide, Manganomanganic oxide, Trimanganese tetraoxide, Trimanganese tetroxide

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: C 5 mg/m^3

Physical Description: Brownish-black powder.
[**Note:** Fumes are generated whenever manganese oxides are heated strongly in air.]

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Chemical & Physical Properties:
MW: 228.8
BP: ?
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 4.88
VP: 0 mmHg (approx)
MLT: 2847°F
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Soluble in hydrochloric acid (liberates chlorine gas)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Asthenia, insom, mental conf; low-back pain; vomit; mal, lass; kidney damage; pneu
TO: Resp sys, CNS, blood, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Marble

Formula:	CAS#:	RTECS#:	IDLH:
$CaCO_3$	1317-65-3	EV9580000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Calcium carbonate, Natural calcium carbonate
[**Note:** Marble is a metamorphic form of calcium carbonate.]

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Physical Description: Odorless, white powder.

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Chemical & Physical Properties:
MW: 100.1
BP: Decomposes
Sol: 0.001%
Fl.P: NA
IP: NA
Sp.Gr: 2.7-2.9
VP: 0 mmHg (approx)
MLT: 1517-2442°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Fluorine, magnesium, acids, alum, ammonium salts

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, muc memb, upper resp sys; cough, sneez, rhin; lac
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air

Mercury compounds [except (organo) alkyls] (as Hg)

Formula: Hg (metal) | **CAS#:** 7439-97-6 (metal) | **RTECS#:** OV4550000 (metal) | **IDLH:** 10 mg/m^3 (as Hg)

Conversion: | **DOT:** 2809 172 (metal)

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/m^3 [skin]
Other: C 0.1 mg/m^3 [skin]
OSHA PEL†: C 0.1 mg/m^3

Measurement Methods (see Table 1):
NIOSH 6009 **OSHA** ID140

Physical Description: Metal: Silver-white, heavy, odorless liquid.
[**Note:** "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.]

Chemical & Physical Properties:
MW: 200.6
BP: 674°F
Sol: Insoluble
FI.P: NA
IP: ?
Sp.Gr: 13.6 (metal)
VP: 0.0012 mmHg
FRZ: -38°F
UEL: NA
LEL: NA
Metal: Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Incompatibilities and Reactivities: Acetylene, ammonia, chlorine dioxide, azides, calcium (amalgam formation), sodium carbide, lithium, rubidium, copper

Respirator Recommendations (see Tables 3 and 4):
Mercury vapor:
NIOSH
0.5 mg/m^3: CcrS†/Sa
1.25 mg/m^3: Sa:Cf/PaprS†(canister)
2.5 mg/m^3: CcrFS†/GmFS†/SaT:Cf/PaprTS(canister)/ScbaF/SaF
10 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Other mercury compounds:
NIOSH/OSHA
1 mg/m^3: CcrS†/Sa
2.5 mg/m^3: Sa:Cf/PaprS†(canister)
5 mg/m^3: CcrFS†/GmFS†/SaT:Cf/PaprTS(canister)/ScbaF/SaF
10 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; cough, chest pain, dysp, bron, pneu; tremor, insom, irrity, indecision, head, lass; stomatitis, salv; GI dist, anor, low-wgt; prot
TO: Eyes, skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Mercury (organo) alkyl compounds (as Hg)

Formula: | **CAS#:** | **RTECS#:** | **IDLH:** 2 mg/m^3 (as Hg)

Conversion: | **DOT:**

Synonyms/Trade Names: Synonyms vary depending upon the specific (organo) alkyl mercury compound.

Exposure Limits:
NIOSH REL: TWA 0.01 mg/m^3
ST 0.03 mg/m^3 [skin]
OSHA PEL†: TWA 0.01 mg/m^3
C 0.04 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Appearance and odor vary depending upon the specific (organo) alkyl mercury compound.

Chemical & Physical Properties:
Properties vary depending upon the specific (organo) alkyl mercury compound.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.1 mg/m^3: Sa
0.25 mg/m^3: Sa:Cf
0.5 mg/m^3: SaT:Cf/ScbaF/SaF
2 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and Reactivities: Strong oxidizers such as chlorine

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Pares; ataxia, dysarthria; vision, hearing dist; spasticity, jerking limbs; dizz; salv; lac; nau, vomit, diarr, constip; skin burns; emotional dist; kidney inj; possible terato effects
TO: Eyes, skin, CNS, PNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Mesityl oxide

Formula: $(CH_3)_2C=CHCOCH_3$ | **CAS#:** 141-79-7 | **RTECS#:** SB4200000 | **IDLH:** 1400 ppm [10%LEL]

Conversion: 1 ppm = 4.02 mg/m^3 | **DOT:** 1229 129

Synonyms/Trade Names: Isobutenyl methyl ketone, Isopropylideneacetone, Methyl isobutenyl ketone, 4-Methyl-3-penten-2-one

Exposure Limits:
NIOSH REL: TWA 10 ppm (40 mg/m^3)
OSHA PEL†: TWA 25 ppm (100 mg/m^3)

Physical Description: Oily, colorless to light-yellow liquid with a peppermint- or honey-like odor.

Measurement Methods (see Table 1):
NIOSH 1301, 2553
OSHA 7

Chemical & Physical Properties:
MW: 98.2
BP: 266°F
Sol: 3%
Fl.P: 87°F
IP: 9.08 eV
Sp.Gr(59°F): 0.86
VP: 9 mmHg
FRZ: -52°F
UEL: 7.2%
LEL: 1.4%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
250 ppm: Sa:Cf£/PaprOv£
500 ppm: CcrFOv/GmFOv/PaprTOv£/ ScbaF/SaF
1400 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; narco, coma; in animals: liver, kidney damage; CNS effects
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

M

Methacrylic acid

Formula: $CH_2=C(CH_3)COOH$ | **CAS#:** 79-41-4 | **RTECS#:** OZ2975000 | **IDLH:** N.D.

Conversion: 1 ppm = 3.52 mg/m^3 | **DOT:** 2531 153P (inhibited)

Synonyms/Trade Names: Methacrylic acid (glacial), Methacrylic acid (inhibited), α-Methacrylic acid, 2-Methylacrylic acid, 2-Methylpropenoic acid

Exposure Limits:
NIOSH REL: TWA 20 ppm (70 mg/m^3) [skin]
OSHA PEL†: none

Physical Description: Colorless liquid or solid (below 61°F) with an acrid, repulsive odor.

Measurement Methods (see Table 1):
OSHA PV2005

Chemical & Physical Properties:
MW: 86.1
BP: 325°F
Sol(77°F): 9%
Fl.P(oc): 171°F
IP: ?
Sp.Gr: 1.02 (Liquid)
VP: 0.7 mmHg
FRZ: 61°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, elevated temperatures, hydrochloric acid
[**Note:** Typically contains 100 ppm of the monomethyl ether of hydroquinone to prevent polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; eye, skin burns
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Methomyl	Formula: $CH_3C(SCH_3)NOC(O)NHCH_3$	CAS#: 16752-77-5	RTECS#: AK2975000	IDLH: N.D.
Conversion:	**DOT:** 2757 151 (carbamate pesticide, solid, toxic)			
Synonyms/Trade Names: Lannate®, Methyl N-((methylamino)carbonyl)oxy)ethanimidothioate, S-Methyl-N-(methylcarbamoyloxy)thioacetimidate				
Exposure Limits: **NIOSH REL:** TWA 2.5 mg/m^3 **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **NIOSH** 5601	
Physical Description: White, crystalline solid with a slight, sulfur-like odor. [insecticide]				
Chemical & Physical Properties: **MW:** 162.2 **BP:** ? **Sol(77°F):** 6% **FI.P:** NA **IP:** ? **Sp.Gr(75°F):** 1.29 **VP(77°F):** 0.00005 mmHg **MLT:** 172°F **UEL:** NA **LEL:** NA Noncombustible Solid, but may be dissolved in flammable liquids.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Quick drench		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Strong bases				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes; blurred vision, miosis; salv; abdom cramps, nau, vomit; dysp; lass, musc twitch; liver, kidney damage **TO:** Eyes, resp sys, CNS, CVS, liver, kidneys, blood chol		**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed		

M

Methoxychlor	Formula: $(C_6H_4OCH_3)_2CHCCl_3$	CAS#: 72-43-5	RTECS#: KJ3675000	IDLH: Ca [5000 mg/m^3]
Conversion:	**DOT:** 2761 151 (organochlorine pesticide, solid, toxic)			
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				
Exposure Limits: **NIOSH REL:** Ca See Appendix A **OSHA PEL†:** TWA 15 mg/m^3			**Measurement Methods (see Table 1):** **NIOSH** S371 (II-4) **OSHA** PV2038	
Physical Description: Colorless to light-yellow crystals with a slight, fruity odor. [insecticide]				
Chemical & Physical Properties: **MW:** 345.7 **BP:** Decomposes **Sol:** 0.00001% **FI.P:** ? **IP:** ? **Sp.Gr:** 1.41 **VP:** Very low **MLT:** 171°F **UEL:** ? **LEL:** ? Combustible Solid, but difficult to burn.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** N.R. **Wash skin:** When contam/Daily **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE	
Incompatibilities and Reactivities: Oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing **SY:** In animals: fasc, trembling, convuls; kidney, liver damage; [carc] **TO:** CNS, liver, kidneys [in animals: liver & ovarian cancer]		**First Aid (see Table 6):** **Skin:** Soap wash **Breath:** Fresh air **Swallow:** Medical attention immed		

Methoxyflurane

Formula:	CAS#:	RTECS#:	IDLH:
$CHCl_2CF_2OCH_3$	76-38-0	KN7820000	N.D.

Conversion: 1 ppm = 6.75 mg/m^3

DOT:

Synonyms/Trade Names: 2,2-Dichloro-1,1-difluoroethyl methyl ether; 2,2-Dichloro-1,1-difluoro-1-methoxyethane; Methoflurane; Methoxyfluorane; Penthrane

Exposure Limits:
NIOSH REL*: C 2 ppm (13.5 mg/m^3) [60-minute]
[***Note:** REL for exposure to waste anesthetic gas.]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a fruity odor. [inhalation anesthetic]

Chemical & Physical Properties:
MW: 165.0
BP: 220°F
Sol: Slight
Fl.P: ?
IP: ?
Sp.Gr(77°F): 1.42
VP: 23 mmHg
FRZ: -31°F
UEL: ?
LEL(176°F): 7%
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes; CNS depres, analgesia, anes, convuls, resp depres; liver, kidney inj; in animals: repro, terato effects
TO: Eyes, CNS, liver, kidneys, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

M

4-Methoxyphenol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3OC_6H_4OH$	150-76-5	SL7700000	N.D.

Conversion:

DOT:

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

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to white, waxy solid with an odor of caramel & phenol.

Chemical & Physical Properties:
MW: 124.2
BP: 469°F
Sol(77°F): 4%
Fl.P(oc): 270°F
IP: 7.50 eV
Sp.Gr: 1.55
VP: <0.01 mmHg
MLT: 135°F
UEL: ?
LEL: ?
Combustible Solid; under certain conditions, a dust cloud can probably explode if ignited by a spark or flame.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, strong bases, acid chlorides, acid anhydrides

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat, upper resp sys; eye, skin burns; CNS depres
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Methyl acetate	Formula: CH_3COOCH_3	CAS#: 79-20-9	RTECS#: AI9100000	IDLH: 3100 ppm [10%LEL]
Conversion: 1 ppm = 3.03 mg/m^3	**DOT:** 1231 129			
Synonyms/Trade Names: Methyl ester of acetic acid, Methyl ethanoate				

Exposure Limits:
NIOSH REL: TWA 200 ppm (610 mg/m^3)
ST 250 ppm (760 mg/m^3)
OSHA PEL†: TWA 200 ppm (610 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1458
OSHA 7

Physical Description: Colorless liquid with a fragrant, fruity odor.

Chemical & Physical Properties:
MW: 74.1
BP: 135°F
Sol: 25%
Fl.P: 14°F
IP: 10.27 eV
Sp.Gr: 0.93
VP: 173 mmHg
FRZ: -145°F
UEL: 16%
LEL: 3.1%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: CcrOv*/Sa*
3100 ppm: Sa:Cf*/CcrFOv/GmFOv/PaprOv*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids; water
[**Note:** Reacts slowly with water to form acetic acid & methanol.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; head, drow; optic nerve atrophy; chest tight; in animals: narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

M

Methyl acetylene	Formula: $CH_3C{\equiv}CH$	CAS#: 74-99-7	RTECS#: UK4250000	IDLH: 1700 ppm [10%LEL]
Conversion: 1 ppm = 1.64 mg/m^3	**DOT:**			
Synonyms/Trade Names: Allylene, Propine, Propyne, 1-Propyne				

Exposure Limits:
NIOSH REL: TWA 1000 ppm (1650 mg/m^3)
OSHA PEL: TWA 1000 ppm (1650 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S84 (II-5)

Physical Description: Colorless gas with a sweet odor.
[**Note:** A fuel that is shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 40.1
BP: -10°F
Sol: Insoluble
Fl.P: NA (Gas)
IP: 10.36 eV
RGasD: 1.41
VP: 5.2 atm
FRZ: -153°F
UEL: ?
LEL: 1.7%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1700 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (such as chlorine), copper alloys
[**Note:** Can decompose explosively at 4.5 to 5.6 atmospheres of pressure.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit resp sys; tremor, hyperexcitability, anes; liquid: frostbite
TO: Resp sys, CNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Methyl acetylene-propadiene mixture

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3{\equiv}CH/CH_2{=}C{=}CH_2$	59355-75-8	UK4920000	3400 ppm [10%LEL]

Conversion: 1 ppm = 1.64 mg/m^3

DOT: 1060 116P (stabilized)

Synonyms/Trade Names: MAPP gas, Methyl acetylene-allene mixture, Propadiene-methyl acetylene, Methyl acetylene-propadiene mixture (stabilized), Propyne-allene mixture, Propyne-propadiene mixture

Exposure Limits:
NIOSH REL: TWA 1000 ppm (1800 mg/m^3)
ST 1250 ppm (2250 mg/m^3)
OSHA PEL†: TWA 1000 ppm (1800 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S85 (II-6)
OSHA 7

Physical Description: Colorless gas with a strong, characteristic, foul odor.
[**Note:** A fuel that is shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 40.1
BP: -36 to -4°F
Sol: Insoluble
Fl.P: NA (Gas)
IP: ?
RGasD: 1.48
VP: >1 atm
FRZ: -213°F
UEL: 10.8%
LEL: 3.4%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
3400 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, copper alloys
[**Note:** Forms explosive compounds at high pressure in contact with alloys containing more than 67% copper.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit resp sys; excitement, conf, anes; liquid: frostbite
TO: Resp sys, CNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Methyl acrylate

Formula:	CAS#:	RTECS#:	IDLH:
$CH_2{=}CHCOOCH_3$	96-33-3	AT2800000	250 ppm

Conversion: 1 ppm = 3.52 mg/m^3

DOT: 1919 129P (inhibited)

Synonyms/Trade Names: Methoxycarbonylethylene, Methyl ester of acrylic acid, Methyl propenoate

Exposure Limits:
NIOSH REL: TWA 10 ppm (35 mg/m^3) [skin]
OSHA PEL: TWA 10 ppm (35 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1459, 2552
OSHA 92

Physical Description: Colorless liquid with an acrid odor.

Chemical & Physical Properties:
MW: 86.1
BP: 176°F
Sol: 6%
Fl.P: 27°F
IP: 9.90 eV
Sp.Gr: 0.96
VP: 65 mmHg
FRZ: -106°F
UEL: 25%
LEL: 2.8%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: Sa*
250 ppm: Sa:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates, oxidizers such as peroxides, strong alkalis
[**Note:** Polymerizes easily; usually contains an inhibitor such as hydroquinone.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, upper resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Methylacrylonitrile	Formula: $CH_2=C(CH_3)CN$	CAS#: 126-98-7	RTECS#: UD1400000	IDLH: N.D.
Conversion: 1 ppm = 2.74 mg/m^3	**DOT:** 3079 131P (inhibited)			

Synonyms/Trade Names: 2-Cyanopropene-1, 2-Cyano-1-propene, Isoprene cyanide, Isopropenylnitrile, Methacrylonitrile, α-Methylacrylonitrile, 2-Methylpropenenitrile

Exposure Limits:
NIOSH REL: TWA 1 ppm (3 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with an odor like bitter almonds.

Chemical & Physical Properties:
MW: 67.1
BP: 195°F
Sol: 3%
Fl.P: 34°F
IP: ?
Sp.Gr: 0.80
VP(77°F): 71 mmHg
FRZ: -32°F
UEL: 6.8%
LEL: 2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids, strong oxidizers, alkali, light
[**Note:** Polymerization may occur due to elevated temperature, visible light, or contact with a concentrated alkali.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; lac; in animals: convuls, loss of motor control in hind limbs
TO: Eyes, skin, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Methylal	Formula: $CH_3OCH_2OCH_3$	CAS#: 109-87-5	RTECS#: PA8750000	IDLH: 2200 ppm [10%LEL]
Conversion: 1 ppm = 3.11 mg/m^3	**DOT:** 1234 127			

Synonyms/Trade Names: Dimethoxymethane, Formal, Formaldehyde dimethylacetal, Methoxymethyl methyl ether, Methylene dimethyl ether

Exposure Limits:
NIOSH REL: TWA 1000 ppm (3100 mg/m^3)
OSHA PEL: TWA 1000 ppm (3100 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1611

Physical Description: Colorless liquid with a chloroform-like odor.

Chemical & Physical Properties:
MW: 76.1
BP: 111°F
Sol: 33%
Fl.P(oc): -26°F
IP: 10.00 eV
Sp.Gr: 0.86
VP: 330 mmHg
FRZ: -157°F
UEL: 13.8%
LEL: 2.2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2200 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; anes
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Methyl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
CH_3OH	67-56-1	PC1400000	6000 ppm

Conversion: 1 ppm = 1.31 mg/m^3 **DOT:** 1230 131

Synonyms/Trade Names: Carbinol, Columbian spirits, Methanol, Pyroligneous spirit, Wood alcohol, Wood naphtha, Wood spirit

Exposure Limits:
NIOSH REL: TWA 200 ppm (260 mg/m^3)
ST 250 ppm (325 mg/m^3) [skin]
OSHA PEL†: TWA 200 ppm (260 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2000, 3800
OSHA 91

Physical Description: Colorless liquid with a characteristic pungent odor.

Chemical & Physical Properties:
MW: 32.1
BP: 147°F
Sol: Miscible
Fl.P: 52°F
IP: 10.84 eV
Sp.Gr: 0.79
VP: 96 mmHg
FRZ: -144°F
UEL: 36%
LEL: 6.0%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: Sa
5000 ppm: Sa:Cf
6000 ppm: SaT:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, upper resp sys; head, drow, dizz, nau, vomit; vis dist, optic nerve damage (blindness); derm
TO: Eyes, skin, resp sys, CNS, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Methylamine

Formula:	CAS#:	RTECS#:	IDLH:
CH_3NH_2	74-89-5	PF6300000	100 ppm

Conversion: 1 ppm = 1.27 mg/m^3 **DOT:** 1061 118 (anhydrous); 1235 132 (aqueous)

Synonyms/Trade Names: Aminomethane, Methylamine (anhydrous), Methylamine (aqueous), Monomethylamine

Exposure Limits:
NIOSH REL: TWA 10 ppm (12 mg/m^3)
OSHA PEL: TWA 10 ppm (12 mg/m^3)

Measurement Methods (see Table 1):
OSHA 40

Physical Description: Colorless gas with a fish- or ammonia-like odor.
[**Note:** A liquid below 21°F. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 31.1
BP: 21°F
Sol: Soluble
Fl.P: NA (Gas)
14°F (Liquid)
IP: 8.97 eV
RGasD: 1.08
Sp.Gr: 0.70 (Liquid at 13°F)
VP: 3.0 atm
FRZ: -136°F
UEL: 20.7%
LEL: 4.9%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (solution)
Frostbite
Eyes: Prevent eye contact (solution)
Frostbite
Wash skin: When contam (solution)
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: CcrFS/GmFS/PaprS£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Mercury, strong oxidizers, nitromethane
[**Note:** Corrosive to copper & zinc alloys, aluminum & galvanized surfaces.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs (solution), Ing (solution), Con (solution/liquid)
SY: Irrit eyes, skin, resp sys; cough; skin, muc memb burns; derm; conj; liquid: frostbite
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed (solution)/Frostbite
Skin: Water flush immed (solution)/Frostbite
Breath: Resp support
Swallow: Medical attention immed (solution)

Methyl (n-amyl) ketone	Formula: $CH_3CO[CH_2]_4CH_3$	CAS#: 110-43-0	RTECS#: MJ5075000	IDLH: 800 ppm
Conversion: 1 ppm = 4.67 mg/m^3	**DOT:** 1110 127			
Synonyms/Trade Names: Amyl methyl ketone, n-Amyl methyl ketone, 2-Heptanone				

Exposure Limits:
NIOSH REL: TWA 100 ppm (465 mg/m^3)
OSHA PEL: TWA 100 ppm (465 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1301, 2553

Physical Description: Colorless to white liquid with a banana-like, fruity odor.

Chemical & Physical Properties:
MW: 114.2
BP: 305°F
Sol: 0.4%
Fl.P: 102°F
IP: 9.33 eV
Sp.Gr: 0.81
VP: 3 mmHg
FRZ: -32°F
UEL(250°F): 7.9%
LEL(151°F): 1.1%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
800 ppm: CcrOv*/PaprOv*/GmFOv/ Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong acids, alkalis & oxidizers [**Note:** Will attack some forms of plastic.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; head; narco, coma; derm
TO: Eyes, skin, resp sys, CNS, PNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air
Swallow: Medical attention immed

M

Methyl bromide	Formula: CH_3Br	CAS#: 74-83-9	RTECS#: PA4900000	IDLH: Ca [250 ppm]
Conversion: 1 ppm = 3.89 mg/m^3	**DOT:** 1062 123			
Synonyms/Trade Names: Bromomethane, Monobromomethane				

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: C 20 ppm (80 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2520
OSHA PV2040

Physical Description: Colorless gas with a chloroform-like odor at high concentrations. [**Note:** A liquid below 38°F. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 95.0
BP: 38°F
Sol: 2%
Fl.P: NA (Gas)
IP: 10.54 eV
RGasD: 3.36
Sp.Gr: 1.73 (Liquid at 32°F)
VP: 1.9 atm
FRZ: -137°F
UEL: 16.0%
LEL: 10%
Flammable Gas, but only in presence of a high energy ignition source.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Eyes: Prevent eye contact (liquid)
Wash skin: When contam (liquid)
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench (liquid)

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Aluminum, magnesium, strong oxidizers [**Note:** Attacks aluminum to form aluminum trimethyl, which is SPONTANEOUSLY flammable.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs (liquid), Con (liquid)
SY: Irrit eyes, skin, resp sys; musc weak, inco, vis dist, dizz; nau, vomit, head; mal; hand tremor; convuls; dysp; skin vesic; liquid: frostbite; [carc]
TO: Eyes, skin, resp sys, CNS [in animals: lung, kidney & forestomach tumors]

First Aid (see Table 6):
Eye: Irr immed (liquid)
Skin: Water flush immed (liquid)
Breath: Resp support

Methyl Cellosolve®	Formula: $CH_3OCH_2CH_2OH$	CAS#: 109-86-4	RTECS#: KL5775000	IDLH: 200 ppm
Conversion: 1 ppm = 3.11 mg/m^3	**DOT:** 1188 127			
Synonyms/Trade Names: EGME, Ethylene glycol monomethyl ether, Glycol monomethyl ether, 2-Methoxyethanol				

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.3 mg/m^3) [skin]
OSHA PEL: TWA 25 ppm (80 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1403
OSHA 53, 79

Physical Description: Colorless liquid with a mild, ether-like odor.

Chemical & Physical Properties:
MW: 76.1
BP: 256°F
Sol: Miscible
Fl.P: 102°F
IP: 9.60 eV
Sp.Gr: 0.96
VP: 6 mmHg
FRZ: -121°F
UEL: 14%
LEL: 1.8%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1 ppm: Sa*
2.5 ppm: Sa:Cf*
5 ppm: ScbaF/SaF
100 ppm: Sa:Pd,Pp*
200 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, caustics

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; head, drow, lass; ataxia, tremor; anemic pallor; in animals: repro, terato effects
TO: Eyes, resp sys, CNS, blood, kidneys, repro sys, hemato sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Methyl Cellosolve® acetate	Formula: $CH_3COOCH_2CH_2OCH_3$	CAS#: 110-49-6	RTECS#: KL5950000	IDLH: 200 ppm
Conversion: 1 ppm = 4.83 mg/m^3	**DOT:** 1189 129			
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/m^3 [skin]
OSHA PEL: TWA 25 ppm (120 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1451
OSHA 53, 79

Physical Description: Colorless liquid with a mild, ether-like odor.

Chemical & Physical Properties:
MW: 118.1
BP: 293°F
Sol: Miscible
Fl.P: 120°F
IP: ?
Sp.Gr: 1.01
VP: 2 mmHg
FRZ: -85°F
UEL: 8.2%
LEL: 1.7%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1 ppm: Sa*
2.5 ppm: Sa:Cf*
5 ppm: ScbaF/SaF
100 ppm: Sa:Pd,Pp*
200 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; kidney, brain damage; in animals: narco; repro, terato effects
TO: Eyes, resp sys, kidneys, brain, CNS, PNS, repro sys, hemato sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Methyl chloride	Formula: CH_3Cl	CAS#: 74-87-3	RTECS#: PA6300000	IDLH: Ca [2000 ppm]
Conversion: 1 ppm = 2.07 mg/m^3	**DOT:** 1063 115			
Synonyms/Trade Names: Chloromethane, Monochloromethane				

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)

Measurement Methods (see Table 1):
NIOSH 1001

Physical Description: Colorless gas with a faint, sweet odor which is not noticeable at dangerous concentrations. [**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 50.5
BP: -12°F
Sol: 0.5%
FI.P: NA (Gas)
IP: 11.28 eV
RGasD: 1.78
VP: 5.0 atm
FRZ: -144°F
UEL: 17.4%
LEL: 8.1%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as potassium, powdered aluminum, zinc, and magnesium; water [**Note:** Reacts with water (hydrolyzes) to form hydrochloric acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Dizz, nau, vomit; vis dist, stagger, slurred speech, convuls, coma; liver, kidney damage; liquid: frostbite; repro, terato effects; [carc]
TO: CNS, liver, kidneys, repro sys [in animals: lung, kidney & forestomach tumors]

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

M

Methyl chloroform	Formula: CH_3CCl_3	CAS#: 71-55-6	RTECS#: KJ2975000	IDLH: 700 ppm
Conversion: 1 ppm = 5.46 mg/m^3	**DOT:** 2831 160			
Synonyms/Trade Names: Chlorothene; 1,1,1-Trichloroethane; 1,1,1-Trichloroethane (stabilized)				

Exposure Limits:
NIOSH REL: C 350 ppm (1900 mg/m^3) [15-minute]
See Appendix C (Chloroethanes)
OSHA PEL†: TWA 350 ppm (1900 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003

Physical Description: Colorless liquid with a mild, chloroform-like odor.

Chemical & Physical Properties:
MW: 133.4
BP: 165°F
Sol: 0.4%
FI.P: ?
IP: 11.00 eV
Sp.Gr: 1.34
VP: 100 mmHg
FRZ: -23°F
UEL: 12.5%
LEL: 7.5%
Combustible Liquid, but burns with difficulty.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
700 ppm: Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; head, lass, CNS depres, poor equi; derm; card arrhy; liver damage
TO: Eyes, skin, CNS, CVS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Methyl-2-cyanoacrylate	Formula: $CH_2=C(CN)COOCH_3$	CAS#: 137-05-3	RTECS#: AS7000000	IDLH: N.D.
Conversion: 1 ppm = 4.54 mg/m^3	**DOT:**			

Synonyms/Trade Names: Mecrylate, Methyl cyanoacrylate, Methyl α-cyanoacrylate, Methyl ester of 2-cyanoacrylic acid

Exposure Limits:
NIOSH REL: TWA 2 ppm (8 mg/m^3)
ST 4 ppm (16 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 55

Physical Description: Colorless liquid with a characteristic odor.

Chemical & Physical Properties:
MW: 111.1
BP: ?
Sol: 30%
Fl.P: 174°F
IP: ?
Sp.Gr(81°F): 1.10
VP(77°F): 0.2 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Moisture [**Note:** Contact with moisture causes rapid polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; blurred vision, lac; rhinitis
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash
Breath: Resp support
Swallow: Medical attention immed

M

Methylcyclohexane	Formula: $CH_3C_6H_{11}$	CAS#: 108-87-2	RTECS#: GV6125000	IDLH: 1200 ppm [LEL]
Conversion: 1 ppm = 4.02 mg/m^3	**DOT:** 2296 128			

Synonyms/Trade Names: Cyclohexylmethane, Hexahydrotoluene

Exposure Limits:
NIOSH REL: TWA 400 ppm (1600 mg/m^3)
OSHA PEL†: TWA 500 ppm (2000 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1500
OSHA 7

Physical Description: Colorless liquid with a faint, benzene-like odor.

Chemical & Physical Properties:
MW: 98.2
BP: 214°F
Sol: Insoluble
Fl.P: 25°F
IP: 9.85 eV
Sp.Gr: 0.77
VP: 37 mmHg
FRZ: -196°F
UEL: 6.7%
LEL: 1.2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1200 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; dizz, drow; in animals: narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Methylcyclohexanol	Formula: $CH_3C_6H_{10}OH$	CAS#: 25639-42-3	RTECS#: GW0175000	IDLH: 500 ppm
Conversion: 1 ppm = 4.67 mg/m^3	**DOT:** 2617 129			
Synonyms/Trade Names: Hexahydrocresol, Hexahydromethylphenol				
Exposure Limits: **NIOSH REL:** TWA 50 ppm (235 mg/m^3) **OSHA PEL†:** TWA 100 ppm (470 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1404	
Physical Description: Straw-colored liquid with a weak odor like coconut oil.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 114.2 **BP:** 311-356°F **Sol:** 4% **Fl.P:** 149-158°F **IP:** 9.80 eV **Sp.Gr:** 0.92 **VP(86°F):** 2 mmHg **FRZ:** -58°F **UEL:** ? **LEL:** ? Class IIIA Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH** **500 ppm:** Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, upper resp sys; head; in animals: narco; liver, kidney damage **TO:** Eyes, skin, resp sys, CNS, kidneys, liver	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

o-Methylcyclohexanone	Formula: $CH_3C_6H_9O$	CAS#: 583-60-8	RTECS#: GW1750000	IDLH: 600 ppm
Conversion: 1 ppm = 4.59 mg/m^3	**DOT:** 2297 128			
Synonyms/Trade Names: 2-Methylcyclohexanone				
Exposure Limits: **NIOSH REL:** TWA 50 ppm (230 mg/m^3) [skin] ST 75 ppm (345 mg/m^3) **OSHA PEL†:** TWA 100 ppm (460 mg/m^3) [skin]			**Measurement Methods (see Table 1):** **NIOSH** 2521	
Physical Description: Colorless liquid with a weak, peppermint-like odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 112.2 **BP:** 325°F **Sol:** Insoluble **Fl.P:** 118°F **IP:** ? **Sp.Gr:** 0.93 **VP:** 1 mmHg **FRZ:** 7°F **UEL:** ? **LEL:** ? Class II Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH** **500 ppm:** Sa* **600 ppm:** Sa:Cf*/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** In animals: irrit eyes, muc memb; narco; derm **TO:** Skin, resp sys, liver, kidneys, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

Methyl cyclopentadienyl manganese tricarbonyl (as Mn)	Formula: $CH_3C_5H_4Mn(CO)_3$	CAS#: 12108-13-3	RTECS#: OP1450000	IDLH: N.D.
Conversion:	DOT:			

Synonyms/Trade Names: CI-2, Combustion Improver-2, Manganese tricarbonylmethylcyclopentadienyl, 2-Methylcyclopentadienyl manganese tricarbonyl, MMT

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3 [skin]
OSHA PEL†: C 5 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Yellow to dark-orange liquid with a faint, pleasant odor. [**Note:** A solid below 36°F.]

Chemical & Physical Properties:
MW: 218.1
BP: 449°F
Sol: Insoluble
FI.P: 230°F
IP: ?
Sp.Gr: 1.39
VP(212°F): 7 mmHg
FRZ: 36°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Light (decomposes)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; dizz, nau, head; in animals: tremor, severe clonic spasms, lass, slow respiration; liver, kidney inj
TO: Eyes, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

M

Methyl demeton	Formula: $C_6H_{15}O_3PS_2$	CAS#: 8022-00-2	RTECS#: TG1760000	IDLH: N.D.
Conversion:	DOT:			

Synonyms/Trade Names: Demeton methyl; O,O-Dimethyl 2-ethylmercaptoethyl thiophosphate; Metasystox®; Methyl mercaptophos; Methyl systox®

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Oily, colorless to pale-yellow liquid with an unpleasant odor. [insecticide] [**Note:** Technical grade consists of 2 isomers: thiono & thiolo.]

Chemical & Physical Properties:
MW: 230.3
BP: Decomposes
Sol: 0.03-0.3%
FI.P: ?
IP: ?
Sp.Gr: 1.20
VP: 0.0004 mmHg
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, alkalis, water

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; ache eyes, rhin; nau, head, dizz, vomit
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

4,4'-Methylenebis(2-chloroaniline)	Formula: $CH_2(C_6H_4ClNH_2)_2$	CAS#: 101-14-4	RTECS#: CY1050000	IDLH: Ca [N.D.]
Conversion:	**DOT:**			

Synonyms/Trade Names: DACPM; 3,3'-Dichloro-4,4'-diaminodiphenylmethane; MBOCA; 4,4'-Methylenebis(o-chloro aniline); 4,4'-Methylenebis(2-chlorobenzenamine); MOCA

Exposure Limits:
NIOSH REL: Ca
TWA 0.003 mg/m^3 [skin]
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 24, 71

Physical Description: Tan-colored pellets or flakes with a faint, amine-like odor.

Chemical & Physical Properties:
MW: 267.2
BP: ?
Sol: Slight
FI.P: ?
IP: ?
Sp.Gr: 1.44
VP(77°F): 0.00001 mmHg
MLT: 230°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Chemically-active metals (e.g., potassium, sodium, magnesium, zinc)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Hema, cyan, nau, methemo, kidney irrit; [carc]
TO: Liver, blood, kidneys [in animals: liver, lung & bladder tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

M

Methylene bis(4-cyclohexylisocyanate)	Formula: $CH_2[(C_6H_{10})NCO]_2$	CAS#: 5124-30-1	RTECS#: NQ9250000	IDLH: N.D.
Conversion: 1 ppm = 10.73 mg/m^3	**DOT:**			

Synonyms/Trade Names: Dicyclohexylmethane 4,4'-diisocyanate; DMDI; bis(4-Isocyanatocyclohexyl)methane; HMDI; Hydrogenated MDI; Reduced MDI; Saturated MDI

Exposure Limits:
NIOSH REL: C 0.01 ppm (0.11 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5525
OSHA PV2092

Physical Description: Clear, colorless to light-yellow liquid.

Chemical & Physical Properties:
MW: 262.4
BP: ?
Sol: Reacts
FI.P: >395°F
IP: ?
Sp.Gr(77°F): 1.07
VP(77°F): 0.001 mmHg
FRZ: <14°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
0.1 ppm: Sa*
0.25 ppm: Sa:Cf*
0.5 ppm: ScbaF/SaF
1 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Water, ethanol, alcohols, amines, bases, acids, organotin catalysts
[**Note:** May slowly polymerize if heated above 122°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; skin, resp sens; chest tight, dysp, cough, dry throat, wheez, pulm edema; skin blisters
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Methylene bisphenyl isocyanate

Formula:	CAS#:	RTECS#:	IDLH:
$CH_2(C_6H_4NCO)_2$	101-68-8	NQ9350000	75 mg/m^3

Conversion: 1 ppm = 10.24 mg/m^3 **DOT:**

Synonyms/Trade Names: 4,4'-Diphenylmethane diisocyanate; MDI; Methylene bis(4-phenyl isocyanate); Methylene di-p-phenylene ester of isocyanic acid

Exposure Limits:
NIOSH REL: TWA 0.05 mg/m^3 (0.005 ppm)
C 0.2 mg/m^3 (0.020 ppm) [10-minute]
OSHA PEL: C 0.2 mg/m^3 (0.02 ppm)

Measurement Methods (see Table 1):
NIOSH 5521, 5522, 5525
OSHA 18

Physical Description: White to light-yellow, odorless flakes. [**Note:** A liquid above 99°F.]

Chemical & Physical Properties:
MW: 250.3
BP: 597°F
Sol: 0.2%
Fl.P: 390°F
IP: ?
Sp.Gr: 1.23 (Solid at 77°F)
1.19 (Liquid at 122°F)
VP(77°F): 0.000005 mmHg
MLT: 99°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
0.5 mg/m^3: Sa*
1.25 mg/m^3: Sa:Cf*
2.5 mg/m^3: ScbaF/SaF
75 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong alkalis, acids, alcohol [**Note:** Polymerizes at 450°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat; resp sens; cough, pulm secretions, chest pain, dysp; asthma
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Methylene chloride

Formula:	CAS#:	RTECS#:	IDLH:
CH_2Cl_2	75-09-2	PA8050000	Ca [2300 ppm]

Conversion: 1 ppm = 3.47 mg/m^3 **DOT:** 1593 160

Synonyms/Trade Names: Dichloromethane, Methylene dichloride

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1052] TWA 25 ppm
ST 125 ppm

Measurement Methods (see Table 1):
NIOSH 1005, 3800
OSHA 59, 80

Physical Description: Colorless liquid with a chloroform-like odor. [**Note:** A gas above 104°F.]

Chemical & Physical Properties:
MW: 84.9
BP: 104°F
Sol: 2%
Fl.P: ?
IP: 11.32 eV
Sp.Gr: 1.33
VP: 350 mmHg
FRZ: -139°F
UEL: 23%
LEL: 13%
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers; caustics; chemically-active metals such as aluminum, magnesium powders, potassium & sodium; concentrated nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; lass, drow, dizz; numb, tingle limbs; nau; [carc]
TO: Eyes, skin, CVS, CNS [in animals: lung, liver, salivary & mammary gland tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

4,4'-Methylenedianiline

Formula:	CAS#:	RTECS#:	IDLH:
$CH_2(C_6H_4NH_2)_2$	101-77-9	BY5425000	Ca [N.D.]

Conversion: **DOT:**

Synonyms/Trade Names: 4,4'-Diaminodiphenylmethane; para, para'-Diaminodiphenyl-methane; Dianilinomethane; 4,4'-Diphenylmethanediamine; MDA

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1050] TWA 0.010 ppm
ST 0.100 ppm

Measurement Methods (see Table 1):
NIOSH 5029

Physical Description: Pale-brown, crystalline solid with a faint, amine-like odor.

Chemical & Physical Properties:
MW: 198.3
BP: 748°F
Sol: 0.1%
Fl.P: 374°F
IP: 10.70 eV
Sp.Gr: 1.06 (Liquid at 212°F)
VP(77°F): 0.0000002 mmHg
MLT: 198°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; jaun, hepatitis; myocardial damage; in animals: heart, liver, spleen damage; [carc]
TO: Eyes, liver, CVS, spleen [in animals: bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Methyl ethyl ketone peroxide

Formula:	CAS#:	RTECS#:	IDLH:
$C_8H_{16}O_4$	1338-23-4	EL9450000	N.D.

Conversion: 1 ppm = 7.21 mg/m^3 **DOT:**

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/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 3508
OSHA 77

Physical Description: Colorless liquid with a characteristic odor.
[**Note:** Explosive decomposition occurs at 230°F.]

Chemical & Physical Properties:
MW: 176.2
BP: 244°F (Decomposes)
Sol: Soluble
Fl.P(oc): 125-200°F (60% MEKP)
IP: ?
Sp.Gr(59°F): 1.12
VP: ?
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; cough, dysp, pulm edema; blurred vision; blisters, scars skin; abdom pain, vomit, diarr; derm; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Methyl formate

Formula: $HCOOCH_3$ | **CAS#:** 107-31-3 | **RTECS#:** LQ8925000 | **IDLH:** 4500 ppm

Conversion: 1 ppm = 2.46 mg/m^3 | **DOT:** 1243 129

Synonyms/Trade Names: Methyl ester of formic acid, Methyl methanoate

Exposure Limits:
NIOSH REL: TWA 100 ppm (250 mg/m^3)
ST 150 ppm (375 mg/m^3)
OSHA PEL†: TWA 100 ppm (250 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S291 (II-5)
OSHA PV2041

Physical Description: Colorless liquid with a pleasant odor.
[**Note:** A gas above 89°F.]

Chemical & Physical Properties:
MW: 60.1
BP: 89°F
Sol: 30%
FI.P: -2°F
IP: 10.82 eV
Sp.Gr: 0.98
VP: 476 mmHg
FRZ: -148°F
UEL: 23%
LEL: 4.5%
Class IA Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: Sa*
2500 ppm: Sa:Cf*
4500 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers
[**Note:** Reacts slowly with water to form methanol & formic acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose; chest tight, dysp; vis dist; CNS depres; in animals: pulm edema; narco
TO: Eyes, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

M

5-Methyl-3-heptanone

Formula: $C_2H_5COCH_2CH(CH_3)CH_2CH_3$ | **CAS#:** 541-85-5 | **RTECS#:** MJ7350000 | **IDLH:** 100 ppm

Conversion: 1 ppm = 5.24 mg/m^3 | **DOT:** 2271 127

Synonyms/Trade Names: Amyl ethyl ketone, Ethyl amyl ketone, 3-Methyl-5-heptanone

Exposure Limits:
NIOSH REL: TWA 25 ppm (130 mg/m^3)
OSHA PEL: TWA 25 ppm (130 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1301, 2553

Physical Description: Colorless liquid with a pungent odor.

Chemical & Physical Properties:
MW: 128.2
BP: 315°F
Sol: Insoluble
FI.P: 138°F
IP: ?
Sp.Gr: 0.82
VP: 2 mmHg
FRZ: -70°F
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: CcrOv*/PaprOv*/GmFOv/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; head; narco, coma; derm
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

Methyl hydrazine

Formula:	CAS#:	RTECS#:	IDLH:
CH_3NHNH_2	60-34-4	MV5600000	Ca [20 ppm]

Conversion: 1 ppm = 1.89 mg/m^3 **DOT:** 1244 131

Synonyms/Trade Names: MMH, Monomethylhydrazine

Exposure Limits:
NIOSH REL: Ca
C 0.04 ppm (0.08 mg/m^3) [2-hr]
See Appendix A
OSHA PEL: C 0.2 ppm (0.35 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 3510

Physical Description: Fuming, colorless liquid with an ammonia-like odor.

Chemical & Physical Properties:
MW: 46.1
BP: 190°F
Sol: Miscible
FI.P: 17°F
IP: 8.00 eV
Sp.Gr(77°F): 0.87
VP: 38 mmHg
FRZ: -62°F
UEL: 92%
LEL: 2.5%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and 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

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; vomit, diarr, tremor, ataxia; anoxia, cyan; convuls; [carc]
TO: Eyes, skin, resp sys, CNS, liver, blood, CVS [in animals: lung, liver, blood vessel & intestine tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

M

Methyl iodide

Formula:	CAS#:	RTECS#:	IDLH:
CH_3I	74-88-4	PA9450000	Ca [100 ppm]

Conversion: 1 ppm = 5.80 mg/m^3 **DOT:** 2644 151

Synonyms/Trade Names: Iodomethane, Monoiodomethane

Exposure Limits:
NIOSH REL: Ca
TWA 2 ppm (10 mg/m^3) [skin]
See Appendix A
OSHA PEL: TWA 5 ppm (28 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1014

Physical Description: Colorless liquid with a pungent, ether-like odor. [**Note:** Turns yellow, red, or brown on exposure to light & moisture.]

Chemical & Physical Properties:
MW: 141.9
BP: 109°F
Sol: 1%
FI.P: NA
IP: 9.54 eV
Sp.Gr: 2.28
VP: 400 mmHg
FRZ: -88°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers [**Note:** Decomposes at 518°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; nau, vomit; dizz, ataxia; slurred speech, drow; derm; [carc]
TO: Eyes, skin, resp sys, CNS [in animals: lung, kidney & forestomach tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Methyl isoamyl ketone	Formula: $CH_3COCH_2CH_2CH(CH_3)_2$	CAS#: 110-12-3	RTECS#: MP3850000	IDLH: N.D.
Conversion: 1 ppm = 4.67 mg/m^3	**DOT:** 2302 127			
Synonyms/Trade Names: Isoamyl methyl ketone, Isopentyl methyl ketone, 2-Methyl-5-hexanone, 5-Methyl-2-hexanone, MIAK				
Exposure Limits: **NIOSH REL:** TWA 50 ppm (240 mg/m^3) **OSHA PEL†:** TWA 100 ppm (475 mg/m^3)			**Measurement Methods (see Table 1):** **OSHA** PV2042	
Physical Description: Colorless, clear liquid with a pleasant, fruity odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 114.2 **BP:** 291°F **Sol:** 0.5% **Fl.P:** 97°F **IP:** 9.284 eV **Sp.Gr:** 0.81 **VP:** 5 mmHg **FRZ:** -101°F **UEL(200°F):** 8.2% **LEL(200°F):** 1.0% Class IC Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.	**NIOSH** **500 ppm:** CcrOv*/Sa* **1250 ppm:** Sa:Cf*/PaprOv* **2500 ppm:** CcrFOv/GmFOv/PaprTOv*/ SaT:Cf*/ScbaF/SaF **5000 ppm:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; head, narco, coma; derm; in animals: liver, kidney damage **TO:** Eyes, skin, resp sys, CNS, liver, kidneys	**Eye:** Irr immed **Skin:** Soap flush prompt **Breath:** Resp support **Swallow:** Medical attention immed

Methyl isobutyl carbinol	Formula: $(CH_3)_2CHCH_2CH(OH)CH_3$	CAS#: 108-11-2	RTECS#: SA7350000	IDLH: 400 ppm
Conversion: 1 ppm = 4.18 mg/m^3	**DOT:** 2053 129			
Synonyms/Trade Names: Isobutylmethylcarbinol, Methyl amyl alcohol, 4-Methyl-2-pentanol, MIBC				
Exposure Limits: **NIOSH REL:** TWA 25 ppm (100 mg/m^3) ST 40 ppm (165 mg/m^3) [skin] **OSHA PEL†:** TWA 25 ppm (100 mg/m^3) [skin]			**Measurement Methods (see Table 1):** **NIOSH** 1402, 1405 **OSHA** 7	
Physical Description: Colorless liquid with a mild odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 102.2 **BP:** 271°F **Sol:** 2% **Fl.P:** 106°F **IP:** ? **Sp.Gr:** 0.81 **VP:** 3 mmHg **FRZ:** -130°F **UEL:** 5.5% **LEL:** 1.0% Class II Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH/OSHA** **250 ppm:** Sa* **400 ppm:** Sa:Cf*/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Abs, Ing, Con **SY:** Irrit eyes, skin; head, drow; derm; in animals: narco **TO:** Eyes, skin, CNS	**Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed

Methyl isocyanate	Formula: CH_3NCO	CAS#: 624-83-9	RTECS#: NQ9450000	IDLH: 3 ppm
Conversion: 1 ppm = 2.34 mg/m^3	**DOT:** 2480 155			
Synonyms/Trade Names: Methyl ester of isocyanic acid, MIC				
Exposure Limits: **NIOSH REL:** TWA 0.02 ppm (0.05 mg/m^3) [skin] **OSHA PEL:** TWA 0.02 ppm (0.05 mg/m^3) [skin]			**Measurement Methods (see Table 1):** **OSHA** 54	
Physical Description: Colorless liquid with a sharp, pungent odor.				
Chemical & Physical Properties: **MW:** 57.1 **BP:** 102-104°F **Sol(59°F):** 10% **FI.P:** 19°F **IP:** 10.67 eV **Sp.Gr:** 0.96 **VP:** 348 mmHg **FRZ:** -49°F **UEL:** 26% **LEL:** 5.3% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.2 ppm:** Sa* **0.5 ppm:** Sa:Cf* **1 ppm**: ScbaF/SaF **3 ppm**: SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Water, oxidizers, acids, alkalis, amines, iron, tin, copper [**Note:** Usually contains inhibitors to prevent polymerization.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, nose, throat; resp sens, cough, pulm secretions, chest pain, dysp; asthma; eye, skin damage; in animals: pulm edema **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

Methyl isopropyl ketone	Formula: $CH_3COCH(CH_3)_2$	CAS#: 563-80-4	RTECS#: EL9100000	IDLH: N.D.
Conversion: 1 ppm = 3.53 mg/m^3	**DOT:** 2397 127			
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			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless liquid with an acetone-like odor.				
Chemical & Physical Properties: **MW:** 86.2 **BP:** 199°F **Sol:** Very slight **FI.P:** ? **IP:** 9.32 eV **Sp.Gr:** 0.81 **VP:** 42 mmHg **FRZ:** -134°F **UEL:** ? **LEL:** ? Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb, resp sys; cough **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Methyl mercaptan

Formula:	CAS#:	RTECS#:	IDLH:
CH_3SH	74-93-1	PB4375000	150 ppm

Conversion: 1 ppm = 1.97 mg/m^3 **DOT:** 1064 117

Synonyms/Trade Names: Mercaptomethane, Methanethiol, Methyl sulfhydrate

Exposure Limits:
NIOSH REL: C 0.5 ppm (1 mg/m^3) [15-minute]
OSHA PEL†: C 10 ppm (20 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2542
OSHA 26

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.]

Chemical & Physical Properties:
MW: 48.1
BP: 43°F
Sol: 2%
Fl.P: NA (Gas)
(oc) 0°F (Liquid)
IP: 9.44 eV
RGasD: 1.66
Sp.Gr: 0.90 (Liquid at 32°F)
VP: 1.7 atm
FRZ: -186°F
UEL: 21.8%
LEL: 3.9%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Frostbite
Eyes: Prevent eye contact (liquid)
Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (liquid)
Quick drench (liquid)
Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/
SaT:Cf/ScbaF/SaF
150 ppm: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, bleaches, copper, aluminum, nickel-copper alloys

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit eyes, skin, resp sys; narco; cyan; convuls; liquid: frostbite
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed (liquid)/Frostbite
Skin: Water flush immed (liquid)/Frostbite
Breath: Resp support

Methyl methacrylate

Formula:	CAS#:	RTECS#:	IDLH:
$CH_2=C(CH_3)COOCH_3$	80-62-6	OZ5075000	1000 ppm

Conversion: 1 ppm = 4.09 mg/m^3 **DOT:** 1247 129P (inhibited)

Synonyms/Trade Names: Methacrylate monomer, Methyl ester of methacrylic acid, Methyl-2-methyl-2-propenoate

Exposure Limits:
NIOSH REL: TWA 100 ppm (410 mg/m^3)
OSHA PEL: TWA 100 ppm (410 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2537
OSHA 94

Physical Description: Colorless liquid with an acrid, fruity odor.

Chemical & Physical Properties:
MW: 100.1
BP: 214°F
Sol: 1.5%
Fl.P(oc): 50°F
IP: 9.70 eV
Sp.Gr: 0.94
VP: 29 mmHg
FRZ: -54°F
UEL: 8.2%
LEL: 1.7%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: Sa:Cf£/CcrFOv/GmFOv/
PaprOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Methyl parathion

Formula: $(CH_3O)_2P(S)OC_6H_4NO_2$ | **CAS#:** 298-00-0 | **RTECS#:** TG0175000 | **IDLH:** N.D.

Conversion: **DOT:** 2783 152 (solid); 3018 152 (liquid)

Synonyms/Trade Names: Azophos®; O,O-Dimethyl-O-p-nitrophenylphosphorothioate; Parathion methyl

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5600
OSHA PV2112

Physical Description: White to tan, crystalline solid or powder with a pungent, garlic-like odor. [pesticide] [**Note:** The commercial product in xylene is a tan liquid.]

Chemical & Physical Properties:
MW: 263.2
BP: 289°F
Sol(77°F): 0.006%
Fl.P: ?
IP: ?
Sp.Gr: 1.36
VP: 0.00001 mmHg
MLT: 99°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
2 mg/m^3: CcrOv95/Sa
5 mg/m^3: Sa:Cf/PaprOvHie
10 mg/m^3: CcrFOv100/GmFOv100/PaprTOvHie/SaT:Cf/ScbaF/SaF
200 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, water [**Note:** Explosive risk when heated above 122°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; nau, vomit, abdom cramps, diarr, salv; head, dizz, lass; rhin, chest tight; blurred vision, miosis; card irreg; musc fasc; dysp
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Methyl silicate

Formula: $(CH_3O)_4Si$ | **CAS#:** 681-84-5 | **RTECS#:** VV9800000 | **IDLH:** N.D.

Conversion: 1 ppm = 6.23 mg/m^3 **DOT:** 2606 155

Synonyms/Trade Names: Methyl orthosilicate, Tetramethoxysilane, Tetramethyl ester of silicic acid, Tetramethyl silicate

Exposure Limits:
NIOSH REL: TWA 1 ppm (6 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Clear, colorless liquid. [**Note:** A solid below 28°F.]

Chemical & Physical Properties:
MW: 152.3
BP: 250°F
Sol: Soluble
Fl.P: 205°F
IP: ?
Sp.Gr: 1.02
VP(77°F): 12 mmHg
FRZ: 28°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers; hexafluorides of rhenium, molybdenum & tungsten

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, corn damage (following even short-term exposure to the vapor); lung, kidney inj; pulm edema
TO: Eyes, resp sys, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

α-Methyl styrene

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_5C(CH_3)=CH_2$	98-83-9	WL5075300	700 ppm

Conversion: 1 ppm = 4.83 mg/m^3 **DOT:**

Synonyms/Trade Names: AMS, Isopropenyl benzene, 1-Methyl-1-phenylethylene, 2-Phenyl propylene

Exposure Limits:
NIOSH REL: TWA 50 ppm (240 mg/m^3)
ST 100 ppm (485 mg/m^3)
OSHA PEL†: C 100 ppm (480 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1501
OSHA 7

Physical Description: Colorless liquid with a characteristic odor.

Chemical & Physical Properties:
MW: 118.2
BP: 330°F
Sol: Insoluble
Fl.P: 129°F
IP: 8.35 eV
Sp.Gr: 0.91
VP: 2 mmHg
FRZ: -10°F
UEL: 6.1%
LEL: 1.9%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
500 ppm: CcrOv*/Sa*
700 ppm: Sa:Cf*/CcrFOv/GmFOv/PaprOv*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, peroxides, halogens, catalysts for vinyl or ionic polymers; aluminum, iron chloride, copper [**Note:** Usually contains an inhibitor such as tert-butyl catechol.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; drow; derm
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Metribuzin

Formula:	CAS#:	RTECS#:	IDLH:
$C_8H_{14}N_4OS$	21087-64-9	XZ2990000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: 4-Amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2044

Physical Description: Colorless, crystalline solid. [herbicide]

Chemical & Physical Properties:
MW: 214.3
BP: ?
Sol: 0.1%
Fl.P: NA
IP: ?
Sp.Gr: 1.31
VP: 0.0000004 mmHg
MLT: 257°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: CNS depres; thyroid, liver enzyme changes
TO: CNS, thyroid, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air
Swallow: Medical attention immed

Mica (containing less than 1% quartz)	Formula:	CAS#: 12001-26-2	RTECS#: VV8760000	IDLH: 1500 mg/m^3
Conversion:	**DOT:**			

Synonyms/Trade Names: Biotite, Lepidolite, Margarite, Muscovite, Phlogopite, Roscoelite, Zimmwaldite

Exposure Limits:
NIOSH REL: TWA 3 mg/m^3 (resp)
OSHA PEL†: TWA 20 mppcf

Measurement Methods (see Table 1):
NIOSH 0600

Physical Description: Colorless, odorless flakes or sheets of hydrous silicates.

Chemical & Physical Properties:
MW: 797 (approx)
BP: ?
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 2.6-3.2
VP: 0 mmHg (approx)
MLT: ?
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
15 mg/m^3: Qm
30 mg/m^3: 95XQ/Sa
75 mg/m^3: Sa:Cf/PaprHie
150 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
1500 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes; pneumoconiosis, cough, dysp; lass; low-wgt
TO: Resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

M

Mineral wool fiber	Formula:	CAS#:	RTECS#: PY8070000	IDLH: N.D.
Conversion:	**DOT:**			

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/cm^3 (fibers ≤ 3.5 µm diameter & ≥ 10 µm in length)
TWA 5 mg/m^3 (total)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 7400

Physical Description: Typically, a mineral "wool" with diameters >0.5 µm & >1.5 µm in length.

Chemical & Physical Properties:
MW: varies
BP: NA
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: ?
UEL: NA
LEL: NA
Noncombustible Fibers

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5X REL: Qm
10X REL: 95XQ/Sa
25X REL: Sa:Cf/PaprHie
50X REL: 100F/PaprTHie/ScbaF/SaF
1000X REL: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys; dysp
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Molybdenum	Formula: Mo	CAS#: 7439-98-7	RTECS#: QA4680000	IDLH: 5000 mg/m^3 (as Mo)
Conversion:	**DOT:**			

Synonyms/Trade Names: Molybdenum metal

Exposure Limits:
NIOSH REL*: See Appendix D
OSHA PEL*†: TWA 15 mg/m^3
[***Note:** The PEL also applies to other insoluble molybdenum compounds (as Mo).]

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Physical Description: Dark gray or black powder with a metallic luster.

Chemical & Physical Properties:
MW: 95.9
BP: 8717°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 10.28
VP: 0 mmHg (approx)
MLT: 4752°F
UEL: NA
LEL: NA
Combustible Solid in form of dust or powder.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
75 mg/m^3: Qm
150 mg/m^3: 95XQ/Sa
375 mg/m^3: Sa:Cf/PaprHie
750 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
5000 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, nose, throat; anor, diarr, low-wgt; listlessness; liver, kidney damage
TO: Eyes, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support
Swallow: Medical attention immed

Molybdenum (soluble compounds, as Mo)	Formula:	CAS#:	RTECS#:	IDLH: 1000 mg/m^3 (as Mo)
Conversion:	**DOT:**			

Synonyms/Trade Names: Synonyms vary depending upon the specific soluble molybdenum compound.

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Physical Description: Appearance and odor vary depending upon the specific soluble molybdenum compound.

Chemical & Physical Properties:
Properties vary depending upon the specific soluble molybdenum compound.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
25 mg/m^3: Qm*
50 mg/m^3: 95XQ*/Sa*
125 mg/m^3: Sa:Cf*/PaprHie*
250 mg/m^3: 100F/SaT:Cf*/PaprTHie*/ScbaF/SaF
1000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, nose, throat; anor; inco; dysp; anemia
TO: Eyes, resp sys, kidneys, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

Monocrotophos	Formula: $C_7H_{14}NO_5P$	CAS#: 6923-22-4	RTECS#: TC4375000	IDLH: N.D.
Conversion:	**DOT:** 2783 152 (organophosphorus pesticide, solid)			
Synonyms/Trade Names: Azodrin®, 3-Hydroxy-N-methylcrotonamide dimethylphosphate, Monocron				
Exposure Limits: **NIOSH REL:** TWA 0.25 mg/m^3 **OSHA PEL†:** none **Physical Description:** Colorless to reddish-brown solid with a mild, ester odor. [insecticide]				**Measurement Methods (see Table 1):** **NIOSH** 5600 **OSHA** PV2045
Chemical & Physical Properties: **MW:** 223.2 **BP:** 257°F **Sol:** Miscible **Fl.P:** >200°F **IP:** ? **Sp.Gr:** ? **VP:** 0.000007 mmHg **MLT:** 129°F **UEL:** ? **LEL:** ? Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and 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.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, miosis, blurred vision; dizz, convuls; dysp; salv, abdom cramps, nau, diarr, vomit; in animals: possible terato effects **TO:** Eyes, resp sys, CNS, CVS, blood chol, repro sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

M

Monomethyl aniline	Formula: $C_6H_5NHCH_3$	CAS#: 100-61-8	RTECS#: BY4550000	IDLH: 100 ppm
Conversion: 1 ppm = 4.38 mg/m^3	**DOT:** 2294 153			
Synonyms/Trade Names: MA, (Methylamino)benzene, N-Methyl aniline, Methylphenylamine, N-Phenylmethylamine				
Exposure Limits: **NIOSH REL:** TWA 0.5 ppm (2 mg/m^3) [skin] **OSHA PEL†:** TWA 2 ppm (9 mg/m^3) [skin] **Physical Description:** Yellow to light-brown liquid with a weak, ammonia-like odor.				**Measurement Methods (see Table 1):** **NIOSH** 3511
Chemical & Physical Properties: **MW:** 107.2 **BP:** 384°F **Sol:** Insoluble **Fl.P:** 175°F **IP:** 7.32 eV **Sp.Gr:** 0.99 **VP:** 0.3 mmHg **FRZ:** -71°F **UEL:** ? **LEL:** ? Class IIIA Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **5 ppm:** Sa **12.5 ppm:** Sa:Cf **25 ppm:** SaT:Cf/ScbaF/SaF **100 ppm:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS/ScbaE	
Incompatibilities and Reactivities: Strong acids, strong oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Lass, dizz, head; dysp, cyan; methemo; pulm edema; liver, kidney damage **TO:** Resp sys, liver, kidneys, blood, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Morpholine

Formula: C_4H_9ON | **CAS#:** 110-91-8 | **RTECS#:** QD6475000 | **IDLH:** 1400 ppm [10%LEL]

Conversion: 1 ppm = 3.56 mg/m^3 | **DOT:** 2054 132

Synonyms/Trade Names: Diethylene imidoxide; Diethylene oximide; Tetrahydro-1,4-oxazine; Tetrahydro-p-oxazine

Exposure Limits:
NIOSH REL: TWA 20 ppm (70 mg/m^3) [skin]
ST 30 ppm (105 mg/m^3)
OSHA PEL†: TWA 20 ppm (70 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH S150 (II-3)

Physical Description: Colorless liquid with a weak, ammonia- or fish-like odor. [**Note:** A solid below 23°F.]

Chemical & Physical Properties:
MW: 87.1
BP: 264°F
Sol: Miscible
Fl.P(oc): 98°F
IP: 8.88 eV
Sp.Gr: 1.007
VP: 6 mmHg
FRZ: 23°F
UEL: 11.2%
LEL: 1.4%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (>15%)
Quick drench (>25%)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
500 ppm: Sa:Cf£/PaprOv£
1000 ppm: CcrFOv/GmFOv/PaprTOv£/ ScbaF/SaF
1400 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong acids, strong oxidizers, metals, nitro compounds [**Note:** Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, resp sys; vis dist; cough; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Naphtha (coal tar)

Formula: | **CAS#:** 8030-30-6 | **RTECS#:** DE3030000 | **IDLH:** 1000 ppm [10%LEL]

Conversion: 1 ppm = 4.50 mg/m^3 (approx) | **DOT:**

Synonyms/Trade Names: Crude solvent coal tar naphtha, High solvent naphtha, Naphtha

Exposure Limits:
NIOSH REL: TWA 100 ppm (400 mg/m^3)
OSHA PEL: TWA 100 ppm (400 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1550

Physical Description: Reddish-brown, mobile liquid with an aromatic odor.

Chemical & Physical Properties:
MW: 110 (approx)
BP: 320-428°F
Sol: Insoluble
Fl.P: 100-109°F
IP: ?
Sp.Gr: 0.89-0.97
VP: <5 mmHg
FRZ: ?
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: Sa:Cf£/CcrFOv/GmFOv/ PaprOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; dizz, drow; derm; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Naphthalene

Formula: $C_{10}H_8$ | **CAS#:** 91-20-3 | **RTECS#:** QJ0525000 | **IDLH:** 250 ppm

Conversion: 1 ppm = 5.24 mg/m^3 | **DOT:** 1334 133 (crude or refined); 2304 133 (molten)

Synonyms/Trade Names: Naphthalin, Tar camphor, White tar

Exposure Limits:
NIOSH REL: TWA 10 ppm (50 mg/m^3)
ST 15 ppm (75 mg/m^3)
OSHA PEL†: TWA 10 ppm (50 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1501
OSHA 35

Physical Description: Colorless to brown solid with an odor of mothballs.
[**Note:** Shipped as a molten solid.]

Chemical & Physical Properties:
MW: 128.2
BP: 424°F
Sol: 0.003%
Fl.P: 174°F
IP: 8.12 eV
Sp.Gr: 1.15
VP: 0.08 mmHg
MLT: 176°F
UEL: 5.9%
LEL: 0.9%
Combustible Solid, but will take some effort to ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: CcrOv95*/Sa*
250 ppm: Sa:Cf*/CcrFOv100/ PaprOvHie*/ ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, chromic anhydride

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; head, conf, excitement, mal; nau, vomit, abdom pain; irrit bladder; profuse sweat; jaun; hema, renal shutdown; derm, optical neuritis, corn damage
TO: Eyes, skin, blood, liver, kidneys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Molten flush immed/sol-liq soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Naphthalene diisocyanate

Formula: $C_{10}H_6(NCO)_2$ | **CAS#:** 3173-72-6 | **RTECS#:** NQ9600000 | **IDLH:** N.D.

Conversion: 1 ppm = 8.60 mg/m^3 | **DOT:**

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/m^3 (0.005 ppm)
C 0.170 mg/m^3 (0.020 ppm) [10-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 5525
OSHA PV2046

Physical Description: White to light-yellow, crystalline flakes.

Chemical & Physical Properties:
MW: 210.2
BP: 505°F
Sol: ?
Fl.P(oc): 311°F
IP: ?
Sp.Gr: ?
VP(75°F): 0.003 mmHg
MLT: 261°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
0.05 ppm: Sa*
0.125 ppm: Sa:Cf*
0.25 ppm: ScbaF/SaF
1 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat; resp sens, cough, pulm secretions, chest pain, dysp; asthma
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

α-Naphthylamine

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_7NH_2$	134-32-7	QM1400000	Ca [N.D.]

Conversion: **DOT:** 2077 153

Synonyms/Trade Names: 1-Aminonaphthalene, 1-Naphthylamine

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1004] See Appendix B

Measurement Methods (see Table 1):
NIOSH 5518
OSHA 93

Physical Description: Colorless crystals with an ammonia-like odor.
[**Note:** Darkens in air to a reddish-purple color.]

Chemical & Physical Properties:
MW: 143.2
BP: 573°F
Sol: 0.002%
Fl.P: 315°F
IP: 7.30 eV
Sp.Gr: 1.12
VP(220°F): 1 mmHg
MLT: 122°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Oxidizes in air

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Derm; hemorrhagic cystitis; dysp, ataxia, methemo; hema; dysuria; [carc]
TO: Bladder, skin [bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

N

β-Naphthylamine

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_7NH_2$	91-59-8	QM2100000	Ca [N.D.]

Conversion: **DOT:** 1650 153

Synonyms/Trade Names: 2-Aminonaphthalene, 2-Naphthylamine

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1009] See Appendix B

Measurement Methods (see Table 1):
NIOSH 5518
OSHA 93

Physical Description: Odorless, white to red crystals with a faint, aromatic odor.
[**Note:** Darkens in air to a reddish-purple color.]

Chemical & Physical Properties:
MW: 143.2
BP: 583°F
Sol: Miscible in hot water
Fl.P: 315°F
IP: 9.71 eV
Sp.Gr(208°F): 1.06
VP(226°F): 1 mmHg
MLT: 232°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Derm; hemorrhagic cystitis; dysp; ataxia; methemo, hema; dysuria; [carc]
TO: Bladder, skin [bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Niax® Catalyst ESN	Formula:	CAS#: 62765-93-9	RTECS#: QR3900000	IDLH: N.D.
Conversion:	DOT:			

Synonyms/Trade Names: None
[**Note:** A mixture of 95% dimethylaminopropionitrile & 5% bis(2-dimethylamino)ethyl ether.]

Exposure Limits:
NIOSH REL: See Appendix C
OSHA PEL: See Appendix C

Measurement Methods (see Table 1):
None available

Physical Description: A liquid mixture.
[**Note:** Used in the past as a catalyst in the manufacture of flexible polyurethane foams.]

Chemical & Physical Properties:
MW: mixture
BP: ?
Sol: ?
Fl.P: ?
IP: ?
Sp.Gr: ?
VP: ?
FRZ: ?
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; urinary dist; neurological disorders; pins & needles in hands & feet; musc weak, lass, nau, vomit; decr nerve conduction in lower legs
TO: Eyes, skin, urinary tract, PNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

N

Nickel carbonyl	Formula: $Ni(CO)_4$	CAS#: 13463-39-3	RTECS#: QR6300000	IDLH: Ca [2 ppm]
Conversion: 1 ppm = 6.98 mg/m^3	DOT: 1259 131			

Synonyms/Trade Names: Nickel tetracarbonyl, Tetracarbonyl nickel

Exposure Limits:
NIOSH REL: Ca
TWA 0.001 ppm (0.007 mg/m^3)
See Appendix A
OSHA PEL: TWA 0.001 ppm (0.007 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6007

Physical Description: Colorless to yellow liquid with a musty odor. [**Note:** A gas above 110°F.]

Chemical & Physical Properties:
MW: 170.7
BP: 110°F
Sol: 0.05%
Fl.P: <-4°F
IP: 8.28 eV
Sp.Gr(63°F): 1.32
VP: 315 mmHg
FRZ: -13°F
UEL: ?
LEL: 2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Nitric acid, bromine, chlorine & other oxidizers; flammable materials

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Abs, Con
SY: Head, dizz; nau, vomit, epigastric pain; substernal pain; cough, hyperpnea; cyan; lass; leucyt, pneu; delirium, convuls; [carc]; in animals: repro, terato effects
TO: Lungs, paranasal sinus, CNS, repro sys [lung & nasal cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Nickel metal and other compounds (as Ni)

Formula: Ni (metal) | **CAS#:** 7440-02-0 (metal) | **RTECS#:** QR5950000 (metal) | **IDLH:** Ca [10 mg/m^3 (as Ni)]

Conversion: | **DOT:**

Synonyms/Trade Names: **Nickel metal:** Elemental nickel, Nickel catalyst
Synonyms of other nickel compounds vary depending upon the specific compound.

Exposure Limits:
NIOSH REL*: Ca
TWA 0.015 mg/m^3
See Appendix A
OSHA PEL*†: TWA 1 mg/m^3
[***Note:** The REL and PEL do not apply to Nickel carbonyl.]

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102
OSHA ID121, ID125G

Physical Description: Metal: Lustrous, silvery, odorless solid.

Chemical & Physical Properties:
MW: 58.7
BP: 5139°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 8.90 (Metal)
VP: 0 mmHg (approx)
MLT: 2831°F
UEL: NA
LEL: NA
Metal: Combustible Solid; nickel sponge catalyst may ignite SPONTANEOUSLY in air.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong acids, sulfur, selenium, wood & other combustibles, nickel nitrate

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Sens derm, allergic asthma, pneu; [carc]
TO: Nasal cavities, lungs, skin [lung and nasal cancer]

First Aid (see Table 6):
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Nicotine

Formula: $C_5H_4NC_4H_7NCH_3$ | **CAS#:** 54-11-5 | **RTECS#:** QS5250000 | **IDLH:** 5 mg/m^3

Conversion: | **DOT:** 1654 151

Synonyms/Trade Names: 3-(1-Methyl-2-pyrrolidyl)pyridine

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3 [skin]
OSHA PEL: TWA 0.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 2544, 2551

Physical Description: Pale-yellow to dark-brown liquid with a fish-like odor when warm. [insecticide]

Chemical & Physical Properties:
MW: 162.2
BP: 482°F (Decomposes)
Sol: Miscible
Fl.P: 203°F
IP: 8.01 eV
Sp.Gr: 1.01
VP: 0.08 mmHg
FRZ: -110°F
UEL: 4.0%
LEL: 0.7%
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Nau, salv, abdom pain, vomit, diarr; head, dizz, hearing, vis dist; conf, lass, inco; card arrhy; convuls, dysp; in animals: terato effects
TO: CNS, CVS, lungs, GI tract, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Nitric acid

Formula: HNO_3 | **CAS#:** 7697-37-2 | **RTECS#:** QU5775000 | **IDLH:** 25 ppm

Conversion: 1 ppm = 2.58 mg/m^3

DOT: 2032 157 (fuming); 2031 157 (other than red fuming)

Synonyms/Trade Names: Aqua fortis, Engravers acid, Hydrogen nitrate, Red fuming nitric acid (RFNA), White fuming nitric acid (WFNA)

Exposure Limits:
NIOSH REL: TWA 2 ppm (5 mg/m^3)
ST 4 ppm (10 mg/m^3)
OSHA PEL†: TWA 2 ppm (5 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 7903
OSHA ID165SG

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.]

Chemical & Physical Properties:
MW: 63.0
BP: 181°F
Sol: Miscible
FI.P: NA
IP: 11.95 eV
Sp.Gr(77°F): 1.50
VP: 48 mmHg
FRZ: -44°F
UEL: NA
LEL: NA
Noncombustible Liquid, but increases the flammability of combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash (pH<2.5)
Quick drench (pH<2.5)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 ppm: Sa:Cf*/CcrFS¿/GmFS¿/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and Reactivities: Combustible materials, metallic powders, hydrogen sulfide, carbides, alcohols [**Note:** Reacts with water to produce heat. Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; delayed pulm edema, pneu, bron; dental erosion
TO: Eyes, skin, resp sys, teeth

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

N

Nitric oxide

Formula: NO | **CAS#:** 10102-43-9 | **RTECS#:** QX0525000 | **IDLH:** 100 ppm

Conversion: 1 ppm = 1.23 mg/m^3

DOT: 1660 124

Synonyms/Trade Names: Mononitrogen monoxide, Nitrogen monoxide

Exposure Limits:
NIOSH REL: TWA 25 ppm (30 mg/m^3)
OSHA PEL: TWA 25 ppm (30 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6014
OSHA ID190

Physical Description: Colorless gas. [**Note:** Shipped as a nonliquefied compressed gas.]

Chemical & Physical Properties:
MW: 30.0
BP: -241°F
Sol: 5%
FI.P: NA
IP: 9.27 eV
RGasD: 1.04
VP: 34.2 atm
FRZ: -263°F
UEL: NA
LEL: NA
Nonflammable Gas, but will accelerate the burning of combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: Sa:Cf*/CcrFS¿/PaprS*¿/GmFS¿/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and Reactivities: Fluorine, combustible materials, ozone, NH_3, chlorinated hydrocarbons, metals, carbon disulfide [**Note:** Reacts with water to form nitric acid. Rapidly converted in air to nitrogen dioxide.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Irrit eyes, wet skin, nose, throat; drow, uncon; methemo
TO: Eyes, skin, resp sys, blood, CNS

First Aid (see Table 6):
Breath: Resp support

p-Nitroaniline	Formula: $NO_2C_6H_4NH_2$	CAS#: 100-01-6	RTECS#: BY7000000	IDLH: 300 mg/m^3
Conversion:	**DOT:** 1661 153			

Synonyms/Trade Names: para-Aminonitrobenzene, 4-Nitroaniline, 4-Nitrobenzenamine, p-Nitrophenylamine, PNA

Exposure Limits:
NIOSH REL: TWA 3 mg/m^3 [skin]
OSHA PEL†: TWA 6 mg/m^3 (1 ppm) [skin]

Measurement Methods (see Table 1):
NIOSH 5033

Physical Description: Bright yellow, crystalline powder with a slight ammonia-like odor.

Chemical & Physical Properties:
MW: 138.1
BP: 630°F
Sol: 0.08%
Fl.P: 390°F
IP: 8.85 eV
Sp.Gr: 1.42
VP: 0.00002 mmHg
MLT: 295°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
30 mg/m^3: Sa*
75 mg/m^3: Sa:Cf*
150 mg/m^3: ScbaF/SaF
300 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong reducers
[**Note:** May result in spontaneous heating of organic materials in the presence of moisture.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit nose, throat; cyan, ataxia; tacar, tachypnea; dysp; irrity; vomit, diarr; convuls; resp arrest; anemia; methemo; jaundice
TO: Resp sys, blood, heart, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Nitrobenzene	Formula: $C_6H_5NO_2$	CAS#: 98-95-3	RTECS#: DA6475000	IDLH: 200 ppm
Conversion: 1 ppm = 5.04 mg/m^3	**DOT:** 1662 152			

Synonyms/Trade Names: Essence of mirbane, Nitrobenzol, Oil of mirbane

Exposure Limits:
NIOSH REL: TWA 1 ppm (5 mg/m^3) [skin]
OSHA PEL: TWA 1 ppm (5 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2005, 2017

Physical Description: Yellow, oily liquid with a pungent odor like paste shoe polish.
[**Note:** A solid below 42°F.]

Chemical & Physical Properties:
MW: 123.1
BP: 411°F
Sol: 0.2%
Fl.P: 190°F
IP: 9.92 eV
Sp.Gr: 1.20
VP(77°F): 0.3 mmHg
FRZ: 42°F
UEL: ?
LEL(200°F): 1.8%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 ppm: CcrOv*/Sa*
25 ppm: Sa:Cf*/PaprOv*
50 ppm: CcrFOv/GmFOv/PaprTOv*/ScbaF/SaF
200 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Concentrated nitric acid, nitrogen tetroxide, caustics, phosphorus pentachloride, chemically-active metals such as tin or zinc

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; anoxia; derm; anemia; methemo; in animals: liver, kidney damage; testicular effects
TO: Eyes, skin, blood, liver, kidneys, CVS, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

4-Nitrobiphenyl	Formula: $C_6H_5C_6H_4NO_2$	CAS#: 92-93-3	RTECS#: DV5600000	IDLH: Ca [N.D.]
Conversion:	**DOT:**			

Synonyms/Trade Names: p-Nitrobiphenyl, p-Nitrodiphenyl, 4-Nitrodiphenyl, p-Phenylnitrobenzene, 4-Phenylnitrobenzene, PNB

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1003] See Appendix B

Measurement Methods (see Table 1):
NIOSH P&CAM273 (II-4)
OSHA PV2082

Physical Description: White to yellow, needle-like, crystalline solid with a sweetish odor.

Chemical & Physical Properties:
MW: 199.2
BP: 644°F
Sol: Insoluble
Fl.P: 290°F
IP: ?
Sp.Gr: ?
VP: ?
MLT: 237°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong reducers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, drow, dizz; dysp; ataxia, lass; methemo; urinary burning; acute hemorrhagic cystitis; [carc]
TO: Bladder, blood [in animals: bladder tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

N

p-Nitrochlorobenzene	Formula: $ClC_6H_4NO_2$	CAS#: 100-00-5	RTECS#: CZ1050000	IDLH: Ca [100 mg/m^3]
Conversion:	**DOT:** 1578 152			

Synonyms/Trade Names: p-Chloronitrobenzene, 4-Chloronitrobenzene, 1-Chloro-4-nitrobenzene, 4-Nitrochlorobenzene, PCNB, PNCB

Exposure Limits:
NIOSH REL: Ca
See Appendix A [skin]
OSHA PEL: TWA 1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 2005

Physical Description: Yellow, crystalline solid with a sweet odor.

Chemical & Physical Properties:
MW: 157.6
BP: 468°F
Sol: Slight
Fl.P: 261°F
IP: 9.96 eV
Sp.Gr: 1.52
VP(86°F): 0.2 mmHg
MLT: 182°F
UEL: ?
LEL: ?
Solid that does not burn, or burns with difficulty.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Anoxia; unpleasant taste; anemia; methemo; in animals: hema; spleen, kidney, bone marrow changes; repro effects; [carc]
TO: Blood, liver, kidneys, CVS, spleen, bone marrow, repro sys [in animals: vascular & liver tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Nitroethane

Formula: $CH_3CH_2NO_2$ | **CAS#:** 79-24-3 | **RTECS#:** KI5600000 | **IDLH:** 1000 ppm

Conversion: 1 ppm = 3.07 mg/m^3 | **DOT:** 2842 129

Synonyms/Trade Names: Nitroetan

Exposure Limits:
NIOSH REL: TWA 100 ppm (310 mg/m^3)
OSHA PEL: TWA 100 ppm (310 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2526

Physical Description: Colorless, oily liquid with a mild, fruity odor.

Chemical & Physical Properties:
MW: 75.1
BP: 237°F
Sol: 5%
FI.P: 82°F
IP: 10.88 eV
Sp.Gr: 1.05
VP(77°F): 21 mmHg
FRZ: -130°F
UEL: ?
LEL: 3.4%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and Reactivities: Amines; strong acids, alkalis & oxidizers; hydrocarbons; combustibles; metal oxides

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Derm; in animals: lac; dysp, pulm rales, edema; liver, kidney inj; narco
TO: Skin, resp sys, CNS, kidneys, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Nitrogen dioxide

Formula: NO_2 | **CAS#:** 10102-44-0 | **RTECS#:** QW9800000 | **IDLH:** 20 ppm

Conversion: 1 ppm = 1.88 mg/m^3 | **DOT:** 1067 124

Synonyms/Trade Names: Dinitrogen tetroxide (N_2O_4), Nitrogen peroxide

Exposure Limits:
NIOSH REL: ST 1 ppm (1.8 mg/m^3)
OSHA PEL†: C 5 ppm (9 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6014
OSHA ID182

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_2O_4.]

Chemical & Physical Properties:
MW: 46.0
BP: 70°F
Sol: Reacts
FI.P: NA
IP: 9.75 eV
RGasD: 2.62
Sp.Gr: 1.44 (Liquid at 68°F)
VP: 720 mmHg
FRZ: 15°F
UEL: NA
LEL: NA
Noncombustible Liquid/Gas, but will accelerate the burning of combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
20 ppm: Sa:Cf£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and Reactivities: Combustible material, water, chlorinated hydrocarbons, carbon disulfide, ammonia [**Note:** Reacts with water to form nitric acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat; cough, mucoid frothy sputum, decr pulm func, chronic bron, dysp; chest pain; pulm edema, cyan, tachypnea, tacar
TO: Eyes, resp sys, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Nitrogen trifluoride

Formula:	CAS#:	RTECS#:	IDLH:
NF_3	7783-54-2	QX1925000	1000 ppm

Conversion: 1 ppm = 2.90 mg/m^3

DOT: 2451 122

Synonyms/Trade Names: Nitrogen fluoride, Trifluoramine, Trifluorammonia

Exposure Limits:
NIOSH REL: TWA 10 ppm (29 mg/m^3)
OSHA PEL: TWA 10 ppm (29 mg/m^3)

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a moldy odor.
[**Note:** Shipped as a nonliquefied compressed gas.]

Chemical & Physical Properties:
MW: 71.0
BP: -200°F
Sol: Slight
FI.P: NA
IP: 12.97 eV
RGasD: 2.46
VP: >1 atm
FRZ: -340°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
100 ppm: CcrS/Sa
250 ppm: Sa:Cf/PaprS
500 ppm: CcrFS/GmFS/PaprTS*/SaT:Cf*/ScbaF/SaF
1000 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Water, oil, grease, oxidizable materials, ammonia, carbon monoxide, methane, hydrogen, hydrogen sulfide, activated charcoal, diborane

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: In animals: anoxia, cyan; methemo; lass, dizz, head; liver, kidney inj
TO: Blood, liver, kidneys

First Aid (see Table 6):
Breath: Resp support

N

Nitroglycerine

Formula:	CAS#:	RTECS#:	IDLH:
$CH_2NO_3CHNO_3CH_2NO_3$	55-63-0	QX2100000	75 mg/m^3

Conversion: 1 ppm = 9.29 mg/m^3

DOT: 1204 127 (≤ 1% solution in alcohol);
3064 127 (1-5% solution in alcohol)

Synonyms/Trade Names: Glyceryl trinitrate; NG; 1,2,3-Propanetriol trinitrate; Trinitroglycerine

Exposure Limits:
NIOSH REL: ST 0.1 mg/m^3 [skin]
OSHA PEL†: C 0.2 ppm (2 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2507
OSHA 43

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%).]

Chemical & Physical Properties:
MW: 227.1
BP: Begins to decompose at 122-140°F
Sol: 0.1%
FI.P: Explodes
IP: ?
Sp.Gr: 1.60
VP: 0.0003 mmHg
FRZ: 56°F
UEL: ?
LEL: ?
Explosive Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1 mg/m^3: Sa*
2.5 mg/m^3: Sa:Cf*
5 mg/m^3: SaT:Cf*/ScbaF/SaF
75 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Heat, ozone, shock, acids [**Note:** An OSHA Class A Explosive (1910.109).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Throb head; dizz; nau, vomit, abdom pain; hypotension; flush; palp; methemo; delirium, CNS depres; angina; skin irrit
TO: CVS, blood, skin, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Nitromethane

Formula:	CAS#:	RTECS#:	IDLH:
CH_3NO_2	75-52-5	PA9800000	750 ppm

Conversion: 1 ppm = 2.50 mg/m^3

DOT: 1261 129

Synonyms/Trade Names: Nitrocarbol

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL: TWA 100 ppm (250 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2527

Physical Description: Colorless, oily liquid with a disagreeable odor.

Chemical & Physical Properties:
MW: 61.0
BP: 214°F
Sol: 10%
FI.P: 95°F
IP: 11.08 eV
Sp.Gr: 1.14
VP: 28 mmHg
FRZ: -20°F
UEL: ?
LEL: 7.3%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
OSHA
750 ppm: Sa:Cf£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and Reactivities: Amines; strong acids, alkalis & oxidizers; hydrocarbons & other combustible materials; metallic oxides [**Note:** Slowly corrodes steel & copper when wet.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Derm; in animals: irrit eyes, resp sys; convuls, narco; liver damage
TO: Eyes, skin, CNS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

2-Nitronaphthalene

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_7NO_2$	581-89-5	QJ9760000	Ca [N.D.]

Conversion:

DOT: 2538 133

Synonyms/Trade Names: β-Nitronaphthalene

Exposure Limits:
NIOSH REL: Ca*
See Appendix A
[***Note:** Since metabolized to β-Naphthylamine.]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless solid.

Chemical & Physical Properties:
MW: 178.2
BP: ?
Sol: Insoluble
FI.P: ?
IP: 8.67 eV
Sp.Gr: ?
VP: ?
MLT: 174°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: For "Nitrates" in general: Aluminum, cyanides, esters, phosphorus, tin chlorides, thiocyanates, sodium hypophosphite

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit skin, resp sys; derm; [carc]
TO: Skin, resp sys [bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

1-Nitropropane	Formula: $CH_3CH_2CH_2NO_2$	CAS#: 108-03-2	RTECS#: TZ5075000	IDLH: 1000 ppm
Conversion: 1 ppm = 3.64 mg/m^3	**DOT:** 2608 129			
Synonyms/Trade Names: Nitropropane, 1-NP				
Exposure Limits: **NIOSH REL:** TWA 25 ppm (90 mg/m^3) **OSHA PEL:** TWA 25 ppm (90 mg/m^3)			**Measurement Methods (see Table 1):** **OSHA** 46	
Physical Description: Colorless liquid with a somewhat disagreeable odor.				
Chemical & Physical Properties: **MW:** 89.1 **BP:** 269°F **Sol:** 1% **FI.P:** 96°F **IP:** 10.81 eV **Sp.Gr:** 1.00 **VP:** 8 mmHg **FRZ:** -162°F **UEL:** ? **LEL:** 2.2% Class IC Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** Prevent eye contact **Wash skin:** N.R. **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **250 ppm:** Sa* **625 ppm:** Sa:Cf* **1000 ppm:** ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** ScbaE	
Incompatibilities and Reactivities: Amines; strong acids, alkalis & oxidizers; hydrocarbons & other combustible materials; metal oxides				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes; head, nau, vomit, diarr; in animals: liver, kidney damage **TO:** Eyes, CNS, liver, kidneys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

N

2-Nitropropane	Formula: $(CH_3)_2CH(NO_2)$	CAS#: 79-46-9	RTECS#: TZ5250000	IDLH: Ca [100 ppm]
Conversion: 1 ppm = 3.64 mg/m^3	**DOT:** 2608 129			
Synonyms/Trade Names: Dimethylnitromethane, iso-Nitropropane, 2-NP				
Exposure Limits: **NIOSH REL:** Ca See Appendix A **OSHA PEL†:** TWA 25 ppm (90 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 2528 **OSHA** 15, 46	
Physical Description: Colorless liquid with a pleasant, fruity odor.				
Chemical & Physical Properties: **MW:** 89.1 **BP:** 249°F **Sol:** 2% **FI.P:** 75°F **IP:** 10.71 eV **Sp.Gr:** 0.99 **VP:** 13 mmHg **FRZ:** -135°F **UEL:** 11.0% **LEL:** 2.6% Class IC Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** ScbaE	
Incompatibilities and Reactivities: Amines; strong acids, alkalis & oxidizers; metal oxides; combustible materials				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, nose, resp sys; head, anor, nau, vomit, diarr; kidney, liver damage; [carc] **TO:** Eyes, skin, resp sys, CNS, kidneys, liver [in animals: liver tumors]			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

N-Nitrosodimethylamine	Formula: $(CH_3)_2N_2O$	CAS#: 62-75-9	RTECS#: IQ0525000	IDLH: Ca [N.D.]
Conversion:	**DOT:**			

Synonyms/Trade Names: Dimethylnitrosamine; N,N-Dimethylnitrosamine; DMNA; N-Methyl-N-nitroso-methanamine; NDMA; N-Nitroso-N,N-dimethylamine

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1016] See Appendix B

Measurement Methods (see Table 1):
NIOSH 2522
OSHA 38

Physical Description: Yellow, oily liquid with a faint, characteristic odor.

Chemical & Physical Properties:
MW: 74.1
BP: 306°F
Sol: Soluble
FI.P: ?
IP: 8.69 eV
Sp.Gr: 1.005
VP: 3 mmHg
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Strong oxidizers [**Note:** Should be stored in dark bottles.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Nau, vomit, diarr, abdom cramps; head; fever; enlarged liver, jaun; decr liver, kidney, pulm func; [carc]
TO: Liver, kidneys,lungs [in animals; lung, kidney, liver & nasal cavity tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

m-Nitrotoluene	Formula: $NO_2C_6H_4CH_3$	CAS#: 99-08-1	RTECS#: XT2975000	IDLH: 200 ppm
Conversion: 1 ppm = 5.61 mg/m^3	**DOT:** 1664 152			

Synonyms/Trade Names: m-Methylnitrobenzene, 3-Methylnitrobenzene, meta-Nitrotoluene, 3-Nitrotoluene

Exposure Limits:
NIOSH REL: TWA 2 ppm (11 mg/m^3) [skin]
OSHA PEL†: TWA 5 ppm (30 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2005

Physical Description: Yellow liquid with a weak, aromatic odor.
[**Note:** A solid below 59°F.]

Chemical & Physical Properties:
MW: 137.1
BP: 450°F
Sol: 0.05%
FI.P: 223°F
IP: 9.48 eV
Sp.Gr: 1.16
VP: 0.1 mmHg
FRZ: 59°F
UEL: ?
LEL: 1.6%
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
20 ppm: Sa*
50 ppm: Sa:Cf*
100 ppm: SaT:Cf*/ScbaF/SaF
200 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, sulfuric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Anoxia, cyan; head, lass, dizz; ataxia; dysp; tacar; nau, vomit
TO: Blood, CNS, CVS, skin, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

o-Nitrotoluene	Formula: $NO_2C_6H_4CH_3$	CAS#: 88-72-2	RTECS#: XT3150000	IDLH: 200 ppm
Conversion: 1 ppm = 5.61 mg/m^3	**DOT:** 1664 152			
Synonyms/Trade Names: o-Methylnitrobenzene, 2-Methylnitrobenzene, ortho-Nitrotoluene, 2-Nitrotoluene				
Exposure Limits: **NIOSH REL:** TWA 2 ppm (11 mg/m^3) [skin] **OSHA PEL†:** TWA 5 ppm (30 mg/m^3) [skin]			**Measurement Methods (see Table 1):** **NIOSH** 2005	
Physical Description: Yellow liquid with a weak, aromatic odor. [**Note:** A solid below 25°F.]				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 137.1 **BP:** 432°F **Sol:** 0.07% **Fl.P:** 223°F **IP:** 9.43 eV **Sp.Gr:** 1.16 **VP:** 0.1 mmHg **FRZ:** 25°F **UEL:** ? **LEL:** 2.2% Class IIIB Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH** **20 ppm:** Sa* **50 ppm:** Sa:Cf* **100 ppm:** SaT:Cf*/ScbaF/SaF **200 ppm:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, sulfuric acid	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Anoxia, cyan; head, lass, dizz; ataxia; dysp; tacar; nau, vomit **TO:** Blood, CNS, CVS, skin, GI tract	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

N

p-Nitrotoluene	Formula: $NO_2C_6H_4CH_3$	CAS#: 99-99-0	RTECS#: XT3325000	IDLH: 200 ppm
Conversion: 1 ppm = 5.61 mg/m^3	**DOT:** 1664 152			
Synonyms/Trade Names: p-Methylnitrobenzene, 4-Methylnitrobenzene, para-Nitrotoluene, 4-Nitrotoluene				
Exposure Limits: **NIOSH REL:** TWA 2 ppm (11 mg/m^3) [skin] **OSHA PEL†:** TWA 5 ppm (30 mg/m^3) [skin]			**Measurement Methods (see Table 1):** **NIOSH** 2005	
Physical Description: Crystalline solid with a weak, aromatic odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 137.1 **BP:** 460°F **Sol:** 0.04% **Fl.P:** 223°F **IP:** 9.50 eV **Sp.Gr:** 1.12 **VP:** 0.1 mmHg **MLT:** 126°F **UEL:** ? **LEL:** 1.6% Combustible Solid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily	**NIOSH** **20 ppm:** Sa* **50 ppm:** Sa:Cf* **100 ppm:** SaT:Cf*/ScbaF/SaF **200 ppm:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, sulfuric acid	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Anoxia, cyan; head, lass, dizz; ataxia; dysp; tacar; nau, vomit **TO:** Blood, CNS, CVS, skin, GI tract	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

Nitrous oxide

Formula:	CAS#:	RTECS#:	IDLH:
N_2O	10024-97-2	QX1350000	N.D.

Conversion: 1 ppm = 1.80 mg/m^3

DOT: 1070 122; 2201 122 (refrigerated liquid)

Synonyms/Trade Names: Dinitrogen monoxide, Hyponitrous acid anhydride, Laughing gas

Exposure Limits:
NIOSH REL*: TWA 25 ppm (46 mg/m^3) (TWA over the time exposed)
[***Note:** REL for exposure to waste anesthetic gas.]
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 3800, 6600
OSHA ID166

Physical Description: Colorless gas with a slightly sweet odor. [inhalation anesthetic]
[**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 44.0
BP: -127°F
Sol(77°F): 0.1%
Fl.P: NA
IP: 12.89 eV
RGasD: 1.53
VP: 51.3 atm
FRZ: -132°F
UEL: NA
LEL: NA
Nonflammable Gas, but supports combustion at elevated temperatures.

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Aluminum, boron, hydrazine, lithium hydride, phosphine, sodium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Dysp; drow, head; asphy; repro effects; liquid: frostbite
TO: Resp sys, CNS, repro sys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Fresh air

Nonane

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3(CH_2)_7CH_3$	111-84-2	RA6115000	N.D.

Conversion: 1 ppm = 5.25 mg/m^3

DOT: 1920 128

Synonyms/Trade Names: n-Nonane, Nonyl hydride

Exposure Limits:
NIOSH REL: TWA 200 ppm (1050 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a gasoline-like odor.

Chemical & Physical Properties:
MW: 128.3
BP: 303°F
Sol: Insoluble
Fl.P: 88°F
IP: 10.21 eV
Sp.Gr: 0.72
VP: 3 mmHg
FRZ: -60°F
UEL: 2.9%
LEL: 0.8%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers (e.g., peroxides, nitrates, perchlorates)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; head, drow, dizz, conf, nau, tremor, inco; chemical pneu (aspir liquid)
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

1-Nonanethiol	Formula: $CH_3(CH_2)_8SH$	CAS#: 1455-21-6	RTECS#:	IDLH: N.D.
Conversion: 1 ppm = 6.56 mg/m^3	**DOT:** 1228 131			
Synonyms/Trade Names: 1-Mercaptononane, n-Nonyl mercaptan, Nonylthiol				
Exposure Limits: **NIOSH REL:** C 0.5 ppm (3.3 mg/m^3) [15-minute] **OSHA PEL:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Liquid.				
Chemical & Physical Properties: **MW:** 160.3 **BP:** ? **Sol:** Insoluble **FI.P:** ? **IP:** ? **Sp.Gr:** ? **VP:** ? **FRZ:** ? **UEL:** ? **LEL:** ? Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **5 ppm:** CcrOv/Sa **12.5 ppm:** Sa:Cf/PaprOv **25 ppm:** CcrFOv/GmFOv/PaprTOv/ ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids & bases, alkali metals				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat; lass, cyan, incr respiration, nau, drow, head, vomit **TO:** Eyes, skin, resp sys, blood, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed	

Octachloronaphthalene	Formula: $C_{10}C_{l8}$	CAS#: 2234-13-1	RTECS#: QK0250000	IDLH: See Appendix F
Conversion:	**DOT:**			
Synonyms/Trade Names: Halowax® 1051; 1,2,3,4,5,6,7,8-Octachloronaphthalene; Perchloronaphthalene				
Exposure Limits: **NIOSH REL:** TWA 0.1 mg/m^3 ST 0.3 mg/m^3 [skin] **OSHA PEL†:** TWA 0.1 mg/m^3 [skin]			**Measurement Methods (see Table 1):** **NIOSH** S97 (II-2)	
Physical Description: Waxy, pale-yellow solid with an aromatic odor.				
Chemical & Physical Properties: **MW:** 403.7 **BP:** 770°F **Sol:** Insoluble **FI.P:** NA **IP:** ? **Sp.Gr:** 2.00 **VP:** <1 mmHg **MLT:** 365°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam/Daily **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **1 mg/m^3:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE **See Appendix F**	
Incompatibilities and Reactivities: Strong oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Acne-form derm; liver damage, jaun **TO:** Skin, liver			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

1-Octadecanethiol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3(CH_2)_{17}SH$	2885-00-9		N.D.

Conversion: 1 ppm = 11.72 mg/m^3
DOT: 1228 131 (liquid)

Synonyms/Trade Names: 1-Mercaptooctadecane, Octadecyl mercaptan, Stearyl mercaptan

Exposure Limits:
NIOSH REL: C 0.5 ppm (5.9 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Solid or liquid (above 77°F).

Chemical & Physical Properties:
MW: 286.6
BP: ?
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr: 0.85
VP: ?
MLT: 77°F
UEL: ?
LEL: ?
Combustible Solid
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids & bases, alkali metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz, lass, cyan, nau, convuls
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Octane

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3[CH_2]_6CH_3$	111-65-9	RG8400000	1000 ppm [10%LEL]

Conversion: 1 ppm = 4.67 mg/m^3
DOT: 1262 128

Synonyms/Trade Names: n-Octane, normal-Octane

Exposure Limits:
NIOSH REL: TWA 75 ppm (350 mg/m^3)
C 385 ppm (1800 mg/m^3) [15-minute]
OSHA PEL†: TWA 500 ppm (2350 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1500
OSHA 7

Physical Description: Colorless liquid with a gasoline-like odor.

Chemical & Physical Properties:
MW: 114.2
BP: 258°F
Sol(77°F): 0.00007%
Fl.P: 56°F
IP: 9.82 eV
Sp.Gr: 0.70
VP: 10 mmHg
FRZ: -70°F
UEL: 6.5%
LEL: 1.0%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
750 ppm: Sa*
1000 ppm: Sa:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose; drow; derm; chemical pneu (aspir liquid); in animals: narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

1-Octanethiol	Formula: $CH_3(CH_2)_7SH$	CAS#: 111-88-6	RTECS#:	IDLH: N.D.
Conversion: 1 ppm = 5.98 mg/m^3	**DOT:** 1228 131			
Synonyms/Trade Names: 1-Mercaptooctane, n-Octyl mercaptan, Octylthiol, 1-Octylthiol				
Exposure Limits: **NIOSH REL:** C 0.5 ppm (3.0 mg/m^3) [15-minute] **OSHA PEL:** none			**Measurement Methods (see Table 1):** **NIOSH** 2510	
Physical Description: Water-white liquid with a mild odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 146.3 **BP:** 390°F **Sol:** Insoluble **Fl.P(oc):** 115°F **IP:** ? **Sp.Gr:** 0.84 **VP(212°F):** 3 mmHg **FRZ:** -57°F **UEL:** ? **LEL:** ? Class II Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**NIOSH** **5 ppm:** CcrOv/Sa **12.5 ppm:** Sa:Cf/PaprOv **25 ppm:** CcrFOv/GmFOv/PaprTOv/ ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids & bases, alkali metals	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat; lass, cyan, incr respiration, nau, drow, head, vomit **TO:** Eyes, skin, resp sys, blood, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

Oil mist (mineral)	Formula:	CAS#: 8012-95-1	RTECS#: PY8030000	IDLH: 2500 mg/m^3
Conversion:	**DOT:**			
Synonyms/Trade Names: Heavy mineral oil mist, Paraffin oil mist, White mineral oil mist				
Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 ST 10 mg/m^3 **OSHA PEL:** TWA 5 mg/m^3			**Measurement Methods (see Table 1):** **NIOSH** 5026, 5524	
Physical Description: Colorless, oily liquid aerosol dispersed in air. [**Note:** Has an odor like burned lubricating oil.]				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: Varies **BP:** 680°F **Sol:** Insoluble **Fl.P(oc):** 380°F **IP:** ? **Sp.Gr:** 0.90 **VP:** <0.5 mmHg **FRZ:** 0°F **UEL:** ? **LEL:** ? Class IIIB Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** N.R. **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily	**NIOSH/OSHA** **50 mg/m^3:** 100XQ/Sa **125 mg/m^3:** Sa:Cf/PaprHie **250 mg/m^3:** 100F/SaT:Cf/PaprTHie/ ScbaF/SaF **2500 mg/m^3:** Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE

Incompatibilities and Reactivities: None reported	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Irrit eyes, skin, resp sys **TO:** Eyes, skin, resp sys	**First Aid (see Table 6):** **Skin:** Soap wash **Breath:** Fresh air

Osmium tetroxide

Formula:	CAS#:	RTECS#:	IDLH:
OsO_4	20816-12-0	RN1140000	1 mg/m^3

Conversion: 1 ppm = 10.40 mg/m^3 **DOT:** 2471 154

Synonyms/Trade Names: Osmic acid anhydride, Osmium oxide

Exposure Limits:
NIOSH REL: TWA 0.002 mg/m^3 (0.0002 ppm)
ST 0.006 mg/m^3 (0.0006 ppm)
OSHA PEL†: TWA 0.002 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Colorless, crystalline solid or pale-yellow mass with an unpleasant, acrid, chlorine-like odor. [**Note:** A liquid above 105°F.]

Chemical & Physical Properties:
MW: 254.2
BP: 266°F
Sol(77°F): 6%
FI.P: NA
IP: 12.60 eV
Sp.Gr: 5.10
VP: 7 mmHg
MLT: 105°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.1 mg/m^3: CcrFS100/GmFS100/ScbaF/SaF
1 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS100/ScbaE

Incompatibilities and Reactivities: Hydrochloric acid, easily oxidized organic materials
[**Note:** Begins to sublime below BP. Contact with other materials may cause fire.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp sys; lac, vis dist; conj; head; cough, dysp; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

O

Oxalic acid

Formula:	CAS#:	RTECS#:	IDLH:
HOOCCOOH×2H_2O	144-62-7	RO2450000	500 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: Ethanedioic acid, Oxalic acid (aqueous), Oxalic acid dihydrate

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
ST 2 mg/m^3
OSHA PEL†: TWA 1 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Colorless, odorless powder or granular solid.
[**Note:** The anhydrous form $(COOH)_2$ is an odorless, white solid.]

Chemical & Physical Properties:
MW: 126.1
BP: Sublimes
Sol: 14%
FI.P: ?
IP: ?
Sp.Gr: 1.90
VP: <0.001 mmHg
MLT: 215°F (Sublimes)
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 mg/m^3: Sa:Cf£/PaprHie£
50 mg/m^3: 100F/ScbaF/SaF
500 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, silver compounds, strong alkalis, chlorites
[**Note:** Gives off water of crystallization at 215°F and begins to sublime.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; eye burns; local pain, cyan; shock, collapse, convuls; kidney damage
TO: Eyes, skin, resp sys, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

Oxygen difluoride	Formula: OF_2	CAS#: 7783-41-7	RTECS#: RS2100000	IDLH: 0.5 ppm
Conversion: 1 ppm = 2.21 mg/m^3	**DOT:** 2190 124			
Synonyms/Trade Names: Difluorine monoxide, Fluorine monoxide, Oxygen fluoride				
Exposure Limits: **NIOSH REL:** C 0.05 ppm (0.1 mg/m^3) **OSHA PEL†:** TWA 0.05 ppm (0.1 mg/m^3)			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless gas with a peculiar, foul odor. [**Note:** Shipped as a nonliquefied compressed gas.]				
Chemical & Physical Properties: **MW:** 54.0 **BP:** -230°F **Sol:** 0.02% **Fl.P:** NA **IP:** 13.11 eV **RGasD:** 1.88 **VP:** >1 atm **FRZ:** -371°F **UEL:** NA **LEL:** NA Nonflammable Gas, but a strong oxidizer.	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.5 ppm:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS¿/ScbaE	
Incompatibilities and 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.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Irrit eyes, skin, resp sys; head; pulm edema; eye, skin burns (from contact with the gas under pressure) **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support	

Ozone	Formula: O_3	CAS#: 10028-15-6	RTECS#: RS8225000	IDLH: 5 ppm
Conversion: 1 ppm = 1.96 mg/m^3	**DOT:**			
Synonyms/Trade Names: Triatomic oxygen				
Exposure Limits: **NIOSH REL:** C 0.1 ppm (0.2 mg/m^3) **OSHA PEL†:** TWA 0.1 ppm (0.2 mg/m^3)			**Measurement Methods (see Table 1):** **OSHA** ID214	
Physical Description: Colorless to blue gas with a very pungent odor.				
Chemical & Physical Properties: **MW:** 48.0 **BP:** -169°F **Sol(32°F):** 0.001% **Fl.P:** NA **IP:** 12.52 eV **RGasD:** 1.66 **VP:** >1 atm **FRZ:** -315°F **UEL:** NA **LEL:** NA Nonflammable Gas, but a powerful oxidizer.	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **1 ppm**: CcrS¿/Sa **2.5 ppm:** Sa:Cf/PaprS¿ **5 ppm:** CcrFS¿/GmFS¿/SaT:Cf/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS¿/ScbaE	
Incompatibilities and Reactivities: All oxidizable materials (both organic & inorganic)				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Irrit eyes, muc memb; pulm edema; chronic resp disease **TO:** Eyes, resp sys			**First Aid (see Table 6):** **Eye:** Medical attention **Breath:** Fresh air; 100% O_2	

Paraffin wax fume	Formula: C_nH_{2n+2}	CAS#: 8002-74-2	RTECS#: RV0350000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Paraffin fume, Paraffin scale fume

Exposure Limits:
NIOSH REL: TWA 2 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2047

Physical Description: Paraffin wax is a white to slightly yellowish, odorless solid.
[**Note:** Consists of a mixture of high molecular weight hydrocarbons (e.g., $C_{36}H_{74}$).]

Chemical & Physical Properties:
MW: 350-420
BP: ?
Sol: Insoluble
Fl.P: 390°F
IP: ?
Sp.Gr: 0.88-0.92
VP: ?
MLT: 115-154°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys; discomfort, nau
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support

P

Paraquat (Paraquat dichloride)	Formula: $CH_3(C_5H_4N)_2CH_3{\times}2Cl$	CAS#: 1910-42-5	RTECS#: DW2275000	IDLH: 1 mg/m^3
Conversion:	**DOT:**			

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 ($C_{12}H_{14}N_2^{++}$; 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^3 (resp) [skin]
OSHA PEL†: TWA 0.5 mg/m^3 (resp) [skin]

Measurement Methods (see Table 1):
NIOSH 5003

Physical Description: Yellow solid with a faint, ammonia-like odor. [herbicide]
[**Note:** Paraquat may also be found commercially as a methyl sulfate salt $C_{12}H_{14}N_2{\times}2CH_3SO_4$.]

Chemical & Physical Properties:
MW: 257.2
BP: Decomposes
Sol: Miscible
Fl.P: NA
IP: ?
Sp.Gr: 1.24
VP: <0.0000001 mmHg
MLT: 572°F (Decomposes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1 mg/m^3: CcrOv95*/PaprOvHie*/ Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkylaryl-sulfonate wetting agents
[**Note:** Corrosive to metals. Decomposes in presence of ultraviolet light.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat, resp sys; epis; derm; fingernail damage; irrit GI tract; heart, liver, kidney damage
TO: Eyes, skin, resp sys, heart, liver, kidneys, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Parathion	**Formula:** $(C_2H_5O)_2P(S)OC_6H_4NO_2$	**CAS#:** 56-38-2	**RTECS#:** TF4550000	**IDLH:** 10 mg/m^3
Conversion:	**DOT:** 2783 152			

Synonyms/Trade Names: O,O-Diethyl-O(p-nitrophenyl) phosphorothioate; Diethyl parathion; Ethyl parathion; Parathion-ethyl

Exposure Limits:
NIOSH REL: TWA 0.05 mg/m^3 [skin]
OSHA PEL: TWA 0.1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5600
OSHA 62

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.]

Chemical & Physical Properties:
MW: 291.3
BP: 707°F
Sol: 0.001%
Fl.P(oc): 392°F
IP: ?
Sp.Gr: 1.27
VP: 0.00004 mmHg
FRZ: 43°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
0.5 mg/m^3: CcrOv95/Sa
1.25 mg/m^3: Sa:Cf/PaprOvHie
2.5 mg/m^3: CcrFOv100/SaT:Cf/PaprTOvHie/ScbaF/SaF
10 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkaline materials

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; miosis; rhin; head; chest tight, wheez, lar spasm, salv, cyan; anor, nau, vomit, abdom cramps, diarr; sweat; musc fasc, lass, para; dizz, conf, ataxia; convuls, coma; low BP; card irreg
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

P

Particulates not otherwise regulated	**Formula:**	**CAS#:**	**RTECS#:**	**IDLH:** N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: "Inert" dusts, Nuisance dusts, PNOR
[**Note:** Includes all inert or nuisance dusts, whether mineral, inorganic, not listed specifically in 1910.1000.]

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Dusts from solid substances without specific occupational exposure standards.

Chemical & Physical Properties:
Properties vary depending upon the specific solid.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, throat, upper resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Pentaborane

Formula:	CAS#:	RTECS#:	IDLH:
B_5H_9	19624-22-7	RY8925000	1 ppm

Conversion: 1 ppm = 2.58 mg/m^3 **DOT:** 1380 135

Synonyms/Trade Names: Pentaboron nonahydride

Exposure Limits:
NIOSH REL: TWA 0.005 ppm (0.01 mg/m^3)
ST 0.015 ppm (0.03 mg/m^3)
OSHA PEL†: TWA 0.005 ppm (0.01 mg/m^3)

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a pungent odor like sour milk.

Chemical & Physical Properties:
MW: 63.1
BP: 140°F
Sol: Reacts
Fl.P: 86°F
IP: 9.90 eV
Sp.Gr: 0.62
VP: 171 mmHg
FRZ: -52°F
UEL: ?
LEL: 0.42%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.05 ppm: Sa
0.125 ppm: Sa:Cf
0.25 ppm: SaT:Cf/ScbaF/SaF
1 ppm: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; dizz, head, drow, inco, tremor, convuls, behavioral changes; tonic spasm face, neck, abdom, limbs
TO: Eyes, skin, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

P

Pentachloroethane

Formula:	CAS#:	RTECS#:	IDLH:
$CHCl_2CCl_3$	76-01-7	KI6300000	N.D.

Conversion: **DOT:** 1669 151

Synonyms/Trade Names: Ethane pentachloride, Pentalin

Exposure Limits:
NIOSH REL: Handle with care in the workplace.
See Appendix C (Chloroethanes)
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 2517

Physical Description: Colorless liquid with a sweetish, chloroform-like odor.

Chemical & Physical Properties:
MW: 202.3
BP: 322°F
Sol: 0.05%
Fl.P: ?
IP: 11.28 eV
Sp.Gr: 1.68
VP: 3 mmHg
FRZ: -20°F
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: (Sodium-potassium alloy + bromoform), alkalis, metals, water
[**Note:** Hydrolysis produces dichloroacetic acid. Reaction with alkalis & metals produces spontaneously explosive chloroacetylenes.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, skin; lass, restless, irreg respiration, musc inco; liver, kidney, lung changes
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Pentachloronaphthalene	Formula: $C_{10}H_3Cl_5$	CAS#: 1321-64-8	RTECS#: QK0300000	IDLH: See Appendix F
Conversion:	**DOT:**			
Synonyms/Trade Names: Halowax® 1013; 1,2,3,4,5-Pentachloronaphthalene				

Exposure Limits: **NIOSH REL:** TWA 0.5 mg/m^3 [skin] **OSHA PEL:** TWA 0.5 mg/m^3 [skin]	Measurement Methods (see Table 1): **NIOSH** S96 (II-2)
Physical Description: Pale-yellow or white solid or powder with an aromatic odor.	

Chemical & Physical Properties: **MW:** 300.4 **BP:** 636°F **Sol:** Insoluble **FI.P:** NA **IP:** ? **Sp.Gr:** 1.67 **VP:** <1 mmHg **MLT:** 248°F **UEL:** NA **LEL:** NA Noncombustible Solid	Personal Protection/Sanitation (see Table 2): **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily	Respirator Recommendations (see Tables 3 and 4): **NIOSH/OSHA** **5 mg/m^3:** Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE **See Appendix F**

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Head, lass, dizz, anor; pruritus, acne-form skin eruptions; jaun, liver nec **TO:** Skin, liver, CNS	First Aid (see Table 6): **Eye:** Irr immed **Skin:** Soap prompt/molten flush immed **Breath:** Resp support **Swallow:** Medical Attention immed

Pentachlorophenol	Formula: C_6Cl_5OH	CAS#: 87-86-5	RTECS#: SM6300000	IDLH: 2.5 mg/m^3
Conversion:	**DOT:** 3155 154			
Synonyms/Trade Names: PCP; Penta; 2,3,4,5,6-Pentachlorophenol				

Exposure Limits: **NIOSH REL:** TWA 0.5 mg/m^3 [skin] **OSHA PEL:** TWA 0.5 mg/m^3 [skin]	Measurement Methods (see Table 1): **NIOSH** 5512
Physical Description: Colorless to white, crystalline solid with a benzene-like odor. [fungicide]	

Chemical & Physical Properties: **MW:** 266.4 **BP:** 588°F (Decomposes) **Sol:** 0.001% **FI.P:** NA **IP:** NA **Sp.Gr:** 1.98 **VP(77°F):** 0.0001 mmHg **MLT:** 374°F **UEL:** NA **LEL:** NA Noncombustible Solid	Personal Protection/Sanitation (see Table 2): **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench	Respirator Recommendations (see Tables 3 and 4): **NIOSH/OSHA** **2.5 mg/m^3:** CcrOv95*/PaprOvHie*/ Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, acids, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, nose, throat; sneez, cough; lass, anor, low-wgt; sweat; head, dizz; nau, vomit; dysp, chest pain; high fever; derm **TO:** Eyes, skin, resp sys, CVS, liver, kidneys, CNS	First Aid (see Table 6): **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

Pentaerythritol

Formula: $C(CH_2OH)_4$ | **CAS#:** 115-77-5 | **RTECS#:** RZ2490000 | **IDLH:** N.D.

Conversion: | **DOT:**

Synonyms/Trade Names: 2,2-bis(Hydroxymethyl)-1,3-propanediol; Methane tetramethylol; Monopentaerythritol; PE; Tetrahydroxymethylolmethane; Tetramethylolmethane

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Colorless to white, crystalline, odorless powder.
[**Note:** Technical grade is 88% monopentaerythritol & 12% dipentaerythritol.]

Chemical & Physical Properties:
MW: 136.2
BP: Sublimes
Sol(59°F): 6%
FI.P: ?
IP: ?
Sp.Gr: 1.38
VP: 0.00000008 mmHg
MLT: 500°F (Sublimes)
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Organic acids, oxidizers
[**Note:** Explosive compound is formed when a mixture of PE & thiophosphoryl chloride is heated.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp sys
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash
Breath: Fresh air
Swallow: Medical attention immed

P

n-Pentane

Formula: $CH_3[CH_2]_3CH_3$ | **CAS#:** 109-66-0 | **RTECS#:** RZ9450000 | **IDLH:** 1500 ppm [10%LEL]

Conversion: 1 ppm = 2.95 mg/m^3 | **DOT:** 1265 128

Synonyms/Trade Names: Pentane, normal-Pentane

Exposure Limits:
NIOSH REL: TWA 120 ppm (350 mg/m^3)
C 610 ppm (1800 mg/m^3) [15-minute]
OSHA PEL†: TWA 1000 ppm (2950 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1500
OSHA 7

Physical Description: Colorless liquid with a gasoline-like odor.
[**Note:** A gas above 97°F. May be utilized as a fuel.]

Chemical & Physical Properties:
MW: 72.2
BP: 97°F
Sol: 0.04%
FI.P: -57°F
IP: 10.34 eV
Sp.Gr: 0.63
VP: 420 mmHg
FRZ: -202°F
UEL: 7.8%
LEL: 1.5%
Class IA Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
1200 ppm: Sa
1500 ppm: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; derm; chemical pneu (aspir liquid); drow; in animals: narco
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash prompt
Breath: Resp support
Swallow: Medical attention immed

1-Pentanethiol	Formula: $CH_3(CH_2)_4SH$	CAS#: 110-66-7	RTECS#: SA3150000	IDLH: N.D.
Conversion: 1 ppm = 4.26 mg/m^3	**DOT:** 1111 130			
Synonyms/Trade Names: Amyl hydrosulfide, Amyl mercaptan, Amyl sulfhydrate, Pentyl mercaptan				
Exposure Limits: **NIOSH REL:** C 0.5 ppm (2.1 mg/m^3) [15-minute] **OSHA PEL:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Water-white to yellowish liquid with a strong, garlic-like odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 104.2 **BP:** 260°F **Sol:** Insoluble **Fl.P(oc):** 65°F **IP:** ? **Sp.Gr:** 0.84 **VP(77°F):** 14 mmHg **FRZ:** -104°F **UEL:** ? **LEL:** ? Class IB Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.	**NIOSH** **5 ppm:** CcrOv/Sa **12.5 ppm:** Sa:Cf/PaprOv **25 ppm:** CcrFOv/GmFOv/PaprTOv/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, alkali metals, calcium hypochlorite, concentrated nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat, resp sys; head, nau, dizz; vomit, diarr; derm, skin sens **TO:** Eyes, skin, resp sys, CNS	**Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

2-Pentanone	Formula: $CH_3COCH_2CH_2CH_3$	CAS#: 107-87-9	RTECS#: SA7875000	IDLH: 1500 ppm
Conversion: 1 ppm = 3.52 mg/m^3	**DOT:** 1249 127			
Synonyms/Trade Names: Ethyl acetone, Methyl propyl ketone, MPK				
Exposure Limits: **NIOSH REL:** TWA 150 ppm (530 mg/m^3) **OSHA PEL†:** TWA 200 ppm (700 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1300, 2555	
Physical Description: Colorless to water-white liquid with a characteristic acetone-like odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 86.1 **BP:** 215°F **Sol:** 6% **Fl.P:** 45°F **IP:** 9.39 eV **Sp.Gr:** 0.81 **VP:** 27 mmHg **FRZ:** -108°F **UEL:** 8.2% **LEL:** 1.5% Class IB Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.	**NIOSH** **1500 ppm:** CcrOv*/PaprOv*/GmFOv/Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, bromine trifluoride

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; head; derm; narco, coma **TO:** Eyes, skin, resp sys, CNS	**Eye:** Irr immed **Skin:** Water flush **Breath:** Resp support **Swallow:** Medical attention immed

Perchloromethyl mercaptan

Formula:	CAS#:	RTECS#:	IDLH:
Cl_3CSCl	594-42-3	PB0370000	10 ppm

Conversion: 1 ppm = 7.60 mg/m^3 **DOT:** 1670 157

Synonyms/Trade Names: PCM, PMM, Trichloromethane sulfenyl chloride, Trichloromethyl sulfur chloride

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.8 mg/m^3)
OSHA PEL: TWA 0.1 ppm (0.8 mg/m^3)

Measurement Methods (see Table 1):
None available

Physical Description: Pale-yellow, oily liquid with an unbearable, acrid odor.

Chemical & Physical Properties:
MW: 185.9
BP: 297°F (Decomposes)
Sol: Insoluble
Fl.P: NA
IP: ?
Sp.Gr: 1.69
VP: 3 mmHg
FRZ: ?
UEL: NA
LEL: NA
Noncombustible Liquid, but will support combustion.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 ppm: CcrOv*/Sa*
2.5 ppm: Sa:Cf*/PaprOv*
5 ppm: CcrFOv/GmFOv/PaprTOv*/ SaT:Cf*/ScbaF/SaF
10 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Alkalis, amines, hot iron, water
[**Note:** Corrosive to most metals. Forms HCl, sulfur & CO_2 on contact with water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; lac; cough, dysp, deep breath pain, coarse rales; vomit; pallor, tacar; acidosis; anuria; liver, kidney damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

P

Perchloryl fluoride

Formula:	CAS#:	RTECS#:	IDLH:
ClO_3F	7616-94-6	SD1925000	100 ppm

Conversion: 1 ppm = 4.19 mg/m^3 **DOT:** 3083 124

Synonyms/Trade Names: Chlorine fluoride oxide, Chlorine oxyfluoride, Trioxychlorofluoride

Exposure Limits:
NIOSH REL: TWA 3 ppm (14 mg/m^3)
ST 6 ppm (28 mg/m^3)
OSHA PEL†: TWA 3 ppm (13.5 mg/m^3)

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a characteristic, sweet odor.
[**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 102.5
BP: -52°F
Sol: 0.06%
Fl.P: NA
IP: 13.60 eV
RGasD: 3.64
VP: 10.5 atm
FRZ: -234°F
UEL: NA
LEL: NA
Nonflammable Gas, but will support combustion.

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
30 ppm: Sa
75 ppm: Sa:Cf*
100 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and Reactivities: Combustibles, strong bases, amines, finely divided metals, reducing agents, alcohols

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit resp sys; liquid: frostbite; in animals: methemo; cyan; lass, dizz, head; pulm edema; pneu; anoxia
TO: Skin, resp sys, blood

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Perlite	Formula:	CAS#: 93763-70-3	RTECS#: SD5254000	IDLH: N.D.
Conversion:	DOT:			

Synonyms/Trade Names: Expanded perlite
[**Note:** An amorphous material consisting of fused sodium potassium aluminum silicate.]

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Odorless, light-gray to glassy-black solid.
[**Note:** Expanded perlite is a fluffy, white particulate.]

Chemical & Physical Properties:
MW: varies
BP: ?
Sol: <1%
Fl.P: NA
IP: NA
Sp.Gr: 2.2 - 2.4 (crude)
0.05 - 0.3 (expanded)
VP: 0 mmHg (approx)
MLT: >2000°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, throat, upper resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

P

Petroleum distillates (naphtha)	Formula:	CAS#: 8002-05-9	RTECS#: SE7449000	IDLH: 1100 ppm [10%LEL]
Conversion: 1 ppm = 4.05 mg/m^3	DOT:			

Synonyms/Trade Names: Aliphatic petroleum naphtha, Petroleum naphtha, Rubber solvent

Exposure Limits:
NIOSH REL: TWA 350 mg/m^3
C 1800 mg/m^3 [15-minute]
OSHA PEL†: TWA 500 ppm (2000 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1550

Physical Description: Colorless liquid with a gasoline- or kerosene-like odor.
[**Note:** A mixture of paraffins (C_5 to C_{13}) that may contain a small amount of aromatic hydrocarbons.]

Chemical & Physical Properties:
MW: 99 (approx)
BP: 86-460°F
Sol: Insoluble
Fl.P: -40 to -86°F
IP: ?
Sp.Gr: 0.63-0.66
VP: 40 mmHg (approx)
FRZ: -99°F
UEL: 5.9%
LEL: 1.1%
Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
850 ppm: Sa
1100 ppm: Sa:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat; dizz, drow, head, nau; dry cracked skin; chemical pneu (aspir liquid)
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Phenol

Formula: C_6H_5OH | **CAS#:** 108-95-2 | **RTECS#:** SJ3325000 | **IDLH:** 250 ppm

Conversion: 1 ppm = 3.85 mg/m^3

DOT: 1671 153 (solid); 2312 153 (molten); 2821 153 (solution)

Synonyms/Trade Names: Carbolic acid, Hydroxybenzene, Monohydroxybenzene, Phenyl alcohol, Phenyl hydroxide

Exposure Limits:
NIOSH REL: TWA 5 ppm (19 mg/m^3) [skin]
C 15.6 ppm (60 mg/m^3) [15-minute]
OSHA PEL: TWA 5 ppm (19 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2546
OSHA 32

Physical Description: Colorless to light-pink, crystalline solid with a sweet, acrid odor. [**Note:** Phenol liquefies by mixing with about 8% water.]

Chemical & Physical Properties:
MW: 94.1
BP: 359°F
Sol(77°F): 9%
FI.P: 175°F
IP: 8.50 eV
Sp.Gr: 1.06
VP: 0.4 mmHg
MLT: 109°F
UEL: 8.6%
LEL: 1.8%
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 ppm: CcrOv95/Sa
125 ppm: Sa:Cf/PaprOvHie
250 ppm: CcrFOv100/GmFOv100/PaprTOvHie/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, calcium hypochlorite, aluminum chloride, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; anor, low-wgt; lass, musc ache, pain; dark urine; cyan; liver, kidney damage; skin burns; derm; ochronosis; tremor, convuls, twitch
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

P

Phenothiazine

Formula: $S(C_6H_4)_2NH$ | **CAS#:** 92-84-2 | **RTECS#:** SN5075000 | **IDLH:** N.D.

Conversion:

DOT:

Synonyms/Trade Names: Dibenzothiazine, Fenothiazine, Thiodiphenylamine

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2048

Physical Description: Grayish-green to greenish-yellow solid. [insecticide]

Chemical & Physical Properties:
MW: 199.3
BP: 700°F
Sol: Insoluble
FI.P: ?
IP: ?
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: 365°F
UEL: ?
LEL: ?
Combustible Solid, but not a high fire risk.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Itching, irrit, reddening skin; hepatitis, hemolytic anemia, abdom cramps, tacar; kidney damage; skin photo sens
TO: Skin, CVS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

p-Phenylene diamine	Formula: $C_6H_4(NH_2)_2$	CAS#: 106-50-3	RTECS#: SS8050000	IDLH: 25 mg/m^3
Conversion:	**DOT:** 1673 153			

Synonyms/Trade Names: 4-Aminoaniline; 1,4-Benzenediamine; p-Diaminobenzene; 1,4-Diaminobenzene; 1,4-Phenylene diamine

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL: TWA 0.1 mg/m^3 [skin]

Measurement Methods (see Table 1):
OSHA 87

Physical Description: White to slightly red, crystalline solid.

Chemical & Physical Properties:
MW: 108.2
BP: 513°F
Sol(75°F): 4%
FI.P: 312°F
IP: 6.89 eV
Sp.Gr: ?
VP: <1 mmHg
MLT: 295°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2.5 mg/m^3: Sa:Cf£
5 mg/m^3: ScbaF/SaF
25 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit pharynx, larynx; bronchial asthma; sens derm
TO: Resp sys, skin

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Phenyl ether (vapor)	Formula: $C_6H_5OC_6H_5$	CAS#: 101-84-8	RTECS#: KN8970000	IDLH: 100 ppm
Conversion: 1 ppm = 6.96 mg/m^3	**DOT:**			

Synonyms/Trade Names: Diphenyl ether, Diphenyl oxide, Phenoxy benzene, Phenyl oxide

Exposure Limits:
NIOSH REL: TWA 1 ppm (7 mg/m^3)
OSHA PEL: TWA 1 ppm (7 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1617
OSHA PV2022

Physical Description: Colorless, crystalline solid or liquid (above 82°F) with a geranium-like odor.

Chemical & Physical Properties:
MW: 170.2
BP: 498°F
Sol: Insoluble
FI.P: 239°F
IP: 8.09 eV
Sp.Gr: 1.08
VP(77°F): 0.02 mmHg
MLT: 82°F
UEL: 6.0%
LEL: 0.7%
Combustible Solid
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 ppm: Sa:Cf£/PaprOvHie£
50 ppm: CcrFOv100/GmFOv100/ScbaF/SaF
100 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, nose, skin; nau
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support

Phenyl ether-biphenyl mixture (vapor)	Formula: $C_6H_5OC_6H_5/C_6H_5C_6H_5$	CAS#: 8004-13-5	RTECS#: DV1500000	IDLH: 10 ppm
Conversion: 1 ppm = 6.79 mg/m^3 (approx)	**DOT:**			

Synonyms/Trade Names: Diphenyl oxide-diphenyl mixture, Dowtherm® A

Exposure Limits:
NIOSH REL: TWA 1 ppm (7 mg/m^3)
OSHA PEL: TWA 1 ppm (7 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 2013

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.]

Chemical & Physical Properties:
MW: 166 (approx)
BP: 495°F
Sol: Insoluble
Fl.P: 239°F
IP: ?
Sp.Gr(77°F): 1.06
VP(77°F): 0.08 mmHg
FRZ: 54°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 ppm: Sa:Cf£/CcrFOv100/GmFOv100/PaprOvHie£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, nose, skin; nau
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support

P

Phenyl glycidyl ether	Formula: $C_9H_{10}O_2$	CAS#: 122-60-1	RTECS#: TZ3675000	IDLH: Ca [100 ppm]
Conversion: 1 ppm = 6.14 mg/m^3	**DOT:**			

Synonyms/Trade Names: 1,2-Epoxy-3-phenoxy propane; Glycidyl phenyl ether; PGE; Phenyl 2,3-epoxypropyl ether

Exposure Limits:
NIOSH REL: Ca
C 1 ppm (6 mg/m^3) [15-minute]
See Appendix A
OSHA PEL†: TWA 10 ppm (60 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1619
OSHA 7

Physical Description: Colorless liquid. [**Note:** A solid below 38°F.]

Chemical & Physical Properties:
MW: 150.1
BP: 473°F
Sol: 0.2%
Fl.P: 248°F
IP: ?
Sp.Gr: 1.11
VP: 0.01 mmHg
FRZ: 38°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, amines, strong acids, strong bases

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; upper resp sys; skin sens; narco; possible hemato, repro effects; [carc]
TO: Eyes, skin, CNS, hemato sys, repro sys [in animals: nasal cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Phenylhydrazine	**Formula:** $C_6H_5NHNH_2$	**CAS#:** 100-63-0	**RTECS#:** MV8925000	**IDLH:** Ca [15 ppm]
Conversion: 1 ppm = 4.42 mg/m^3	**DOT:** 2572 153			

Synonyms/Trade Names: Hydrazinobenzene, Monophenylhydrazine

Exposure Limits:
NIOSH REL: Ca
C 0.14 ppm (0.6 mg/m^3) [2-hr] [skin]
See Appendix A
OSHA PEL†: TWA 5 ppm (22 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 3518

Physical Description: Colorless to pale-yellow liquid or solid (below 67°F) with a faint, aromatic odor.

Chemical & Physical Properties:
MW: 108.1
BP: 470°F (Decomposes)
Sol: Slight
Fl.P: 190°F
IP: 7.64 eV
Sp.Gr: 1.10
VP(77°F): 0.04 mmHg
FRZ: 67°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and Reactivities: Strong oxidizers, lead dioxide

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Skin sens, hemolytic anemia, dysp, cyan; jaun; kidney damage; vascular thrombosis; [carc]
TO: Blood, resp sys, liver, kidneys, skin [in animals: tumors of the lungs, liver, blood vessels & intestine]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

P

N-Phenyl-β-naphthylamine	**Formula:** $C_{10}H_7NHC_6H_5$	**CAS#:** 135-88-6	**RTECS#:** QM4550000	**IDLH:** Ca [N.D.]
Conversion:	**DOT:**			

Synonyms/Trade Names: 2-Anilinonaphthalene, β-Naphthylphenylamine, PBNA, 2-Phenylaminonaphthalene, Phenyl-β-naphthylamine

Exposure Limits:
NIOSH REL: Ca*
See Appendix A
[***Note:** Since metabolized to β-Naphthylamine.]
OSHA PEL: none

Measurement Methods (see Table 1):
OSHA 96

Physical Description: White to yellow crystals or gray to tan flakes or powder.
[**Note:** Commercial product may contain 20-30 ppm of β-Naphthylamine.]

Chemical & Physical Properties:
MW: 219.3
BP: 743°F
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr: 1.24
VP: ?
MLT: 226°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irritation; leucoplakia; acne, hypersensitivity to sunlight; [carc]
TO: Eyes, skin, bladder [bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Phenylphosphine

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_5PH_2$	638-21-1	SZ2100000	N.D.

Conversion: 1 ppm = 4.50 mg/m^3 **DOT:**

Synonyms/Trade Names: Fenylfosfin, PF, Phosphaniline

Exposure Limits:
NIOSH REL: C 0.05 ppm (0.25 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Clear, colorless liquid with a foul odor.

Chemical & Physical Properties:
MW: 110.1
BP: 320°F
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr(59°F): 1.001
VP: ?
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported [**Note:** Spontaneously combustible in high concentrations in air. Potential exposure to gaseous PF when polyphosphinates are heated above 392°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: blood changes, anemia, testicular degeneration; loss of appetite, diarr, lac, hind leg tremor; derm
TO: Blood, CNS, skin, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

P

Phorate

Formula:	CAS#:	RTECS#:	IDLH:
$(C_2H_5O)_2P(S)SCH_2SC_2H_5$	298-02-2	TD9450000	N.D.

Conversion: **DOT:** 3018 152 (organophosphorus pesticide, liquid, toxic)

Synonyms/Trade Names: O,O-Diethyl S-(ethylthio)methylphosphorodithioate; O,O-Diethyl S-ethylthiomethylthiothionophosphate; Thimet; Timet

Exposure Limits:
NIOSH REL: TWA 0.05 mg/m^3
ST 0.2 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5600

Physical Description: Clear liquid with a skunk-like odor. [insecticide]

Chemical & Physical Properties:
MW: 260.4
BP: ?
Sol: 0.005%
Fl.P(oc): 320°F
IP: ?
Sp.Gr(77°F): 1.16
VP: 0.0008 mmHg
FRZ: -45°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid, but does not readily ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Water, alkalis [**Note:** Hydrolyzed in the presence of moisture and by alkalis.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; miosis; rhin; head; chest tight, wheez, lar spasm, salv, cyan; anor, nau, vomit, abdom cramps, diarr; sweat; musc fasc, lass, para; dizz, conf, ataxia; convuls, coma; low BP; card irreg
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Phosdrin

Formula: $C_7H_{13}PO_6$ | **CAS#:** 7786-34-7 | **RTECS#:** GQ5250000 | **IDLH:** 4 ppm

Conversion: 1 ppm = 9.17 mg/m^3 | **DOT:** 2783 152

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/m^3) [skin]
ST 0.03 ppm (0.3 mg/m^3)
OSHA PEL†: TWA 0.1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 5600

Physical Description: Pale-yellow to orange liquid with a weak odor.
[**Note:** Insecticide that may be absorbed on a dry carrier.]

Chemical & Physical Properties:
MW: 224.2
BP: Decomposes
Sol: Miscible
Fl.P(oc): 347°F
IP: ?
Sp.Gr: 1.25
VP: 0.003 mmHg
FRZ: 44°F (trans-)
70°F (cis-)
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.1 ppm: Sa
0.25 ppm: Sa:Cf
0.5 ppm: SaT:Cf/ScbaF/SaF
4 ppm: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers [**Note:** Corrosive to cast iron, some stainless steels & brass.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; miosis; rhin; head; chest tight, wheez, lar spasm, salv, cyan; anor, nau, vomit, abdom cramps, diarr; para; ataxia, convuls; low BP, card irreg
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

P

Phosgene

Formula: $COCl_2$ | **CAS#:** 75-44-5 | **RTECS#:** SY5600000 | **IDLH:** 2 ppm

Conversion: 1 ppm = 4.05 mg/m^3 | **DOT:** 1076 125

Synonyms/Trade Names: Carbon oxychloride, Carbonyl chloride, Carbonyl dichloride, Chloroformyl chloride

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.4 mg/m^3)
C 0.2 ppm (0.8 mg/m^3) [15-minute]
OSHA PEL: TWA 0.1 ppm (0.4 mg/m^3)

Measurement Methods (see Table 1):
OSHA 61

Physical Description: Colorless gas with a suffocating odor like musty hay.
[**Note:** A fuming liquid below 47°F. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 98.9
BP: 47°F
Sol: Slight
Fl.P: NA
IP: 11.55 eV
RGasD: 3.48
Sp.Gr: 1.43 (Liquid at 32°F)
VP: 1.6 atm
FRZ: -198°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Eyes: Prevent eye contact (liquid)
Wash skin: When contam (liquid)
Remove: When wet or contam (liquid)
Change: N.R.
Provide: Quick drench (liquid)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 ppm: Sa*
2 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Moisture, alkalis, ammonia, alcohols, copper
[**Note:** Reacts slowly in water to form hydrochloric acid & carbon dioxide.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Irrit eyes; dry burning throat; vomit; cough, foamy sputum, dysp, chest pain, cyan; liquid: frostbite
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed (liquid)
Skin: Water flush immed (liquid)
Breath: Resp support

Phosphine

Formula:	CAS#:	RTECS#:	IDLH:
PH_3	7803-51-2	SY7525000	50 ppm

Conversion: 1 ppm = 1.39 mg/m^3

DOT: 2199 119

Synonyms/Trade Names: Hydrogen phosphide, Phosphorated hydrogen, Phosphorus hydride, Phosphorus trihydride

Exposure Limits:
NIOSH REL: TWA 0.3 ppm (0.4 mg/m^3)
ST 1 ppm (1 mg/m^3)
OSHA PEL†: TWA 0.3 ppm (0.4 mg/m^3)

Measurement Methods (see Table 1):
OSHA 1003, ID180

Physical Description: Colorless gas with a fish- or garlic-like odor. [pesticide]
[**Note:** Shipped as a liquefied compressed gas. Pure compound is odorless.]

Chemical & Physical Properties:
MW: 34.0
BP: -126°F
Sol: Slight
FI.P: NA (Gas)
IP: 9.96 eV
RGasD: 1.18
VP: 41.3 atm
FRZ: -209°F
UEL: ?
LEL: 1.79%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
3 ppm: Sa
7.5 ppm: Sa:Cf
15 ppm: GmFS/ScbaF/SaF
50 ppm: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Air, oxidizers, chlorine, acids, moisture, halogenated hydrocarbons, copper [**Note:** May ignite SPONTANEOUSLY on contact with air.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Nau, vomit, abdom pain, diarr; thirst; chest tight, dysp; musc pain, chills; stupor or syncope; pulm edema; liquid: frostbite
TO: Resp sys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

P

Phosphoric acid

Formula:	CAS#:	RTECS#:	IDLH:
H_3PO_4	7664-38-2	TB6300000	1000 mg/m^3

Conversion:

DOT: 1805 154 (liquid or solution); 3453 154 (solid)

Synonyms/Trade Names: Orthophosphoric acid, Phosphoric acid (aqueous), White phosphoric acid

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
ST 3 mg/m^3
OSHA PEL†: TWA 1 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7903
OSHA ID165SG

Physical Description: Thick, colorless, odorless, crystalline solid. [**Note:** Often used in an aqueous solution.]

Chemical & Physical Properties:
MW: 98.0
BP: 415°F
Sol: Miscible
FI.P: NA
IP: ?
Sp.Gr(77°F): 1.87 (pure)
1.33 (50% solution)
VP: 0.03 mmHg
MLT: 108°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash (>1.6%)
Quick drench (>1.6%)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 mg/m^3: Sa:Cf*
50 mg/m^3: 100F/ScbaF/SaF
1000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong caustics, most metals [**Note:** Readily reacts with metals to form flammable hydrogen gas. DO NOT MIX WITH SOLUTIONS CONTAINING BLEACH OR AMMONIA.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; eye, skin, burns; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush Immed
Breath: Resp support
Swallow: Medical attention immed

Phosphorus (yellow)	Formula: P_4	CAS#: 7723-14-0	RTECS#: TH3500000	IDLH: 5 mg/m^3
Conversion:	**DOT:** 1381 136			
Synonyms/Trade Names: Elemental phosphorus, White phosphorus				

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3
OSHA PEL: TWA 0.1 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7905

Physical Description: White to yellow, soft, waxy solid with acrid fumes in air.
[**Note:** Usually shipped or stored in water.]

Chemical & Physical Properties:
MW: 124.0
BP: 536°F
Sol: 0.0003%
FI.P: ?
IP: ?
Sp.Gr: 1.82
VP: 0.03 mmHg
MLT: 111°F
UEL: ?
LEL: ?
Flammable Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact*
[***Note:** Flame retardant personal protective equipment should be provided.]
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 mg/m^3: Sa
2.5 mg/m^3: Sa:Cf£
5 mg/m^3: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: ScbaE

Incompatibilities and Reactivities: Air, oxidizers (including elemental sulfur & strong caustics), halogens
[**Note:** Ignites SPONTANEOUSLY in moist air.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp tract; eye, skin burns; abdom pain, nau, jaun; anemia; cachexia; dental pain, salv, jaw pain, swell
TO: Eyes, skin, resp sys, liver, kidneys, jaw, teeth, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Phosphorus oxychloride	Formula: $POCl_3$	CAS#: 10025-87-3	RTECS#: TH4897000	IDLH: N.D.
Conversion: 1 ppm = 6.27 mg/m^3	**DOT:** 1810 137			
Synonyms/Trade Names: Phosphorus chloride, Phosphorus oxytrichloride, Phosphoryl chloride				

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.6 mg/m^3)
ST 0.5 ppm (3 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Clear, colorless to yellow, oily liquid with a pungent & musty odor.
[**Note:** A solid below 34°F.]

Chemical & Physical Properties:
MW: 153.3
BP: 222°F
Sol: Decomposes
FI.P: NA
IP: ?
Sp.Gr(77°F): 1.65
VP(81°F): 40 mmHg
FRZ: 34°F
UEL: NA
LEL: NA
Noncombustible Liquid, but may set fire to combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Water, combustible materials, carbon disulfide, dimethyl-formamide, metals (except nickel & lead) [**Note:** Decomposes in water to hydrochloric & phosphoric acids.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; eye, skin burns; dysp, cough, pulm edema; dizz, head, lass; abdom pain, nau, vomit; neph
TO: Eyes, skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Phosphorus pentachloride

Formula:	CAS#:	RTECS#:	IDLH:
PCl_5	10026-13-8	TB6125000	70 mg/m^3

Conversion: **DOT:** 1806 137

Synonyms/Trade Names: Pentachlorophosphorus, Phosphoric chloride, Phosphorus perchloride

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
OSHA PEL: TWA 1 mg/m^3

Measurement Methods (see Table 1):
NIOSH S257 (II-5)

Physical Description: White to pale-yellow, crystalline solid with a pungent, unpleasant odor.

Chemical & Physical Properties:
MW: 208.3
BP: Sublimes
Sol: Reacts
FI.P: NA
IP: ?
Sp.Gr: 3.60
VP(132°F): 1 mmHg
MLT: 324°F (Sublimes)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 mg/m^3: Sa*
25 mg/m^3: Sa:Cf*
50 mg/m^3: ScbaF/SaF
70 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Water, magnesium oxide, chemically-active metals such as sodium and potassium, alkalis, amines
[**Note:** Hydrolyzes in water (even in humid air) to form hydrochloric acid & phosphoric acid. Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; bron; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

P

Phosphorus pentasulfide

Formula:	CAS#:	RTECS#:	IDLH:
P_2S_5/P_4S_{10}	1314-80-3	TH4375000	250 mg/m^3

Conversion: **DOT:** 1340 139

Synonyms/Trade Names: Phosphorus persulfide, Phosphorus sulfide, Sulfur phosphide

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
ST 3 mg/m^3
OSHA PEL†: TWA 1 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Greenish-gray to yellow, crystalline solid with an odor of rotten eggs.

Chemical & Physical Properties:
MW: 222.3 (P_2S_5)
444.6 (P_4S_{10})
BP: 957°F
Sol: Reacts
FI.P: ?
IP: ?
Sp.Gr: 2.09
VP(572°F): 1 mmHg
MLT: 550°F
UEL: ?
LEL: ?
Flammable Solid, which may SPONTANEOUSLY ignite in presence of moisture.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 mg/m^3: Sa*
25 mg/m^3: Sa:Cf*
50 mg/m^3: ScbaF/SaF
250 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS100/ScbaE

Incompatibilities and Reactivities: Water, alcohols, strong oxidizers, acids, alkalis [**Note:** Reacts with water to form hydrogen sulfide, sulfur dioxide, and phosphoric acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; apnea, coma, convuls; conj pain, lac, photo, kerato-conj, corn vesic; dizz; head; lass; irrity, insom; GI dist
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Dust off solid; water flush
Breath: Resp support
Swallow: Medical attention immed

Phosphorus trichloride

Formula:	CAS#:	RTECS#:	IDLH:
PCl_3	7719-12-2	TH3675000	25 ppm

Conversion: 1 ppm = 5.62 mg/m^3 **DOT:** 1809 137

Synonyms/Trade Names: Phosphorus chloride

Exposure Limits:
NIOSH REL: TWA 0.2 ppm (1.5 mg/m^3)
ST 0.5 ppm (3 mg/m^3)
OSHA PEL†: TWA 0.5 ppm (3 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6402

Physical Description: Colorless to yellow, fuming liquid with an odor like hydrochloric acid.

Chemical & Physical Properties:
MW: 137.4
BP: 169°F
Sol: Reacts
FI.P: NA
IP: 9.91 eV
Sp.Gr: 1.58
VP: 100 mmHg
FRZ: -170°F
UEL: NA
LEL: NA
Noncombustible Liquid; however, a strong oxidizer that may ignite combustibles upon contact.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 ppm: ScbaF/SaF
25 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; pulm edema; eye, skin burns
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Phthalic anhydride

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_4(CO)_2O$	85-44-9	TI3150000	60 mg/m^3

Conversion: 1 ppm = 6.06 mg/m^3 **DOT:** 2214 156

Synonyms/Trade Names: 1,2-Benzenedicarboxylic anhydride; PAN; Phthalic acid anhydride

Exposure Limits:
NIOSH REL: TWA 6 mg/m^3 (1 ppm)
OSHA PEL†: TWA 12 mg/m^3 (2 ppm)

Measurement Methods (see Table 1):
NIOSH S179 (II-3)
OSHA 90

Physical Description: White solid (flake) or a clear, colorless, mobile liquid (molten) with a characteristic, acrid odor.

Chemical & Physical Properties:
MW: 148.1
BP: 563°F
Sol: 0.6%
FI.P: 305°F
IP: 10.00 eV
Sp.Gr: 1.53 (Flake)
1.20 (Molten)
VP: 0.0015 mmHg
MLT: 267°F
UEL: 10.5%
LEL: 1.7%
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
30 mg/m^3: Qm*
60 mg/m^3: 95XQ*/95F/PaprHie*/
Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, water [**Note:** Converted to phthalic acid in hot water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; conj; nasal ulcer bleeding; bron, bronchial asthma; derm; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

m-Phthalodinitrile

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_4(CN)_2$	626-17-5	CZ1900000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: 1,3-Benzenedicarbonitrile; m-Dicyanobenzene; 1,3-Dicyanobenzene; Isophthalodinitrile; m-PDN

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Needle-like, colorless to white, crystalline, flaky solid with an almond-like odor.

Chemical & Physical Properties:
MW: 128.1
BP: Sublimes
Sol: Slight
Fl.P: ?
IP: ?
Sp.Gr: 4.42
VP: 0.01 mmHg
MLT: 324°F (Sublimes)
UEL: ?
LEL: ?
Combustible Solid and a severe explosion hazard.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers (e.g., chlorine, bromine, fluorine)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Head, nau, conf; in animals: irrit eyes, skin
TO: Eyes, skin, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

P

Picloram

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_3Cl_3O_2N_2$	1918-02-1	TJ7525000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: 4-Amino-3,5,6-trichloropicolinic acid; 4-Amino-3,5,6-trichloro-2-picolinic acid; ATCP; Tordon®

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 15 mg/m^3 (total) TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Colorless to white crystals with a chlorine-like odor. [herbicide]

Chemical & Physical Properties:
MW: 241.5
BP: Decomposes
Sol: 0.04%
Fl.P: ?
IP: ?
Sp.Gr: ?
VP(95°F): 0.0000006 mmHg
MLT: 424°F (Decomposes)
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Hot concentrated alkali (hydrolyzes)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; nau; in animals: liver, kidney changes
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air
Swallow: Medical attention immed

Picric acid	**Formula:** $(NO_2)_3C_6H_2OH$	**CAS#:** 88-89-1	**RTECS#:** TJ7875000	**IDLH:** 75 mg/m^3
Conversion: 1 ppm = 9.37 mg/m^3	**DOT:** 1344 113 (wet, ≥ 10% water); 3364 113 (wetted, ≥ 10% water)			

Synonyms/Trade Names: Phenol trinitrate; 2,4,6-Trinitrophenol [**Note:** An OSHA Class A Explosive (1910.109).]

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3
ST 0.3 mg/m^3 [skin]
OSHA PEL: TWA 0.1 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S228 (II-4)

Physical Description: Yellow, odorless solid. [**Note:** Usually used as an aqueous solution.]

Chemical & Physical Properties:
MW: 229.1
BP: Explodes above 572°F
Sol: 1%
Fl.P: 302°F
IP: ?
Sp.Gr: 1.76
VP(383°F): 1 mmHg
MLT: 252°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.5 mg/m^3: Qm
1 mg/m^3: 95XQ/Sa
2.5 mg/m^3: Sa:Cf/PaprHie
5 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
75 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Copper, lead, zinc & other metals; salts; plaster; concrete; ammonia [**Note:** Corrosive to metals. An explosive mixture results when the aqueous solution crystallizes.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; sens derm; yellow-stained hair, skin; lass, myalgia, anuria, polyuria; bitter taste, GI dist; hepatitis, hema, album, neph
TO: Eyes, skin, kidneys, liver, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

P

Pindone	**Formula:** $C_9H_5O_2C(O)C(CH_3)_3$	**CAS#:** 83-26-1	**RTECS#:** NK6300000	**IDLH:** 100 mg/m^3
Conversion:	**DOT:**			

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/m^3
OSHA PEL: TWA 0.1 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Bright-yellow powder with almost no odor. [rodenticide]

Chemical & Physical Properties:
MW: 230.3
BP: Decomposes
Sol(77°F): 0.002%
Fl.P: ?
IP: ?
Sp.Gr: 1.06
VP: Very low
MLT: 230°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.5 mg/m^3: Qm
1 mg/m^3: 95XQ/Sa
2.5 mg/m^3: Sa:Cf/PaprHie
5 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
100 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing
SY: Epis, excess bleeding from minor cuts, bruises; smoky urine, black tarry stools; abdom, back pain
TO: Blood prothrombin

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support
Swallow: Medical attention immed

Piperazine dihydrochloride	Formula: $C_4H_{10}N_2 \times 2HCl$	CAS#: 142-64-3	RTECS#: TL4025000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Piperazine hydrochloride
[**Note:** The monochloride, $C_4H_{10}N_2 \times HCl$ is also commercially available.]

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: White to cream-colored needles or powder.

Chemical & Physical Properties:
MW: 159.1
BP: ?
Sol: 41%
Fl.P: ?
IP: ?
Sp.Gr: ?
VP: ?
MLT: 635°F
UEL: ?
LEL: ?
Combustible Solid, but does not ignite easily.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Water [**Note:** Slightly hygroscopic (i.e., absorbs moisture from the air).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; skin burns, sens; asthma; GI upset, head, nau, vomit, inco, musc weak
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

P

Plaster of Paris	Formula: $CaSO_4 \cdot 0.5H_2O$	CAS#: 26499-65-0	RTECS#: TP0700000	IDLH: N.D.
Conversion:	**DOT:**			

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/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: White or yellowish, finely divided, odorless powder.

Chemical & Physical Properties:
MW: 145.2
BP: ?
Sol(77°F): 0.3%
Fl.P: NA
IP: NA
Sp.Gr: 2.5
VP: 0 mmHg (approx)
MLT: 325°F (Loses H_2O)
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Moisture, water
[**Note:** Hygroscopic (i.e., absorbs moisture from the air). Reacts with water to form Gypsum.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb, resp sys; cough
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support
Swallow: Medical attention immed

Platinum	Formula: Pt	CAS#: 7440-06-4	RTECS#: TP2160000	IDLH: N.D.
Conversion:	**DOT:**			
Synonyms/Trade Names: Platinum black, Platinum metal, Platinum sponge				
Exposure Limits: **NIOSH REL:** TWA 1 mg/m^3 **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **NIOSH** 7300, 7303 **OSHA** ID121, ID130SG	
Physical Description: Silvery, whitish-gray, malleable, ductile metal.				
Chemical & Physical Properties: **MW:** 195.1 **BP:** 6921°F **Sol:** Insoluble **Fl.P:** NA **IP:** NA **Sp.Gr:** 21.45 **VP:** 0 mmHg (approx) **MLT:** 3222°F **UEL:** NA **LEL:** NA Noncombustible Solid in bulk form, but finely divided powder can be dangerous to handle.	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Aluminum, acetone, arsenic, ethane, hydrazine, hydrogen peroxide, lithium, phosphorus, selenium, tellurium, various fluorides				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit skin, resp sys; derm **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed	

Platinum (soluble salts, as Pt)	Formula:	CAS#:	RTECS#:	IDLH: 4 mg/m^3 (as Pt)
Conversion:	**DOT:**			
Synonyms/Trade Names: Synonyms vary depending upon the specific soluble platinum salt.				
Exposure Limits: **NIOSH REL:** TWA 0.002 mg/m^3 **OSHA PEL:** TWA 0.002 mg/m^3			**Measurement Methods (see Table 1):** **NIOSH** 7300, 7303, S191 (II-7)	
Physical Description: Appearance and odor vary depending upon the specific soluble platinum salt.				
Chemical & Physical Properties: Properties vary depending upon the specific soluble platinum salt.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.05 mg/m^3:** Sa:Cf£ **0.1 mg/m^3:** 100F/ScbaF/SaF **4 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: Varies				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, nose; cough, dysp, wheez, cyan; derm, sens skin; lymphocytosis **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

Portland cement

Formula:	CAS#:	RTECS#:	IDLH:
	65997-15-1	VV8770000	5000 mg/m^3

Conversion: **DOT:**

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:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 50 mppcf

Measurement Methods (see Table 1):
NIOSH 0500
OSHA ID207

Physical Description: Gray, odorless powder.

Chemical & Physical Properties:
MW: ?
BP: NA
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: NA
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 mg/m^3: Qm
100 mg/m^3: 95XQ/Sa
250 mg/m^3: Sa:Cf/PaprHie
500 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
5000 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose; cough, expectoration; exertional dysp, wheez, chronic bron; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Fresh air
Swallow: Medical attention immed

P

Potassium cyanide (as CN)

Formula:	CAS#:	RTECS#:	IDLH:
KCN	151-50-8	TS8750000	25 mg/m^3 (as CN)

Conversion: **DOT:** 1680 157 (solid); 3413 157 (solution)

Synonyms/Trade Names: Potassium salt of hydrocyanic acid

Exposure Limits:
NIOSH REL*: C 5 mg/m^3 (4.7 ppm) [10-minute]
OSHA PEL*: TWA 5 mg/m^3
[***Note:** The REL and PEL also apply to other cyanides (as CN) except Hydrogen cyanide.]

Measurement Methods (see Table 1):
NIOSH 6010, 7904

Physical Description: White, granular or crystalline solid with a faint, almond-like odor.

Chemical & Physical Properties:
MW: 65.1
BP: 2957°F
Sol(77°F): 72%
Fl.P: NA
IP: NA
Sp.Gr: 1.55
VP: 0 mmHg (approx)
MLT: 1173°F
UEL: NA
LEL: NA
Noncombustible Solid, but contact with acids releases highly flammable hydrogen cyanide.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 mg/m^3: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (such as acids, acid salts, chlorates & nitrates)
[**Note:** Absorbs moisture from the air forming a syrup.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, upper resp sys; asphy; lass, head, conf; nau, vomit; incr resp rate, slow gasping respiration; thyroid, blood changes
TO: Eyes, skin, resp sys, CVS, CNS, thyroid, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Potassium hydroxide	**Formula:** KOH	**CAS#:** 1310-58-3	**RTECS#:** TT2100000	**IDLH:** N.D.
Conversion:	**DOT:** 1813 154 (dry, solid); 1814 154 (solution)			
Synonyms/Trade Names: Caustic potash, Lye, Potassium hydrate				
Exposure Limits: **NIOSH REL:** C 2 mg/m^3 **OSHA PEL†:** none				**Measurement Methods (see Table 1):** **NIOSH** 7401
Physical Description: Odorless, white or slightly yellow lumps, rods, flakes, sticks, or pellets. [**Note:** May be used as an aqueous solution.]				
Chemical & Physical Properties: **MW:** 56.1 **BP:** 2415°F **Sol(59°F):** 107% **FI.P:** NA **IP:** ? **Sp.Gr:** 2.04 **VP(1317°F):** 1 mmHg **MLT:** 716°F **UEL:** NA **LEL:** NA Noncombustible Solid; however, may react with H_2O & other substances and generate sufficient heat to ignite combustible materials.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Acids, water, metals (when wet), halogenated hydrocarbons, maleic anhydride [**Note:** Heat is generated if KOH comes in contact with H_2O & CO_2 from the air.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, resp sys; cough, sneez; eye, skin burns; vomit, diarr **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

P

Propane	**Formula:** $CH_3CH_2CH_3$	**CAS#:** 74-98-6	**RTECS#:** TX2275000	**IDLH:** 2100 ppm [10%LEL]
Conversion: 1 ppm = 1.80 mg/m^3	**DOT:** 1075 115; 1978 115			
Synonyms/Trade Names: Bottled gas, Dimethyl methane, n-Propane, Propyl hydride				
Exposure Limits: **NIOSH REL:** TWA 1000 ppm (1800 mg/m^3) **OSHA PEL:** TWA 1000 ppm (1800 mg/m^3)				**Measurement Methods (see Table 1):** **NIOSH** S87 (II-2) **OSHA** PV2077
Physical Description: Colorless, odorless gas. [**Note:** A foul-smelling odorant is often added when used for fuel purposes. Shipped as a liquefied compressed gas.]				
Chemical & Physical Properties: **MW:** 44.1 **BP:** -44°F **Sol:** 0.01% **FI.P:** NA (Gas) **IP:** 11.07 eV **RGasD:** 1.55 **VP(70°F):** 8.4 atm **FRZ:** -306°F **UEL:** 9.5% **LEL:** 2.1% Flammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** Frostbite **Eyes:** Frostbite **Wash skin:** N.R. **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Frostbite wash		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **2100 ppm:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** ScbaE	
Incompatibilities and Reactivities: Strong oxidizers				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con (liquid) **SY:** Dizz, conf, excitation, asphy; liquid: frostbite **TO:** CNS			**First Aid (see Table 6):** **Eye:** Frostbite **Skin:** Frostbite **Breath:** Resp support	

Propane sultone

Formula:	CAS#:	RTECS#:	IDLH:
$C_3H_6O_3S$	1120-71-4	RP5425000	Ca [N.D.]

Conversion: **DOT:**

Synonyms/Trade Names: 3-Hydroxy-1-propanesulphonic acid sultone; 1,3-Propane sultone

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: White, crystalline solid or a colorless liquid (above 86°F). [**Note:** Releases a foul odor as it melts.]

Chemical & Physical Properties:
MW: 122.2
BP: ?
Sol: 10%
Fl.P: >235°F
IP: ?
Sp.Gr: 1.39
VP: ?
MLT: 86°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; [carc]
TO: Eyes, skin, resp sys [in animals: skin tumors, leukemia, gliomas]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

P

1-Propanethiol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3CH_2CH_2SH$	107-03-9	TZ7300000	N.D.

Conversion: 1 ppm = 3.12 mg/m^3 **DOT:** 2402 130

Synonyms/Trade Names: 3-Mercaptopropane, Propane-1-thiol, Propyl mercaptan, n-Propyl mercaptan

Exposure Limits:
NIOSH REL: C 0.5 ppm (1.6 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with an offensive, cabbage-like odor.

Chemical & Physical Properties:
MW: 76.2
BP: 153°F
Sol: Slight
Fl.P: -5°F
IP: 9.195 eV
Sp.Gr: 0.84
VP(77°F): 155 mmHg
FRZ: -172°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids & bases, alkali metals, calcium hypochlorite

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat, resp sys; head, nau, dizz, cyan; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, CNS, blood, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Propargyl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
C_3H_3OH	107-19-7	UK5075000	N.D.

Conversion: 1 ppm = 2.29 mg/m^3 **DOT:** 1986 131

Synonyms/Trade Names: 1-Propyn-3-ol; 2-Propyn-1-ol; 2-Propynyl alcohol

Exposure Limits:
NIOSH REL: TWA 1 ppm (2 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 97

Physical Description: Colorless to straw-colored liquid with a mild, geranium odor.

Chemical & Physical Properties:
MW: 56.1
BP: 237°F
Sol: Miscible
Fl.P(oc): 97°F
IP: 10.51 eV
Sp.Gr: 0.97
VP: 12 mmHg
FRZ: -62°F
UEL: ?
LEL: ?
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Phosphorus pentoxide, oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit skin, muc memb; CNS depres; in animals: liver, kidney damage
TO: Skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

β-Propiolactone

Formula:	CAS#:	RTECS#:	IDLH:
$C_3H_4O_2$	57-57-8	RQ7350000	Ca [N.D]

Conversion: **DOT:**

Synonyms/Trade Names: BPL; Hydroacrylic acid, β-lactone; 3-Hydroxy-β-lactone; 3-Hydroxy-propionic acid; β-Lactone; 2-Oxetanone; 3-Propiolactone

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1013]
See Appendix B

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a slightly sweet odor.

Chemical & Physical Properties:
MW: 72.1
BP: 323°F (Decomposes)
Sol: 37%
Fl.P: 165°F
IP: ?
Sp.Gr: 1.15
VP(77°F): 3 mmHg
FRZ: -28°F
UEL: ?
LEL: 2.9%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

See Appendix E (page 351)

Incompatibilities and Reactivities: Acetates, halogens, thiocyanates, thiosulfates
[**Note:** May polymerize upon storage.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Skin irrit, blistering, burns; corn opac; frequent urination; dysuria; hema; [carc]
TO: Kidneys, skin, lungs, eyes [in animals: tumors of the liver, skin & stomach]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Propionic acid

Formula:	CAS#:	RTECS#:	IDLH:
CH_3CH_2COOH	79-09-4	UE5950000	N.D.

Conversion: 1 ppm = 3.03 mg/m^3 **DOT:** 1848 132

Synonyms/Trade Names: Carboxyethane, Ethanecarboxylic acid, Ethylformic acid, Metacetonic acid, Methyl acetic acid, Propanoic acid

Exposure Limits:
NIOSH REL: TWA 10 ppm (30 mg/m^3)
ST 15 ppm (45 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless, oily liquid with a pungent, disagreeable, rancid odor. [**Note:** A solid below 5°F.]

Chemical & Physical Properties:
MW: 74.1
BP: 286°F
Sol: Miscible
Fl.P: 126°F
IP: 10.24 eV
Sp.Gr: 0.99
VP: 3 mmHg
FRZ: 5°F
UEL: 12.1%
LEL: 2.9%
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Alkalis, strong oxidizers (e.g., chromium trioxide) [**Note:** Corrosive to steel.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; blurred vision, corn burns; skin burns; abdom pain, nau, vomit
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

P

Propionitrile

Formula:	CAS#:	RTECS#:	IDLH:
CH_3CH_2CN	107-12-0	UF9625000	N.D.

Conversion: 1 ppm = 2.25 mg/m^3 **DOT:** 2404 131

Synonyms/Trade Names: Cyanoethane, Ethyl cyanide, Propanenitrile, Propionic nitrile, Propiononitrile

Exposure Limits:
NIOSH REL: TWA 6 ppm (14 mg/m^3)
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 1606 (adapt)

Physical Description: Colorless liquid with a pleasant, sweetish, ethereal odor. [**Note:** Forms cyanide in the body.]

Chemical & Physical Properties:
MW: 55.1
BP: 207°F
Sol: 11.9%
Fl.P: 36°F
IP: 11.84 eV
Sp.Gr: 0.78
VP: 35 mmHg
FRZ: -133°F
UEL: ?
LEL: 3.1%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
60 ppm: CcrOv/Sa
150 ppm: Sa:Cf/PaprOv
300 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
1000 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers & reducing agents, strong acids & bases
[**Note:** Hydrogen cyanide is produced when propionitrile is heated to decomposition.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; nau, vomit; chest pain; lass; stupor, convuls; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, CVS, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Propoxur	Formula: $CH_3NHCOOC_6H_4OCH(CH_3)_2$	CAS#: 114-26-1	RTECS#: FC3150000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Aprocarb®, o-Isopropoxyphenyl-N-methylcarbamate, N-Methyl-2-isopropoxyphenyl-carbamate

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3
OSHA PEL†: none

Physical Description: White to tan, crystalline powder with a faint, characteristic odor. [insecticide]

Measurement Methods (see Table 1):
NIOSH 5601
OSHA PV2007

Chemical & Physical Properties:
MW: 209.3
BP: Decomposes
Sol: 0.2%
Fl.P: >300°F
IP: ?
Sp.Gr: ?
VP: 0.000007 mmHg
MLT: 187-197°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong oxidizers, alkalis
[**Note:** Emits highly toxic methyl isocyanate fumes when heated to decomposition.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Miosis, blurred vision; sweat, salv; abdom cramps, nau, diarr, vomit; head, lass, musc twitch
TO: CNS, liver, kidneys, GI tract, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

P

n-Propyl acetate	Formula: $CH_3COOCH_2CH_2CH_3$	CAS#: 109-60-4	RTECS#: AJ3675000	IDLH: 1700 ppm
Conversion: 1 ppm = 4.18 mg/m^3	**DOT:** 1276 129			

Synonyms/Trade Names: Propylacetate, n-Propyl ester of acetic acid

Exposure Limits:
NIOSH REL: TWA 200 ppm (840 mg/m^3)
ST 250 ppm (1050 mg/m^3)
OSHA PEL†: TWA 200 ppm (840 mg/m^3)

Physical Description: Colorless liquid with a mild, fruity odor.

Measurement Methods (see Table 1):
NIOSH 1450
OSHA 7

Chemical & Physical Properties:
MW: 102.2
BP: 215°F
Sol: 2%
Fl.P: 55°F
IP: 10.04 eV
Sp.Gr: 0.84
VP: 25 mmHg
FRZ: -134°F
UEL: 8%
LEL(100°F): 1.7%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1700 ppm: Sa:Cf£/CcrFOv/GmFOv/PaprOv£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Nitrates; strong oxidizers, alkalis & acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, nose, throat; narco; derm
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush prompt
Breath: Resp support
Swallow: Medical attention immed

n-Propyl alcohol

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3CH_2CH_2OH$	71-23-8	UH8225000	800 ppm

Conversion: 1 ppm = 2.46 mg/m^3 **DOT:** 1274 129

Synonyms/Trade Names: Ethyl carbinol, 1-Propanol, n-Propanol, Propyl alcohol

Exposure Limits:
NIOSH REL: TWA 200 ppm (500 mg/m^3) [skin]
ST 250 ppm (625 mg/m^3)
OSHA PEL†: TWA 200 ppm (500 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1401, 1405
OSHA 7

Physical Description: Colorless liquid with a mild, alcohol-like odor.

Chemical & Physical Properties:
MW: 60.1
BP: 207°F
Sol: Miscible
Fl.P: 72°F
IP: 10.15 eV
Sp.Gr: 0.81
VP: 15 mmHg
FRZ: -196°F
UEL: 13.7%
LEL: 2.2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
800 ppm: CcrOv*/PaprOv*/GmFOv/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; dry cracking skin; drow, head; ataxia, GI pain; abdom cramps, nau, vomit, diarr; in animals: narco
TO: Eyes, skin, resp sys, GI tract, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

P

Propylene dichloride

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3CHClCH_2Cl$	78-87-5	TX9625000	Ca [400 ppm]

Conversion: 1 ppm = 4.62 mg/m^3 **DOT:** 1279 130

Synonyms/Trade Names: Dichloro-1,2-propane; 1,2-Dichloropropane

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: TWA 75 ppm (350 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1013
OSHA 7

Physical Description: Colorless liquid with a chloroform-like odor. [pesticide]

Chemical & Physical Properties:
MW: 113.0
BP: 206°F
Sol: 0.3%
Fl.P: 60°F
IP: 10.87 eV
Sp.Gr: 1.16
VP: 40 mmHg
FRZ: -149°F
UEL: 14.5%
LEL: 3.4%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, active metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; drow, dizz; liver, kidney damage; in animals: CNS depres; [carc]
TO: Eyes, skin, resp sys, liver, kidneys, CNS [in animals: liver & mammary gland tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Propylene glycol dinitrate	Formula: $CH_3CNO_2OHCHNO_2OH$	CAS#: 6423-43-4	RTECS#: TY6300000	IDLH: N.D.
Conversion: 1 ppm = 6.79 mg/m^3	**DOT:**			

Synonyms/Trade Names: PGDN; Propylene glycol-1,2-dinitrate; 1,2-Propylene glycol dinitrate

Exposure Limits:
NIOSH REL: TWA 0.05 ppm (0.3 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a disagreeable odor. [**Note:** A solid below 18°F.]

Chemical & Physical Properties:
MW: 166.1
BP: ?
Sol: 0.1%
Fl.P: ?
IP: ?
Sp.Gr(77°F): 1.23
VP(72°F): 0.07 mmHg
FRZ: 18°F
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Ammonia compounds, amines, oxidizers, reducing agents, combustible materials [**Note:** Similar to Ethylene glycol dinitrate in explosion potential.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; conj; methemo; head, impaired balance, vis dist; in animals: liver, kidney damage
TO: Eyes, CNS, blood, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Propylene glycol monomethyl ether	Formula: $CH_3OCH_2CHCH_3$	CAS#: 107-98-2	RTECS#: UB7700000	IDLH: N.D.
Conversion: 1 ppm = 3.69 mg/m^3	**DOT:**			

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/m^3)
ST 150 ppm (540 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2554
OSHA 99

Physical Description: Clear, colorless liquid with a mild, ethereal odor.

Chemical & Physical Properties:
MW: 90.1
BP: 248°F
Sol: Miscible
Fl.P: 97°F
IP: ?
Sp.Gr: 0.96
VP(77°F): 12 mmHg
FRZ: -139°F (Sets to glass)
UEL(calc): 13.8%
LEL(calc.): 1.6%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, strong acids [**Note:** Hygroscopic (i.e., absorbs moisture from air). May slowly form reactive peroxides during prolonged storage.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; head, nau, dizz, drow, inco; vomit, diarr
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash
Breath: Resp support
Swallow: Medical attention immed

Propylene imine	Formula: C_3H_7N	CAS#: 75-55-8	RTECS#: CM8050000	IDLH: Ca [100 ppm]
Conversion: 1 ppm = 2.34 mg/m^3	**DOT:** 1921 131P (inhibited)			

Synonyms/Trade Names: 2-Methylaziridine, 2-Methylethyleneimine, Propyleneimine, Propylene imine (inhibited), Propylenimine

Exposure Limits:
NIOSH REL: Ca
TWA 2 ppm (5 mg/m^3) [skin]
See Appendix A
OSHA PEL: TWA 2 ppm (5 mg/m^3) [skin]

Measurement Methods (see Table 1):
None available

Physical Description: Colorless, oily liquid with an ammonia-like odor.

Chemical & Physical Properties:
MW: 57.1
BP: 152°F
Sol: Miscible
Fl.P: 25°F
IP: 9.00 eV
Sp.Gr: 0.80
VP: 112 mmHg
FRZ: -85°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Eye, skin burns; [carc]
TO: Eyes, skin [in animals: nasal tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Propylene oxide	Formula: C_3H_6O	CAS#: 75-56-9	RTECS#: TZ2975000	IDLH: Ca [400 ppm]
Conversion: 1 ppm = 2.38 mg/m^3	**DOT:** 1280 127P			

Synonyms/Trade Names: 1,2-Epoxy propane; Methyl ethylene oxide; Methyloxirane; Propene oxide; 1,2-Propylene oxide

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: TWA 100 ppm (240 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1612
OSHA 88

Physical Description: Colorless liquid with a benzene-like odor. [**Note:** A gas above 94°F.]

Chemical & Physical Properties:
MW: 58.1
BP: 94°F
Sol: 41%
Fl.P: -35°F
IP: 9.81 eV
Sp.Gr: 0.83
VP: 445 mmHg
FRZ: -170°F
UEL: 36%
LEL: 2.3%
Class IA Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; skin blisters, burns; [carc]
TO: Eyes, skin, resp sys [in animals: nasal tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

n-Propyl nitrate	Formula: $CH_3CH_2CH_2ONO_2$	CAS#: 627-13-4	RTECS#: UK0350000	IDLH: 500 ppm
Conversion: 1 ppm = 4.30 mg/m^3	**DOT:** 1865 131			
Synonyms/Trade Names: Propyl ester of nitric acid				

Exposure Limits:
NIOSH REL: TWA 25 ppm (105 mg/m^3)
ST 40 ppm (170 mg/m^3)
OSHA PEL†: TWA 25 ppm (110 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S227 (II-3)
OSHA 7

Physical Description: Colorless to straw-colored liquid with an ether-like odor.

Chemical & Physical Properties:
MW: 105.1
BP: 231°F
Sol: Slight
FI.P: 68°F
IP: 11.07 eV
Sp.Gr: 1.07
VP: 18 mmHg
FRZ: -148°F
UEL: 100%
LEL: 2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
250 ppm: Sa
500 ppm: Sa:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, combustible materials
[**Note:** Forms explosive mixtures with combustible materials.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes, skin; methemo, anoxia, cyan; dysp, lass, dizz, head
TO: Eyes, skin, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Pyrethrum	Formula: $C_{20}H_{28}O_3/C_{21}H_{28}O_5/C_{21}H_{30}O_3/C_{22}H_{30}O_5/C_{21}H_{28}O_3/C_{22}H_{28}O_5$	CAS#: 8003-34-7	RTECS#: UR4200000	IDLH: 5000 mg/m^3
Conversion:	**DOT:**			
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:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5008
OSHA 70

Physical Description: Brown, viscous oil or solid. [insecticide]

Chemical & Physical Properties:
MW: 316-374
BP: ?
Sol: Insoluble
FI.P: 180-190°F
IP: ?
Sp.Gr: 1 (approx)
VP: Low
MLT: ?
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: CcrOv95*/Sa*
125 mg/m^3: Sa:Cf*/PaprOvHie*
250 mg/m^3: CcrFOv100/PaprTOvHie*/ScbaF/SaF
5000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Erythema, derm, papules, pruritus, rhin; sneez; asthma
TO: Resp sys, skin, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Pyridine

Formula:	CAS#:	RTECS#:	IDLH:
C_5H_5N	110-86-1	UR8400000	1000 ppm

Conversion: 1 ppm = 3.24 mg/m^3 **DOT:** 1282 129

Synonyms/Trade Names: Azabenzene, Azine

Exposure Limits:
NIOSH REL: TWA 5 ppm (15 mg/m^3)
OSHA PEL: TWA 5 ppm (15 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1613
OSHA 7

Physical Description: Colorless to yellow liquid with a nauseating, fish-like odor.

Chemical & Physical Properties:
MW: 79.1
BP: 240°F
Sol: Miscible
FI.P: 68°F
IP: 9.27 eV
Sp.Gr: 0.98
VP: 16 mmHg
FRZ: -44°F
UEL: 12.4%
LEL: 1.8%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
125 ppm: Sa:Cf£/PaprOv£
50 ppm: CcrFOv/GmFOv/PaprTOv£/ ScbaF/SaF
1000 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; head, anxi, dizz, insom; nau, anor; derm; liver, kidney damage
TO: Eyes, skin, CNS, liver, kidneys, GI tract,

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Quinone

Formula:	CAS#:	RTECS#:	IDLH:
OC_6H_4O	106-51-4	DK2625000	100 mg/m^3

Conversion: 1 ppm = 4.42 mg/m^3 **DOT:** 2587 153

Synonyms/Trade Names: 1,4-Benzoquinone; p-Benzoquinone; 1,4-Cyclohexadiene dioxide; p-Quinone

Exposure Limits:
NIOSH REL: TWA 0.4 mg/m^3 (0.1 ppm)
OSHA PEL: TWA 0.4 mg/m^3 (0.1 ppm)

Measurement Methods (see Table 1):
NIOSH S181 (II-4)

Physical Description: Pale-yellow solid with an acrid, chlorine-like odor.

Chemical & Physical Properties:
MW: 108.1
BP: Sublimes
Sol: Slight
FI.P: 100-200°F
IP: 9.68 eV
Sp.Gr: 1.32
VP(77°F): 0.1 mmHg
MLT: 240°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 mg/m^3: Sa:Cf£
20 mg/m^3: ScbaF/SaF
100 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Eye irrit, conj; kera; skin irrit
TO: Eyes, skin

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Resorcinol

Formula: $C_6H_4(OH)_2$ | **CAS#:** 108-46-3 | **RTECS#:** VG9625000 | **IDLH:** N.D.

Conversion: 1 ppm = 4.50 mg/m^3 | **DOT:** 2876 153

Synonyms/Trade Names: 1,3-Benzenediol; m-Benzenediol; 1,3-Dihydroxybenzene; m-Dihydroxybenzene; 3-Hydroxyphenol; m-Hydroxyphenol

Exposure Limits:
NIOSH REL: TWA 10 ppm (45 mg/m^3)
ST 20 ppm (90 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5701
OSHA PV2053

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.]

Chemical & Physical Properties:
MW: 110.1
BP: 531°F
Sol: 110%
Fl.P: 261°F
IP: 8.63 eV
Sp.Gr: 1.27
VP(77°F): 0.0002 mmHg
MLT: 228°F
UEL: ?
LEL(392°F): 1.4%
Class IIIB Combustible Liquid, but may be difficult to ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Acetanilide, albumin, alkalis, antipyrine, camphor, ferric salts, menthol, spirit nitrous ether, strong oxidizers & bases
[**Note:** Hygroscopic (i.e., absorbs moisture from the air).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat, upper resp sys; methemo; cyan, convuls; restless, bluish skin, incr heart rate, dysp; dizz, drow, hypothermia, hema; spleen, kidney, liver changes; derm
TO: Eyes, skin, resp sys, CVS, CNS, blood, spleen, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Rhodium (metal fume and insoluble compounds, as Rh)

Formula: Rh (metal) | **CAS#:** 7440-16-6 (metal) | **RTECS#:** VI9069000 | **IDLH:** 100 mg/m^3 (as Rh)

Conversion: | **DOT:**

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/m^3
OSHA PEL: TWA 0.1 mg/m^3

Measurement Methods (see Table 1):
NIOSH S188 (II-3)

Physical Description: Metal: White, hard, ductile, malleable solid with a bluish-gray luster.

Chemical & Physical Properties:
MW: 102.9
BP: 6741°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 12.41 (metal)
VP: 0 mmHg (approx)
MLT: 3571°F
UEL: NA
LEL: NA
Metal: Noncombustible Solid in bulk form, but flammable as dust or powder.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.5 mg/m^3: Qm
1 mg/m^3: 95XQ/Sa
2.5 mg/m^3: Sa:Cf/PaprHie
5 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
100 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Chlorine trifluoride, oxygen difluoride

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Possible resp sens
TO: Resp sys

First Aid (see Table 6):
Breath: Resp support
Swallow: Medical attention immed

Rhodium (soluble compounds, as Rh)	Formula:	CAS#:	RTECS#:	IDLH:
				2 mg/m^3 (as Rh)

Conversion: **DOT:**

Synonyms/Trade Names: Synonyms vary depending upon the specific soluble rhodium compound.

Exposure Limits:
NIOSH REL: TWA 0.001 mg/m^3
OSHA PEL: TWA 0.001 mg/m^3

Measurement Methods (see Table 1):
NIOSH S189 (II-3)

Physical Description: Appearance and odor vary depending upon the specific soluble rhodium compound.

Chemical & Physical Properties:
Properties vary depending upon the specific soluble rhodium compound.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.01 mg/m^3: 100XQ*/Sa*
0.025 mg/m^3: Sa:Cf*/PaprHie*
0.05 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
2 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes; CNS damage
TO: Eyes, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

Ronnel	Formula:	CAS#:	RTECS#:	IDLH:
	$(CH_3O)_2P(S)OC_6H_2Cl_3$	299-84-3	TG0525000	300 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: O,O-Dimethyl O-(2,4,5-trichlorophenyl) phosphorothioate; Fenchlorophos

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3
OSHA PEL†: TWA 15 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5600
OSHA PV2054

Physical Description: White to light-tan, crystalline solid. [insecticide] [**Note:** A liquid above 106°F.]

Chemical & Physical Properties:
MW: 321.6
BP: Decomposes
Sol(77°F): 0.004%
FI.P: NA
IP: ?
Sp.Gr(77°F): 1.49
VP(77°F): 0.0008 mmHg
MLT: 106°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
100 mg/m^3: CcrOv95/Sa
250 mg/m^3: Sa:Cf/PaprOvHie
300 mg/m^3: CcrFOv100/GmFOv100/PaprTOvHie*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: irrit eyes; chol inhibition; liver, kidney damage
TO: Eyes, liver, kidneys, blood plasma

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Rosin core solder, pyrolysis products (as formaldehyde)	Formula:	CAS#:	RTECS#:	IDLH: N.D.
Conversion:	DOT:			

Synonyms/Trade Names: Rosin flux pyrolysis products, Rosin core soldering flux pyrolysis products

Exposure Limits:
NIOSH REL*: TWA 0.1 mg/m^3
[***Note:** "Ca" in the presence of formaldehyde, acetaldehyde, or malonaldehyde. See Appendices A & C (Aldehydes).]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2541, 3500

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 & CO_2.

Chemical & Physical Properties:
Properties vary depending upon the specific rosin core solder being used.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

In the presence of Formaldeyde, Acetaldehyde, or Malonaldehyde:
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Irrit eyes, nose, throat, upper resp sys [carc (in the presence of Formaldehyde, Acetaldehyde, or Malonaldehyde)]
TO: Eyes, resp sys [nasal cancer; thyroid gland tumors in animals (in the presence of Formaldehyde, Acetaldehyde, or Malonaldehyde)]

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support

Rotenone	Formula: $C_{23}H_{22}O_6$	CAS#: 83-79-4	RTECS#: DJ2800000	IDLH: 2500 mg/m^3
Conversion:	DOT:			

Synonyms/Trade Names:
1,2,12,12a-Tetrahydro-8,9-dimethoxy-2-(1-methylethenyl)-[1]benzopyrano[3,4-b]furo[2,3-h][1]benzopyran-6(6aH)-one

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5007

Physical Description: Colorless to red, odorless, crystalline solid. [insecticide]

Chemical & Physical Properties:
MW: 394.4
BP: Decomposes
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr: 1.27
VP: <0.00004 mmHg
MLT: 330°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: CcrOv95/Sa
125 mg/m^3: Sa:Cf/PaprOvHie
250 mg/m^3: CcrFOv100/GmFOv100/PaprTOvHie/SaT:Cf/ScbaF/SaF
2500 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; numb muc memb; nau, vomit, abdom pain; musc tremor, inco, clonic convuls, stupor
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Rouge

Formula:	CAS#:	RTECS#:	IDLH:
Fe_2O_3	1309-37-1	NO7400000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Iron(III)oxide, Iron oxide red, Red iron oxide, Red oxide

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: A fine, red powder of ferric oxide.
[**Note:** Usually used in cake form or impregnated in paper or cloth.]

Chemical & Physical Properties:
MW: 159.7
BP: ?
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 5.24
VP: 0 mmHg (approx)
MLT: 2849°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Calcium hypochlorite, carbon monoxide, hydrogen peroxide

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Selenium

Formula:	CAS#:	RTECS#:	IDLH:
Se	7782-49-2	VS7700000	1 mg/m^3 (as Se)

Conversion: **DOT:** 2658 152 (powder)

Synonyms/Trade Names: Elemental selenium, Selenium alloy

Exposure Limits:
NIOSH REL*: TWA 0.2 mg/m^3
OSHA PEL*: TWA 0.2 mg/m^3
[***Note:** The REL and PEL also apply to other selenium compounds (as Se) except Selenium hexafluoride.]

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102, S190 (II-7)
OSHA ID121

Physical Description: Amorphous or crystalline, red to gray solid.
[**Note:** Occurs as an impurity in most sulfide ores.]

Chemical & Physical Properties:
MW: 79.0
BP: 1265°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 4.28
VP: 0 mmHg (approx)
MLT: 392°F
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 mg/m^3: Qm*/95XQ*/100F/PaprHie*/PaprHie*/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Acids, strong oxidizers, chromium trioxide, potassium bromate, cadmium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; vis dist; head; chills, fever; dysp, bron; metallic taste, garlic breath, GI dist; derm; eye, skin burns; in animals: anemia; liver nec, cirr; kidney, spleen damage
TO: Eyes, skin, resp sys, liver, kidneys, blood, spleen

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Selenium hexafluoride	Formula: SeF_6	CAS#: 7783-79-1	RTECS#: VS9450000	IDLH: 2 ppm
Conversion: 1 ppm = 7.89 mg/m^3	**DOT:** 2194 125			
Synonyms/Trade Names: Selenium fluoride				
Exposure Limits: **NIOSH REL:** TWA 0.05 ppm **OSHA PEL:** TWA 0.05 ppm (0.4 mg/m^3)			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless gas.				
Chemical & Physical Properties: **MW:** 193.0 **BP:** -30°F **Sol:** Insoluble **Fl.P:** NA **IP:** ? **RGasD:** 6.66 **VP:** >1 atm **FRZ:** -59°F **UEL:** NA **LEL:** NA Nonflammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.5 ppm:** Sa **1.25 ppm:** Sa:Cf **2 ppm:** SaT:Cf/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS/ScbaE	
Incompatibilities and Reactivities: Water [**Note:** Hydrolyzes very slowly in cold water.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh **SY:** In animals: pulm irrit, edema **TO:** Resp sys			**First Aid (see Table 6):** **Breath:** Resp support	

Silica, amorphous	Formula: SiO_2	CAS#: 7631-86-9	RTECS#: VV7310000	IDLH: 3000 mg/m^3
Conversion:	**DOT:**			
Synonyms/Trade Names: Diatomaceous earth, Diatomaceous silica, Diatomite, Precipitated amorphous silica, Silica gel, Silicon dioxide (amorphous)				
Exposure Limits: **NIOSH REL:** TWA 6 mg/m^3 **OSHA PEL†:** TWA 20 mppcf [(80 mg/m^3)/%SiO_2]			**Measurement Methods (see Table 1):** **NIOSH** 7501	
Physical Description: Transparent to gray, odorless powder. [**Note:** Amorphous silica is the non-crystalline form of SiO_2.]				
Chemical & Physical Properties: **MW:** 60.1 **BP:** 4046°F **Sol:** Insoluble **Fl.P:** NA **IP:** NA **Sp.Gr:** 2.20 **VP:** 0 mmHg (approx) **MLT:** 3110°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **30 mg/m^3:** Qm **60 mg/m^3:** 95XQ/Sa **150 mg/m^3:** Sa:Cf/PaprHie **300 mg/m^3:** 100F/SaT:Cf/PaprTHie/ScbaF/SaF **3000 mg/m^3:** Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: Fluorine, oxygen difluoride, chlorine trifluoride				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Irrit eyes, pneumoconiosis **TO:** Eyes, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Breath:** Fresh air	

Silica, crystalline (as respirable dust)	**Formula:** SiO_2	**CAS#:** 14808-60-7	**RTECS#:** VV7330000	**IDLH:** Ca [25 mg/m^3 (cristobalite, tridymite); 50 mg/m^3 (quartz, tripoli)]
Conversion:	**DOT:**			

Synonyms/Trade Names: Cristobalite, Quartz, Tridymite, Tripoli

Exposure Limits:
NIOSH REL: Ca
TWA 0.05 mg/m^3
See Appendix A
OSHA PEL: See Appendix C (Mineral Dusts)

Measurement Methods (see Table 1):
NIOSH 7500, 7601, 7602
OSHA ID142

Physical Description: Colorless, odorless solid. [**Note:** A component of many mineral dusts.]

Chemical & Physical Properties:
MW: 60.1
BP: 4046°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 2.66
VP: 0 mmHg (approx)
MLT: 3110°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
0.5 mg/m^3: 95XQ
1.25 mg/m^3: PaprHie/Sa:Cf
2.5 mg/m^3: 100F/PaprTHie
25 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Powerful oxidizers: fluorine, chlorine trifluoride, manganese trioxide, oxygen difluoride, hydrogen peroxide, etc.; acetylene; ammonia

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Cough, dysp, wheez; decr pulm func, progressive resp symptoms (silicosis); irrit eyes; [carc]
TO: Eyes, resp sys [in animals: lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Silicon	**Formula:** Si	**CAS#:** 7440-21-3	**RTECS#:** VW0400000	**IDLH:** N.D.
Conversion:	**DOT:** 1346 170 (amorphous powder)			

Synonyms/Trade Names: Elemental silicon
[**Note:** Does not occur free in nature, but is found in silicon dioxide (silica) & in various silicates.]

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Black to gray, lustrous, needle-like crystals.
[**Note:** The amorphous form is a dark-brown powder.]

Chemical & Physical Properties:
MW: 28.1
BP: 4271°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr(77°F): 2.33
VP: 0 mmHg (approx)
MLT: 2570°F
UEL: NA
LEL: NA
MEC: 160 g/m^3
Combustible Solid in powder form.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: Prevent eye contact
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Chlorine, fluorine, oxidizers, calcium, cesium carbide, alkaline carbonates

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; cough
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air
Swallow: Medical attention immed

Silicon carbide	Formula: SiC	CAS#: 409-21-2	RTECS#: VW0450000	IDLH: N.D.
Conversion:	**DOT:**			
Synonyms/Trade Names: Carbon silicide, Carborundum®, Silicon monocarbide				
Exposure Limits: **NIOSH REL:** TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp) **OSHA PEL†:** TWA 15 mg/m^3 (total) TWA 5 mg/m^3 (resp)			**Measurement Methods (see Table 1):** **NIOSH** 0500, 0600	
Physical Description: Yellow to green to bluish-black, iridescent crystals.				
Chemical & Physical Properties: **MW:** 40.1 **BP:** Sublimes **Sol:** Insoluble **Fl.P:** NA **IP:** 9.30 eV **Sp.Gr:** 3.23 **VP:** 0 mmHg (approx) **MLT:** 4892°F (Sublimes) **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: None reported [**Note:** Sublimes with decomposition at 4892°F.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, upper resp sys; cough **TO:** Eyes, skin, resp sys		**First Aid (see Table 6):** **Eye:** Irr immed **Breath:** Fresh air **Swallow:** Medical attention immed		

Silicon tetrahydride	Formula: SiH_4	CAS#: 7803-62-5	RTECS#: VV1400000	IDLH: N.D.
Conversion: 1 ppm = 1.31 mg/m^3	**DOT:** 2203 116			
Synonyms/Trade Names: Monosilane, Silane, Silicane				
Exposure Limits: **NIOSH REL:** TWA 5 ppm (7 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless gas with a repulsive odor.				
Chemical & Physical Properties: **MW:** 32.1 **BP:** -169°F **Sol:** Decomposes **Fl.P:** NA (Gas) **IP:** ? **RGasD:** 1.11 **VP:** >1 atm **FRZ:** -301°F **UEL:** ? **LEL:** ? Flammable Gas (may ignite SPONTANEOUSLY in air).	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Halogens (bromine, chlorine, carbonyl chloride, antimony pentachloride, tin(IV) chloride), water				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh **SY:** Irrit eyes, skin, muc memb; nau, head **TO:** Eyes, skin, resp sys, CNS		**First Aid (see Table 6):** **Breath:** Resp support		

Silver (metal dust and soluble compounds, as Ag)

Formula: Ag (metal) | **CAS#:** 7440-22-4 (metal) | **RTECS#:** VW3500000 (metal) | **IDLH:** 10 mg/m^3 (as Ag)

Conversion: | **DOT:**

Synonyms/Trade Names: **Silver metal:** Argentum
Synonyms of soluble silver compounds such as Silver nitrate ($AgNO_3$) vary depending upon the specific compound.

Exposure Limits:
NIOSH REL: TWA 0.01 mg/m^3
OSHA PEL: TWA 0.01 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 9102
OSHA ID121

Physical Description: Metal: White, lustrous solid.

Chemical & Physical Properties:
MW: 107.9
BP: 3632°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 10.49 (metal)
VP: 0 mmHg (approx)
MLT: 1761°F
UEL: NA
LEL: NA
Metal: Noncombustible Solid, but flammable in form of dust or powder.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam ($AgNO_3$)
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.25 mg/m^3: Sa:Cf£/PaprHie£
0.5 mg/m^3: 100F/ScbaF/SaF
10 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Acetylene, ammonia, hydrogen peroxide, bromoazide, chlorine trifluoride, ethyleneimine, oxalic acid, tartaric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Blue-gray eyes, nasal septum, throat, skin; irrit, ulceration skin; GI dist
TO: Nasal septum, skin, eyes

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

Soapstone (containing less than 1% quartz)

Formula: 3MgO-4SiO_2-H_2O | **CAS#:** | **RTECS#:** VV8780000 | **IDLH:** 3000 mg/m^3

Conversion: | **DOT:**

Synonyms/Trade Names: Massive talc, Soapstone silicate, Steatite

Exposure Limits:
NIOSH REL: TWA 6 mg/m^3 (total)
TWA 3 mg/m^3 (resp)
OSHA PEL†: TWA 20 mppcf

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Odorless, white-gray powder.

Chemical & Physical Properties:
MW: 379.3
BP: ?
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 2.7-2.8
VP: 0 mmHg (approx)
MLT: ?
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
30 mg/m^3: Qm
60 mg/m^3: 95XQ/Sa
150 mg/m^3: PaprHie
300 mg/m^3: 100F/SaT:Cf*/PaprTHie*/ ScbaF/SaF
3000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Pneumoconiosis: cough, dysp; digital clubbing; cyan; basal crackles, cor pulmonale
TO: Resp sys, CVS

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support

Sodium aluminum fluoride (as F)	Formula: Na_3AlF_6	CAS#: 15096-52-3	RTECS#: WA9625000	IDLH: 250 mg/m^3 (as F)
Conversion:	**DOT:**			

Synonyms/Trade Names: Cryocide, Cryodust, Cryolite, Sodium hexafluoroaluminate

Exposure Limits:
NIOSH REL*: TWA 2.5 mg/m^3
OSHA PEL*: TWA 2.5 mg/m^3
[***Note:** The REL and PEL also apply to other inorganic, solid fluorides (as F).]

Measurement Methods (see Table 1):
NIOSH 7902
OSHA ID110

Physical Description: Colorless to dark odorless solid. [pesticide]
[**Note:** Loses color on heating.]

Chemical & Physical Properties:
MW: 209.9
BP: Decomposes
Sol: 0.04%
FI.P: NA
IP: NA
Sp.Gr: 2.90
VP: 0 mmHg (approx)
MLT: 1832°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
12.5 mg/m^3: Qm
25 mg/m^3: 95XQ*/Sa*
62.5 mg/m^3: Sa:Cf*/PaprHie*+
125 mg/m^3: 100F+/ScbaF/SaF
250 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F+/ScbaE

+Note: May need acid gas sorbent

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp sys; nau, abdom pain, diarr; salv, thirst, sweat; stiff spine; derm; calcification of ligaments of ribs, pelvis
TO: Eyes, skin, resp sys, CNS, skeleton, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Fresh air
Swallow: Medical attention immed

Sodium azide	Formula: NaN_3	CAS#: 26628-22-8	RTECS#: VY8050000	IDLH: N.D.
Conversion:	**DOT:** 1687 153			

Synonyms/Trade Names: Azide, Azium, Sodium salt of hydrazoic acid

Exposure Limits:
NIOSH REL: C 0.1 ppm (as HN_3) [skin]
C 0.3 mg/m^3 (as NaN_3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA ID121, ID211

Physical Description: Colorless to white, odorless, crystalline solid. [pesticide]
[**Note:** Forms hydrazoic acid (HN_3) in water.]

Chemical & Physical Properties:
MW: 65.0
BP: Decomposes
Sol(63°F): 42%
FI.P: ?
IP: 11.70 eV
Sp.Gr: 1.85
VP: ?
MLT: 527°F (Decomposes)
UEL: ?
LEL: ?
Combustible Solid (if heated above 572°F).

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; head, dizz, lass, blurred vision; low BP, bradycardia; kidney changes
TO: Eyes, skin, CNS, CVS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Sodium bisulfite	Formula: $NaHSO_3$	CAS#: 7631-90-5	RTECS#: VZ2000000	IDLH: N.D.
Conversion:	**DOT:** 2693 154 (solution)			

Synonyms/Trade Names: Monosodium salt of sulfurous acid, Sodium acid bisulfite, Sodium bisulphite, Sodium hydrogen sulfite

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: White crystals or powder with a slight odor of sulfur dioxide.

Chemical & Physical Properties:
MW: 104.1
BP: Decomposes
Sol: 29%
FI.P: NA
IP: NA
Sp.Gr: 1.48
VP: ?
MLT: Decomposes
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Heat (decomposes) [**Note:** Slowly oxidized to the sulfate on exposure to air.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air
Swallow: Medical attention immed

Sodium cyanide (as CN)	Formula: NaCN	CAS#: 143-33-9	RTECS#: VZ7525000	IDLH: 25 mg/m^3 (as CN)
Conversion:	**DOT:** 1689 157 (solid); 3414 157 (solution)			

Synonyms/Trade Names: Sodium salt of hydrocyanic acid

Exposure Limits:
NIOSH REL*: C 5 mg/m^3 (4.7 ppm) [10-minute]
OSHA PEL*: TWA 5 mg/m^3
[***Note:** The REL and PEL also apply to other cyanides (as CN) except Hydrogen cyanide.]

Measurement Methods (see Table 1):
NIOSH 6010, 7904

Physical Description: White, granular or crystalline solid with a faint, almond-like odor.

Chemical & Physical Properties:
MW: 49.0
BP: 2725°F
Sol(77°F): 58%
FI.P: NA
IP: NA
Sp.Gr: 1.60
VP: 0 mmHg (approx)
MLT: 1047°F
UEL: NA
LEL: NA
Noncombustible Solid, but contact with acids releases highly flammable hydrogen cyanide.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 mg/m^3: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (such as acids, acid salts, chlorates & nitrates) [**Note:** Absorbs moisture from the air forming a syrup.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; asphy; lass, head, conf; nau, vomit; incr resp rate; slow gasping respiration; thyroid, blood changes
TO: Eyes, skin, CVS, CNS, thyroid, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Sodium fluoride (as F)	Formula: NaF	CAS#: 7681-49-4	RTECS#: WB0350000	IDLH: 250 mg/m^3 (as F)
Conversion:	**DOT:** 1690 154			

Synonyms/Trade Names: Floridine, Sodium monofluoride

Exposure Limits:
NIOSH REL*: TWA 2.5 mg/m^3
OSHA PEL*: TWA 2.5 mg/m^3
[***Note:** The REL and PEL also apply to other inorganic, solid fluorides (as F).]

Measurement Methods (see Table 1):
NIOSH 7902, 7906
OSHA ID110

Physical Description: Odorless, white powder or colorless crystals.
[**Note:** Pesticide grade is often dyed blue.]

Chemical & Physical Properties:
MW: 42.0
BP: 3099°F
Sol: 4%
Fl.P: NA
IP: NA
Sp.Gr: 2.78
VP: 0 mmHg (approx)
MLT: 1819°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
12.5 mg/m^3: Qm
25 mg/m^3: 95XQ*/Sa*
62.5 mg/m^3: Sa:Cf*/PaprHie*+
125 mg/m^3: 100F+/ScbaF/SaF
250 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F+/ScbaE

+Note: May need acid gas sorbent

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp sys; nau, abdom pain, diarr; salv, thirst, sweat; stiff spine; derm; calcification of ligaments of ribs, pelvis
TO: Eyes, skin, resp sys, CNS, skeleton, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Fresh air
Swallow: Medical attention immed

Sodium fluoroacetate	Formula: FCH_2COONa	CAS#: 62-74-8	RTECS#: AH9100000	IDLH: 2.5 mg/m^3
Conversion:	**DOT:** 2629 151			

Synonyms/Trade Names: SFA, Sodium monofluoroacetate

Exposure Limits:
NIOSH REL: TWA 0.05 mg/m^3
ST 0.15 mg/m^3 [skin]
OSHA PEL†: TWA 0.05 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S301 (II-5)

Physical Description: Fluffy, colorless to white (sometimes dyed black), odorless powder. [**Note:** A liquid above 95°F.] [rodenticide]

Chemical & Physical Properties:
MW: 100.0
BP: Decomposes
Sol: Miscible
Fl.P: NA
IP: ?
Sp.Gr: ?
VP: Low
MLT: 392°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.25 mg/m^3: Qm
0.5 mg/m^3: 95XQ/Sa
1.25 mg/m^3: Sa:Cf/PaprHie
2.5 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Vomit; anxi, auditory halu; facial pares; twitch face musc; pulsus altenans, ectopic heartbeat, tacar, card arrhy; pulm edema; nystagmus; convuls; liver, kidney damage
TO: Resp sys, CVS, liver, kidneys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Sodium hydroxide	Formula: NaOH	CAS#: 1310-73-2	RTECS#: WB4900000	IDLH: 10 mg/m^3
Conversion:	**DOT:** 1823 154 (dry, solid); 1824 154 (solution)			
Synonyms/Trade Names: Caustic soda, Lye, Soda lye, Sodium hydrate				
Exposure Limits: **NIOSH REL:** C 2 mg/m^3 **OSHA PEL†:** TWA 2 mg/m^3			**Measurement Methods (see Table 1):** **NIOSH** 7401	
Physical Description: Colorless to white, odorless solid (flakes, beads, granular form).				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 40.0 **BP:** 2534°F **Sol:** 111% **FI.P:** NA **IP:** NA **Sp.Gr:** 2.13 **VP:** 0 mmHg (approx) **MLT:** 605°F **UEL:** NA **LEL:** NA Noncombustible Solid, but when in contact with water may generate sufficient heat to ignite combustible materials.	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench	**NIOSH/OSHA** **10 mg/m^3:** Sa:Cf£/100F/PaprHie£/ ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE

Incompatibilities and Reactivities: Water; acids; flammable liquids; organic halogens; metals such as aluminum, tin & zinc; nitromethane [**Note:** Corrosive to metals.]	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; pneu; eye, skin burns; temporary loss of hair **TO:** Eyes, skin, resp sys	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed

Sodium metabisulfite	Formula: $Na_2S_2O_5$	CAS#: 7681-57-4	RTECS#: UX8225000	IDLH: N.D.
Conversion:	**DOT:**			
Synonyms/Trade Names: Disodium pyrosulfite, Sodium metabisulphite, Sodium pyrosulfite				
Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **NIOSH** 0500	
Physical Description: White to yellowish crystals or powder with an odor of sulfur dioxide.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 190.1 **BP:** Decomposes **Sol:** 54% **FI.P:** NA **IP:** NA **Sp.Gr:** 1.4 **VP:** ? **MLT:** >302°F (Decomposes) **UEL:** NA **LEL:** NA Noncombustible Solid	**Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.	Not available.

Incompatibilities and Reactivities: Heat (decomposes) [**Note:** Slowly oxidized to the sulfate on exposure to air & moisture.]	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb **TO:** Eyes, skin, resp sys	**First Aid (see Table 6):** **Eye:** Irr immed **Breath:** Fresh air **Swallow:** Medical attention immed

Starch

Formula:	CAS#:	RTECS#:	IDLH:
$(C_6H_{10}O_5)n$	9005-25-8	GM5090000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Corn starch, Rice starch, Sorghum gum, α-Starch, Starch gum, Tapioca starch

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Fine, white, odorless powder.
[**Note:** A carbohydrate polymer composed of 25% amylose & 75% amylpectin.]

Chemical & Physical Properties:
MW: varies
BP: Decomposes
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 1.45
VP: 0 mmHg (approx)
MLT: Decomposes
UEL: NA
LEL: NA
MEC: 50 g/m^3
Noncombustible Solid, but may form explosive mixture with air.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, acids, iodine, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; cough, chest pain; derm; rhin
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air
Swallow: Medical attention immed

Stibine

Formula:	CAS#:	RTECS#:	IDLH:
SbH_3	7803-52-3	WJ0700000	5 ppm

Conversion: 1 ppm = 5.10 mg/m^3 **DOT:** 2676 119

Synonyms/Trade Names: Antimony hydride, Antimony trihydride, Hydrogen antimonide

Exposure Limits:
NIOSH REL: TWA 0.1 ppm (0.5 mg/m^3)
OSHA PEL: TWA 0.1 ppm (0.5 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6008

Physical Description: Colorless gas with a disagreeable odor like hydrogen sulfide.

Chemical & Physical Properties:
MW: 124.8
BP: -1°F
Sol: Slight
Fl.P: NA (Gas)
IP: 9.51 eV
RGasD: 4.31
VP: >1 atm
FRZ: -126°F
UEL: ?
LEL: ?
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 ppm: Sa
2.5 ppm: Sa:Cf
5 ppm: SaT:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Acids, halogenated hydrocarbons, oxidizers, moisture, chlorine, ozone, ammonia

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Head, lass; nau, abdom pain; lumbar pain, hema, hemolytic anemia; jaun; pulm irrit
TO: Blood, liver, kidneys, resp sys

First Aid (see Table 6):
Breath: Resp support

Stoddard solvent	Formula:	CAS#:	RTECS#:	IDLH:
		8052-41-3	WJ8925000	20,000 mg/m^3

Conversion: **DOT:** 1268 128 (petroleum distillates, n.o.s.)

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% C_{10} or higher hydrocarbons.]

Exposure Limits:
NIOSH REL: TWA 350 mg/m^3
C 1800 mg/m^3 [15-minute]
OSHA PEL†: TWA 500 ppm (2900 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1550

Physical Description: Colorless liquid with a kerosene-like odor.

Chemical & Physical Properties:
MW: Varies
BP: 309-396°F
Sol: Insoluble
FI.P: 102-110°F
IP: ?
Sp.Gr: 0.78
VP: ?
FRZ: ?
UEL: ?
LEL: ?
Class II Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
3500 mg/m^3: CcrOv*/Sa*
8750 mg/m^3: Sa:Cf*/PaprOv*
17,500 mg/m^3: CcrFOv/GmFOv/PaprTOv*/ScbaF/SaF
20,000 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, nose, throat; dizz; derm; chemical pneu (aspir liquid); in animals: kidney damage
TO: Eyes, skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Strychnine	Formula:	CAS#:	RTECS#:	IDLH:
	$C_{21}H_{22}N_2O_2$	57-24-9	WL2275000	3 mg/m^3

Conversion: **DOT:** 1692 151

Synonyms/Trade Names: Nux vomica, Strynchnos

Exposure Limits:
NIOSH REL: TWA 0.15 mg/m^3
OSHA PEL: TWA 0.15 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5016

Physical Description: Colorless to white, odorless, crystalline solid. [pesticide]

Chemical & Physical Properties:
MW: 334.4
BP: Decomposes
Sol: 0.02%
FI.P: ?
IP: ?
Sp.Gr: 1.36
VP: Low
MLT: 514°F
UEL: ?
LEL: ?
Combustible Solid, but difficult to ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.75 mg/m^3: Qm
1.5 mg/m^3: 95XQ/Sa
3 mg/m^3: Sa:Cf/PaprHie/100F/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Stiff neck, facial musc; restless, anxi, incr acuity of perception; incr reflex excitability; cyan; tetanic convuls with opisthotonos
TO: CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Styrene	**Formula:** $C_6H_5CH=CH_2$	**CAS#:** 100-42-5	**RTECS#:** WL3675000	**IDLH:** 700 ppm
Conversion: 1 ppm = 4.26 mg/m^3	**DOT:** 2055 128P (inhibited)			
Synonyms/Trade Names: Ethenyl benzene, Phenylethylene, Styrene monomer, Styrol, Vinyl benzene				

Exposure Limits:
NIOSH REL: TWA 50 ppm (215 mg/m^3)
ST 100 ppm (425 mg/m^3)
OSHA PEL†: TWA 100 ppm
C 200 ppm
600 ppm (5-minute maximum peak in any 3 hours)

Measurement Methods (see Table 1):
NIOSH 1501, 3800
OSHA 9, 89

Physical Description: Colorless to yellow, oily liquid with a sweet, floral odor.

Chemical & Physical Properties:
MW: 104.2
BP: 293°F
Sol: 0.03%
Fl.P: 88°F
IP: 8.40 eV
Sp.Gr: 0.91
VP: 5 mmHg
FRZ: -23°F
UEL: 6.8%
LEL: 0.9%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
500 ppm: CcrOv*/Sa*
700 ppm: Sa:Cf*/CcrFOv/GmFOv/PaprOv*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, resp sys; head, lass, dizz, conf, mal, drow, unsteady gait; narco; defatting derm; possible liver inj; repro effects
TO: Eyes, skin, resp sys, CNS, liver, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush
Breath: Resp support
Swallow: Medical attention immed

Subtilisins	**Formula:**	**CAS#:** 1395-21-7 (BPN) 9014-01-1 (Carlsburg)	**RTECS#:** CO9450000 (BPN) CO9550000 (Carlsburg)	**IDLH:** N.D.
Conversion:	**DOT:**			
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:
NIOSH REL: ST 0.00006 mg/m^3 [60-minute]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Light-colored, free-flowing powders.
[**Note:** A protein containing numerous amino acids.]

Chemical & Physical Properties:
MW: 28,000 (approx)
BP: ?
Sol: ?
Fl.P: NA
IP: NA
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: ?
UEL: NA
LEL: NA

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; resp sens (enzyme asthma): sweat, head, chest pain, flu-like symptoms, cough, breathlessness, wheez
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Succinonitrile

Formula:	CAS#:	RTECS#:	IDLH:
$NCCH_2CH_2CN$	110-61-2	WN3850000	N.D.

Conversion: 1 ppm = 3.28 mg/m^3

DOT:

Synonyms/Trade Names: Butanedinitrile; 1,2-Dicyanoethane; Dinile; Ethylene cyanide; Ethylene dicyanide; Succinic dinitrile

Exposure Limits:
NIOSH REL: TWA 6 ppm (20 mg/m^3)
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH Nitriles Criteria Document

Physical Description: Colorless, odorless, waxy solid.
[**Note:** Forms cyanide in the body.]

Chemical & Physical Properties:
MW: 80.1
BP: 509°F
Sol: 13%
Fl.P: 270°F
IP: ?
Sp.Gr: 0.99
VP(212°F): 2 mmHg
MLT: 134°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
60 ppm: Sa
150 ppm: Sa:Cf
250 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz, lass, conf, convuls; blurred vision; dysp; abdom pain, nau, vomit
TO: Eyes, skin, resp sys, CNS, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Sucrose

Formula:	CAS#:	RTECS#:	IDLH:
$C_{12}H_{22}O_{11}$	57-50-1	WN6500000	N.D.

Conversion:

DOT:

Synonyms/Trade Names: Beet sugar, Cane sugar, Confectioner's sugar, Granulated sugar, Rock candy, Saccarose, Sugar, Table sugar

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Hard, white, odorless crystals, lumps, or powder.
[**Note:** May have a characteristic, caramel odor when heated.]

Chemical & Physical Properties:
MW: 342.3
BP: Decomposes
Sol: 200%
Fl.P: NA
IP: NA
Sp.Gr: 1.59
VP: 0 mmHg (approx)
MLT: 320-367°F (Decomposes)
UEL: NA
LEL: NA
MEC: 45 g/m^3
Noncombustible Solid, but fine airborne dust may explode.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, sulfuric acid, nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, upper resp sys; cough
TO: Eyes, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Sulfur dioxide

Formula:	CAS#:	RTECS#:	IDLH:
SO_2	7446-09-5	WS4550000	100 ppm

Conversion: 1 ppm = 2.62 mg/m^3 **DOT:** 1079 125

Synonyms/Trade Names: Sulfurous acid anhydride, Sulfurous oxide, Sulfur oxide

Exposure Limits:
NIOSH REL: TWA 2 ppm (5 mg/m^3)
ST 5 ppm (13 mg/m^3)
OSHA PEL†: TWA 5 ppm (13 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 3800, 6004
OSHA ID104, ID200

Physical Description: Colorless gas with a characteristic, irritating, pungent odor. [**Note:** A liquid below 14°F. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 64.1
BP: 14°F
Sol: 10%
Fl.P: NA
IP: 12.30 eV
RGasD: 2.26
VP: 3.2 atm
FRZ: -104°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet or contam (liquid)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
20 ppm: CcrS*/Sa*
50 ppm: Sa:Cf*/PaprS*
100 ppm: CcrFS/GmFS/PaprTS*/SaT:Cf*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Powdered alkali metals (such as sodium & potassium), water, ammonia, zinc, aluminum, brass, copper [**Note:** Reacts with water to form sulfurous acid (H_2SO_3).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, nose, throat; rhin; choking, cough; reflex bronchoconstriction; liquid: frostbite
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Sulfur hexafluoride

Formula:	CAS#:	RTECS#:	IDLH:
SF_6	2551-62-4	WS4900000	N.D.

Conversion: 1 ppm = 5.98 mg/m^3 **DOT:** 1080 126

Synonyms/Trade Names: Sulfur fluoride [**Note:** May contain highly toxic sulfur pentafluoride as an impurity.]

Exposure Limits:
NIOSH REL: TWA 1000 ppm (6000 mg/m^3)
OSHA PEL: TWA 1000 ppm (6000 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6602

Physical Description: Colorless, odorless gas. [**Note:** Shipped as a liquefied compressed gas. Condenses directly to a solid upon cooling.]

Chemical & Physical Properties:
MW: 146.1
BP: Sublimes
Sol(77°F): 0.003%
Fl.P: NA
IP: 19.30 eV
RGasD: 5.11
VP: 21.5 atm
FRZ: -83°F (Sublimes)
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Disilane

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Asphy: incr breath rate, pulse rate; slight musc inco, emotional upset; lass, nau, vomit, convuls; liquid: frostbite
TO: Resp sys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Sulfuric acid

Formula:	CAS#:	RTECS#:	IDLH:
H_2SO_4	7664-93-9	WS5600000	15 mg/m^3

Conversion:

DOT: 1830 137; 1831 137 (fuming); 1832 137 (spent)

Synonyms/Trade Names: Battery acid, Hydrogen sulfate, Oil of vitriol, Sulfuric acid (aqueous)

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
OSHA PEL: TWA 1 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7903
OSHA ID113, ID165SG

Physical Description: Colorless to dark-brown, oily, odorless liquid.
[**Note:** Pure compound is a solid below 51°F. Often used in an aqueous solution.]

Chemical & Physical Properties:
MW: 98.1
BP: 554°F
Sol: Miscible
FI.P: NA
IP: ?
Sp.Gr: 1.84 (96-98% acid)
VP: 0.001 mmHg
FRZ: 51°F
UEL: NA
LEL: NA
Noncombustible Liquid, but capable of igniting finely divided combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash (>1%)
Quick drench (>1%)

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
15 mg/m^3: Sa:Cf£/PaprAgHie£/CcrFAg100/GmFAg100/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFAg100/ScbaE

Incompatibilities and Reactivities: Organic materials, chlorates, carbides, fulminates, water, powdered metals
[**Note:** Reacts violently with water with evolution of heat. Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; pulm edema, bron; emphy; conj; stomatis; dental erosion; eye, skin burns; derm
TO: Eyes, skin, resp sys, teeth

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Sulfur monochloride

Formula:	CAS#:	RTECS#:	IDLH:
S_2Cl_2	10025-67-9	WS4300000	5 ppm

Conversion: 1 ppm = 5.52 mg/m^3

DOT: 1828 137

Synonyms/Trade Names: Sulfur chloride, Sulfur subchloride, Thiosulfurous dichloride

Exposure Limits:
NIOSH REL: C 1 ppm (6 mg/m^3)
OSHA PEL†: TWA 1 ppm (6 mg/m^3)

Measurement Methods (see Table 1):
None available

Physical Description: Light-amber to yellow-red, oily liquid with a pungent, nauseating, irritating odor.

Chemical & Physical Properties:
MW: 135.0
BP: 280°F
Sol: Decomposes
FI.P: 245°F
IP: 9.40 eV
Sp.Gr: 1.68
VP: 7 mmHg
FRZ: -107°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 ppm: CcrFS/GmFS/PaprS£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; lac; cough; eye, skin burns; pulm edema
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Sulfur pentafluoride	Formula: S_2F_{10}	CAS#: 5714-22-7	RTECS#: WS4480000	IDLH: 1 ppm
Conversion: 1 ppm = 10.39 mg/m^3	**DOT:**			
Synonyms/Trade Names: Disulfur decafluoride, Sulfur decafluoride				
Exposure Limits: **NIOSH REL:** C 0.01 ppm (0.1 mg/m^3) **OSHA PEL†:** TWA 0.025 ppm (0.25 mg/m^3)			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless liquid or gas (above 84°F) with an odor like sulfur dioxide.				
Chemical & Physical Properties: **MW:** 254.1 **BP:** 84°F **Sol:** Insoluble **FI.P:** NA **IP:** ? **RGasD:** 8.77 **Sp.Gr(32°F):** 2.08 **VP:** 561 mmHg **FRZ:** -134°F **UEL:** NA **LEL:** NA Noncombustible Liquid Nonflammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** N.R. **Remove:** When wet or contam **Change:** N.R. **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **0.1 ppm**: Sa **0.25 ppm:** Sa:Cf **0.5 ppm:** SaT:Cf/ScbaF/SaF **1 ppm**: Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFAg/ScbaE	
Incompatibilities and Reactivities: None reported				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, resp sys; in animals: pulm edema, hemorr **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Sulfur tetrafluoride	Formula: SF_4	CAS#: 7783-60-0	RTECS#: WT4800000	IDLH: N.D.
Conversion: 1 ppm = 4.42 mg/m^3	**DOT:** 2418 125			
Synonyms/Trade Names: Tetrafluorosulfurane				
Exposure Limits: **NIOSH REL:** C 0.1 ppm (0.4 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **OSHA** ID110	
Physical Description: Colorless gas with an odor like sulfur dioxide. [**Note:** Shipped as a liquefied compressed gas.]				
Chemical & Physical Properties: **MW:** 108.1 **BP:** -41°F **Sol:** Reacts **FI.P:** NA **IP:** 12.63 eV **RGasD:** 3.78 **VP(70°F):** 10.5 atm **FRZ:** -185°F **UEL:** NA **LEL:** NA Nonflammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** Frostbite **Eyes:** Frostbite **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R. **Provide:** Frostbite wash		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Moisture, concentrated sulfuric acid, dioxygen difluoride [**Note:** Readily hydrolyzed by moisture, forming hydrofluoric acid & thionyl fluoride.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Irrit eyes, skin, muc memb; eye, skin burns (from SF_4 releasing hydrofluoric acid on exposure to moisture); liquid: frostbite; in animals: dysp, lass, rhin **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Frostbite **Skin:** Frostbite **Breath:** Resp support	

Sulfuryl fluoride

Formula:	CAS#:	RTECS#:	IDLH:
SO_2F_2	2699-79-8	WT5075000	200 ppm

Conversion: 1 ppm = 4.18 mg/m^3 **DOT:** 2191 123

Synonyms/Trade Names: Sulfur difluoride dioxide, Vikane®

Exposure Limits:
NIOSH REL: TWA 5 ppm (20 mg/m^3)
ST 10 ppm (40 mg/m^3)
OSHA PEL†: TWA 5 ppm (20 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 6012

Physical Description: Colorless, odorless gas. [insecticide/fumigant]
[**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 102.1
BP: -68°F
Sol(32°F): 0.2%
Fl.P: NA
IP: 13.04 eV
RGasD: 3.72
VP(70°F): 15.8 atm
FRZ: -212°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 ppm: Sa*
125 ppm: Sa:Cf*
200 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Conj, rhinitis, pharyngitis, pares; liquid: frostbite: in animals: narco, tremor, convuls; pulm edema; kidney inj
TO: Eyes, skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Sulprofos

Formula:	CAS#:	RTECS#:	IDLH:
$C_{12}H_{19}O_2PS_3$	35400-43-2	TE4165000	N.D.

Conversion: 1 ppm = 13.19 mg/m^3 **DOT:**

Synonyms/Trade Names: Bolstar®, O-Ethyl O-(4-methylthio)phenyl S-propylphosphorodithioate

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5600
OSHA PV2037

Physical Description: Tan-colored liquid with a sulfide-like odor.

Chemical & Physical Properties:
MW: 322.5
BP: ?
Sol: Low
Fl.P: ?
IP: ?
Sp.Gr: 1.20
VP: <8 mmHg
FRZ: ?
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing
SY: Nau, vomit, abdom cramps, diarr, salv; head, dizz, lass; rhin, chest tight; blurred vision, miosis; card irreg; musc fasc; dysp
TO: Resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

2,4,5-T	Formula: $Cl_3C_6H_2OCH_2COOH$	CAS#: 93-76-5	RTECS#: AJ8400000	IDLH: 250 mg/m^3
Conversion:	**DOT:** 2765 152			

Synonyms/Trade Names: 2,4,5-Trichlorophenoxyacetic acid

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3
OSHA PEL: TWA 10 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5001

Physical Description: Colorless to tan, odorless, crystalline solid. [herbicide]

Chemical & Physical Properties:
MW: 255.5
BP: Decomposes
Sol(77°F): 0.03%
FI.P: ?
IP: ?
Sp.Gr: 1.80
VP: 1 x 10^{-7} mmHg
MLT: 307°F
UEL: ?
LEL: ?
Combustible Solid, but burns with difficulty.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: Qm
100 mg/m^3: 95XQ/Sa
250 mg/m^3: Sa:Cf/100F/PaprHie/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: In animals: ataxia; skin irrit, acne-like rash; liver damage
TO: Skin, liver, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Talc (containing no asbestos and less than 1% quartz)	Formula: $Mg_3Si_4O_{10}(OH)_2$	CAS#: 14807-96-6	RTECS#: WW2710000	IDLH: 1000 mg/m^3
Conversion:	**DOT:**			

Synonyms/Trade Names: Hydrous magnesium silicate, Steatite talc

Exposure Limits:
NIOSH REL: TWA 2 mg/m^3 (resp)
OSHA PEL†: TWA 20 mppcf

Measurement Methods (see Table 1):
NIOSH P&CAM355 (III)

Physical Description: Odorless, white powder.

Chemical & Physical Properties:
MW: Varies
BP: ?
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 2.70-2.80
VP: 0 mmHg (approx)
MLT: 1652°F to 1832°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 mg/m^3: Qm
20 mg/m^3: 95XQ/Sa
50 mg/m^3: PaprHie/Sa:Cf
100 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
1000 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Fibrotic pneumoconiosis, irrit eyes
TO: Eyes, resp sys, CVS

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Tantalum (metal and oxide dust, as Ta)	**Formula:** Ta (metal)	**CAS#:** 7440-25-7 (metal)	**RTECS#:** WW5505000 (metal)	**IDLH:** 2500 mg/m^3 (as Ta)
Conversion:	**DOT:**			

Synonyms/Trade Names: **Tantalum metal:** Tantalum-181
Synonyms of other tantalum dusts (including oxide dusts) vary depending upon the specific compound.

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
ST 10 mg/m^3
OSHA PEL: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Metal: Steel-blue to gray solid or black, odorless powder.

Chemical & Physical Properties:
MW: 180.9
BP: 9797°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 16.65 (metal)
14.40 (powder)
VP: 0 mmHg (approx)
MLT: 5425°F
UEL: NA
LEL: NA
MEC: <200 g/m^3
Metal: Combustible Solid; powder ignites SPONTANEOUSLY in air.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 mg/m^3: Qm
50 mg/m^3: 95XQ/Sa
125 mg/m^3: Sa:Cf/PaprHie
250 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
2500 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: HieF/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, bromine trifluoride, fluorine

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin; in animals: pulm irrit
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Resp support

TEDP	**Formula:** $[(CH_3CH_2O)_2PS]_2O$	**CAS#:** 3689-24-5	**RTECS#:** XN4375000	**IDLH:** 10 mg/m^3
Conversion: 1 ppm = 13.18 mg/m^3	**DOT:** 1704 153			

Synonyms/Trade Names: Bladafum®, Dithion®, Sulfotep, Tetraethyl dithionopyrophosphate, Tetraethyl dithiopyrophosphate, Thiotepp®

Exposure Limits:
NIOSH REL: TWA 0.2 mg/m^3 [skin]
OSHA PEL: TWA 0.2 mg/m^3 [skin]

Measurement Methods (see Table 1):
None available

Physical Description: 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.]

Chemical & Physical Properties:
MW: 322.3
BP: Decomposes
Sol: 0.0007%
Fl.P: ?
IP: ?
Sp.Gr(77°F): 1.20
VP: 0.0002 mmHg
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2 mg/m^3: Sa
5 mg/m^3: Sa:Cf
10 mg/m^3: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, iron [**Note:** Corrosive to iron.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; eye pain, blurred vision, lac; rhin; head; cyan; anor, nau, vomit, diarr; local sweat, lass, twitch, para, Cheyne-Stokes respiration, convuls, low BP, card irreg
TO: Eyes, skin, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Tellurium	Formula: Te	CAS#: 13494-80-9	RTECS#: WY2625000	IDLH: 25 mg/m^3 (as Te)
Conversion:	**DOT:**			
Synonyms/Trade Names: Aurum paradoxum, Metallum problematum				
Exposure Limits: **NIOSH REL*:** TWA 0.1 mg/m^3 **OSHA PEL*:** TWA 0.1 mg/m^3 [***Note:** The REL and PEL also apply to other tellurium compounds (as Te) except Tellurium hexafluoride and Bismuth telluride.]			**Measurement Methods (see Table 1):** **NIOSH** 7300, 7301, 7303, 9102 **OSHA** ID121	
Physical Description: Odorless, dark-gray to brown, amorphous powder or grayish-white, brittle solid.				
Chemical & Physical Properties: **MW:** 127.6 **BP:** 1814°F **Sol:** Insoluble **FI.P:** NA **IP:** NA **Sp.Gr:** 6.24 **VP:** 0 mmHg (approx) **MLT:** 842°F **UEL:** NA **LEL:** NA Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.5 mg/m^3:** Qm **1 mg/m^3:** 95XQ/Sa **2.5 mg/m^3:** Sa:Cf/PaprHie **5 mg/m^3:** 100F/SaT:Cf/PaprTHie/ScbaF/SaF **25 mg/m^3:** Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE		
Incompatibilities and Reactivities: Oxidizers, chlorine, cadmium				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Garlic breath, sweat; dry mouth, metallic taste; drow; anor, nau, no sweat; derm; in animals: CNS, red blood cell changes **TO:** Skin, CNS, blood		**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed		

Tellurium hexafluoride	Formula: TeF_6	CAS#: 7783-80-4	RTECS#: WY2800000	IDLH: 1 ppm
Conversion: 1 ppm = 9.88 mg/m^3	**DOT:** 2195 125			
Synonyms/Trade Names: Tellurium fluoride				
Exposure Limits: **NIOSH REL:** TWA 0.02 ppm (0.2 mg/m^3) **OSHA PEL:** TWA 0.02 ppm (0.2 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** S187 (II-3)	
Physical Description: Colorless gas with a repulsive odor.				
Chemical & Physical Properties: **MW:** 241.6 **BP:** Sublimes **Sol:** Decomposes **FI.P:** NA **IP:** ? **RGasD:** 8.34 **VP:** >1 atm **FRZ:** -36°F (Sublimes) **UEL:** NA **LEL:** NA Nonflammable Gas	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.2 ppm:** Sa **0.5 ppm:** Sa:Cf **1 ppm:** SaT:Cf/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS/ScbaE		
Incompatibilities and Reactivities: Water [**Note:** Hydrolyzes slowly in water to telluric acid.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh **SY:** Head; dysp; garlic breath; in animals: pulm edema **TO:** Resp sys		**First Aid (see Table 6):** **Breath:** Resp support		

Temephos

Formula: $S[C_6H_4OP(S)(OCH_3)_2]_2$ | **CAS#:** 3383-96-8 | **RTECS#:** TF6890000 | **IDLH:** N.D.

Conversion: | **DOT:**

Synonyms/Trade Names: Abate®; Temefos; O,O,O'O'-Tetramethyl O,O'-thiodi-p-phenylene phosphorothioate

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600
OSHA PV2056

Physical Description: White, crystalline solid or liquid (above 87°F). [insecticide]
[**Note:** Technical grade is a viscous, brown liquid.]

Chemical & Physical Properties:
MW: 466.5
BP: 248-257°F (Decomposes)
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr: 1.32
VP(77°F): 0.00000007 mmHg
MLT: 87°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, blurred vision; dizz; dysp; salv; abdom cramps, nau, diarr, vomit
TO: Eyes, resp sys, CNS, CVS, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

TEPP

Formula: $[(CH_3CH_2O)_2PO]_2O$ | **CAS#:** 107-49-3 | **RTECS#:** UX6825000 | **IDLH:** 5 mg/m^3

Conversion: 1 ppm = 11.87 mg/m^3 | **DOT:** 2783 152 (solid); 3018 152 (liquid)

Synonyms/Trade Names: Ethyl pyrophosphate, Tetraethyl pyrophosphate, Tetron®

Exposure Limits:
NIOSH REL: TWA 0.05 mg/m^3 [skin]
OSHA PEL: TWA 0.05 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH 2504

Physical Description: Colorless to amber liquid with a faint, fruity odor. [insecticide]
[**Note:** A solid below 32°F.]

Chemical & Physical Properties:
MW: 290.2
BP: Decomposes
Sol: Miscible
Fl.P: NA
IP: ?
Sp.Gr: 1.19
VP: 0.0002 mmHg
FRZ: 32°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.5 mg/m^3: Sa
1.25 mg/m^3: Sa:Cf
2.5 mg/m^3: SaT:Cf/ScbaF/SaF
5 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, alkalis, water
[**Note:** Hydrolyzes quickly in water to form pyrophosphoric acid.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Eye pain, blurred vision, lac; rhin; head, chest tight, cyan; anor, nau, vomit, diarr; lass, twitch, para, Cheyne-Stokes respiration, convuls; low BP, card irreg; sweat
TO: Eyes, resp sys, CNS, CVS, GI tract, blood chol

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

m-Terphenyl	Formula: $C_6H_5C_6H_4C_6H_5$	CAS#: 92-06-8	RTECS#: WZ6470000	IDLH: 500 mg/m^3
Conversion: 1 ppm = 9.57 mg/m^3	**DOT:**			

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/m^3 (0.5 ppm)
OSHA PEL†: C 9 mg/m^3 (1 ppm)

Measurement Methods (see Table 1):
NIOSH 5021

Physical Description: Yellow solid (needles).

Chemical & Physical Properties:
MW: 230.3
BP: 689°F
Sol: Insoluble
Fl.P(oc): 375°F
IP: 8.01
Sp.Gr: 1.23
VP(200°F): 0.01 mmHg
MLT: 192°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
25 mg/m^3: Qm£
50 mg/m^3: 95XQ£/Sa£
125 mg/m^3: Sa:Cf£/PaprHie£
250 mg/m^3: 100F/ScbaF/SaF
500 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; thermal skin burns; head; sore throat; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

o-Terphenyl	Formula: $C_6H_5C_6H_4C_6H_5$	CAS#: 84-15-1	RTECS#: WZ6472000	IDLH: 500 mg/m^3
Conversion: 1 ppm = 9.42 mg/m^3	**DOT:**			

Synonyms/Trade Names: o-Diphenylbenzene; 1,2-Diphenylbenzene; 2-Phenylbiphenyl; 1,2-Terphenyl; ortho-Terphenyl; o-Triphenyl

Exposure Limits:
NIOSH REL: C 5 mg/m^3 (0.5 ppm)
OSHA PEL†: C 9 mg/m^3 (1 ppm)

Measurement Methods (see Table 1):
NIOSH 5021

Physical Description: Colorless or light-yellow solid.

Chemical & Physical Properties:
MW: 230.3
BP: 630°F
Sol: Insoluble
Fl.P(oc): 325°F
IP: 7.99 eV
Sp.Gr: 1.1
VP(200°F): 0.09 mmHg
MLT: 136°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
25 mg/m^3: Qm£
50 mg/m^3: 95XQ£/Sa£
125 mg/m^3: Sa:Cf£/PaprHie£
250 mg/m^3: 100F/ScbaF/SaF
500 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; thermal skin burns; head; sore throat; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

p-Terphenyl

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_5C_6H_4C_6H_5$	92-94-4	WZ6475000	500 mg/m^3

Conversion: 1 ppm = 9.57 mg/m^3 **DOT:**

Synonyms/Trade Names: p-Diphenylbenzene; 1,4-Diphenylbenzene; 4-Phenylbiphenyl; 1,4-Terphenyl; para-Terphenyl; p-Triphenyl

Exposure Limits:
NIOSH REL: C 5 mg/m^3 (0.5 ppm)
OSHA PEL†: C 9 mg/m^3 (1 ppm)

Measurement Methods (see Table 1):
NIOSH 5021

Physical Description: White or light-yellow solid.

Chemical & Physical Properties:
MW: 230.3
BP: 761°F
Sol: Insoluble
FI.P: 405°F
IP: 7.78
Sp.Gr: 1.23
VP: Very low
MLT: 415°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
25 mg/m^3: Qm£
50 mg/m^3: 95XQ£/Sa£
125 mg/m^3: Sa:Cf£/PaprHie£
250 mg/m^3: 100F/ScbaF/SaF
500 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, muc memb; thermal skin burns; head; sore throat; in animals: liver, kidney damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

2,3,7,8-Tetrachloro-dibenzo-p-dioxin

Formula:	CAS#:	RTECS#:	IDLH:
$C_{12}H_4Cl_4O_2$	1746-01-6	HP3500000	Ca [N.D.]

Conversion: **DOT:**

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

Measurement Methods (see Table 1):
None available

Physical Description: Colorless to white, crystalline solid.
[**Note:** Exposure may occur through contact at previously contaminated worksites.]

Chemical & Physical Properties:
MW: 322.0
BP: Decomposes
Sol: 0.00000002%
FI.P: ?
IP: ?
Sp.Gr: ?
VP(77°F): 0.000002 mmHg
MLT: 581°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: UV light (decomposes)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; allergic derm, chloracne; porphyria; GI dist; possible repro, terato effects; in animals: liver, kidney damage; hemorr; [carc]
TO: Eyes, skin, liver, kidneys, repro sys [in animals: tumors at many sites]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

1,1,1,2-Tetrachloro-2,2-difluoroethane	Formula: CCl_3CClF_2	CAS#: 76-11-9	RTECS#: KI1425000	IDLH: 2000 ppm
Conversion: 1 ppm = 8.34 mg/m^3	**DOT:**			
Synonyms/Trade Names: 2,2-Difluoro-1,1,1,2-tetrachloroethane; Freon® 112a; Halocarbon 112a; Refrigerant 112a				

Exposure Limits: **NIOSH REL:** TWA 500 ppm (4170 mg/m^3) **OSHA PEL:** TWA 500 ppm (4170 mg/m^3) **Physical Description:** Colorless solid with a slight, ether-like odor. [**Note:** A liquid above 105°F.]	**Measurement Methods (see Table 1):** **NIOSH** 1016 **OSHA** 7

Chemical & Physical Properties: **MW:** 203.8 **BP:** 197°F **Sol:** 0.01% **Fl.P:** NA **IP:** ? **Sp.Gr:** 1.65 **VP:** 40 mmHg **MLT:** 105°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **2000 ppm:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as potassium, beryllium, powdered aluminum, zinc, calcium, magnesium & sodium; acids

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin; CNS depres; pulm edema; drow; dysp **TO:** Eyes, skin, resp sys, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

1,1,2,2-Tetrachloro-1,2-difluoroethane	Formula: CCl_2FCCl_2F	CAS#: 76-12-0	RTECS#: KI1420000	IDLH: 2000 ppm
Conversion: 1 ppm = 8.34 mg/m^3	**DOT:**			
Synonyms/Trade Names: 1,2-Difluoro-1,1,2,2-tetrachloroethane; Freon® 112; Halocarbon 112; Refrigerant 112				

Exposure Limits: **NIOSH REL:** TWA 500 ppm (4170 mg/m^3) **OSHA PEL:** TWA 500 ppm (4170 mg/m^3) **Physical Description:** Colorless solid or liquid (above 77°F) with a slight, ether-like odor.	**Measurement Methods (see Table 1):** **NIOSH** 1016 **OSHA** 7

Chemical & Physical Properties: **MW:** 203.8 **BP:** 199°F **Sol(77°F):** 0.01% **Fl.P:** NA **IP:** 11.30 eV **Sp.Gr:** 1.65 **VP:** 40 mmHg **MLT:** 77°F **UEL:** NA **LEL:** NA Noncombustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **2000 ppm:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as potassium, beryllium, powdered aluminum, zinc, magnesium, calcium & sodium; acids

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** In animals: irrit eyes, skin; conj; pulm edema; narco **TO:** Eyes, skin, resp sys, CNS	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

1,1,1,2-Tetrachloroethane	Formula: CCl_3CH_2Cl	CAS#: 630-20-6	RTECS#: KI8450000	IDLH: N.D.
Conversion:	**DOT:** 1702 151			

Synonyms/Trade Names: None

Exposure Limits:
NIOSH REL: Handle with caution in the workplace.
See Appendix C (Chloroethanes)
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Yellowish-red liquid.

Chemical & Physical Properties:
MW: 167.9
BP: 267°F
Sol: 0.1%
Fl.P: ?
IP: ?
Sp.Gr: 1.54
VP(77°F): 14 mmHg
FRZ: -94°F
UEL: ?
LEL: ?

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Potassium; sodium; dinitrogen tetraoxide; potassium hydroxide; nitrogen tetroxide; sodium potassium alloy; 2,4-dinitrophenyl disulfide

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin; lass, restless, irreg respiration, musc inco; in animals: liver changes
TO: Eyes, skin, CNS, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

1,1,2,2-Tetrachloroethane	Formula: $CHCl_2CHCl_2$	CAS#: 79-34-5	RTECS#: KI8575000	IDLH: Ca [100 ppm]
Conversion: 1 ppm = 6.87 mg/m^3	**DOT:** 1702 151			

Synonyms/Trade Names: Acetylene tetrachloride, Symmetrical tetrachloroethane

Exposure Limits:
NIOSH REL: Ca
TWA 1 ppm (7 mg/m^3) [skin]
See Appendix A
See Appendix C (Chloroethanes)
OSHA PEL†: TWA 5 ppm (35 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1019, 2562
OSHA 7

Physical Description: Colorless to pale-yellow liquid with a pungent, chloroform-like odor.

Chemical & Physical Properties:
MW: 167.9
BP: 296°F
Sol: 0.3%
Fl.P: NA
IP: 11.10 eV
Sp.Gr(77°F): 1.59
VP: 5 mmHg
FRZ: -33°F
UEL: NA
LEL: NA
Noncombustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals, strong caustics, fuming sulfuric acid
[**Note:** Degrades slowly when exposed to air.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Nau, vomit, abdom pain; tremor fingers; jaun, hepatitis, liver tend; derm; leucyt; kidney damage; [carc]
TO: Skin, liver, kidneys, CNS, GI tract [in animals: liver tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Tetrachloroethylene

Formula: $Cl_2C=CCl_2$ | **CAS#:** 127-18-4 | **RTECS#:** KX3850000 | **IDLH:** Ca [150 ppm]

Conversion: 1 ppm = 6.78 mg/m^3 | **DOT:** 1897 160

Synonyms/Trade Names: Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene

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)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 1001

Physical Description: Colorless liquid with a mild, chloroform-like odor.

Chemical & Physical Properties:
MW: 165.8
BP: 250°F
Sol: 0.02%
FI.P: NA
IP: 9.32 eV
Sp.Gr: 1.62
VP: 14 mmHg
FRZ: -2°F
UEL: NA
LEL: NA
Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat, resp sys; nau; flush face, neck; dizz, inco; head, drow; skin eryt; liver damage; [carc]
TO: Eyes, skin, resp sys, liver, kidneys, CNS [in animals: liver tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Tetrachloronaphthalene

Formula: $C_{10}H_4Cl_4$ | **CAS#:** 1335-88-2 | **RTECS#:** QK3700000 | **IDLH:** See Appendix F

Conversion: | **DOT:**

Synonyms/Trade Names: Halowax®, Nibren wax, Seekay wax

Exposure Limits:
NIOSH REL: TWA 2 mg/m^3 [skin]
OSHA PEL: TWA 2 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S130 (II-2)

Physical Description: Colorless to pale-yellow solid with an aromatic odor.

Chemical & Physical Properties:
MW: 265.9
BP: 599-680°F
Sol: Insoluble
FI.P(oc): 410°F
IP: ?
Sp.Gr: 1.59-1.65
VP: <1 mmHg
MLT: 360°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
20 mg/m^3: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

See Appendix F

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Acne-form derm; head, lass, anor, dizz; jaun, liver inj
TO: Liver, skin, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Tetraethyl lead (as Pb)	Formula: $Pb(C_2H_5)_4$	CAS#: 78-00-2	RTECS#: TP4550000	IDLH: 40 mg/m^3 (as Pb)
Conversion:	**DOT:** 1649 131			
Synonyms/Trade Names: Lead tetraethyl, TEL, Tetraethylplumbane				
Exposure Limits: **NIOSH REL:** TWA 0.075 mg/m^3 [skin] **OSHA PEL:** TWA 0.075 mg/m^3 [skin]			**Measurement Methods (see Table 1):** **NIOSH** 2533	
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.]				
Chemical & Physical Properties: **MW:** 323.5 **BP:** 228°F (Decomposes) **Sol:** 0.00002% **Fl.P:** 200°F **IP:** 11.10 eV **Sp.Gr:** 1.65 **VP:** 0.2 mmHg **FRZ:** -202°F **UEL:** ? **LEL:** 1.8% Class IIIB Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact (>0.1%) **Eyes:** Prevent eye contact **Wash skin:** When contam (>0.1%) **Remove:** When wet or contam (>0.1%) **Change:** Daily **Provide:** Quick drench (>0.1%)		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.75 mg/m^3:** Sa **1.875 mg/m^3:** Sa:Cf **3.75 mg/m^3:** SaT:Cf/ScbaF/SaF **40 mg/m^3:** Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers, sulfuryl chloride, rust, potassium permanganate [**Note:** Decomposes slowly at room temperature and more rapidly at higher temperatures.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Insom, lass, anxiety; tremor, hyper-reflexia, spasticity; bradycardia, hypotension, hypothermia, pallor, nau, anor, low-wgt; conf, halu, psychosis, mania, convuls, coma; eye irrit **TO:** CNS, CVS, kidneys, eyes			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed	

Tetrahydrofuran	Formula: C_4H_8O	CAS#: 109-99-9	RTECS#: LU5950000	IDLH: 2000 ppm [10%LEL]
Conversion: 1 ppm = 2.95 mg/m^3	**DOT:** 2056 127			
Synonyms/Trade Names: Diethylene oxide; 1,4-Epoxybutane; Tetramethylene oxide; THF				
Exposure Limits: **NIOSH REL:** TWA 200 ppm (590 mg/m^3) ST 250 ppm (735 mg/m^3) **OSHA PEL†:** TWA 200 ppm (590 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1609, 3800 **OSHA** 7	
Physical Description: Colorless liquid with an ether-like odor.				
Chemical & Physical Properties: **MW:** 72.1 **BP:** 151°F **Sol:** Miscible **Fl.P:** 6°F **IP:** 9.45 eV **Sp.Gr:** 0.89 **VP:** 132 mmHg **FRZ:** -163°F **UEL:** 11.8% **LEL:** 2% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **2000 ppm:** Sa:Cf£/CcrFOv/GmFOv/PaprOv£/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers, lithium-aluminum alloys [**Note:** Peroxides may accumulate upon prolonged storage in presence of air.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con, Ing **SY:** Irrit eyes, upper resp sys; nau, dizz, head, CNS depres **TO:** Eyes, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Tetramethyl lead (as Pb)	**Formula:** $Pb(CH_3)_4$	**CAS#:** 75-74-1	**RTECS#:** TP4725000	**IDLH:** 40 mg/m^3 (as Pb)
Conversion:	**DOT:**			
Synonyms/Trade Names: Lead tetramethyl, Tetramethylplumbane, TML				

Exposure Limits: **NIOSH REL:** TWA 0.075 mg/m^3 [skin] **OSHA PEL:** TWA 0.075 mg/m^3 [skin]	**Measurement Methods (see Table 1):** **NIOSH** 2534
Physical Description: Colorless liquid (unless dyed red, orange, or blue) with a fruity odor. [**Note:** Main usage is in anti-knock additives for gasoline.]	

Chemical & Physical Properties: **MW:** 267.3 **BP:** 212°F (Decomposes) **Sol:** 0.002% **Fl.P:** 100°F **IP:** 8.50 eV **Sp.Gr:** 2.00 **VP:** 23 mmHg **FRZ:** -15°F **UEL:** ? **LEL:** ? Class II Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact (>0.1%) **Eyes:** Prevent eye contact **Wash skin:** When contam (>0.1%) **Remove:** When wet or contam (>0.1%) **Change:** Daily **Provide:** Quick drench (>0.1%)	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.75 mg/m^3:** Sa **1.875 mg/m^3:** Sa:Cf **3.75 mg/m^3:** SaT:Cf/ScbaF/SaF **40 mg/m^3:** Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers such as sulfuryl chloride or potassium permanganate	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Insom, bad dreams, restless, anxious; hypotension; nau, anor; delirium, mania, convuls; coma **TO:** CNS, CVS, kidneys	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

Tetramethyl succinonitrile	**Formula:** $(CH_3)_2C(CN)C(CN)(CH_3)_2$	**CAS#:** 3333-52-6	**RTECS#:** WN4025000	**IDLH:** 5 ppm
Conversion: 1 ppm = 5.57 mg/m^3	**DOT:**			
Synonyms/Trade Names: Tetramethyl succinodinitrile, TMSN				

Exposure Limits: **NIOSH REL:** TWA 3 mg/m^3 (0.5 ppm) [skin] **OSHA PEL:** TWA 3 mg/m^3 (0.5 ppm) [skin]	**Measurement Methods (see Table 1):** **NIOSH** S155 (II-3) **OSHA** 7
Physical Description: Colorless, odorless solid. [**Note:** Forms cyanide in the body.]	

Chemical & Physical Properties: **MW:** 136.2 **BP:** Sublimes **Sol:** Insoluble **Fl.P:** ? **IP:** ? **Sp.Gr:** 1.07 **VP:** ? **MLT:** 338°F (Sublimes) **UEL:** ? **LEL:** ? Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily	**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **28 mg/m^3:** Sa/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers	
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Head, nau; convuls, coma; liver, kidney, GI effects **TO:** CNS, liver, kidneys, GI tract	**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

Tetranitromethane

Formula:	CAS#:	RTECS#:	IDLH:
$C(NO_2)_4$	509-14-8	PB4025000	4 ppm

Conversion: 1 ppm = 8.02 mg/m^3 **DOT:** 1510 143

Synonyms/Trade Names: Tetan, TNM

Exposure Limits:
NIOSH REL: TWA 1 ppm (8 mg/m^3)
OSHA PEL: TWA 1 ppm (8 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 3513

Physical Description: Colorless to pale-yellow liquid or solid (below 57°F) with a pungent odor.

Chemical & Physical Properties:
MW: 196.0
BP: 259°F
Sol: Insoluble
Fl.P: ?
IP: ?
Sp.Gr: 1.62
VP: 8 mmHg
FRZ: 57°F
UEL: ?
LEL: ?
Combustible Liquid, but difficult to ignite.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
4 ppm: Sa:Cf£/CcrFS¿/GmFS¿/PaprS¿£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS¿/ScbaE

Incompatibilities and Reactivities: Hydrocarbons, alkalis, metals, oxidizers, aluminum, toluene, cotton
[**Note:** Combustible material wet with tetranitromethane may be highly explosive.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; dizz, head; chest pain, dysp; methemo, cyan; skin burns
TO: Eyes, skin, resp sys, blood, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Tetrasodium pyrophosphate

Formula:	CAS#:	RTECS#:	IDLH:
$Na_4P_2O_7$	7722-88-5	UX7350000	N.D.

Conversion: **DOT:**

Synonyms/Trade Names: Pyrophosphate, Sodium pyrophosphate, Tetrasodium diphosphate, Tetrasodium pyrophosphate (anhydrous), TSPP

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Odorless, white powder or granules.
[**Note:** The decahydrate ($Na_4P_2O_7 \times 10H_2O$) is in the form of colorless, transparent crystals.]

Chemical & Physical Properties:
MW: 265.9
BP: Decomposes
Sol(77°F): 7%
Fl.P: NA
IP: NA
Sp.Gr: 2.45
VP: 0 mmHg (approx)
MLT: 1810°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash (solution)

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; derm
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash prompt
Breath: Resp support
Swallow: Medical attention immed

Tetryl	**Formula:** $(NO_2)_3C_6H_2N(NO_2)CH_3$	**CAS#:** 479-45-8	**RTECS#:** BY6300000	**IDLH:** 750 mg/m^3
Conversion:	**DOT:**			
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/m^3 [skin] **OSHA PEL:** TWA 1.5 mg/m^3 [skin]				**Measurement Methods (see Table 1):** **NIOSH** S225 (II-3)
Physical Description: Colorless to yellow, odorless, crystalline solid.				
Chemical & Physical Properties: **MW:** 287.2 **BP:** 356-374°F (Explodes) **Sol:** 0.02% **Fl.P:** Explodes **IP:** ? **Sp.Gr:** 1.57 **VP:** <1 mmHg **MLT:** 268°F **UEL:** ? **LEL:** ? Combustible Solid (Class A Explosive)	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam/Daily **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **7.5 mg/m^3:** Qm **15 mg/m^3:** 95XQ*/Sa* **37.5 mg/m^3:** Sa:Cf*/PaprHie* **75 mg/m^3:** 100F/ScbaF/SaF **750 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: Oxidizable materials, hydrazine				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Sens derm, itch, eryt; edema on nasal folds, cheeks, neck; kera; sneez; anemia; cough, coryza; irrity; mal, head, lass, insom; nau, vomit; liver, kidney damage **TO:** Eyes, skin, resp sys, CNS, liver, kidneys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Thallium (soluble compounds, as Tl)	**Formula:**	**CAS#:**	**RTECS#:**	**IDLH:** 15 mg/m^3 (as Tl)
Conversion:	**DOT:** 1707 151 (compounds, n.o.s.)			
Synonyms/Trade Names: Synonyms vary depending upon the specific soluble thallium compound.				
Exposure Limits: **NIOSH REL:** TWA 0.1 mg/m^3 [skin] **OSHA PEL:** TWA 0.1 mg/m^3 [skin]			**Measurement Methods (see Table 1):** **NIOSH** 7300, 7301, 7303, 9102 **OSHA** ID121	
Physical Description: Appearance and odor vary depending upon the specific soluble thallium compound.				
Chemical & Physical Properties: Properties vary depending upon the specific soluble thallium compound.	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **0.5 mg/m^3:** Qm **1 mg/m^3:** 95XQ/Sa **2.5 mg/m^3:** Sa:Cf/PaprHie **5 mg/m^3:** 100F/SaT:Cf/PaprTHie/ScbaF/SaF **15 mg/m^3:** SaF:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: Varies				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Nau, diarr, abdom pain, vomit; ptosis, strabismus; peri neuritis, tremor; retster tight, chest pain, pulm edema; convuls, chorea, psychosis; liver, kidney damage; alopecia; pares legs **TO:** Eyes, resp sys, CNS, liver, kidneys, GI tract, body hair			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush prompt **Breath:** Resp support **Swallow:** Medical attention immed	

4,4'-Thiobis(6-tert-butyl-m-cresol)	Formula: $[CH_3(OH)C_6H_2C(CH_3)_3]_2S$	CAS#: 96-69-5	RTECS#: GP3150000	IDLH: N.D.
Conversion:	**DOT:**			

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/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Light-gray to tan powder with a slightly aromatic odor.

Chemical & Physical Properties:
MW: 358.6
BP: ?
Sol: 0.08%
Fl.P: 420°F
IP: ?
Sp.Gr: 1.10
VP: 0.0000006 mmHg
MLT: 302°F
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air
Swallow: Medical attention immed

Thioglycolic acid	Formula: $HSCH_2COOH$	CAS#: 68-11-1	RTECS#: AI5950000	IDLH: N.D.
Conversion: 1 ppm = 3.77 mg/m^3	**DOT:** 1940 153			

Synonyms/Trade Names: Acetyl mercaptan, Mercaptoacetate, Mercaptoacetic acid, 2-Mercaptoacetic acid, 2-Thioglycolic acid, Thiovanic acid

Exposure Limits:
NIOSH REL: TWA 1 ppm (4 mg/m^3) [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless liquid with a strong, disagreeable odor characteristic of mercaptans. [**Note:** Olfactory fatigue may occur after short exposures.]

Chemical & Physical Properties:
MW: 92.1
BP: ?
Sol: Miscible
Fl.P: >230°F
IP: ?
Sp.Gr: 1.32
VP(64°F): 10 mmHg
FRZ: 2°F
UEL: ?
LEL: 5.9%
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Air, strong oxidizers, bases, active metals (e.g., sodium potassium, magnesium, calcium) [**Note:** Readily oxidized by air.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; lac, corn damage; skin burns, blisters; in animals: lass; gasping respirations; convuls
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Thionyl chloride	Formula: $SOCl_2$	CAS#: 7719-09-7	RTECS#: XM5150000	IDLH: N.D.
Conversion: 1 ppm = 4.87 mg/m^3	**DOT:** 1836 137			
Synonyms/Trade Names: Sulfinyl chloride, Sulfur chloride oxide, Sulfurous dichloride, Sulfurous oxychloride, Thionyl dichloride				
Exposure Limits: **NIOSH REL:** C 1 ppm (5 mg/m^3) **OSHA PEL†:** none **Physical Description:** Colorless to yellow to reddish liquid with a pungent odor like sulfur dioxide. [**Note:** Fumes form when exposed to moist air.]			**Measurement Methods (see Table 1):** None available	
Chemical & Physical Properties: **MW:** 119.0 **BP:** 169°F **Sol:** Reacts **FI.P:** NA **IP:** ? **Sp.Gr:** 1.64 **VP(70°F):** 100 mmHg **FRZ:** -156°F **UEL:** NA **LEL:** NA Noncombustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R. **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Water, acids, alkalis, ammonia, chloryl perchlorate [**Note:** Reacts violently with water to form sulfur dioxide & hydrogen chloride.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; eye, skin burns **TO:** Eyes, skin, resp sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

Thiram	Formula: $C_6H_{12}N_2S_4$	CAS#: 137-26-8	RTECS#: JO1400000	IDLH: 100 mg/m^3
Conversion:	**DOT:** 2771 151			
Synonyms/Trade Names: bis(Dimethylthiocarbamoyl) disulfide, Tetramethylthiuram disulfide				
Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 **OSHA PEL:** TWA 5 mg/m^3 **Physical Description:** Colorless to yellow, crystalline solid with a characteristic odor. [**Note:** Commercial pesticide products may be dyed blue.]			**Measurement Methods (see Table 1):** **NIOSH** 5005	
Chemical & Physical Properties: **MW:** 240.4 **BP:** Decomposes **Sol:** 0.003% **FI.P:** ? **IP:** ? **Sp.Gr:** 1.29 **VP:** 0.000008 mmHg **MLT:** 312°F **UEL:** ? **LEL:** ? Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **50 mg/m^3:** CcrOv95*/Sa* **100 mg/m^3:** Sa:Cf*/CcrFOv100/GmFOv100/ PaprOvHie*/ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv100/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers, strong acids, oxidizable materials				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, muc memb; derm; Antabuse-like effects **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Tin

Formula: Sn
CAS#: 7440-31-5
RTECS#: XP7320000
IDLH: 100 mg/m^3 (as Sn)

Conversion:
DOT:

Synonyms/Trade Names: Metallic tin, Tin flake, Tin metal, Tin powder

Exposure Limits:
NIOSH REL*: TWA 2 mg/m^3
OSHA PEL*: TWA 2 mg/m^3
[***Note:** The REL and PEL also apply to other inorganic tin compounds (as Sn) except tin oxides.]

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303
OSHA ID121, ID206

Physical Description: Gray to almost silver-white, ductile, malleable, lustrous solid.

Chemical & Physical Properties:
MW: 118.7
BP: 4545°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 7.28
VP: 0 mmHg (approx)
MLT: 449°F
UEL: NA
LEL: NA
Noncombustible Solid, but powdered form may ignite.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 mg/m^3: Qm*
20 mg/m^3: 95XQ*/Sa*
50 mg/m^3: Sa:Cf*/PaprHie*
100 mg/m^3: 100F/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Chlorine, turpentine, acids, alkalis

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys; in animals: vomit, diarr, para with musc twitch
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Tin (organic compounds, as Sn)

Formula:
CAS#:
RTECS#:
IDLH: 25 mg/m^3 (as Sn)

Conversion:
DOT:

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/m^3 [skin]
[***Note:** The REL applies to all organic tin compounds except Cyhexatin.]
OSHA PEL*: TWA 0.1 mg/m^3
[***Note:** The PEL applies to all organic tin compounds.]

Measurement Methods (see Table 1):
NIOSH 5504

Physical Description: Appearance and odor vary depending upon the specific organic tin compound.

Chemical & Physical Properties:
Properties vary depending upon the specific organic tin compound.

Personal Protection/Sanitation (see Table 2):
Recommendations regarding personal protective clothing vary depending upon the specific compound.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1 mg/m^3: CcrOv95/Sa
2.5 mg/m^3: Sa:Cf/PaprOvHie
5 mg/m^3: CcrFOv100/GmFOv100/PaprTOvHie/SaT:Cf/ScbaF/SaF
25 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; head, dizz; psycho-neurologic dist; sore throat, cough; abdom pain, vomit; urine retention; paresis, focal anes; skin burns, pruritus; in animals: hemolysis; hepatic nec; kidney damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys, urinary tract, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Tin(II) oxide (as Sn)	Formula: SnO	CAS#: 21651-19-4	RTECS#: XQ3700000	IDLH: N.D.
Conversion:	DOT:			

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/m^3 **OSHA PEL†:** none	Measurement Methods (see Table 1): **NIOSH** 7300, 7301, 7303
Physical Description: Brownish-black powder.	

Chemical & Physical Properties: **MW:** 134.7 **BP:** Decomposes **Sol:** Insoluble **Fl.P:** NA **IP:** NA **Sp.Gr:** 6.3 **VP:** 0 mmHg (approx) **MLT(600 mmHg):** 1976°F (Decomposes) **UEL:** NA **LEL:** NA	Personal Protection/Sanitation (see Table 2): **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.	Respirator Recommendations (see Tables 3 and 4): Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Stannosis (benign pneumoconiosis): dysp, decr pulm func **TO:** Resp sys	First Aid (see Table 6): **Eye:** Irr immed **Breath:** Fresh air

Tin(IV) oxide (as Sn)	Formula: SnO_2	CAS#: 18282-10-5	RTECS#: XQ4000000	IDLH: N.D.
Conversion:	DOT:			

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/m^3 **OSHA PEL†:** none	Measurement Methods (see Table 1): **NIOSH** 7300, 7301, 7303
Physical Description: White or slightly gray powder.	

Chemical & Physical Properties: **MW:** 150.7 **BP:** Decomposes **Sol:** Insoluble **Fl.P:** NA **IP:** NA **Sp.Gr:** 6.95 **VP:** 0 mmHg (approx) **MLT:** 2966°F (Decomposes) **UEL:** NA **LEL:** NA	Personal Protection/Sanitation (see Table 2): **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.	Respirator Recommendations (see Tables 3 and 4): Not available.

Incompatibilities and Reactivities: Chlorine trifluoride

Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Con **SY:** Stannosis (benign pneumoconiosis): dysp, decr pulm func **TO:** Resp sys	First Aid (see Table 6): **Eye:** Irr immed **Breath:** Fresh air

Titanium dioxide

Formula:	CAS#:	RTECS#:	IDLH:
TiO_2	13463-67-7	XR2275000	Ca [5000 mg/m^3]

Conversion: **DOT:**

Synonyms/Trade Names: Rutile, Titanium oxide, Titanium peroxide

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: TWA 15 mg/m^3

Measurement Methods (see Table 1):
NIOSH S385 (II-3)

Physical Description: White, odorless powder.

Chemical & Physical Properties:
MW: 79.9
BP: 4532-5432°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 4.26
VP: 0 mmHg (approx)
MLT: 3326-3362°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Lung fib; [carc]
TO: Resp sys [in animals: lung tumors]

First Aid (see Table 6):
Breath: Resp support

o-Tolidine

Formula:	CAS#:	RTECS#:	IDLH:
$C_{14}H_{16}N_2$	119-93-7	DD1225000	Ca [N.D.]

Conversion: **DOT:**

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/m^3 [60-minute] [skin]
See Appendix A
See Appendix C
OSHA PEL: See Appendix C

Measurement Methods (see Table 1):
NIOSH 5013
OSHA 71

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.]

Chemical & Physical Properties:
MW: 212.3
BP: 572°F
Sol: 0.1%
FI.P: ?
IP: ?
Sp.Gr: ?
VP: ?
MLT: 264°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose; in animals: liver, kidney damage; [carc]
TO: Eyes, resp sys, liver, kidneys [in animals: liver, bladder & mammary gland tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Toluene	**Formula:** $C_6H_5CH_3$	**CAS#:** 108-88-3	**RTECS#:** XS5250000	**IDLH:** 500 ppm
Conversion: 1 ppm = 3.77 mg/m^3	**DOT:** 1294 130			
Synonyms/Trade Names: Methyl benzene, Methyl benzol, Phenyl methane, Toluol				

Exposure Limits:
NIOSH REL: TWA 100 ppm (375 mg/m^3)
ST 150 ppm (560 mg/m^3)
OSHA PEL†: TWA 200 ppm
C 300 ppm
500 ppm (10-minute maximum peak)

Measurement Methods (see Table 1):
NIOSH 1500, 1501, 3800, 4000
OSHA 111

Physical Description: Colorless liquid with a sweet, pungent, benzene-like odor.

Chemical & Physical Properties:
MW: 92.1
BP: 232°F
Sol(74°F): 0.07%
Fl.P: 40°F
IP: 8.82 eV
Sp.Gr: 0.87
VP: 21 mmHg
FRZ: -139°F
UEL: 7.1%
LEL: 1.1%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
500 ppm: CcrOv*/PaprOv*/
GmFOv/Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose; lass, conf, euph, dizz, head; dilated pupils, lac; anxi, musc ftg, insom; pares; derm; liver, kidney damage
TO: Eyes, skin, resp sys, CNS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Toluenediamine	**Formula:** $CH_3C_6H_3(NH_2)_2$	**CAS#:** 25376-45-8 95-80-7 (2,4-TDA)	**RTECS#:** XS9445000 XS9625000 (2,4-TDA)	**IDLH:** Ca [N.D.]
Conversion:	**DOT:** 1709 151 (2,4-Toluenediamine)			
Synonyms/Trade Names: Diaminotoluene, Methylphenylene diamine, TDA, Toluenediamine isomers, Tolylenediamine [**Note:** Various isomers of TDA exist.]				

Exposure Limits:
NIOSH REL: Ca (all isomers)
See Appendix A
OSHA PEL: none

Measurement Methods (see Table 1):
NIOSH 5516
OSHA 65

Physical Description: Colorless to brown, needle-shaped crystals or powder.
[**Note:** Tends to darken on storage and exposure to air. Properties given are for 2,4-TDA.]

Chemical & Physical Properties:
MW: 122.2
BP: 558°F
Sol: Soluble
Fl.P: 300°F
IP: ?
Sp.Gr: 1.05 (Liquid at 212°F)
VP(224°F): 1 mmHg
MLT: 210°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; derm; ataxia, tacar, nau, vomit, convuls, resp depres; methemo, cyan, head, lass, dizz, bluish skin; liver inj; [carc]
TO: Eyes, skin, resp sys, blood, CVS, liver [in animals: liver, skin & mammary gland tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Toluene-2,4-diisocyanate	Formula: $CH_3C_6H_3(NCO)_2$	CAS#: 584-84-9	RTECS#: CZ6300000	IDLH: Ca [2.5 ppm]
Conversion: 1 ppm = 7.13 mg/m^3	**DOT:** 2078 156			
Synonyms/Trade Names: TDI; 2,4-TDI; 2,4-Toluene diisocyanate				

Exposure Limits:	Measurement Methods (see Table 1):
NIOSH REL: Ca See Appendix A **OSHA PEL†:** C 0.02 ppm (0.14 mg/m^3)	**NIOSH** 2535, 5521, 5522, 5525 **OSHA** 18, 33, 42

Physical Description: Colorless to pale-yellow solid or liquid (above 71°F) with a sharp, pungent odor.

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 174.2 **BP:** 484°F **Sol:** Insoluble **FI.P:** 260°F **IP:** ? **Sp.Gr:** 1.22 **VP(77°F):** 0.01 mmHg **MLT:** 71°F **UEL:** 9.5% **LEL:** 0.9% Class IIIB Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam/Daily **Remove:** When wet or contam **Change:** Daily **Provide:** Eyewash Quick drench	**NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, water, acids, bases & amines (may cause foam & spatter); alcohols [**Note:** Reacts slowly with water to form carbon dioxide and polyureas.]

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat; choke, paroxysmal cough; chest pain, retster soreness; nau, vomit, abdom pain; bron, bronchospasm, pulm edema; dysp, asthma; conj, lac; derm, skin sens; [carc] **TO:** Eyes, skin, resp sys [in animals: pancreas, liver, mammary gland, circulatory sys & skin tumors]	**Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

m-Toluidine	Formula: $CH_3C_6H_4NH_2$	CAS#: 108-44-1	RTECS#: XU2800000	IDLH: N.D.
Conversion:	**DOT:** 1708 153			
Synonyms/Trade Names: 3-Amino-1-methylbenzene, 1-Aminophenylmethane, m-Aminotoluene, 3-Methylaniline, 3-Methylbenzenamine, 3-Toluidine, meta-Toluidine, m-Tolylamine				

T

Exposure Limits:	Measurement Methods (see Table 1):
NIOSH REL: See Appendix D **OSHA PEL†:** none	**NIOSH** 2002 **OSHA** 73

Physical Description: Colorless to light-yellow liquid with an aromatic, amine-like odor. [**Note:** Used as a basis for many dyes.]

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 107.2 **BP:** 397°F **Sol:** 2% **FI.P:** 187°F **IP:** 7.50 eV **Sp.Gr:** 0.999 **VP(106°F):** 1 mmHg **FRZ:** -23°F **UEL:** ? **LEL:** ? Class IIIA Combustible Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.	Not available.

Incompatibilities and Reactivities: Oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Abs, Ing, Con **SY:** Irrit eyes, skin; derm; hema, methemo; cyan, nau, vomit, low BP, convuls; anemia, lass **TO:** Eyes, skin, blood, CVS	**Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

o-Toluidine	Formula: $CH_3C_6H_4NH_2$	CAS#: 95-53-4	RTECS#: XU2975000	IDLH: Ca [50 ppm]
Conversion: 1 ppm = 4.38 mg/m^3	**DOT:** 1708 153			

Synonyms/Trade Names: o-Aminotoluene, 2-Aminotoluene, 1-Methyl-2-aminobenzene, o-Methylaniline, 2-Methylaniline, ortho-Toluidine, o-Tolylamine

Exposure Limits:
NIOSH REL: Ca [skin]
See Appendix A
OSHA PEL: TWA 5 ppm (22 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2002, 2017, 8317
OSHA 73

Physical Description: Colorless to pale-yellow liquid with an aromatic, aniline-like odor.

Chemical & Physical Properties:
MW: 107.2
BP: 392°F
Sol: 2%
Fl.P: 185°F
IP: 7.44 eV
Sp.Gr: 1.01
VP: 0.3 mmHg
FRZ: 6°F
UEL: ?
LEL: ?
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, nitric acid, bases

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes; anoxia, head, cyan; lass, dizz, drow; micro hema; eye burns; derm; [carc]
TO: Eyes, skin, blood, kidneys, liver, CVS [bladder cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

p-Toluidine	Formula: $CH_3C_6H_4NH_2$	CAS#: 106-49-0	RTECS#: XU3150000	IDLH: Ca [N.D.]
Conversion:	**DOT:** 1708 153			

Synonyms/Trade Names: 4-Aminotoluene, 4-Methylaniline, 4-Methylbenzenamine, 4-Toluidine, para-Toluidine, p-Tolylamine

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2002
OSHA 73

Physical Description: White solid with an aromatic odor.
[**Note:** Used as a basis for many dyes.]

Chemical & Physical Properties:
MW: 107.2
BP: 393°F
Sol: 0.7%
Fl.P: 188°F
IP: 7.50 eV
Sp.Gr: 1.05
VP(108°F): 1 mmHg
MLT: 111°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Oxidizers, acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; derm; hema, methemo; cyan, nau, vomit, low BP, convuls; anemia, lass; [carc]
TO: Eyes, skin, blood, CVS [in animals: liver tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Tributyl phosphate

Formula:	CAS#:	RTECS#:	IDLH:
$(CH_3[CH_2]_3O)_3PO$	126-73-8	TC7700000	30 ppm

Conversion: 1 ppm = 10.89 mg/m^3 **DOT:**

Synonyms/Trade Names: Butyl phosphate, TBP, Tributyl ester of phosphoric acid, Tri-n-butyl phosphate

Exposure Limits:
NIOSH REL: TWA 0.2 ppm (2.5 mg/m^3)
OSHA PEL†: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5034

Physical Description: Colorless to pale-yellow, odorless liquid.

Chemical & Physical Properties:
MW: 266.3
BP: 552°F (Decomposes)
Sol: 0.6%
Fl.P(oc): 295°F
IP: ?
Sp.Gr: 0.98
VP(77°F): 0.004 mmHg
FRZ: -112°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
2 ppm: Sa
5 ppm: Sa:Cf
10 ppm: ScbaF/SaF
30 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Alkalis, oxidizers, water, moist air

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys, head; nau
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Trichloroacetic acid

Formula:	CAS#:	RTECS#:	IDLH:
CCl_3COOH	76-03-9	AJ7875000	N.D.

Conversion: 1 ppm = 6.68 mg/m^3 **DOT:** 1839 153 (solid); 2564 153 (solution)

Synonyms/Trade Names: TCA, Trichloroethanoic acid

Exposure Limits:
NIOSH REL: TWA 1 ppm (7 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2017

Physical Description: Colorless to white, crystalline solid with a sharp, pungent odor.

Chemical & Physical Properties:
MW: 163.4
BP: 388°F
Sol: Miscible
Fl.P: NA
IP: ?
Sp.Gr: 1.62
VP(124°F): 1 mmHg
MLT: 136°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Moisture, iron, zinc, aluminum, strong oxidizers
[**Note:** Decomposes on heating to form phosgene & hydrogen chloride. Corrosive to metals.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat, resp sys; cough, dysp, delayed pulm edema; eye, skin burns; derm; salv, vomit, diarr
TO: Eyes, skin, resp sys, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

1,2,4-Trichlorobenzene

Formula:	CAS#:	RTECS#:	IDLH:
$C_6H_3Cl_3$	120-82-1	DC2100000	N.D.

Conversion: 1 ppm = 7.42 mg/m^3 **DOT:** 2321 153 (liquid)

Synonyms/Trade Names: unsym-Trichlorobenzene; 1,2,4-Trichlorobenzol

Exposure Limits:
NIOSH REL: C 5 ppm (40 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5517

Physical Description: Colorless liquid or crystalline solid (below 63°F) with an aromatic odor.

Chemical & Physical Properties:
MW: 181.4
BP: 416°F
Sol: 0.003%
Fl.P: 222°F
IP: ?
Sp.Gr: 1.45
VP: 1 mmHg
FRZ: 63°F
UEL(302°F): 6.6%
LEL(302°F): 2.5%
Class IIIB Combustible Liquid
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Acids, acid fumes, oxidizers, steam

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, muc memb; in animals: liver, kidney damage; possible terato effects
TO: Eyes, skin, resp sys, liver, repro sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

1,1,2-Trichloroethane

Formula:	CAS#:	RTECS#:	IDLH:
$CHCl_2CH_2Cl$	79-00-5	KJ3150000	Ca [100 ppm]

Conversion: 1 ppm = 5.46 mg/m^3 **DOT:**

Synonyms/Trade Names: Ethane trichloride, β-Trichloroethane, Vinyl trichloride

Exposure Limits:
NIOSH REL: Ca
TWA 10 ppm (45 mg/m^3) [skin]
See Appendix A
See Appendix C (Chloroethanes)
OSHA PEL: TWA 10 ppm (45 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 11

Physical Description: Colorless liquid with a sweet, chloroform-like odor.

Chemical & Physical Properties:
MW: 133.4
BP: 237°F
Sol: 0.4%
Fl.P: ?
IP: 11.00 eV
Sp.Gr: 1.44
VP: 19 mmHg
FRZ: -34°F
UEL: 15.5%
LEL: 6%
Combustible Liquid, forms dense soot.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers & caustics; chemically-active metals (such as aluminum, magnesium powders, sodium & potassium)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose; CNS depres; liver, kidney damage; derm; [carc]
TO: Eyes, resp sys, CNS, liver, kidneys [in animals: liver cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Trichloroethylene

Formula:	CAS#:	RTECS#:	IDLH:
$ClCH=CCl_2$	79-01-6	KX4550000	Ca [1000 ppm]

Conversion: 1 ppm = 5.37 mg/m^3 **DOT:** 1710 160

Synonyms/Trade Names: Ethylene trichloride, TCE, Trichloroethene, Trilene

Exposure Limits:
NIOSH REL: Ca
See Appendix A
See Appendix C
OSHA PEL†: TWA 100 ppm
C 200 ppm
300 ppm (5-minute maximum peak in any 2 hours)

Measurement Methods (see Table 1):
NIOSH 1022, 3800
OSHA 1001

Physical Description: Colorless liquid (unless dyed blue) with a chloroform-like odor.

Chemical & Physical Properties:
MW: 131.4
BP: 189°F
Sol: 0.1%
Fl.P: ?
IP: 9.45 eV
Sp.Gr: 1.46
VP: 58 mmHg
FRZ: -99°F
UEL(77°F): 10.5%
LEL(77°F): 8%
Combustible Liquid, but burns with difficulty.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; head, vis dist, lass, dizz, tremor, drow, nau, vomit; derm; card arrhy, pares; liver inj; [carc]
TO: Eyes, skin, resp sys, heart, liver, kidneys, CNS [in animals: liver & kidney cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Trichloronaphthalene

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_5Cl_3$	1321-65-9	QK4025000	See Appendix F

Conversion: **DOT:**

Synonyms/Trade Names: Halowax®, Nibren wax, Seekay wax

Exposure Limits:
NIOSH REL: TWA 5 mg/m^3 [skin]
OSHA PEL: TWA 5 mg/m^3 [skin]

Measurement Methods (see Table 1):
NIOSH S128 (II-2)

Physical Description: Colorless to pale-yellow solid with an aromatic odor.

Chemical & Physical Properties:
MW: 231.5
BP: 579-669°F
Sol: Insoluble
Fl.P(oc): 392°F
IP: ?
Sp.Gr: 1.58
VP: <1 mmHg
MLT: 199°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

See Appendix F

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Anor, nau; dizz; jaun, liver inj
TO: Liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

1,2,3-Trichloropropane	Formula: $CH_2ClCHClCH_2Cl$	CAS#: 96-18-4	RTECS#: TZ9275000	IDLH: Ca [100 ppm]
Conversion: 1 ppm = 6.03 mg/m^3	**DOT:**			

Synonyms/Trade Names: Allyl trichloride, Glycerol trichlorohydrin, Glyceryl trichlorohydrin, Trichlorohydrin

Exposure Limits:
NIOSH REL: Ca
TWA 10 ppm (60 mg/m^3) [skin]
See Appendix A
OSHA PEL†: TWA 50 ppm (300 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless liquid with a chloroform-like odor.

Chemical & Physical Properties:
MW: 147.4
BP: 314°F
Sol: 0.1%
Fl.P: 160°F
IP: ?
Sp.Gr: 1.39
VP: 3 mmHg
FRZ: 6°F
UEL(302°F): 12.6%
LEL(248°F): 3.2%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals, strong caustics & oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; CNS depres; in animals: liver, kidney inj; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys [in animals: forestomach, liver & mammary gland cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

1,1,2-Trichloro-1,2,2-trifluoroethane	Formula: CCl_2FCClF_2	CAS#: 76-13-1	RTECS#: KJ4000000	IDLH: 2000 ppm
Conversion: 1 ppm = 7.67 mg/m^3	**DOT:**			

Synonyms/Trade Names: Chlorofluorocarbon-113, CFC-113, Freon® 113, Genetron® 113, Halocarbon 113, Refrigerant 113, TTE

Exposure Limits:
NIOSH REL: TWA 1000 ppm (7600 mg/m^3)
ST 1250 ppm (9500 mg/m^3)
OSHA PEL†: TWA 1000 ppm (7600 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1020
OSHA 113

Physical Description: Colorless to water-white liquid with an odor like carbon tetrachloride at high concentrations. [**Note:** A gas above 118°F.]

Chemical & Physical Properties:
MW: 187.4
BP: 118°F
Sol(77°F): 0.02%
Fl.P: ?
IP: 11.99 eV
Sp.Gr(77°F): 1.56
VP: 285 mmHg
FRZ: -31°F
UEL: ?
LEL: ?
Noncombustible Liquid at ordinary temperatures, but the gas will ignite and burn weakly at 1256°F.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals such as calcium, powdered aluminum, zinc, magnesium & beryllium [**Note:** Decomposes if in contact with alloys containing >2% magnesium.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit skin, throat, drow, derm; CNS depres; in animals: card arrhy, narco
TO: Skin, heart, CNS, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Triethylamine

Formula:	CAS#:	RTECS#:	IDLH:
$(C_2H_5)_3N$	121-44-8	YE0175000	200 ppm

Conversion: 1 ppm = 4.14 mg/m^3 **DOT:** 1296 132

Synonyms/Trade Names: TEA

Exposure Limits:
NIOSH REL: See Appendix D
OSHA PEL†: TWA 25 ppm (100 mg/m^3)

Measurement Methods (see Table 1):
NIOSH S152 (II-3)
OSHA PV2060

Physical Description: Colorless liquid with a strong, ammonia-like odor.

Chemical & Physical Properties:
MW: 101.2
BP: 193°F
Sol: 2%
FI.P: 20°F
IP: 7.50 eV
Sp.Gr: 0.73
VP: 54 mmHg
FRZ: -175°F
UEL: 8.0%
LEL: 1.2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (>1%)
Quick drench (>1%)

Respirator Recommendations (see Tables 3 and 4):
OSHA
200 ppm: Sa:Cf£/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, chlorine, hypochlorite, halogenated compounds

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; in animals: myocardial, kidney, liver damage
TO: Eyes, skin, resp sys, CVS, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Trifluorobromomethane

Formula:	CAS#:	RTECS#:	IDLH:
$CBrF_3$	75-63-8	PA5425000	40,000 ppm

Conversion: 1 ppm = 6.09 mg/m^3 **DOT:** 1009 126

Synonyms/Trade Names: Bromotrifluoromethane, Fluorocarbon 1301, Freon® 13B1, Halocarbon 13B1, Halon® 1301, Monobromotrifluoromethane, Refrigerant 13B1, Trifluoromonobromomethane

Exposure Limits:
NIOSH REL: TWA 1000 ppm (6100 mg/m^3)
OSHA PEL: TWA 1000 ppm (6100 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1017

Physical Description: Colorless, odorless gas. [**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 148.9
BP: -72°F
Sol: 0.03%
FI.P: NA
IP: 11.78 eV
RGasD: 5.14
VP: >1 atm
FRZ: -267°F
UEL: NA
LEL: NA
Nonflammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: N.R.
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10,000 ppm: Sa
25,000 ppm: Sa:Cf
40,000 ppm: SaT:Cf/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals (such as calcium, powdered aluminum, zinc, and magnesium)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Dizz; card arrhy; liquid: frostbite
TO: CNS, heart

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Trimellitic anhydride

Formula:	CAS#:	RTECS#:	IDLH:
$C_9H_4O_5$	552-30-7	DC2050000	N.D.

Conversion: 1 ppm = 7.86 mg/m^3 **DOT:**

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:
NIOSH REL: TWA 0.005 ppm (0.04 mg/m^3)
Should be handled in the workplace as an extremely toxic substance.
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 5036
OSHA 98

Physical Description: Colorless solid.

Chemical & Physical Properties:
MW: 192.1
BP: ?
Sol: ?
Fl.P: NA
IP: ?
Sp.Gr: ?
VP: 0.000004 mmHg
MLT: 322°F
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, resp sys; pulm edema, resp sens; rhinitis, asthma, cough, wheez, dysp, mal, fever, musc aches, sneez
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Trimethylamine

Formula:	CAS#:	RTECS#:	IDLH:
$(CH_3)_3N$	75-50-3	PA0350000	N.D.

Conversion: 1 ppm = 2.42 mg/m^3 **DOT:** 1083 118 (anhydrous); 1297 132 (aqueous solution)

Synonyms/Trade Names: N,N-Dimethylmethanamine; TMA
[**Note:** May be used in an aqueous solution (typically 25%, 30%, or 40% TMA.]

Exposure Limits:
NIOSH REL: TWA 10 ppm (24 mg/m^3) **OSHA PEL†:** none
ST 15 ppm (36 mg/m^3)

Measurement Methods (see Table 1):
OSHA PV2060

Physical Description: Colorless gas with a fishy, amine odor.
[**Note:** A liquid below 37°F. Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 59.1
BP: 37°F
Sol(86°F): 48%
Fl.P: NA (Gas)
20°F (Liquid)
IP: 7.82 eV
RGasD: 2.09
VP(70°F): 1454 mmHg
FRZ: -179°F
UEL: 11.6%
LEL: 2.0%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid/solution)
Frostbite
Eyes: Prevent eye contact (liquid/solution)
Frostbite
Wash skin: When contam (solution)
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash (liquid/solution)
Quick drench (liquid/solution)
Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and 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).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing (solution), Con
SY: Irrit eyes, skin, nose, throat, resp sys; cough, dysp, delayed pulm edema; blurred vision, corn nec; skin burns; liquid: frostbite
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed (liquid/solution)/Frostbite
Skin: Water flush immed (liquid/solution)/Frostbite
Breath: Resp support
Swallow: Medical attention immed (solution)

1,2,3-Trimethylbenzene	Formula: $C_6H_3(CH_3)_3$	CAS#: 526-73-8	RTECS#: DC3300000	IDLH: N.D.
Conversion: 1 ppm = 4.92 mg/m^3	**DOT:**			

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:
NIOSH REL: TWA 25 ppm (125 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2091

Physical Description: Clear, colorless liquid with a distinctive, aromatic odor.

Chemical & Physical Properties:
MW: 120.2
BP: 349°F
Sol: Low
FI.P: ?
IP: 8.48 eV
Sp.Gr: 0.89
VP(62°F): 1 mmHg
FRZ: -14°F
UEL: 6.6%
LEL: 0.8%
Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat, resp sys; bron; hypochromic anemia; head, drow, lass, dizz, nau, inco; vomit, conf; chemical pneu (aspir liquid)
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

1,2,4-Trimethylbenzene	Formula: $C_6H_3(CH_3)_3$	CAS#: 95-63-6	RTECS#: DC3325000	IDLH: N.D.
Conversion: 1 ppm = 4.92 mg/m^3	**DOT:**			

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:
NIOSH REL: TWA 25 ppm (125 mg/m^3)
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2091

Physical Description: Clear, colorless liquid with a distinctive, aromatic odor.

Chemical & Physical Properties:
MW: 120.2
BP: 337°F
Sol: 0.006%
FI.P: 112°F
IP: 8.27 eV
Sp.Gr: 0.88
VP(56°F): 1 mmHg
FRZ: -77°F
UEL: 6.4%
LEL: 0.9%
Class II Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat, resp sys; bron; hypochromic anemia; head, drow, lass, dizz, nau, inco; vomit, conf; chemical pneu (aspir liquid)
TO: Eyes, skin, resp sys, CNS, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

1,3,5-Trimethylbenzene	Formula: $C_6H_3(CH_3)_3$	CAS#: 108-67-8	RTECS#: OX6825000	IDLH: N.D.
Conversion: 1 ppm = 4.92 mg/m^3	**DOT:** 2325 129			
Synonyms/Trade Names: Mesitylene, Symmetrical trimethylbenzene, sym-Trimethylbenzene				
Exposure Limits: **NIOSH REL:** TWA 25 ppm (125 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **OSHA** PV2091	
Physical Description: Clear, colorless liquid with a distinctive, aromatic odor.				
Chemical & Physical Properties: **MW:** 120.2 **BP:** 329°F **Sol:** 0.002% **Fl.P:** 122°F **IP:** 8.39 eV **Sp.Gr:** 0.86 **VP:** 2 mmHg **FRZ:** -49°F **UEL:** ? **LEL:** ? Class II Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Oxidizers, nitric acid				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, nose, throat, resp sys; bron; hypochromic anemia; head, drow, lass, dizz, nau, inco; vomit, conf; chemical pneu (aspir liquid) **TO:** Eyes, skin, resp sys, CNS, blood			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed	

Trimethyl phosphite	Formula: $(CH_3O)_3P$	CAS#: 121-45-9	RTECS#: TH1400000	IDLH: N.D.
Conversion: 1 ppm = 5.08 mg/m^3	**DOT:** 2329 129			
Synonyms/Trade Names: Methyl phosphite, Trimethoxyphosphine, Trimethyl ester of phosphorous acid				
Exposure Limits: **NIOSH REL:** TWA 2 ppm (10 mg/m^3) **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless liquid with a distinctive, pungent odor.				
Chemical & Physical Properties: **MW:** 124.1 **BP:** 232°F **Sol:** Reacts **Fl.P:** 82°F **IP:** ? **Sp.Gr:** 1.05 **VP(77°F):** 24 mmHg **FRZ:** -108°F **UEL:** ? **LEL:** ? Class IC Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Quick drench		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: Magnesium perchlorate, water [**Note:** Reacts (hydrolyzes) with water.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, upper resp sys; derm; in animals: terato effects **TO:** Eyes, skin, resp sys, repro sys			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap flush immed **Breath:** Resp support **Swallow:** Medical attention immed	

2,4,6-Trinitrotoluene

Formula:	CAS#:	RTECS#:	IDLH:
$CH_3C_6H_2(NO_2)_3$	118-96-7	XU0175000	500 mg/m^3

Conversion: **DOT:** 1356 113 (wet)

Synonyms/Trade Names: 1-Methyl-2,4,6-trinitrobenzene; TNT; Trinitrotoluene; sym-Trinitrotoluene; Trinitrotoluol

Exposure Limits:
NIOSH REL: TWA 0.5 mg/m^3 [skin]
OSHA PEL†: TWA 1.5 mg/m^3 [skin]

Measurement Methods (see Table 1):
OSHA 44

Physical Description: Colorless to pale-yellow, odorless solid or crushed flakes.

Chemical & Physical Properties:
MW: 227.1
BP: 464°F (Explodes)
Sol(77°F): 0.01%
FI.P: ? (Explodes)
IP: 10.59 eV
Sp.Gr: 1.65
VP: 0.0002 mmHg
MLT: 176°F
UEL: ?
LEL: ?
Combustible Solid (Class A Explosive)

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 mg/m^3: Sa*
12.5 mg/m^3: Sa:Cf*
25 mg/m^3: ScbaF/SaF
500 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, ammonia, strong alkalis, combustible materials, heat
[**Note:** Rapid heating will result in detonation.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit skin, muc memb; liver damage, jaun; cyan; sneez; cough, sore throat; peri neur, musc pain; kidney damage; cataract; sens derm; leucyt; anemia; card irreg
TO: Eyes, skin, resp sys, blood, liver, CVS, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Triorthocresyl phosphate

Formula:	CAS#:	RTECS#:	IDLH:
$(CH_3C_6H_4O)_3PO$	78-30-8	TD0350000	40 mg/m^3

Conversion: **DOT:** 2574 151

Synonyms/Trade Names: TCP, TOCP, Tri-o-cresyl ester of phosphoric acid, Tri-o-cresyl phosphate

Exposure Limits:
NIOSH REL: TWA 0.1 mg/m^3 [skin]
OSHA PEL†: TWA 0.1 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5037

Physical Description: Colorless to pale-yellow, odorless liquid or solid (below 52°F).

Chemical & Physical Properties:
MW: 368.4
BP: 770°F (Decomposes)
Sol: Slight
FI.P: 437°F
IP: ?
Sp.Gr: 1.20
VP(77°F): 0.00002 mmHg
FRZ: 52°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.5 mg/m^3: Qm
1 mg/m^3: 95XQ/Sa
2.5 mg/m^3: Sa:Cf/PaprHie
5 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
40 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: GI dist; peri neur; cramps in calves, pares in feet or hands; weak feet, wrist drop, para
TO: PNS, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

Triphenylamine	Formula: $(C_6H_5)_3N$	CAS#: 603-34-9	RTECS#: YK2680000	IDLH: N.D.
Conversion:	**DOT:**			
Synonyms/Trade Names: N,N-Diphenylaniline; N,N-Diphenylbenzenamine				
Exposure Limits: **NIOSH REL:** TWA 5 mg/m^3 **OSHA PEL†:** none			**Measurement Methods (see Table 1):** None available	
Physical Description: Colorless solid.				
Chemical & Physical Properties: **MW:** 245.3 **BP:** 689°F **Sol:** Insoluble **Fl.P:** ? **IP:** 7.60 eV **Sp.Gr:** 0.77 **VP:** ? **MLT:** 261°F **UEL:** ? **LEL:** ?	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** Daily **Remove:** N.R. **Change:** Daily		**Respirator Recommendations (see Tables 3 and 4):** Not available.	
Incompatibilities and Reactivities: None reported				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** In animals: irrit skin **TO:** Skin			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash **Breath:** Resp support **Swallow:** Medical attention immed	

Triphenyl phosphate	Formula: $(C_6H_5O)_3PO$	CAS#: 115-86-6	RTECS#: TC8400000	IDLH: 1000 mg/m^3
Conversion:	**DOT:**			
Synonyms/Trade Names: Phenyl phosphate, TPP, Triphenyl ester of phosphoric acid				
Exposure Limits: **NIOSH REL:** TWA 3 mg/m^3 **OSHA PEL:** TWA 3 mg/m^3			**Measurement Methods (see Table 1):** **NIOSH** 5038	
Physical Description: Colorless, crystalline powder with a phenol-like odor.				
Chemical & Physical Properties: **MW:** 326.3 **BP:** 776°F **Sol(129°F):** 0.002% **Fl.P:** 428°F **IP:** ? **Sp.Gr:** 1.29 **VP(380°F):** 1 mmHg **MLT:** 120°F **UEL:** ? **LEL:** ? Combustible Solid	**Personal Protection/Sanitation (see Table 2):** **Skin:** N.R. **Eyes:** N.R. **Wash skin:** N.R. **Remove:** N.R. **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **15 mg/m^3:** Qm **30 mg/m^3:** 95XQ/Sa **75 mg/m^3:** Sa:Cf/PaprHie **150 mg/m^3:** 100F/SaT:Cf/PaprTHie/ScbaF/SaF **1000 mg/m^3:** Sa:Pd,Pp **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** 100F/ScbaE	
Incompatibilities and Reactivities: None reported				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing **SY:** Minor changes in blood enzymes; in animals: musc weak, para **TO:** Blood, PNS			**First Aid (see Table 6):** **Breath:** Resp support **Swallow:** Medical attention immed	

Tungsten	Formula: W	CAS#: 7440-33-7	RTECS#: YO7175000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Tungsten metal, Wolfram

Exposure Limits:
NIOSH REL*: TWA 5 mg/m^3
ST 10 mg/m^3
[***Note:** The REL also applies to other insoluble tungsten compounds (as W).]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 7074, 7300, 7301
OSHA ID213

Physical Description: Hard, brittle, steel-gray to tin-white solid.

Chemical & Physical Properties:
MW: 183.9
BP: 10,701°F
Sol: Insoluble
Fl.P: NA
IP: NA
Sp.Gr: 19.3
VP: 0 mmHg (approx)
MLT: 6170°F
UEL: NA
LEL: NA
Combustible in the form of finely divided powder; may ignite spontaneously.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
50 mg/m^3: 100XQ/Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100XQ/ScbaE

Incompatibilities and Reactivities: Bromine trifluoride, chlorine trifluoride, fluorine, iodine pentafluoride

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; diffuse pulm fib; loss of appetite, nau, cough; blood changes
TO: Eyes, skin, resp sys, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air
Swallow: Medical attention immed

Tungsten (soluble compounds, as W)	Formula:	CAS#:	RTECS#:	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: Synonyms vary depending upon the specific soluble tungsten compound.

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
ST 3 mg/m^3
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 7074, 7300, 7301
OSHA ID213

Physical Description: Appearance and odor vary depending upon the specific soluble tungsten compound.

Chemical & Physical Properties:
Properties vary depending upon the specific soluble tungsten compound.

Personal Protection/Sanitation (see Table 2):
Recommendations regarding personal protective clothing vary depending upon the specific compound.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 mg/m^3: 100XQ/Sa
25 mg/m^3: Sa:Cf
50 mg/m^3: 100F/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; in animals: CNS disturbances; diarr; resp failure; behavioral, body weight, blood changes
TO: Eyes, skin, resp sys, CNS, GI tract

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash
Breath: Resp support
Swallow: Medical attention immed

Tungsten carbide (cemented)

Formula:	CAS#:	RTECS#:	IDLH:
WC/Co/Ni/Ti	1: 11107-01-0 2: 12718-69-3 3: 37329-49-0	1: YO7350000 2: YO7525000 3: YO7700000	N.D.

Conversion: **DOT:**

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% Ti]

Exposure Limits:
NIOSH REL: See Appendix C **OSHA PEL†:** See Appendix C

Measurement Methods (see Table 1):
None available

Physical Description: A mixture of tungsten carbide, cobalt, and sometimes other metals & metal oxides or carbides.

Chemical & Physical Properties:
Properties vary depending upon the specific mixture.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily (Ni)
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH
0.25 mg Co/m^3: Qm
0.5 mg Co/m^3: 95XQ*/Sa*
1.25 mg Co/m^3: Sa:Cf*/PaprHie*/PaprHie*
2.5 mg Co/m^3: 100F/ScbaF/SaF
20 mg Co/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Tungsten carbide (cemented) containing Nickel:
NIOSH
¥:ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Tungsten carbide: Fluorine, chlorine trifluoride, oxides of nitrogen, lead dioxide

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, resp sys; possible skin sens to cobalt, nickel; diffuse pulm fib; loss of appetite, nau, cough; blood changes
TO: Eyes, skin, resp sys, blood

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air
Swallow: Medical attention immed

Turpentine

Formula:	CAS#:	RTECS#:	IDLH:
$C_{10}H_{16}$ (approx)	8006-64-2	YO8400000	800 ppm

Conversion: 1 ppm = 5.56 mg/m^3 (approx) **DOT:** 1299 128

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/m^3)
OSHA PEL: TWA 100 ppm (560 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1551

Physical Description: Colorless liquid with a characteristic odor.

Chemical & Physical Properties:
MW: 136 (approx)
BP: 309-338°F
Sol: Insoluble
FI.P: 95°F
IP: ?
Sp.Gr: 0.86
VP: 4 mmHg
FRZ: -58 to -76°F
UEL: ?
LEL: 0.8%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
800 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, chlorine, chromic anhydride, stannic chloride, chromyl chloride

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; head, dizz, convuls; skin sens; hema, prot; kidney damage; abdom pain, nau, vomit, diarr; chemical pneu (aspir liquid)
TO: Eyes, skin, resp sys, CNS, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

1-Undecanethiol	Formula: $CH_3(CH_2)_{10}SH$	CAS#: 5332-52-5	RTECS#:	IDLH: N.D.
Conversion: 1 ppm = 7.71 mg/m^3	**DOT:** 1228 131			

Synonyms/Trade Names: Undecyl mercaptan

Exposure Limits:
NIOSH REL: C 0.5 ppm (3.9 mg/m^3) [15-minute]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Liquid.

Chemical & Physical Properties:
MW: 188.4
BP: 495°F
Sol: Insoluble
FI.P: ?
IP: ?
Sp.Gr: 0.84
VP: ?
FRZ: 27°F
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
5 ppm: CcrOv/Sa
12.5 ppm: Sa:Cf/PaprOv
25 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, reducing agents, strong acids & bases, alkali metals

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, resp sys; conf, dizz, head, drow, nau, vomit, lass, convuls
TO: Eyes, skin, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Uranium (insoluble compounds, as U)	Formula: U (metal)	CAS#: 7440-61-1 (metal)	RTECS#: YR3490000 (metal)	IDLH: Ca [10 mg/m^3 (as U)]
Conversion:	**DOT:** 2979 162 (metal, pyrophoric)			

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/m^3
ST 0.6 mg/m^3
See Appendix A
OSHA PEL†: TWA 0.25 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Metal: Silver-white, malleable, ductile, lustrous solid. [**Note:** Weakly radioactive.]

Chemical & Physical Properties:
MW: 238.0
BP: 6895°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 19.05 (metal)
VP: 0 mmHg (approx)
MLT: 2097°F
UEL: NA
LEL: NA
MEC: 60 g/m^3
Metal: Combustible Solid, especially turnings and powder.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Carbon dioxide, carbon tetrachloride, nitric acid, fluorine [**Note:** Complete coverage of uranium metal scrap with oil is essential for prevention of fire.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Derm; kidney damage; blood changes; [carc]; in animals: lung, lymph node damage; [carc] Potential for cancer is a result of alpha-emitting properties & radioactive decay products (e.g., radon).
TO: Skin, kidneys, bone marrow, lymphatic sys [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Uranium (soluble compounds, as U)	Formula:	CAS#:	RTECS#:	IDLH: Ca [10 mg/m^3 (as U)]
Conversion:	**DOT:**			

Synonyms/Trade Names: Synonyms vary depending upon the specific soluble uranium compound.

Exposure Limits:
NIOSH REL: Ca
TWA 0.05 mg/m^3
See Appendix A
OSHA PEL: TWA 0.05 mg/m^3

Measurement Methods (see Table 1):
None available

Physical Description: Appearance and odor vary depending upon the specific soluble uranium compound.

Chemical & Physical Properties:
Properties vary depending upon the specific soluble uranium compound.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam/Daily
Remove: When wet or contam
Change: Daily
Provide: Eyewash (UF_6), Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape (Halides): GmFAg100/ScbaE
Escape (Non-halides): 100F/ScbaE

Incompatibilities and Reactivities: **Uranyl nitrate:** combustibles; **Uranium hexafluoride:** water

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Lac, conj; short breath, cough, chest rales; nau, vomit; skin burns; RBC, casts in urine; prot; high BUN; [carc] Potential for cancer is a result of alpha-emitting properties & radioactive decay products (e.g., radon).
TO: Resp sys, blood, liver, kidneys, lymphatic sys, skin, bone marrow [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

n-Valeraldehyde	Formula: $CH_3(CH_2)_3CHO$	CAS#: 110-62-3	RTECS#: YV3600000	IDLH: N.D.
Conversion: 1 ppm = 3.53 mg/m^3	**DOT:** 2058 129			

Synonyms/Trade Names: Amyl aldehyde, Pentanal, Valeral, Valeraldehyde, Valeric aldehyde

Exposure Limits:
NIOSH REL: TWA 50 ppm (175 mg/m^3)
See Appendix C (Aldehydes)
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 2018, 2536
OSHA 85

Physical Description: Colorless liquid with a strong, acrid, pungent odor.

Chemical & Physical Properties:
MW: 86.2
BP: 217°F
Sol: Slight
Fl.P: 54°F
IP: 9.82 eV
Sp.Gr: 0.81
VP: 26 mmHg
FRZ: -133°F
UEL: ?
LEL: ?
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Vanadium dust	Formula: V_2O_5	CAS#: 1314-62-1	RTECS#: YW2450000	IDLH: 35 mg/m^3 (as V)
Conversion:	**DOT:** 2862 151			

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:
NIOSH REL*: C 0.05 mg V/m^3 [15-minute]
[***Note:** The REL applies to all vanadium compounds except Vanadium metal and Vanadium carbide (see Ferrovanadium dust).]
OSHA PEL†: C 0.5 mg V_2O_5/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 7504, 9102
OSHA ID185

Physical Description: Yellow-orange powder or dark-gray, odorless flakes dispersed in air.

Chemical & Physical Properties:
MW: 181.9
BP: 3182°F (Decomposes)
Sol: 0.8%
FI.P: NA
IP: NA
Sp.Gr: 3.36
VP: 0 mmHg (approx)
MLT: 1274°F
UEL: NA
LEL: NA
Noncombustible Solid, but may increase intensity of fire when in contact with combustible materials.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH (as V)
0.5 mg/m^3: 100XQ*/Sa*
1.25 mg/m^3: Sa:Cf*/PaprHie*
2.5 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
35 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Lithium, chlorine trifluoride

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, throat; green tongue, metallic taste, eczema; cough; fine rales, wheez, bron, dysp
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Vanadium fume	Formula: V_2O_5	CAS#: 1314-62-1	RTECS#: YW2460000	IDLH: 35 mg/m^3 (as V)
Conversion:	**DOT:** 2862 151			

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:
NIOSH REL: C 0.05 mg V/m^3 [15-minute]
OSHA PEL†: C 0.1 mg V_2O_5/m^3

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 7504
OSHA ID185

Physical Description: Finely divided particulate dispersed in air.

Chemical & Physical Properties:
MW: 181.9
BP: 3182°F (Decomposes)
Sol: 0.8%
FI.P: NA
IP: NA
Sp.Gr: 3.36
VP: 0 mmHg (approx)
MLT: 1274°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH (as V)
0.5 mg/m^3: 100XQ*/Sa*
1.25 mg/m^3: Sa:Cf*/PaprHie*
2.5 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
35 mg/m^3: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Lithium, chlorine trifluoride

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, throat; green tongue, metallic taste; cough, fine rales, wheez, bron, dysp; eczema
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Breath: Resp support

Vegetable oil mist

Formula: | **CAS#:** 68956-68-3 | **RTECS#:** YX1850000 | **IDLH:** N.D.

Conversion: | **DOT:**

Synonyms/Trade Names: Vegetable mist

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: An oil extracted from the seeds, fruit, or nuts of vegetables or other plant matter.

Chemical & Physical Properties:
MW: varies
BP: ?
Sol: Insoluble
FI.P: 323-540°F
IP: ?
Sp.Gr: 0.91-0.95
VP: ?
FRZ: ?
UEL: ?
LEL: ?
Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, resp sys; lac
TO: Eyes, skin, resp sys Determine based on working conditions

First Aid (see Table 6):
Eye: Irr immed
Breath: Fresh air

Vinyl acetate

Formula: CH_2=CHOOCCH$_3$ | **CAS#:** 108-05-4 | **RTECS#:** AK0875000 | **IDLH:** N.D.

Conversion: 1 ppm = 3.52 mg/m^3 | **DOT:** 1301 129P

Synonyms/Trade Names: 1-Acetoxyethylene, Ethenyl acetate, Ethenyl ethanoate, VAC, Vinyl acetate monomer, Vinyl ethanoate

Exposure Limits:
NIOSH REL: C 4 ppm (15 mg/m^3) [15-minute]
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 1453
OSHA 51

Physical Description: Colorless liquid with a pleasant, fruity odor.
[**Note:** Raw material for many polyvinyl resins.]

Chemical & Physical Properties:
MW: 86.1
BP: 162°F
Sol: 2%
FI.P: 18°F
IP: 9.19 eV
Sp.Gr: 0.93
VP: 83 mmHg
FRZ: -136°F
UEL: 13.4%
LEL: 2.6%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
40 ppm: CcrOv*/Sa*
100 ppm: Sa:Cf*/PaprOv*
200 ppm: CcrFOv/GmFOv/PaprTOv*/ScbaF/SaF
4000 ppm: Sa:Pd,Pp*
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Acids, bases, silica gel, alumina, oxidizers, azo compounds, ozone
[**Note:** Usually contains a stabilizer (e.g., hydroquinone or diphenylamine) to prevent polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, nose, throat; hoarseness, cough; loss of smell; eye burns, skin blisters
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Vinyl bromide

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=CHBr	593-60-2	KU8400000	Ca [N.D.]

Conversion: 1 ppm = 4.38 mg/m^3 **DOT:** 1085 116P (inhibited)

Synonyms/Trade Names: Bromoethene, Bromoethylene, Monobromoethylene

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 1009
OSHA 8

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.]

Chemical & Physical Properties:
MW: 107.0
BP: 60°F
Sol: Insoluble
FI.P: NA (Gas)
IP: 9.80 eV
RGasD: 3.79
Sp.Gr: 1.49 (Liquid at 60°F)
VP: 1.4 atm
FRZ: -219°F
UEL: 15%
LEL: 9%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact (liquid)
Eyes: Prevent eye contact (liquid)
Wash skin: When contam (liquid)
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers (e.g., perchlorates, peroxides, chlorates, permanganates & nitrates.)
[**Note:** May polymerize in sunlight.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing (liquid), Con
SY: Irrit eyes, skin; dizz, conf, inco, narco, nau, vomit; liquid: frostbite; [carc]
TO: Eyes, skin, CNS, liver [in animals: liver & lymph node tumors]

First Aid (see Table 6):
Eye: Irr immed (liquid)
Skin: Water flush immed (liquid)
Breath: Resp support
Swallow: Medical attention immed (liquid)

Vinyl chloride

Formula:	CAS#:	RTECS#:	IDLH:
CH_2=CHCl	75-01-4	KU9625000	Ca [N.D.]

Conversion: 1 ppm = 2.56 mg/m^3 **DOT:** 1086 116P (inhibited)

Synonyms/Trade Names: Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL: [1910.1017] TWA 1 ppm
C 5 ppm [15-minute]

Measurement Methods (see Table 1):
NIOSH 1007
OSHA 4, 75

Physical Description: Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations.
[**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 62.5
BP: 7°F
Sol(77°F): 0.1%
FI.P: NA (Gas)
IP: 9.99 eV
RGasD: 2.21
VP: 3.3 atm
FRZ: -256°F
UEL: 33.0%
LEL: 3.6%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFS/ScbaE

See Appendix E (page 351)

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Lass; abdom pain, GI bleeding; enlarged liver; pallor or cyan of extremities; liquid: frostbite; [carc]
TO: Liver, CNS, blood, resp sys, lymphatic sys [liver cancer]

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Vinyl cyclohexene dioxide	Formula: $C_8H_{12}O_2$	CAS#: 106-87-6	RTECS#: RN8640000	IDLH: Ca [N.D.]
Conversion: 1 ppm = 5.73 mg/m^3	**DOT:**			

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/m^3) [skin]
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA PV2083

Physical Description: Colorless liquid.

Chemical & Physical Properties:
MW: 140.2
BP: 441°F
Sol: High
Fl.P(oc): 230°F
IP: ?
Sp.Gr: 1.10
VP: 0.1 mmHg
FRZ: -164°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Alcohols, amines, water [**Note:** Slowly hydrolyzes in water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: irrit eyes, skin, resp sys; testicular atrophy; leupen, nec thymus; skin sens; [carc]
TO: Eyes, skin, resp sys, blood, thymus, repro sys [in animals: skin tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Water wash immed
Breath: Resp support
Swallow: Medical attention immed

Vinyl fluoride	Formula: CH_2=CHF	CAS#: 75-02-5	RTECS#: YZ3510000	IDLH: N.D.
Conversion: 1 ppm = 1.89 mg/m^3	**DOT:** 1860 116P (inhibited)			

Synonyms/Trade Names: Fluoroethene, Fluoroethylene, Monofluoroethylene, Vinyl fluoride monomer

Exposure Limits:
NIOSH REL: TWA 1 ppm
C 5 ppm [use 1910.1017]
OSHA PEL: none

Measurement Methods (see Table 1):
None available

Physical Description: Colorless gas with a faint, ethereal odor.
[**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 46.1
BP: -98°F
Sol: Insoluble
Fl.P: NA (Gas)
IP: 10.37 eV
RGasD: 1.60
VP: 25.2 atm
FRZ: -257°F
UEL: 21.7%
LEL: 2.6%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 ppm: CcrOv/Sa
25 ppm: Sa:Cf/PaprOv
50 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
200 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: None reported [**Note:** Inhibited with 0.2% terpenes to prevent polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Head, dizz, conf, inco, narco, nau, vomit; liquid: frostbite
TO: CNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Vinylidene chloride	Formula: $CH_2=CCl_2$	CAS#: 75-35-4	RTECS#: KV9275000	IDLH: Ca [N.D.]
Conversion:	**DOT:** 1303 130P (inhibited)			

Synonyms/Trade Names: 1,1-DCE; 1,1-Dichloroethene; 1,1-Dichloroethylene; VDC; Vinylidene chloride monomer; Vinylidene dichloride

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 1015
OSHA 19

Physical Description: Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor.

Chemical & Physical Properties:
MW: 96.9
BP: 89°F
Sol: 0.04%
Fl.P: -2°F
IP: 10.00 eV
Sp.Gr: 1.21
VP: 500 mmHg
FRZ: -189°F
UEL: 15.5%
LEL: 6.5%
Class IA Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and 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.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, throat; dizz, head, nau, dysp; liver, kidney dist; pneu; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys [in animals: liver & kidney tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush immed
Breath: Resp support
Swallow: Medical attention immed

Vinylidene fluoride	Formula: $CH_2=CF_2$	CAS#: 75-38-7	RTECS#: KW0560000	IDLH: N.D.
Conversion: 1 ppm = 2.62 mg/m^3	**DOT:** 1959 116P			

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

Measurement Methods (see Table 1):
NIOSH 3800

Physical Description: Colorless gas with a faint, ethereal odor. [**Note:** Shipped as a liquefied compressed gas.]

Chemical & Physical Properties:
MW: 64.0
BP: -122°F
Sol: Insoluble
Fl.P: NA (Gas)
IP: 10.29 eV
RGasD: 2.21
VP: 35.2 atm
FRZ: -227°F
UEL: 21.3%
LEL: 5.5%
Flammable Gas

Personal Protection/Sanitation (see Table 2):
Skin: Frostbite
Eyes: Frostbite
Wash skin: N.R.
Remove: When wet (flamm)
Change: N.R.
Provide: Frostbite wash

Respirator Recommendations (see Tables 3 and 4):
NIOSH
10 ppm: CcrOv/Sa
25 ppm: Sa:Cf/PaprOv
50 ppm: CcrFOv/GmFOv/PaprTOv/ScbaF/SaF
200 ppm: SaF:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Oxidizers, aluminum chloride
[**Note:** Violent reaction with hydrogen chloride when heated under pressure.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con (liquid)
SY: Dizz, head, nau; liquid: frostbite
TO: CNS

First Aid (see Table 6):
Eye: Frostbite
Skin: Frostbite
Breath: Resp support

Vinyl toluene	**Formula:** $CH_2=CHC_6H_4CH_3$	**CAS#:** 25013-15-4 (inhibited)	**RTECS#:** WL5075000	**IDLH:** 400 ppm
Conversion: 1 ppm = 4.83 mg/m^3	**DOT:** 2618 130P (inhibited)			
Synonyms/Trade Names: Ethenylmethylbenzene, Methylstyrene, Tolyethylene				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (480 mg/m^3) **OSHA PEL:** TWA 100 ppm (480 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1501 **OSHA** 7	
Physical Description: Colorless liquid with a strong, disagreeable odor.				
Chemical & Physical Properties: **MW:** 118.2 **BP:** 339°F **Sol:** 0.009% **Fl.P:** 127°F **IP:** 8.20 eV **Sp.Gr:** 0.89 **VP:** 1 mmHg **FRZ:** -106°F **UEL:** 11.0% **LEL:** 0.8% Class II Combustible Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet or contam **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH/OSHA** **400 ppm:** CcrOv*/PaprOv*/ GmFOv/Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Oxidizers, peroxides, strong acids, iron or aluminum salts [**Note:** Usually inhibited with tert-butyl catechol to prevent polymerization.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, skin, upper resp sys; drow; in animals: narco **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap flush prompt **Breath:** Resp support **Swallow:** Medical attention immed	

VM & P Naphtha	**Formula:**	**CAS#:** 8032-32-4	**RTECS#:** OI6180000	**IDLH:** N.D.
Conversion:	**DOT:** 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/m^3 C 1800 mg/m^3 [15-minute] **OSHA PEL†:** none			**Measurement Methods (see Table 1):** **NIOSH** 1550 **OSHA** 48	
Physical Description: Clear to yellowish liquid with a pleasant, aromatic odor.				
Chemical & Physical Properties: **MW:** 87-114 (approx) **BP:** 203-320°F **Sol:** Insoluble **Fl.P:** 20-55°F **IP:** ? **Sp.Gr(60°F):** 0.73-0.76 **VP:** 2-20 mmHg **FRZ:** ? **UEL:** 6.0% **LEL:** 1.2% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **3500 mg/m^3:** CcrOv/Sa **8750 mg/m^3:** Sa:Cf/PaprOv **17,500 mg/m^3:** CcrFOv/GmFOv/PaprTOv/ ScbaF/SaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: None reported [**Note:** VM&P Naphtha is a refined petroleum solvent predominantly C_7-C_{11} which is typically 55% paraffins, 30% monocycloparaffins, 2% dicycloparaffins & 12% alklybenzenes.]				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Ing, Con **SY:** Irrit eyes, upper resp sys; derm; CNS depres; chemical pneu (aspir liquid) **TO:** Eyes, skin, resp sys, CNS			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	

Warfarin

Formula:	CAS#:	RTECS#:	IDLH:
$C_{19}H_{16}O_4$	81-81-2	GN4550000	100 mg/m^3

Conversion: **DOT:**

Synonyms/Trade Names: 3-(α-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/m^3
OSHA PEL: TWA 0.1 mg/m^3

Measurement Methods (see Table 1):
NIOSH 5002

Physical Description: Colorless, odorless, crystalline powder. [rodenticide]

Chemical & Physical Properties:
MW: 308.3
BP: Decomposes
Sol: 0.002%
Fl.P: ?
IP: ?
Sp.Gr: ?
VP(71°F): 0.09 mmHg
MLT: 322°F
UEL: ?
LEL: ?
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: N.R.
Wash skin: When contam
Remove: When wet or contam
Change: Daily

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
0.5 mg/m^3: Qm
1 mg/m^3: 95XQ/Sa
2.5 mg/m^3: Sa:Cf/PaprHie
5 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
100 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Strong oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Hema, back pain; hematoma arms, legs; epis, bleeding lips, muc memb hemorr; abdom pain, vomit, fecal blood; petechial rash; abnor hematologic indices
TO: Blood, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Welding fumes

Formula:	CAS#:	RTECS#:	IDLH:
		ZC2550000	Ca [N.D.]

Conversion: **DOT:**

Synonyms/Trade Names: Synonyms vary depending upon the specific component of the welding fumes.

Exposure Limits:
NIOSH REL: Ca
See Appendix A
OSHA PEL†: none

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303

Physical Description: Fumes generated by the process of joining or cutting pieces of metal by heat, pressure, or both.

Chemical & Physical Properties:
Properties vary depending upon the specific component of the welding fumes.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv100/ScbaE

Incompatibilities and Reactivities: Varies

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Symptoms vary depending upon the specific component of the welding fumes; metal fume fever: flu-like symptoms, dysp, cough, musc pain, fever, chills; interstitial pneu; [carc]
TO: Eyes, skin, resp sys, CNS [lung cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support

Wood dust	**Formula:**	**CAS#:**	**RTECS#:**	**IDLH:**
			ZC9850000	Ca [N.D.]

Conversion: **DOT:**

Synonyms/Trade Names: Hard wood dust, Soft wood dust, Western red cedar dust

Exposure Limits:
NIOSH REL: Ca
TWA 1 mg/m^3
See Appendix A
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500

Physical Description: Dust from various types of wood.

Chemical & Physical Properties:
MW: varies
BP: NA
Sol: ?
Fl.P: NA
IP: NA
Sp.Gr: ?
VP: 0 mmHg (approx)
MLT: NA
UEL: NA
LEL: NA
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes; epis; derm; resp hypersensitivity; granulomatous pneu; asthma, cough, wheez, sinusitis; prolonged colds; [carc]
TO: Eyes, skin, resp sys [nasal cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air

m-Xylene	**Formula:**	**CAS#:**	**RTECS#:**	**IDLH:**
	$C_6H_4(CH_3)_2$	108-38-3	ZE2275000	900 ppm

Conversion: 1 ppm = 4.34 mg/m^3 **DOT:** 1307 130

Synonyms/Trade Names: 1,3-Dimethylbenzene; meta-Xylene; m-Xylol

Exposure Limits:
NIOSH REL: TWA 100 ppm (435 mg/m^3)
ST 150 ppm (655 mg/m^3)
OSHA PEL†: TWA 100 ppm (435 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1501, 3800
OSHA 1002

Physical Description: Colorless liquid with an aromatic odor.

Chemical & Physical Properties:
MW: 106.2
BP: 282°F
Sol: Slight
Fl.P: 82°F
IP: 8.56 eV
Sp.Gr: 0.86
VP: 9 mmHg
FRZ: -54°F
UEL: 7.0%
LEL: 1.1%
Class IC Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
900 ppm: CcrOv*/PaprOv*/ Sa*/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat; dizz, excitement, drow, inco, staggering gait; corn vacuolization; anor, nau, vomit, abdom pain; derm
TO: Eyes, skin, resp sys, CNS, GI tract, blood, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

o-Xylene	Formula: $C_6H_4(CH_3)_2$	CAS#: 95-47-6	RTECS#: ZE2450000	IDLH: 900 ppm
Conversion: 1 ppm = 4.34 mg/m^3	**DOT:** 1307 130			
Synonyms/Trade Names: 1,2-Dimethylbenzene; ortho-Xylene; o-Xylol				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3) **OSHA PEL†:** TWA 100 ppm (435 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1501, 3800 **OSHA** 1002	
Physical Description: Colorless liquid with an aromatic odor.				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 106.2 **BP:** 292°F **Sol:** 0.02% **FI.P:** 90°F **IP:** 8.56 eV **Sp.Gr:** 0.88 **VP:** 7 mmHg **FRZ:** -13°F **UEL:** 6.7% **LEL:** 0.9% Class IC Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.	**NIOSH/OSHA** **900 ppm:** CcrOv*/PaprOv*/ Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, nose, throat; dizz, excitement, drow, inco, staggering gait; corn vacuolization; anor, nau, vomit, abdom pain; derm **TO:** Eyes, skin, resp sys, CNS, GI tract, blood, liver, kidneys	**Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

p-Xylene	Formula: $C_6H_4(CH_3)_2$	CAS#: 106-42-3	RTECS#: ZE2625000	IDLH: 900 ppm
Conversion: 1 ppm = 4.41 mg/m^3	**DOT:** 1307 130			
Synonyms/Trade Names: 1,4-Dimethylbenzene; para-Xylene; p-Xylol				
Exposure Limits: **NIOSH REL:** TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3) **OSHA PEL†:** TWA 100 ppm (435 mg/m^3)			**Measurement Methods (see Table 1):** **NIOSH** 1501, 3800 **OSHA** 1002	
Physical Description: Colorless liquid with an aromatic odor. [**Note:** A solid below 56°F.]				

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 106.2 **BP:** 281°F **Sol:** 0.02% **FI.P:** 81°F **IP:** 8.44 eV **Sp.Gr:** 0.86 **VP:** 9 mmHg **FRZ:** 56°F **UEL:** 7.0% **LEL:** 1.1% Class IC Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R.	**NIOSH/OSHA** **900 ppm:** CcrOv*/PaprOv*/ Sa*/ScbaF **§:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, nose, throat; dizz, excitement, drow, inco, staggering gait; corn vacuolization; anor, nau, vomit, abdom pain; derm **TO:** Eyes, skin, resp sys, CNS, GI tract, blood, liver, kidneys	**Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

X

m-Xylene α,α'-diamine	Formula: $C_6H_4(CH_2NH_2)_2$	CAS#: 1477-55-0	RTECS#: PF8970000	IDLH: N.D.
Conversion:	**DOT:**			

Synonyms/Trade Names: 1,3-bis(Aminomethyl)benzene; 1,3-Benzenedimethanamine; MXDA; m-Phenylenebis(methylamine); m-Xylylenediamine

Exposure Limits:
NIOSH REL: C 0.1 mg/m^3 [skin]
OSHA PEL†: none

Measurement Methods (see Table 1):
OSHA 105

Physical Description: Colorless liquid.

Chemical & Physical Properties:
MW: 136.2
BP: 477°F
Sol: Miscible
Fl.P: 243°F
IP: ?
Sp.Gr: 1.032
VP(77°F): 0.03 mmHg
FRZ: 58°F
UEL: ?
LEL: ?
Class IIIB Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: None reported

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: In animals: irrit eyes, skin; liver, kidney, lung damage
TO: Eyes, skin, resp sys, liver, kidneys

First Aid (see Table 6):
Eye: Irr immed
Skin: Water flush immed
Breath: Resp support
Swallow: Medical attention immed

Xylidine	Formula: $(CH_3)_2C_6H_3NH_2$	CAS#: 1300-73-8	RTECS#: ZE8575000	IDLH: 50 ppm
Conversion: 1 ppm = 4.96 mg/m^3	**DOT:** 1711 153			

Synonyms/Trade Names: Aminodimethylbenzene, Aminoxylene, Dimethylaminobenzene, Dimethylaniline, Xylidine isomers (e.g., 2,4-Dimethylaniline)
[**Note:** Dimethylaniline is also used as a synonym for N,N-Dimethylaniline.]

Exposure Limits:
NIOSH REL: TWA 2 ppm (10 mg/m^3) [skin]
OSHA PEL†: TWA 5 ppm (25 mg/m^3) [skin]

Measurement Methods (see Table 1):
NIOSH 2002

Physical Description: Pale-yellow to brown liquid with a weak, aromatic, amine-like odor.

Chemical & Physical Properties:
MW: 121.2
BP: 415-439°F
Sol: Slight
Fl.P: 206°F (2,3-)
IP: 7.65 eV (2,4-)
7.30 eV (2,6-)
Sp.Gr: 0.98
VP: <1 mmHg
FRZ: -33°F
UEL: ?
LEL: 1.0% (o-isomer)
Class IIIB Combustible Liquid (2,3-)

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
20 ppm: CcrOv/Sa
50 ppm: Sa:Cf/CcrFOv/GmFOv/PaprOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, hypochlorite salts

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Anoxia, cyan, methemo; lung, liver, kidney damage
TO: Resp sys, blood, liver, kidneys, CVS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash immed
Breath: Resp support
Swallow: Medical attention immed

X

Yttrium

Formula:	CAS#:	RTECS#:	IDLH:
Y	7440-65-5	ZG2980000	500 mg/m^3 (as Y)

Conversion: **DOT:**

Synonyms/Trade Names: Yttrium metal

Exposure Limits:
NIOSH REL*: TWA 1 mg/m^3
OSHA PEL*: TWA 1 mg/m^3
[***Note:** The REL and PEL also apply to other yttrium compounds (as Y).]

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 7303, 9102
OSHA ID121

Physical Description: Dark-gray to black, odorless solid.

Chemical & Physical Properties:
MW: 88.9
BP: 5301°F
Sol: Soluble in hot H_2O
FI.P: NA
IP: NA
Sp.Gr: 4.47
VP: 0 mmHg (approx)
MLT: 2732°F
UEL: NA
LEL: NA
Noncombustible Solid in bulk form.

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
5 mg/m^3: Qm
10 mg/m^3: 95XQ/Sa
25 mg/m^3: Sa:Cf/PaprHie
50 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
500 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes; in animals: pulm irrit; eye inj; possible liver damage
TO: Eyes, resp sys, liver

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Zinc chloride fume

Formula:	CAS#:	RTECS#:	IDLH:
$ZnCl_2$	7646-85-7	ZH1400000	50 mg/m^3

Conversion: **DOT:** 2331 154

Synonyms/Trade Names: Zinc dichloride fume

Exposure Limits:
NIOSH REL: TWA 1 mg/m^3
ST 2 mg/m^3
OSHA PEL†: TWA 1 mg/m^3

Measurement Methods (see Table 1):
OSHA ID121

Physical Description: White particulate dispersed in air.

Chemical & Physical Properties:
MW: 136.3
BP: 1350°F
Sol(70°F): 435%
FI.P: NA
IP: NA
Sp.Gr(77°F): 2.91
VP: 0 mmHg (approx)
MLT: 554°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
10 mg/m^3: 95XQ*/Sa*
25 mg/m^3: Sa:Cf*/PaprHie*
50 mg/m^3: 100F/PaprTHie*/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Potassium

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Irrit eyes, skin, nose, throat; conj; cough, copious sputum; dysp, chest pain, pulm edema, pneu; pulm fib, cor pulmonale; fever; cyan; tachypnea; skin burns
TO: Eyes, skin, resp sys, CVS

First Aid (see Table 6):
Breath: Resp support

Zinc oxide

Formula: ZnO | **CAS#:** 1314-13-2 | **RTECS#:** ZH4810000 | **IDLH:** 500 mg/m^3

Conversion: | **DOT:** 1516 143

Synonyms/Trade Names: Zinc peroxide

Exposure Limits:
NIOSH REL: Dust: TWA 5 mg/m^3
C 15 mg/m^3
Fume: TWA 5 mg/m^3
ST 10 mg/m^3
OSHA PEL†: TWA 5 mg/m^3 (fume)
TWA 15 mg/m^3 (total dust)
TWA 5 mg/m^3 (resp dust)

Measurement Methods (see Table 1):
NIOSH 7303, 7502
OSHA ID121, ID143

Physical Description: White, odorless solid.

Chemical & Physical Properties:
MW: 81.4
BP: ?
Sol(64°F): 0.0004%
Fl.P: NA
IP: NA
Sp.Gr: 5.61
VP: 0 mmHg (approx)
MLT: 3587°F
UEL: NA
LEL: NA
Noncombustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
50 mg/m^3: 95XQ/Sa
125 mg/m^3: Sa:Cf/PaprHie
250 mg/m^3: 100F/SaT:Cf/PaprTHie/ScbaF/SaF
500 mg/m^3: Sa:Pd,Pp
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Chlorinated rubber (at 419°F), water
[**Note:** Slowly decomposed by water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh
SY: Metal fume fever: chills, musc ache, nau, fever, dry throat, cough; lass; metallic taste; head; blurred vision; low back pain; vomit; mal; chest tight; dysp, rales, decr pulm func
TO: Resp sys

First Aid (see Table 6):
Breath: Resp support

Zinc stearate

Formula: $Zn(C_{18}H_{35}O_2)_2$ | **CAS#:** 557-05-1 | **RTECS#:** ZH5200000 | **IDLH:** N.D.

Conversion: | **DOT:**

Synonyms/Trade Names: Dibasic zinc stearate, Zinc salt of stearic acid, Zinc distearate

Exposure Limits:
NIOSH REL: TWA 10 mg/m^3 (total)
TWA 5 mg/m^3 (resp)
OSHA PEL†: TWA 15 mg/m^3 (total)
TWA 5 mg/m^3 (resp)

Measurement Methods (see Table 1):
NIOSH 0500, 0600

Physical Description: Soft, white powder with a slight, characteristic odor.

Chemical & Physical Properties:
MW: 632.4
BP: ?
Sol: Insoluble
Fl.P(oc): 530°F
IP: NA
Sp.Gr: 1.10
VP: 0 mmHg (approx)
MLT: 266°F
UEL: ?
LEL: ?
MEC: 20 g/m^3
Combustible Solid

Personal Protection/Sanitation (see Table 2):
Skin: N.R.
Eyes: N.R.
Wash skin: N.R.
Remove: N.R.
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
Not available.

Incompatibilities and Reactivities: Oxidizers, dilute acids
[**Note:** Hydrophobic (i.e., repels water).]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, skin, upper resp sys; cough
TO: Eyes, skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Fresh air
Swallow: Medical attention immed

Zirconium compounds (as Zr)	Formula: Zr (metal)	CAS#: 7440-67-7 (metal)	RTECS#: ZH7070000 (metal)	IDLH: 50 mg/m^3 (as Zr)
Conversion:	**DOT:** 1358 170 (powder, wet); 1932 135 (scrap); 2008 135 (powder, dry)			

Synonyms/Trade Names: **Zirconium metal:** Zirconium
Synonyms of other zirconium compounds vary depending upon the specific compound.

Exposure Limits:
NIOSH REL*: TWA 5 mg/m^3
ST 10 mg/m^3
[***Note:** The REL applies to all zirconium compounds (as Zr) except Zirconium tetrachloride.]
OSHA PEL†: TWA 5 mg/m^3

Measurement Methods (see Table 1):
NIOSH 7300, 7301, 9102
OSHA ID121

Physical Description: Metal: Soft, malleable, ductile, solid or gray to gold, amorphous powder.

Chemical & Physical Properties:
MW: 91.2
BP: 6471°F
Sol: Insoluble
FI.P: NA
IP: NA
Sp.Gr: 6.51 (Metal)
VP: 0 mmHg (approx)
MLT: 3375°F
UEL: NA
LEL: NA
Metal: Combustible, but solid form is difficult to ignite; however, powder form may ignite SPONTANEOUSLY and can continue burning under water.

Personal Protection/Sanitation (see Table 2):
Recommendations regarding personal protective clothing vary depending upon the specific compound.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
25 mg/m^3: Qm
50 mg/m^3: 95XQ/PaprHie/100F/Sa/ScbaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: 100F/ScbaE

Incompatibilities and Reactivities: Potassium nitrate, oxidizers
[**Note:** Fine powder may be stored completely immersed in water.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Con
SY: Skin, lung granulomas; in animals: irrit skin, muc memb; X-ray evidence of retention in lungs
TO: Skin, resp sys

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

APPENDICES

Appendix A
NIOSH POTENTIAL OCCUPATIONAL CARCINOGENS

New Policy (Adopted September 1995)

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.

Appendix A (Continued)
NIOSH POTENTIAL OCCUPATIONAL CARCINOGENS

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 the following 13 chemicals identified as potential occupational carcinogens:

- 2-Acetylaminofluorene
- 4-Aminodiphenyl
- Benzidine
- bis-Chloromethyl ether
- 3,3'-Dichlorobenzidine
- 4-Dimethylaminoazobenzene
- Ethyleneimine
- Methyl chloromethyl ether
- α-Naphthylamine
- β-Naphthylamine
- 4-Nitrobiphenyl
- N-Nitrosodimethylamine
- β-Propiolactone

Exposures of workers to these 13 chemicals are to be controlled through the required use of engineering controls, work practices, and personal protective equipment, including respirators. OSHA respirator requirements for these chemicals are provided in Appendix E (page 351). See 29 CFR 1910.1003 - 1910.1016 for more specific details of these requirements.

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 the following nine related low-molecular-weight aldehydes:

- Acrolein (CAS# 107-02-8)
- Butyraldehyde (CAS# 123-72-8)
- Crotonaldehyde (CAS# 4170-30-3)
- Glutaraldehyde (CAS# 111-30-8)
- Glyoxal (CAS# 107-22-2)
- Paraformaldehyde (CAS# 30525-89-4)
- Propiolaldehyde (CAS# 624-67-9)
- Propionaldehyde (CAS# 123-38-6)
- n-Valeraldehyde (CAS# 110-62-3)

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 *NIOSH Current Intelligence Bulletin 55: Carcinogenicity of Acetaldehyde and Malonaldehyde, and Mutagenicity of Related Low-Molecular-Weight Aldehydes* [DHHS (NIOSH) Publication No. 91-112]. This document is available on the NIOSH Web site (http://www.cdc.gov/niosh/91112_55.html).

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 (cummingtonite-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.

Appendix C (Continued)
SUPPLEMENTARY EXPOSURE LIMITS

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* [DHHS (NIOSH) Publication No. 81-106] (http://www.cdc.gov/niosh/81-106.html). 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 the following four chemicals to be potential occupational carcinogens:

- Ethylene dichloride
- Hexachloroethane
- 1,1,2,2-Tetrachloroethane
- 1,1,2-Trichloroethane

Additionally, NIOSH recommends that the following five other chloroethane compounds be treated in the workplace with caution because of their structural similarity to the four chloroethanes shown to be carcinogenic in animals:

- 1,1-Dichloroethane
- Ethyl chloride
- Methyl chloroform
- Pentachloroethane
- 1,1,1,2-Tetrachloroethane

Chromic Acid and Chromates (as CrO_3), 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)/m^3 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/m^3 for chromium metal and chromium(II) and chromium(III) compounds.

The OSHA PEL is 0.1 mg CrO_3/m^3 (ceiling) for chromic acid and chromates (including tert-butyl chromate with a "skin" designation and zinc chromate); 0.5 mg Cr/m^3 (8-hour TWA) for chromium(II) and chromium(III) compounds; and 1 mg Cr/m^3 (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/m^3 (cyclohexane-extractable fraction).

The OSHA PEL (8-hour TWA) for coal tar pitch volatiles is 0.2 mg/m^3 (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 β-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/m^3 (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/m^3 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/m^3 for yarn manufacturing and cotton washing operations, 0.500 mg/m^3 for textile mill waste house operations or for dust from "lower grade washed cotton" used during yarn

manufacturing, and 0.750 mg/m^3 for textile slashing and weaving operations. The OSHA standard 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 a 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 (10-hour TWA) is 0.050 mg/m^3; 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/m^3; 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/m^3.

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 "%SiO_2 + 5" or 10 mg/m^3 divided by the value "%SiO_2 + 2." The OSHA PEL (8-hour TWA) for crystalline silica (as total quartz) is 30 mg/m^3 divided by the value "%SiO_2 + 2." The OSHA PELs (8-hour TWAs) for cristobalite and tridymite are ½ 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/m^3 divided by the value "%SiO_2," 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% SiO_2 is 2.4 mg/m^3 divided by the value "%SiO_2 + 2." The OSHA PEL (8-hour TWA) for coal dust (as the respirable fraction) containing greater than or equal to 5% SiO_2 is 10 mg/m^3 divided by the value "%SiO_2 + 2."

NIAX® Catalyst ESN

In May 1978, OSHA and NIOSH jointly published *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 use 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/m^3; the applicable OSHA PEL is 0.1 mg Co/m^3 (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 (≥ 5% SiO_2) [**TWA** 0.1 mg/m^3 (as the respirable quartz fraction)]
- Ethyl bromide [**TWA** 200 ppm, **STEL** 250 ppm]
- Ethylene glycol [**C** 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 the following compounds:

- α-Alumina
- Benomyl
- Emery
- Glycerine (mist)
- Graphite (synthetic)
- Magnesium oxide fume
- Molybdenum (insoluble compounds as Mo)
- Particulates not otherwise regulated
- Picloram
- 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.

- 2-Acetylaminofluorene
- 4-Aminodiphenyl
- Benzidine
- bis-Chloromethyl ether
- 3,3'-Dichlorobenzidine (and its salts)
- 4-Dimethylaminoazobenezene
- Ethyleneimine
- Methyl chloromethyl ether
- α-Naphthylamine
- β-Naphthylamine
- 4-Nitrobiphenyl
- N-Nitrosodimethylamine
- β-Propiolactone

Acrylonitrile (1910.1045)

Airborne Concentration or Condition of Use	Respirator Type
≤ 20 ppm (parts per million)	**(1)** Chemical cartridge respirator with organic vapor cartridge(s) and half-mask facepiece; or **(2)** Supplied-air respirator with half-mask facepiece.
≤ 100 ppm or maximum use concentration of cartridges or canisters, whichever is lower	**(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.
≤ 4,000 ppm	Supplied-air respirator operated in positive-pressure mode with full facepiece, helmet, suit, or hood.
> 4,000 ppm or unknown concentration	**(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.
Firefighting	Self-contained breathing apparatus with full facepiece in positive-pressure mode.
Escape	**(1)** Any organic vapor respirator; or **(2)** Any self-contained breathing apparatus.

Appendix E (Continued)
OSHA Respirator Requirements for Selected Chemicals

Arsenic, inorganic (1910.1018)

Requirements for Respiratory Protection for Inorganic Arsenic Particulate
Except for Those With Significant Vapor Pressure

Airborne Concentration (as As) or Condition of Use	Required Respirator
≤ 100 µg/m^3 (micrograms per cubic meter)	**(1)** Half-mask air-purifying respirator equipped with high-efficiency filter*; or **(2)** Any half-mask supplied air respirator.
≤ 500 µg/m^3	**(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.
≤ 10,000 µg/m^3	**(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.
≤ 20,000 µg/m^3	Supplied-air respirator with full facepiece, hood, or helmet or suit, operated in positive-pressure mode.
> 20,000 µg/m^3, unknown concentrations, or firefighting	Any full-facepiece self-contained breathing apparatus operated in positive-pressure mode.

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

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

Airborne Concentration (as As) or Condition of Use	Required Respirator
≤ 100 µg/m^3 (micrograms per cubic meter)	**(1)** Half-mask* air-purifying respirator equipped with high-efficiency filter** and acid gas cartridge; or **(2)** Any half-mask* supplied-air respirator.
≤ 500 µg/m^3	**(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.
≤ 10,000 µg/m^3	Half-mask* supplied-air respirator operated in positive-pressure mode.
≤ 20,000 µg/m^3	Supplied-air respirator with full facepiece, hood, or helmet or suit, operated in positive-pressure mode.
> 20,000 µg/m^3, unknown concentrations, or firefighting	Any full-facepiece self-contained breathing apparatus operated in positive-pressure mode.

* 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-disperesed particles of 0.3 µm (micrometers) in diameter or higher.

Appendix E (Continued)
OSHA Respirator Requirements for Selected Chemicals

Asbestos (1910.1001 & 1926.1101)

Airborne Concentration or Condition of Use	Required Respirator
≤ 1 f/cm^3 (fibers per cubic centimeter) (10 X PEL)	Half-mask air-purifying respirator other than a disposable respirator, equipped with high-efficiency filters*.
≤ 5 f/cm^3 (50 X PEL)	Full-facepiece air-purifying respirator equipped with high-efficiency filters*.
≤ 10 f/cm^3 (100 X PEL)	Any powered air-purifying respirator equipped with high-efficiency filters* or any supplied-air respirator operated in continuous-flow mode.
≤ 100 f/cm^3 (1,000 X PEL)	Full-facepiece supplied air respirator operated in pressure-demand mode.
> 100 f/cm^3 (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)

Airborne Concentration or Condition of Use	Required Respirator
≤ 10 ppm (parts per million)	Half-mask air-purifying respirator with organic vapor cartridge.
≤ 50 ppm	**(1)** Full-facepiece respirator with organic vapor cartridges; or **(2)** Full-facepiece gas mask with chin-style canisters*.
≤ 100 ppm	Full-facepiece powered air-purifying respirator with organic vapor canister*.
≤ 1,000 ppm	Supplied-air respirator with full facepiece in positive-pressure mode.
> 1,000 ppm or unknown concentration	**(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.
Escape	**(1)** Any organic vapor gas mask; or **(2)** Any self-contained breathing apparatus with full facepiece.
Firefighting	Full-facepiece self-contained breathing apparatus in positive-pressure mode.

* 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.

Appendix E (Continued)
OSHA Respirator Requirements for Selected Chemicals

1,3-Butadiene (1910.1051)

Airborne Concentration or Condition of Use	Required Respirator
≤ 5 ppm (parts per million)	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.
≤ 10 ppm	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.
≤ 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.
≤ 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.
≤ 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.

Appendix E (Continued)
OSHA Respirator Requirements for Selected Chemicals

Cadmium (1910.1027 & 1926.1127)

Airborne Concentration or Condition of Use	Required Respirator
≤ 50 µg/m^3 (micrograms per cubic meter)	Half-mask, air-purifying respirator equipped with a high-efficiency filter*.
≤ 125 µg/m^3	**(1)** Powered air-purifying respirator with a loose-fiting 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.
≤ 250 µg/m^3	**(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.
≤ 1,250 µg/m^3	**(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.
≤ 5,000 µg/m^3	Supplied-air respirator with half-mask or full facepiece operated in pressure-demand or other positive-pressure mode.
> 5,000 µg/m^3 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/m^3 = 50 µg/m^3). 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)

Airborne Concentration	Required Respirator
≤ 1500 µg/m^3 (micrograms per cubic meter)	**(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.
Any concentrations	**(1)** Type C supplied-air respirator [see page 360] 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.

Cotton dust (1910.1043)

Airborne Concentration	Required Respirator
≤ 5 X PEL	Disposable respirator* with a particulate filter.
≤ 10 X PEL	Quarter- or half-mask respirator, other than a disposable respirator, equipped with particulate filters.
≤ 100 X PEL	Full-facepiece respirator equipped with high-efficiency particulate filters**.
> 100 X PEL	Powered air-purifying respirator equipped with high-efficiency particulate filters.

* 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)

Airborne Concentration or Condition of Use	Required Respirator
≤ 10 ppb (parts per billion)	**(1)** Any supplied-air respirator; or **(2)** any self-contained breathing apparatus.
≤ 50 ppb	**(1)** Any supplied-air respirator with full facepiece, helmet, or hood; or **(2)** any self-contained breathing apparatus with full facepiece.
≤ 1,000 ppb	Type C supplied-air respirator [see page 360] operated in pressure-demand or other positive-pressure or continuous-flow mode.
≤ 2,000 ppb	Type C supplied-air respirator [see page 360] with full facepiece operated in pressure-demand or other positive-pressure mode, or with full facepiece, helmet, or hood operated in continuous-flow mode.
> 2,000 ppb or entry and escape from unknown concentrations	**(1)** A combination respirator which includes a Type C supplied-air respirator [see page 360] 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.
Firefighting	Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive-pressure mode.

Ethylene oxide (1910.1047)

Airborne Concentration or Condition of Use	Required Respirator
≤ 50 ppm (parts per million)	Full-facepiece respirator with ethylene oxide approved canister, front- or back-mounted.
≤ 2,000 ppm	**(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.
> 2,000 ppm or unknown concentrations	**(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.
Firefighting	Positive-pressure self-contained breathing apparatus equipped with full facepiece.
Escape	Any respirator described above.

Formaldehyde (1910.1048)

Airborne Concentration or Condition of Use	Required Respirator
≤ 7.5 ppm (parts per million) (10 X PEL)	Full-facepiece respirator with cartridges or canisters specifically approved for protection against formaldehyde*.
≤ 75 ppm (100 X PEL)	**(1)** Full-face mask respirator with chin style or chest- or back-mounted type with industrial size canister specifically approved for protection against formaldehyde; or **(2)** Type C supplied-air respirator [see page 360], demand type or continuous flow type, with full facepiece, hood, or helmet.
> 75 ppm (100 X PEL) or unknown concentrations (emergencies)	**(1)** Self-contained breathing apparatus with positive-pressure full-facepiece; or **(2)** Combination supplied-air, full-facepiece positive-pressure respirator with auxiliary self-contained air supply.
Firefighting	Self-contained breathing apparatus with positive-pressure in full facepiece.
Escape	**(1)** Self-contained breathing apparatus in demand or pressure-demand mode; or **(2)** Full-face mask respirator with chin-style or front- or back-mounted type industrial size canister specifically approved for protection against formaldehyde.

* A half-mask respirator with cartridges specifically approved for protection against formaldehyde can be substituted for the full-facepiece respirator providing that effective gas-proof goggles are provided and used in combination with the half-mask respirator.

Appendix E (Continued)
OSHA Respirator Requirements for Selected Chemicals

Lead (1910.1025 & 1926.62)

Respirator Requirements of 1910.1025 (General Industry Lead Standard)

Airborne Concentration or Condition of Use	Required Respirator
≤ 0.5 mg/m^3 (milligrams per cubic meter) (10 X PEL)	Half-mask* air-purifying respirator equipped with high-efficiency filters**.
≤ 2.5 mg/m^3 (50 X PEL)	Full-facepiece air-purifying respirator with high-efficiency filters**.
≤ 50 mg/m^3 (1000 X PEL)	**(1)** Any powered air-purifying respirator with high-efficiency filters**; or **(2)** Half-mask* supplied-air respirator operated in positive-pressure mode.
≤ 100 mg/m^3 (2000 X PEL)	Supplied-air respirators with full facepiece, hood, helmet, or suit, operated in positive-pressure mode.
> 100 mg/m^3, unknown concentration, or firefighting	Full-facepiece, self-contained breathing apparatus operated in positive-pressure mode.

* 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.

Respirator Requirements of 1926.62 (Construction Lead Standard)

Airborne Concentration or Condition of Use	Required Respirator
≤ 0.5 mg/m^3 (milligrams per cubic meter)	**(1)** Half-mask* air-purifying respirator with high-efficiency filters**; or **(2)** Half-mask* supplied-air respirator operated in demand (negative pressure) mode.
≤ 1.25 mg/m^3	**(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 [see page 360] operated in a continuous-flow mode).
≤ 2.5 mg/m^3	**(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.
≤ 50 mg/m^3	Half-mask* supplied-air respirator operated in pressure-demand or other positive-pressure mode.
≤ 100 mg/m^3	Full-facepiece supplied-air respirator operated in pressure-demand or other positive-pressure mode (e.g., Type CE abrasive blasting respirators [see page 360] operated in a continuous-flow mode).
> 100 mg/m^3, unknown concentration, or firefighting	Full-facepiece self-contained breathing apparatus in pressure-demand or other positive-pressure mode.

* 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)

Airborne Concentration or Condition of Use	Required Respirator
≤ 625 ppm (parts per million) (25 X PEL)	Continuous-flow supplied-air respirator, hood or helmet.
≤ 1250 ppm (50 X PEL)	**(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.
≤ 5,000 ppm (200 X PEL)	**(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.
> 5,000 ppm or unknown concentration	**(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.
Firefighting	Positive-pressure full-facepiece self-contained breathing apparatus.
Emergency escape	**(1)** Any continuous-flow or pressure-demand self-contained breathing apparatus; or **(2)** Gas mask with organic vapor canister.

4,4'-Methylenedianiline (1910.1050 & 1926.60)

Airborne Concentration or Condition of Use	Required Respirator
≤ 10 X PEL	Half-mask respirator with high-efficiency* cartridge**.
≤ 50 X PEL	Full-facepiece respirator with high-efficiency* cartridge or canister**.
≤ 1,000 X PEL	Full-facepiece powered air-purifying respirator with high-efficiency* cartridge**.
> 1,000 X PEL or unknown concentration	**(1)** Self-contained breathing apparatus with full facepiece in positive-pressure mode; or **(2)** Full-facepiece positive-pressure demand supplied-air respirator with auxiliary self-contained air supply.
Escape	**(1)** Any full-facepiece air-purifying respirator with high-efficiency* cartridges**; or **(2)** Any positive-pressure or continuous-flow self-contained breathing apparatus with full facepiece or hood.
Firefighting	Full-facepiece self-contained breathing apparatus in positive-pressure demand mode.

* 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.
** Combination High-Efficiency/Organic Vapor Cartridges shall be used whenever Methylenedianiline is in liquid form or a process requiring heat is used.

Appendix E (Continued)
OSHA Respirator Requirements for Selected Chemicals

Vinyl Chloride (1910.1017)

Airborne Concentration or Condition of Use	Required Respirator
≤ 10 ppm (parts per million)	**(1)** Combination Type C supplied-air respirator [see below], demand type, with half facepiece, and auxiliary self-contained air supply; **(2)** Type C supplied-air respirator [see below], 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.
≤ 25 ppm	**(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.
≤ 100 ppm	**(1)** Combination Type C supplied-air respirator [see below], 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 [see below], demand type, with full facepiece.
≤ 1,000 ppm	Type C supplied-air respirator [see below], continuous-flow type, with full or half facepiece, helmet, or hood.
≤ 3,600 ppm	**(1)** Combination Type C supplied-air respirator [see below], 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.
> 3,600 ppm or unknown concentration	Open-circuit self-contained breathing apparatus, pressure-demand type, with full facepiece.

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).

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.

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).

Octachloronaphthalene
Pentachloronaphthalene
Tetrachloronaphthalene
Trichloronaphthalene

IDLH values for these four chloronaphthalene compounds are unknown. The *Documentation for Immediately Dangerous to Life or Health Concentrations* (NTIS Publication Number PB-94-195047) 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* on the NIOSH Web site (http://www.cdc.gov/niosh/idlh/idlh-1.html).

Chemical	NIOSH REL/OSHA PEL	"Effective" IDLH (10 X REL/PEL)
Octachloronaphthalene	TWA 0.1 mg/m^3 *	1 mg/m^3
Pentachloronaphthalene	TWA 0.5 mg/m^3	5 mg/m^3
Tetrachloronaphthalene	TWA 5 mg/m^3	50 mg/m^3
Trichloronaphthalene	TWA 2 mg/m^3	20 mg/m^3

* NIOSH also recommends a STEL of 0.3 mg/m^3 for octachloronaphthalene; the TWA of 0.1 mg/m^3 was used to calculate the "Effective" IDLH of 1 mg/m^3.

Appendix G
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Acetaldehyde	**TWA** 100 ppm (180 mg/m^3), **ST** 150 ppm (270 mg/m^3)
Acetic anhydride	**C** 5 ppm (20 mg/m^3)
Acetone	**TWA** 750 ppm (1800 mg/m^3), **ST** 1000 ppm (2400 mg/m^3)
Acetonitrile	**TWA** 40 ppm (70 mg/m^3), **ST** 60 ppm (105 mg/m^3)
Acetylsalicyclic acid	**TWA** 5 mg/m^3
Acrolein	**TWA** 0.1 ppm (0.25 mg/m^3), **ST** 0.3 ppm (0.8 mg/m^3)
Acrylamide	**TWA** 0.03 mg/m^3 [skin]
Acrylic acid	**TWA** 10 ppm (30 mg/m^3) [skin]
Allyl alcohol	**TWA** 2 ppm (5 mg/m^3), **ST** 4 ppm (10 mg/m^3) [skin]
Allyl chloride	**TWA** 1 ppm (3 mg/m^3), **ST** 2 ppm (6 mg/m^3)
Allyl glycidyl ether	**TWA** 5 ppm (22 mg/m^3), **ST** 10 ppm (44 mg/m^3)
Allyl propyl disulfide	**TWA** 2 ppm (12 mg/m^3), **ST** 3 ppm (18 mg/m^3)
α-Alumina	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Aluminum (pyro powders & welding fumes, as Al)	**TWA** 5 mg/m^3
Aluminum (soluble salts & alkyls, as Al)	**TWA** 2 mg/m^3
Amitrole	**TWA** 0.2 mg/m^3
Ammonia	**ST** 35 ppm (27 mg/m^3)
Ammonium chloride fume	**TWA** 10 mg/m^3, **ST** 20 mg/m^3
Ammonium sulfamate	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Aniline (and homologs)	**TWA** 2 ppm (8 mg/m^3) [skin]
Atrazine	**TWA** 5 mg/m^3
Barium sulfate	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Benomyl	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Benzenethiol	**TWA** 0.5 ppm (2 mg/m^3)
Bismuth telluride (doped with selenium sulfide, as Bi_2Te_3)	**TWA** 5 mg/m^3
Borates, tetra, sodium salts (Anhydrous)	**TWA** 10 mg/m^3
Borates, tetra, sodium salts (Decahydrate)	**TWA** 10 mg/m^3
Borates, tetra, sodium salts (Pentahydrate)	**TWA** 10 mg/m^3
Boron oxide	**TWA** 10 mg/m^3
Boron tribromide	**C** 1 ppm (10 mg/m^3)
Bromacil	**TWA** 1 ppm (10 mg/m^3)
Bromine	**TWA** 0.1 ppm (0.7 mg/m^3), **ST** 0.3 ppm (2 mg/m^3)

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Bromine pentafluoride	**TWA** 0.1 ppm (0.7 mg/m^3)
n-Butane	**TWA** 800 ppm (1900 mg/m^3)
2-Butanone	**TWA** 200 ppm (590 mg/m^3), **ST** 300 ppm (885 mg/m^3)
2-Butoxyethanol	**TWA** 25 ppm (120 mg/m^3) [skin]
n-Butyl acetate	**TWA** 150 ppm (710 mg/m^3), **ST** 200 ppm (950 mg/m^3)
Butyl acrylate	**TWA** 10 ppm (55 mg/m^3)
n-Butyl alcohol	**C** 50 ppm (150 mg/m^3) [skin]
sec-Butyl alcohol	**TWA** 100 ppm (305 mg/m^3)
tert-Butyl alcohol	**TWA** 100 ppm (300 mg/m^3), **ST** 150 ppm (450 mg/m^3)
n-Butyl glycidyl ether	**TWA** 25 ppm (135 mg/m^3)
n-Butyl lactate	**TWA** 5 ppm (25 mg/m^3)
n-Butyl mercaptan	**TWA** 0.5 ppm (1.5 mg/m^3)
o-sec-Butylphenol	**TWA** 5 ppm (30 mg/m^3) [skin]
p-tert-Butyltoluene	**TWA** 10 ppm (60 mg/m^3), **ST** 20 ppm (120 mg/m^3)
Calcium cyanamide	**TWA** 0.5 mg/m^3
Caprolactam	Dust: **TWA** 1 mg/m^3, **ST** 3 mg/m^3 Vapor: **TWA** 5 ppm (20 mg/m^3), **ST** 10 ppm (40 mg/m^3)
Captafol	**TWA** 0.1 mg/m^3
Captan	**TWA** 5 mg/m^3
Carbofuran	**TWA** 0.1 mg/m^3
Carbon dioxide	**TWA** 10,000 ppm (18,000 mg/m^3) **ST** 30,000 ppm (54,000 mg/m^3)
Carbon disulfide	**TWA** 4 ppm (12 mg/m^3), **ST** 12 ppm (36 mg/m^3) [skin]
Carbon monoxide	**TWA** 35 ppm (40 mg/m^3), C 200 ppm (229 mg/m^3)
Carbon tetrabromide	**TWA** 0.1 ppm (1.4 mg/m^3), **ST** 0.3 ppm (4 mg/m^3)
Carbon tetrachloride	**TWA** 2 ppm (12.6 mg/m^3)
Carbonyl fluoride	**TWA** 2 ppm (5 mg/m^3), **ST** 5 ppm (15 mg/m^3)
Catechol	**TWA** 5 ppm (20 mg/m^3) [skin]
Cesium hydroxide	**TWA** 2 mg/m^3
Chlorinated camphene	**TWA** 0.5 mg/m^3, **ST** 1 mg/m^3 [skin]
Chlorine	**TWA** 0.5 ppm (1.5 mg/m^3), **ST** 1 ppm (3 mg/m^3)
Chlorine dioxide	**TWA** 0.1 ppm (0.3 mg/m^3), **ST** 0.3 ppm (0.9 mg/m^3)
Chloroacetyl chloride	**TWA** 0.05 ppm (0.2 mg/m^3)
o-Chlorobenzylidene malononitrile	**C** 0.05 ppm (0.4 mg/m^3) [skin]
Chlorodifluoromethane	**TWA** 1000 ppm (3500 mg/m^3)
Chloroform	**TWA** 2 ppm (9.78 mg/m^3)

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
1-Chloro-1-nitropropane	**TWA** 2 ppm (10 mg/m^3)
Chloropentafluoroethane	**TWA** 1000 ppm (6320 mg/m^3)
β-Chloroprene	**TWA** 10 ppm (35 mg/m^3) [skin]
o-Chlorostyrene	**TWA** 50 ppm (285 mg/m^3), **ST** 75 ppm (428 mg/m^3)
o-Chlorotoluene	**TWA** 50 ppm (250 mg/m^3)
Chlorpyrifos	**TWA** 0.2 mg/m^3 [skin]
Coal dust	**TWA** 2 mg/m^3 (<5% SiO_2) (resp dust) **TWA** 0.1 mg/m^3 (≥ 5% SiO_2) (resp quartz)
Cobalt metal dust & fume (as Co)	**TWA** 0.05 mg/m^3
Cobalt carbonyl (as Co)	**TWA** 0.1 mg/m^3
Cobalt hydrocarbonyl (as Co)	**TWA** 0.1 mg/m^3
Crag® herbicide	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Crufomate	**TWA** 5 mg/m^3
Cyanamide	**TWA** 2 mg/m^3
Cyanogen	**TWA** 10 ppm (20 mg/m^3)
Cyanogen chloride	**C** 0.3 ppm (0.6 mg/m^3)
Cyclohexanol	**TWA** 50 ppm (200 mg/m^3) [skin]
Cyclohexanone	**TWA** 25 ppm (100 mg/m^3) [skin]
Cyclohexylamine	**TWA** 10 ppm (40 mg/m^3)
Cyclonite	**TWA** 1.5 mg/m^3 [skin]
Cyclopentane	**TWA** 600 ppm (1720 mg/m^3)
Cyhexatin	**TWA** 5 mg/m^3
Decaborane	**TWA** 0.3 mg/m^3 (0.05 ppm), **ST** 0.9 mg/m^3 (0.15 ppm) [skin]
Diazinon®	**TWA** 0.1 mg/m^3 [skin]
2-N-Dibutylaminoethanol	**TWA** 2 ppm (14 mg/m^3)
Dibutyl phosphate	**TWA** 1 ppm (5 mg/m^3), **ST** 2 ppm (10 mg/m^3)
Dichloroacetylene	**C** 0.1 ppm (0.4 mg/m^3)
p-Dichlorobenzene	**TWA** 75 ppm (450 mg/m^3), **ST** 110 ppm (675 mg/m^3)
1,3-Dichloro-5,5-dimethylhydantoin	**TWA** 0.2 mg/m^3, **ST** 0.4 mg/m^3
Dichloroethyl ether	**TWA** 5 ppm (30 mg/m^3), **ST** 10 ppm (60 mg/m^3) [skin]
Dichloromonofluoromethane	**TWA** 10 ppm (40 mg/m^3)
1,1-Dichloro-1-nitroethane	**TWA** 2 ppm (10 mg/m^3)
1,3-Dichloropropene	**TWA** 1 ppm (5 mg/m^3) [skin]
2,2-Dichloropropionic acid	**TWA** 1 ppm (6 mg/m^3)
Dicrotophos	**TWA** 0.25 mg/m^3 [skin]

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Dicyclopentadiene	**TWA** 5 ppm (30 mg/m^3)
Dicyclopentadienyl iron	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Diethanolamine	**TWA** 3 ppm (15 mg/m^3)
Diethylamine	**TWA** 10 ppm (30 mg/m^3), **ST** 25 ppm (75 mg/m^3)
Diethylenetriamine	**TWA** 1 ppm (4 mg/m^3)
Diethyl ketone	**TWA** 200 ppm (705 mg/m^3)
Diethyl phthalate	**TWA** 5 mg/m^3
Diglycidyl ether	**TWA** 0.1 ppm (0.5 mg/m^3)
Diisobutyl ketone	**TWA** 25 ppm (150 mg/m^3)
N,N-Dimethylaniline	**TWA** 5 ppm (25 mg/m^3), **ST** 10 ppm (50 mg/m^3) [skin]
Dimethyl-1,2-dibromo-2,2-dichlorethyl phosphate	**TWA** 3 mg/m^3 [skin]
Dimethyl sulfate	**TWA** 0.1 ppm (0.5 mg/m^3) [skin]
Dinitolmide	**TWA** 5 mg/m^3
Di-sec octyl phthalate	**TWA** 5 mg/m^3, **ST** 10 mg/m^3
Dioxane	**TWA** 25 ppm (90 mg/m^3) [skin]
Dioxathion	**TWA** 0.2 mg/m^3 [skin]
Diphenylamine	**TWA** 10 mg/m^3
Dipropylene glycol methyl ether	**TWA** 100 ppm (600 mg/m^3) **ST** 150 ppm (900 mg/m^3) [skin]
Dipropyl ketone	**TWA** 50 ppm (235 mg/m^3)
Diquat (Diquat dibromide)	**TWA** 0.5 mg/m^3
Disulfiram	**TWA** 2 mg/m^3
Disulfoton	**TWA** 0.1 mg/m^3 [skin]
2,6-Di-tert-butyl-p-cresol	**TWA** 10 mg/m^3
Diuron	**TWA** 10 mg/m^3
Divinyl benzene	**TWA** 10 ppm (50 mg/m^3)
Emery	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Endosulfan	**TWA** 0.1 mg/m^3 [skin]
Epichlorohydrin	**TWA** 2 ppm (8 mg/m^3) [skin]
Ethanolamine	**TWA** 3 ppm (8 mg/m^3), **ST** 6 ppm (15 mg/m^3)
Ethion	**TWA** 0.4 mg/m^3 [skin]
Ethyl acrylate	**TWA** 5 ppm (20 mg/m^3), **ST** 25 ppm (100 mg/m^3) [skin]
Ethyl benzene	**TWA** 100 ppm (435 mg/m^3), **ST** 125 ppm (545 mg/m^3)
Ethyl bromide	**TWA** 200 ppm (890 mg/m^3), **ST** 250 ppm (1110 mg/m^3)
Ethylene chlorohydrin	**C** 1 ppm (3 mg/m^3) [skin]
Ethylene dichloride	**TWA** 1 ppm (4 mg/m^3), **ST** 2 ppm (8 mg/m^3)

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Ethylene glycol	**C** 50 ppm (125 mg/m^3)
Ethylene glycol dinitrate	**ST** 0.1 mg/m^3 [skin]
Ethyl ether	**TWA** 400 ppm (1200 mg/m^3), **ST** 500 ppm (1500 mg/m^3)
Ethylidene norbornene	**C** 5 ppm (25 mg/m^3)
Ethyl mercaptan	**TWA** 0.5 ppm (1 mg/m^3)
N-Ethylmorpholine	**TWA** 5 ppm (23 mg/m^3) [skin]
Ethyl silicate	**TWA** 10 ppm (85 mg/m^3)
Fenamiphos	**TWA** 0.1 mg/m^3 [skin]
Fensulfothion	**TWA** 0.1 mg/m^3
Fenthion	**TWA** 0.2 mg/m^3 [skin]
Ferbam	**TWA** 10 mg/m^3
Ferrovanadium dust	**TWA** 1 mg/m^3, **ST** 3 mg/m^3
Fluorotrichloromethane	**C** 1000 ppm (5600 mg/m^3)
Fonofos	**TWA** 0.1 mg/m^3 [skin]
Formamide	**TWA** 20 ppm (30 mg/m^3), **ST** 30 ppm (45 mg/m^3)
Furfural	**TWA** 2 ppm (8 mg/m^3) [skin]
Furfuryl alcohol	**TWA** 10 ppm (40 mg/m^3), **ST** 15 ppm (60 mg/m^3) [skin]
Gasoline	**TWA** 300 ppm (900 mg/m^3), **ST** 500 ppm (1500 mg/m^3)
Germanium tetrahydride	**TWA** 0.2 ppm (0.6 mg/m^3)
Glutaraldehyde	**C** 0.2 ppm (0.8 mg/m^3)
Glycerin (mist)	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Glycidol	**TWA** 25 ppm (75 mg/m^3)
Graphite (natural)	**TWA** 2.5 mg/m^3 (resp)
Graphite (synthetic)	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
n-Heptane	**TWA** 400 ppm (1600 mg/m^3), **ST** 500 ppm (2000 mg/m^3)
Hexachlorobutadiene	**TWA** 0.02 ppm (0.24 mg/m^3)
Hexachlorocyclopentadiene	**TWA** 0.01 ppm (0.1 mg/m^3)
Hexafluoroacetone	**TWA** 0.1 ppm (0.7 mg/m^3) [skin]
n-Hexane	**TWA** 50 ppm (180 mg/m^3)
Hexane isomers (except n-Hexane)	**TWA** 500 ppm (1800 mg/m^3), **ST** 1000 ppm (3600 mg/m^3)
2-Hexanone	**TWA** 5 ppm (20 mg/m^3)
Hexone	**TWA** 50 ppm (205 mg/m^3), **ST** 75 ppm (300 mg/m^3)
Hexylene glycol	**C** 25 ppm (125 mg/m^3)
Hydrazine	**TWA** 0.1 ppm (0.1 mg/m^3) [skin]
Hydrogenated terphenyls	**TWA** 0.5 ppm (5 mg/m^3)
Hydrogen bromide	**C** 3 ppm (10 mg/m^3)

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Hydrogen cyanide	**ST** 4.7 ppm (5 mg/m^3) [skin]
Hydrogen fluoride (as F)	**TWA** 3 ppm, **ST** 6 ppm
Hydrogen sulfide	**TWA** 10 ppm (14 mg/m^3), **ST** 15 ppm (21 mg/m^3)
2-Hydroxypropyl acrylate	**TWA** 0.5 ppm (3 mg/m^3) [skin]
Indene	**TWA** 10 ppm (45 mg/m^3)
Indium	**TWA** 0.1 mg/m^3
Iodoform	**TWA** 0.6 ppm (10 mg/m^3)
Iron pentacarbonyl (as Fe)	**TWA** 0.1 ppm (0.8 mg/m^3), **ST** 0.2 ppm (1.6 mg/m^3)
Iron salts (soluble, as Fe)	**TWA** 1 mg/m^3
Isoamyl alcohol (primary & secondary)	**TWA** 100 ppm (360 mg/m^3), **ST** 125 ppm (450 mg/m^3)
Isobutane	**TWA** 800 ppm (1900 mg/m^3)
Isobutyl alcohol	**TWA** 50 ppm (150 mg/m^3)
Isooctyl alcohol	**TWA** 50 ppm (270 mg/m^3) [skin]
Isophorone	**TWA** 4 ppm (23 mg/m^3)
Isophorone diisocyanate	**TWA** 0.005 ppm, **ST** 0.02 ppm [skin]
2-Isopropoxyethanol	**TWA** 25 ppm (105 mg/m^3)
Isopropyl acetate	**TWA** 250 ppm (950 mg/m^3), **ST** 310 ppm (1185 mg/m^3)
Isopropyl alcohol	**TWA** 400 ppm (980 mg/m^3), **ST** 500 ppm (1225 mg/m^3)
Isopropylamine	**TWA** 5 ppm (12 mg/m^3), **ST** 10 ppm (24 mg/m^3)
N-Isopropylaniline	**TWA** 2 ppm (10 mg/m^3) [skin]
Isopropyl glycidyl ether	**TWA** 50 ppm (240 mg/m^3), **ST** 75 ppm (360 mg/m^3)
Kaolin	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Ketene	**TWA** 0.5 ppm (0.9 mg/m^3), **ST** 1.5 ppm (3 mg/m^3)
Magnesium oxide fume	**TWA** 10 mg/m^3
Malathion	**TWA** 10 mg/m^3 [skin]
Manganese compounds and fume (as Mn)	Compounds: **C** 5 mg/m^3 Fume: **TWA** 1 mg/m^3, **ST** 3 mg/m^3
Manganese cyclopentadienyl tricarbonyl (as Mn)	**TWA** 0.1 mg/m^3 [skin]
Manganese tetroxide (as Mn)	**TWA** 1 mg/m^3
Mercury compounds, as Hg [except (organo) alkyls]	Hg Vapor: **TWA** 0.05 mg/m^3 [skin] Non-alkyl compounds: **C** 0.1 mg/m^3 [skin]
Mercury (organo) alkyl compounds (as Hg)	**TWA** 0.01 mg/m^3, **ST** 0.03 mg/m^3 [skin]
Mesityl oxide	**TWA** 15 ppm (60 mg/m^3), **ST** 25 ppm (100 mg/m^3)
Methacrylic acid	**TWA** 20 ppm (70 mg/m^3) [skin]
Methomyl	**TWA** 2.5 mg/m^3

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Methoxychlor	**TWA** 10 mg/m^3
4-Methoxyphenol	**TWA** 5 mg/m^3
Methyl acetate	**TWA** 200 ppm (610 mg/m^3), **ST** 250 ppm (760 mg/m^3)
Methyl acetylene-propadiene mixture	**TWA** 1000 ppm (1800 mg/m^3), **ST** 1250 ppm (2250 mg/m^3)
Methylacrylonitrile	**TWA** 1 ppm (3 mg/m^3) [skin]
Methyl alcohol	**TWA** 200 ppm (260 mg/m^3), **ST** 250 ppm (325 mg/m^3) [skin]
Methyl bromide	**TWA** 5 ppm (20 mg/m^3) [skin]
Methyl chloride	**TWA** 50 ppm (105 mg/m^3), **ST** 100 ppm (210 mg/m^3)
Methyl chloroform	**TWA** 350 ppm (1900 mg/m^3), **ST** 450 ppm (2450 mg/m^3)
Methyl-2-cyanoacrylate	**TWA** 2 ppm (8 mg/m^3), **ST** 4 ppm (16 mg/m^3)
Methylcyclohexane	**TWA** 400 ppm (1600 mg/m^3)
Methylcyclohexanol	**TWA** 50 ppm (235 mg/m^3)
o-Methylcyclohexanone	**TWA** 50 ppm (230 mg/m^3), **ST** 75 ppm (345 mg/m^3) [skin]
Methyl cyclopentadienyl manganese tricarbonyl (as Mn)	**TWA** 0.2 mg/m^3 [skin]
Methyl demeton	**TWA** 0.5 mg/m^3 [skin]
4,4'-Methylenebis(2-chloro-aniline)	**TWA** 0.02 ppm (0.22 mg/m^3) [skin]
Methylene bis (4-cyclo-hexylisocyanate)	**C** 0.01 ppm (0.11 mg/m^3) [skin]
Methyl ethyl ketone peroxide	**C** 0.7 ppm (5 mg/m^3)
Methyl formate	**TWA** 100 ppm (250 mg/m^3), **ST** 150 ppm (375 mg/m^3)
Methyl iodide	**TWA** 2 ppm (10 mg/m^3) [skin]
Methyl isoamyl ketone	**TWA** 50 ppm (240 mg/m^3)
Methyl isobutyl carbinol	**TWA** 25 ppm (100 mg/m^3), **ST** 40 ppm (165 mg/m^3) [skin]
Methyl isopropyl ketone	**TWA** 200 ppm (705 mg/m^3)
Methyl mercaptan	**TWA** 0.5 ppm (1 mg/m^3)
Methyl parathion	**TWA** 0.2 mg/m^3 [skin]
Methyl silicate	**TWA** 1 ppm (6 mg/m^3)
α-Methyl styrene	**TWA** 50 ppm (240 mg/m^3), **ST** 100 ppm (485 mg/m^3)
Metribuzin	**TWA** 5 mg/m^3
Mica	**TWA** 3 mg/m^3 (resp)
Molybdenum (insoluble compounds, as Mo)	**TWA** 10 mg/m^3
Monocrotophos	**TWA** 0.25 mg/m^3
Monomethyl aniline	**TWA** 0.5 ppm (2 mg/m^3) [skin]
Morpholine	**TWA** 20 ppm (70 mg/m^3), **ST** 30 ppm (105 mg/m^3) [skin]

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Naphthalene	**TWA** 10 ppm (50 mg/m^3), **ST** 15 ppm (75 mg/m^3)
Nickel metal & other compounds (as Ni)	Metal & insoluble compounds: **TWA** 1 mg/m^3 Soluble compounds: **TWA** 0.1 mg/m^3
Nitric acid	**TWA** 2 ppm (5 mg/m^3), **ST** 4 ppm (10 mg/m^3)
p-Nitroaniline	**TWA** 3 mg/m^3 [skin]
Nitrogen dioxide	**ST** 1 ppm (1.8 mg/m^3)
Nitroglycerine	**ST** 0.1 mg/m^3 [skin]
2-Nitropropane	**TWA** 10 ppm (35 mg/m^3)
Nitrotoluene (o-, m-, p-isomers)	**TWA** 2 ppm (11 mg/m^3) [skin]
Nonane	**TWA** 200 ppm (1050 mg/m^3)
Octachloronaphthalene	**TWA** 0.1 mg/m^3, **ST** 0.3 mg/m^3 [skin]
Octane	**TWA** 300 ppm (1450 mg/m^3), **ST** 375 ppm (1800 mg/m^3)
Osmium tetroxide (as Os)	**TWA** 0.002 mg/m^3 (0.0002 ppm), **ST** 0.006 mg/m^3 (0.0006 ppm)
Oxalic acid	**TWA** 1 mg/m^3, **ST** 2 mg/m^3
Oxygen difluoride	**C** 0.05 ppm (0.1 mg/m^3)
Ozone	**TWA** 0.1 ppm (0.2 mg/m^3), **ST** 0.3 ppm (0.6 mg/m^3)
Paraffin wax fume	**TWA** 2 mg/m^3
Paraquat	**TWA** 0.1 mg/m^3 (resp) [skin]
Pentaborane	**TWA** 0.005 ppm (0.01 mg/m^3), **ST** 0.015 ppm (0.03 mg/m^3)
Pentaerythritol	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
n-Pentane	**TWA** 600 ppm (1800 mg/m^3), **ST** 750 ppm (2250 mg/m^3)
2-Pentanone	**TWA** 200 ppm (700 mg/m^3), **ST** 250 ppm (875 mg/m^3)
Perchloryl fluoride	**TWA** 3 ppm (14 mg/m^3), **ST** 6 ppm (28 mg/m^3)
Petroleum distillates (naphtha)	**TWA** 400 ppm (1600 mg/m^3)
Phenothiazine	**TWA** 5 mg/m^3 [skin]
Phenyl glycidyl ether	**TWA** 1 ppm (6 mg/m^3)
Phenylhydrazine	**TWA** 5 ppm (20 mg/m^3), **ST** 10 ppm (45 mg/m^3) [skin]
Phenylphosphine	**C** 0.05 ppm (0.25 mg/m^3)
Phorate	**TWA** 0.05 mg/m^3, **ST** 0.2 mg/m^3 [skin]
Phosdrin	**TWA** 0.01 ppm (0.1 mg/m^3), **ST** 0.03 ppm (0.3 mg/m^3) [skin]
Phosphine	**TWA** 0.3 ppm (0.4 mg/m^3), **ST** 1 ppm (1 mg/m^3)
Phosphoric acid	**TWA** 1 mg/m^3, **ST** 3 mg/m^3
Phosphorus oxychloride	**TWA** 0.1 ppm (0.6 mg/m^3)
Phosphorus pentasulfide	**TWA** 1 mg/m^3, **ST** 3 mg/m^3
Phosphorus trichloride	**TWA** 0.2 ppm (1.5 mg/m^3), **ST** 0.5 ppm (3 mg/m^3)
Phthalic anhydride	**TWA** 6 mg/m^3 (1 ppm)
m-Phthalodinitrile	**TWA** 5 mg/m^3

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Picloram	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Piperazine dihydrochloride	**TWA** 5 mg/m^3
Platinum metal (as Pt)	**TWA** 1 mg/m^3
Portland cement	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Potassium hydroxide	**TWA** 2 mg/m^3
Propargyl alcohol	**TWA** 1 ppm (2 mg/m^3) [skin]
Propionic acid	**TWA** 10 ppm (30 mg/m^3)
Propoxur	**TWA** 0.5 mg/m^3
n-Propyl acetate	**TWA** 200 ppm (840 mg/m^3), **ST** 250 ppm (1050 mg/m^3)
n-Propyl alcohol	**TWA** 200 ppm (500 mg/m^3), **ST** 250 ppm (625 mg/m^3)
Propylene dichloride	**TWA** 75 ppm (350 mg/m^3), **ST** 110 ppm (510 mg/m^3)
Propylene glycol dinitrate	**TWA** 0.05 ppm (0.3 mg/m^3)
Propylene glycol monomethyl ether	**TWA** 100 ppm (360 mg/m^3), **ST** 150 ppm (540 mg/m^3)
Propylene oxide	**TWA** 20 ppm (50 mg/m^3)
n-Propyl nitrate	**TWA** 25 ppm (105 mg/m^3), **ST** 40 ppm (170 mg/m^3)
Resorcinol	**TWA** 10 ppm (45 mg/m^3), **ST** 20 ppm (90 mg/m^3)
Ronnel	**TWA** 10 mg/m^3
Rosin core solder, pyrolysis products (as formaldehyde)	**TWA** 0.1 mg/m^3
Rouge	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Silica, amorphous	**TWA** 6 mg/m^3, **TWA** 0.1 mg/m^3 (fused)
Silica, crystalline (as respirable dust)	**TWA** 0.05 mg/m^3 (cristobalite), **TWA** 0.05 mg/m^3 (tridymite), **TWA** 0.1 mg/m^3 (quartz), **TWA** 0.1 mg/m^3 (tripoli)
Silicon	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Silicon carbide	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Silicon tetrahydride	**TWA** 5 ppm (7 mg/m^3)
Soapstone	**TWA** 6 mg/m^3 (total), **TWA** 3 mg/m^3 (resp)
Sodium azide	**C** 0.1 ppm (as HN_3) [skin], **C** 0.3 mg/m^3 (as NaN_3) [skin]
Sodium bisulfite	**TWA** 5 mg/m^3
Sodium fluoroacetate	**TWA** 0.05 mg/m^3, **ST** 0.15 mg/m^3 [skin]
Sodium hydroxide	**C** 2 mg/m^3
Sodium metabisulfite	**TWA** 5 mg/m^3
Stoddard solvent	**TWA** 525 mg/m^3 (100 ppm)
Styrene	**TWA** 50 ppm (215 mg/m^3), **ST** 100 ppm (425 mg/m^3)
Subtilisins	**ST** 0.00006 mg/m^3 [60-minute]
Sulfur dioxide	**TWA** 2 ppm (5 mg/m^3), **ST** 5 ppm (13 mg/m^3)

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Sulfur monochloride	**C** 1 ppm (6 mg/m^3)
Sulfur tetrafluoride	**C** 0.1 ppm (0.4 mg/m^3)
Sulfuryl fluoride	**TWA** 5 ppm (20 mg/m^3), **ST** 10 ppm (40 mg/m^3)
Sulprofos	**TWA** 1 mg/m^3
Talc	**TWA** 2 mg/m^3 (resp)
Temephos	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Terphenyl (o-, m-, p-isomers)	**C** 5 mg/m^3 (0.5 ppm)
1,1,2,2-Tetrachloroethane	**TWA** 1 ppm (7 mg/m^3) [skin]
Tetrachloroethylene	**TWA** 25 ppm (170 mg/m^3)
Tetrahydrofuran	**TWA** 200 ppm (590 mg/m^3), **ST** 250 ppm (735 mg/m^3)
Tetrasodium pyrophosphate	**TWA** 5 mg/m^3
4,4'-Thiobis(6-tert-butyl-m-cresol)	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Thioglycolic acid	**TWA** 1 ppm (4 mg/m^3) [skin]
Thionyl chloride	**C** 1 ppm (5 mg/m^3)
Tin (organic compounds, as Sn)	**TWA** 0.1 mg/m^3 [skin]
Tin(II) oxide (as Sn)	**TWA** 2 mg/m^3
Tin(IV) oxide (as Sn)	**TWA** 2 mg/m^3
Titanium dioxide	**TWA** 10 mg/m^3
Toluene	**TWA** 100 ppm (375 mg/m^3), **ST** 150 ppm (560 mg/m^3)
Toluene-2,4-diisocyanate	**TWA** 0.005 ppm (0.04 mg/m^3), **ST** 0.02 ppm (0.15 mg/m^3)
m-Toluidine	**TWA** 2 ppm (9 mg/m^3) [skin]
p-Toluidine	**TWA** 2 ppm (9 mg/m^3) [skin]
Tributyl phosphate	**TWA** 0.2 ppm (2.5 mg/m^3)
Trichloroacetic acid	**TWA** 1 ppm (7 mg/m^3)
1,2,4-Trichlorobenzene	**C** 5 ppm (40 mg/m^3)
Trichloroethylene	**TWA** 50 ppm (270 mg/m^3), **ST** 200 ppm (1080 mg/m^3)
1,2,3-Trichloropropane	**TWA** 10 ppm (60 mg/m^3)
1,1,2-Trichloro-1,2,2-trifluoroethane	**TWA** 1000 ppm (7600 mg/m^3) **ST** 1250 ppm (9500 mg/m^3)
Triethylamine	**TWA** 10 ppm (40 mg/m^3), **ST** 15 ppm (60 mg/m^3)
Trimellitic anhydride	**TWA** 0.005 ppm (0.04 mg/m^3)
Trimethylamine	**TWA** 10 ppm (24 mg/m^3), **ST** 15 ppm (36 mg/m^3)
1,2,3-Trimethylbenzene	**TWA** 25 ppm (125 mg/m^3)
1,2,4-Trimethylbenzene	**TWA** 25 ppm (125 mg/m^3)
1,3,5-Trimethylbenzene	**TWA** 25 ppm (125 mg/m^3)

Appendix G (Continued)
VACATED 1989 OSHA PELs

Chemical	Vacated 1989 OSHA PEL
Trimethyl phosphite	**TWA** 2 ppm (10 mg/m^3)
2,4,6-Trinitrotoluene	**TWA** 0.5 mg/m^3 [skin]
Triorthocresyl phosphate	**TWA** 0.1 mg/m^3 [skin]
Triphenylamine	**TWA** 5 mg/m^3
Tungsten (insoluble compounds, as W)	**TWA** 5 mg/m^3, **ST** 10 mg/m^3
Tungsten (soluble compounds, as W)	**TWA** 1 mg/m^3, **ST** 3 mg/m^3
Tungsten carbide (cemented)	**TWA** 5 mg/m^3 (as W), **ST** 10 mg/m^3 (as W), **TWA** 0.05 mg/m^3 (as Co), **TWA** 1 mg/m^3 (as Ni)
Uranium (insoluble compounds, as U)	**TWA** 0.2 mg/m^3, **ST** 0.6 mg/m^3
n-Valeraldehyde	**TWA** 50 ppm (175 mg/m^3)
Vanadium dust	**TWA** 0.05 mg V_2O_5/m^3 (resp)
Vanadium fume	**C** 0.05 mg V_2O_5/m^3
Vinyl acetate	**TWA** 10 ppm (30 mg/m^3), **ST** 20 ppm (60 mg/m^3)
Vinyl bromide	**TWA** 5 ppm (20 mg/m^3)
Vinyl cyclohexene dioxide	**TWA** 10 ppm (60 mg/m^3) [skin]
Vinylidene chloride	**TWA** 1 ppm (4 mg/m^3)
VM & P Naphtha	**TWA** 1350 mg/m^3 (300 ppm), **ST** 1800 mg/m^3 (400 ppm)
Welding fumes	**TWA** 5 mg/m^3
Wood dust (all wood dusts except Western red cedar)	**TWA** 5 mg/m^3, **ST** 10 mg/m^3
Wood dust (Western red cedar)	**TWA** 2.5 mg/m^3
Xylene (o-, m-, p-isomers)	**TWA** 100 ppm (435 mg/m^3), **ST** 150 ppm (655 mg/m^3)
m-Xylene α,α'-diamine	**C** 0.1 mg/m^3 [skin]
Xylidine	**TWA** 2 ppm (10 mg/m^3) [skin]
Zinc chloride fume	**TWA** 1 mg/m^3, **ST** 2 mg/m^3
Zinc oxide	**TWA** 5 mg/m^3 (fume), **ST** 10 mg/m^3 (fume), **TWA** 10 mg/m^3 (total dust), **TWA** 5 mg/m^3 (resp dust)
Zinc stearate	**TWA** 10 mg/m^3 (total), **TWA** 5 mg/m^3 (resp)
Zirconium compounds (as Zr)	**TWA** 5 mg/m^3, **ST** 10 mg/m^3

INDICES

CAS Number Index

CAS #	Page	CAS #	Page	CAS #	Page	CAS #	Page
50-00-0	148	71-23-8	268	75-45-6	63	78-92-2	40
50-29-3	88	71-36-3	39	75-47-8	173	78-93-3	36
50-78-2	6	71-43-2	26	75-50-3	319	79-00-5	315
53-96-3	5	71-55-6	203	75-52-5	230	79-01-6	316
54-11-5	224	72-20-8	127	75-55-8	270	79-04-9	61
55-38-9	144	72-43-5	195	75-56-9	270	79-06-1	7
55-63-0	229	74-83-9	201	75-61-6	109	79-09-4	266
56-23-5	55	74-86-2	5	75-63-8	318	79-10-7	8
56-38-2	241	74-87-3	203	75-65-0	40	79-20-9	197
56-81-5	152	74-88-4	211	75-69-4	146	79-24-3	228
57-14-7	115	74-89-5	200	75-71-8	98	79-27-6	6
57-24-9	286	74-90-8	168	75-74-1	303	79-34-5	300
57-50-1	288	74-93-1	214	75-86-5	4	79-41-4	194
57-57-8	265	74-96-4	134	75-99-0	102	79-44-7	114
57-74-9	57	74-97-5	63	76-01-7	242	79-46-9	231
58-89-9	186	74-98-6	263	76-03-9	314	80-62-6	214
60-11-7	112	74-99-7	197	76-06-2	67	81-81-2	334
60-29-7	140	75-00-3	135	76-11-9	299	83-26-1	259
60-34-4	211	75-01-4	330	76-12-0	299	83-79-4	275
60-57-1	105	75-02-5	331	76-13-1	317	84-15-1	297
61-82-5	15	75-04-7	133	76-14-2	102	84-66-2	108
62-53-3	18	75-05-8	4	76-15-3	67	84-74-2	95
62-73-7	103	75-07-0	2	76-22-2	49	85-00-7	123
62-74-8	283	75-08-1	141	76-38-0	196	85-44-9	257
62-75-9	232	75-09-2	208	76-44-8	157	86-50-0	23
63-25-2	51	75-12-7	149	77-47-4	159	86-88-4	20
64-17-5	132	75-15-0	53	77-73-6	104	87-68-3	158
64-18-6	149	75-21-8	139	77-78-1	116	87-86-5	243
64-19-7	2	75-25-2	34	78-00-2	302	88-72-2	233
67-56-1	200	75-28-5	176	78-10-4	142	88-89-1	259
67-63-0	181	75-31-0	181	78-30-8	322	89-72-5	43
67-64-1	3	75-34-3	99	78-34-2	121	90-04-0	18
67-66-3	65	75-35-4	332	78-59-1	179	91-20-3	221
67-72-1	159	75-38-7	332	78-82-0	178	91-59-8	222
68-11-1	306	75-43-4	100	78-83-1	177	91-94-1	97
68-12-2	115	75-44-5	253	78-87-5	268	92-06-8	297

CAS Number Index (Continued)

CAS #	Page	CAS #	Page	CAS #	Page	CAS #	Page
92-52-4	121	100-37-8	107	107-13-1	8	108-94-1	84
92-67-1	14	100-41-4	133	107-15-3	136	108-95-2	248
92-84-2	248	100-42-5	287	107-16-4	153	108-98-5	26
92-87-5	27	100-44-7	28	107-18-6	10	109-59-1	180
92-93-3	227	100-61-8	219	107-19-7	265	109-60-4	267
92-94-4	298	100-63-0	251	107-20-0	60	109-66-0	244
93-76-5	293	100-74-3	142	107-21-1	137	109-73-9	41
94-36-0	27	101-14-4	207	107-22-2	345	109-74-0	44
94-75-7	88	101-68-8	208	107-30-2	66	109-77-3	190
95-13-6	171	101-77-9	209	107-31-3	210	109-79-5	43
95-47-6	336	101-84-8	249	107-41-5	165	109-86-4	202
95-48-7	79	102-54-5	104	107-49-3	296	109-87-5	199
95-49-8	69	102-81-8	94	107-66-4	95	109-89-7	106
95-50-1	96	104-94-9	19	107-87-9	245	109-94-4	140
95-53-4	313	105-46-4	38	107-98-2	269	109-99-9	302
95-63-6	320	105-60-2	50	108-03-2	231	110-12-3	212
95-80-7	311	106-35-4	134	108-05-4	329	110-19-0	177
96-12-8	93	106-42-3	336	108-10-1	164	110-43-0	201
96-18-4	317	106-44-5	79	108-11-2	212	110-49-6	202
96-22-0	108	106-46-7	97	108-18-9	110	110-54-3	162
96-33-3	198	106-49-0	313	108-20-3	182	110-61-2	288
96-45-7	139	106-50-3	249	108-21-4	180	110-62-3	327 345
96-69-5	306	106-51-4	272	108-24-7	3		
97-77-8	124	106-87-6	331	108-31-6	189	110-66-7	245
98-00-0	150	106-89-8	128	108-38-3	335	110-80-5	130
98-01-1	150	106-92-3	11	108-39-4	78	110-82-7	83
98-51-1	44	106-93-4	136	108-44-1	312	110-83-8	85
98-82-8	81	106-97-8	35	108-46-3	273	110-86-1	272
98-83-9	216	106-99-0	35	108-67-8	321	110-91-8	220
98-95-3	226	107-02-8	7 345	108-83-8	110	111-15-9	131
99-08-1	232			108-84-9	165	111-30-8	152 345
99-65-0	117	107-03-9	264	108-87-2	204		
99-99-0	233	107-05-1	10	108-88-3	311	111-31-9	163
100-00-5	227	107-06-2	137	108-90-7	62	111-40-0	107
100-01-6	226	107-07-3	135	108-91-8	85	111-42-2	106
100-25-4	118	107-12-0	266	108-93-0	84	111-44-4	100

CAS Number Index (Continued)

CAS #	Page	CAS #	Page	CAS #	Page	CAS #	Page
111-65-9	236	124-40-3	111	298-04-4	124	563-12-2	130
111-69-3	9	126-73-8	314	299-84-3	274	563-80-4	213
111-76-2	36	126-98-7	199	299-86-5	80	581-89-5	230
111-84-2	234	126-99-8	68	300-76-5	114	583-60-8	205
111-88-6	237	127-18-4	301	302-01-2	166	584-84-9	312
112-07-2	37	127-19-5	111	309-00-2	9	591-78-6	164
112-55-0	126	128-37-0	94	314-40-9	33	593-60-2	330
114-26-1	267	131-11-3	116	330-54-1	125	594-42-3	246
115-29-7	127	133-06-2	51	333-41-5	92	594-72-9	101
115-77-5	244	134-32-7	222	334-88-3	92	600-25-9	66
115-86-6	323	135-88-6	251	353-50-4	55	603-34-9	323
115-90-2	143	136-78-7	78	406-90-6	147	615-05-4	91
117-81-7	120	137-05-3	204	409-21-2	279	624-67-9	345
118-52-5	98	137-26-8	307	420-04-2	81	624-83-9	213
118-96-7	322	138-22-7	42	460-19-5	82	626-17-5	258
119-90-4	91	140-88-5	132	463-51-4	185	626-38-0	17
119-93-7	310	141-32-2	39	479-45-8	305	627-13-4	271
120-80-9	56	141-43-5	129	504-29-0	14	628-63-7	17
120-82-1	315	141-66-2	103	506-77-4	82	628-96-6	138
121-44-8	318	141-78-6	131	509-14-8	304	630-08-0	54
121-45-9	321	141-79-7	194	526-73-8	320	630-20-6	300
121-69-7	113	142-64-3	260	528-29-0	118	638-21-1	252
121-75-5	189	142-82-5	157	532-27-4	61	680-31-9	162
121-82-4	86	143-10-2	89	534-52-1	119	681-84-5	215
122-39-4	122	143-33-9	282	540-59-0	99	684-16-2	161
122-60-1	250	143-50-0	184	540-88-5	38	768-52-5	182
123-19-3	123	144-62-7	238	541-85-5	210	822-06-0	161
123-31-9	170	148-01-6	117	542-75-6	101	944-22-9	147
123-38-6	345	150-76-5	196	542-78-9	190	999-61-1	171
123-42-2	90	151-50-8	262	542-88-1	65	1120-71-4	264
123-51-3	175	151-56-4	138	542-92-7	86	1189-85-1	41
123-72-8	345	151-67-7	156	546-93-0	188	1300-73-8	337
123-86-4	37	156-62-7	47	552-30-7	319	1302-74-5	126
123-91-1	120	287-92-3	87	556-52-5	153	1303-86-2	31
123-92-2	175	298-00-0	215	557-05-1	339	1303-96-4	30
124-38-9	53	298-02-2	252	558-13-4	54	1304-82-1	29

CAS Number Index (Continued)

CAS #	Page	CAS #	Page	CAS #	Page	CAS #	Page
1305-62-0	47	1746-01-6	298	7439-96-5	191	7664-41-7	15
1305-78-8	48	1910-42-5	240	7439-97-6	193	7664-93-9	290
1306-19-0	45	1912-24-9	23	7439-98-7	218	7681-49-4	283
1309-37-1	173 276	1918-02-1	258	7440-02-0	224	7681-57-4	284
		1929-82-4	69	7440-06-4	261	7697-37-2	225
1309-48-4	188	2039-87-4	68	7440-16-6	273	7719-09-7	307
1310-58-3	263	2104-64-5	129	7440-21-3	278	7719-12-2	257
1310-73-2	284	2179-59-1	11	7440-22-4	280	7722-84-1	169
1314-13-2	339	2234-13-1	235	7440-25-7	294	7722-88-5	304
1314-62-1	328	2238-07-5	109	7440-31-5	308	7723-14-0	255
1314-80-3	256	2425-06-1	50	7440-33-7	324	7726-95-6	33
1317-35-7	192	2426-08-6	42	7440-36-0	19	7727-43-7	25
1317-38-0	77	2551-62-4	289	7440-38-2	20	7773-06-0	16
1317-65-3	46 186 192	2698-41-1	62	7440-44-0	155	7778-18-9	49
		2699-79-8	292	7440-41-7	28	7778-44-1	46
		2885-00-9	236	7440-43-9	45	7782-41-4	146
1321-64-8	243	2917-26-2	160	7440-47-3	72	7782-42-5	154
1321-65-9	316	2921-88-2	70	7440-48-4	75	7782-49-2	276
1321-74-0	125	2971-90-6	73	7440-50-8	76	7782-50-5	59
1330-43-4	30	3033-62-3	112	7440-58-6	156	7782-65-2	151
1332-21-4	22	3173-72-6	221	7440-61-1	326	7783-06-4	170
1332-58-7	183	3333-52-6	303	7440-65-5	338	7783-07-5	169
1333-82-0	70	3383-96-8	296	7440-67-7	340	7783-41-7	239
1333-86-4	52	3689-24-5	294	7440-74-6	172	7783-54-2	229
1335-87-1	160	4016-14-2	183	7446-09-5	289	7783-60-0	291
1335-88-2	301	4098-71-9	179	7553-56-2	172	7783-79-1	277
1338-23-4	209	4170-30-3	80 345	7572-29-4	96	7783-80-4	295
1344-28-1	12			7580-67-8	187	7784-42-1	21
1344-95-2	48	5124-30-1	207	7616-94-6	246	7786-34-7	253
1395-21-7	287	5332-52-5	326	7631-86-9	277	7789-30-2	35
1455-21-6	235	5714-22-7	291	7631-90-5	282	7790-91-2	60
1477-55-0	337	6032-29-7	176	7637-07-2	32	7803-51-2	254
1563-66-2	52	6423-43-4	269	7646-85-7	338	7803-52-3	285
1569-69-3	83	6923-22-4	219	7647-01-0	167	7803-62-5	279
1639-09-4	158	7429-90-5	12	7664-38-2	254	8001-35-2	58
1738-25-6	113	7439-92-1	185	7664-39-3	168	8002-05-9	247

CAS Number Index (Continued)

CAS #	Page	CAS #	Page	CAS #	Page	CAS #	Page
8002-74-2	240	10028-15-6	239	13463-67-7	310	25013-15-4	333
8003-34-7	271	10035-10-6	167	13494-80-9	295	25321-14-6	119
8004-13-5	250	10049-04-4	59	13838-16-9	128	25376-45-8	311
8006-61-9	151	10102-43-9	225	14484-64-1	144	25639-42-3	205
8006-64-2	325	10102-44-0	228	14807-96-6	293	26499-65-0	260
8008-20-6	184	10210-68-1	74	14808-60-7	278	26628-22-8	281
8012-95-1	237	10294-33-4	32	14977-61-8	72	26952-21-6	178
8022-00-2	206	10361-37-2	24	15096-52-3	281	30525-89-4	345
8030-30-6	220	11097-69-1	64	16219-75-3	141	34590-94-8	122
8032-32-4	333	11107-01-0	325	16752-77-5	195	35400-43-2	292
8052-41-3	286	12001-26-2	217	16842-03-8	75	37329-49-0	325
8052-42-4	22	12079-65-1	191	17702-41-9	89	53469-21-9	64
8065-48-3	90	12108-13-3	206	17804-35-2	25	59355-75-8	198
9004-34-6	56	12125-02-9	16	18282-10-5	309	61788-32-7	166
9005-25-8	285	12179-04-3	31	19287-45-7	93	62765-93-9	223
9014-01-1	287	12604-58-9	145	19624-22-7	242	65996-93-2	74
10022-31-8	24	12718-69-3	325	20816-12-0	238	65997-15-1	262
10024-97-2	234	13121-70-5	87	21087-64-9	216	68476-85-7	187
10025-67-9	290	13397-24-5	155	21351-79-1	57	68956-68-3	329
10025-87-3	255	13463-39-3	223	21651-19-4	309	93763-70-3	247
10026-13-8	256	13463-40-6	174	22224-92-6	143		

DOT ID Number Index

DOT ID #	Page	DOT ID #	Page	DOT ID #	Page	DOT ID #	Page
1001	5	1080	289	1163	115	1230	200
1005	15	1083	319	1165	120	1231	197
1008	32	1085	330	1170	132	1233	165
1009	318	1086	330	1171	130	1234	199
1010	35	1089	2	1172	131	1235	200
1011	35	1090	3	1173	131	1239	66
1013	53	1092	7	1175	133	1243	210
1016	54	1093	8	1184	137	1244	211
1017	59	1098	10	1185	138	1245	164
1018	63	1100	10	1188	202	1247	214
1020	67	1104	17	1189	202	1249	245
1026	82		175	1190	140	1259	223
1028	98	1105	175	1193	36	1261	230
1029	100		176	1198	148	1262	236
1032	111	1110	201	1199	150	1265	244
1036	133	1111	245	1203	151	1268	286
1037	135	1114	26	1204	229		333
1040	139	1120	39	1206	157	1274	268
1045	146		40	1208	162	1276	267
1048	167	1123	37		163	1279	268
1050	167		38	1212	177	1280	270
1051	168	1125	41	1213	177	1282	272
1052	168	1131	53	1219	181	1292	142
1053	170	1134	62	1220	180	1294	311
1060	198	1135	135	1221	181	1296	318
1061	200	1143	80	1223	184	1297	319
1062	201	1145	83	1224	134	1299	325
1063	203	1146	87			1301	329
1064	214	1148	90		89	1303	332
1067	228	1150	99		126	1307	335
1070	234	1154	106		158		336
1075	35	1155	140	1228	160	1309	12
	176	1156	108		163	1326	156
	187	1157	110		235	1334	221
	263	1158	110		236	1340	256
1076	253	1159	182		237	1344	259
1079	289	1160	111		326	1346	278
				1229	194		

DOT ID Number Index (Continued)

DOT ID #	Page	DOT ID #	Page	DOT ID #	Page	DOT ID #	Page
1356	322	1605	136	1758	72	1920	234
1358	340	1613	168	1779	149	1921	270
1361	73	1648	4	1788	167	1932	340
1365	77	1649	302	1789	167	1940	306
1376	173	1650	222	1790	168	1941	109
1380	242	1651	20	1805	254	1958	102
1381	255	1654	224	1806	256	1959	332
1383	13	1660	225	1809	257	1969	176
1396	12	1661	226	1810	255	1978	263
1403	47	1662	226	1813	263	1986	265
1414	187	1664	232	1814	263	1991	68
1446	24		233	1823	284		42
1463	70	1669	242	1824	284	1993	84
1510	304	1670	246	1828	290		179
1516	339	1671	248	1830	290	1994	174
1541	4	1673	249	1831	290	1999	22
1547	18	1680	262	1832	290	2008	340
1549	19	1687	281	1836	307	2014	169
1558	20	1689	282	1839	314	2015	169
1562	20	1690	283	1845	53	2023	128
1564	24	1692	286	1846	55	2029	166
	25	1697	61	1848	266	2030	166
1566	28	1702	300	1860	331	2031	225
1567	28	1704	294	1865	271	2032	225
1573	46	1707	305	1868	89	2038	119
1578	227	1708	312	1885	27	2047	101
1580	67		313	1887	63	2048	104
1583	67	1709	311	1888	65	2049	125
1589	82	1710	316	1891	134	2053	212
1591	96	1711	337	1897	301	2054	220
1593	208	1715	3	1910	48	2055	287
1595	116	1738	28	1911	93	2056	302
1597	117	1744	33	1915	84	2058	327
	118	1745	34	1916	100	2073	15
1598	119	1749	60	1917	132	2074	7
1600	119	1752	61	1918	81	2076	78
1604	136	1755	70	1919	198		79

DOT ID Number Index (Continued)

DOT ID #	Page	DOT ID #	Page	DOT ID #	Page	DOT ID #	Page
2077	222	2304	221	2587	272	2762	57
2078	312	2312	248	2590	22	2763	23
2079	107	2315	64	2606	215	2765	88
2187	53	2321	315	2608	231		293
2188	21	2325	321	2617	205	2771	307
2190	239	2329	321	2618	333	2781	123
2191	292	2331	338	2629	283	2782	123
2192	151	2337	26	2644	211		
2194	277	2347	43	2646	159		23
2195	295	2348	39	2647	190		70
2199	254	2357	85	2650	101		92
2201	234	2362	99	2658	276		103
2202	169	2363	141	2662	170		124
2203	279	2369	36	2667	44	2783	189
2205	9	2397	213	2671	14		215
2209	148	2402	264	2672	15		219
2212	22	2404	266	2676	285		241
2214	257	2411	44	2681	57		253
2215	189	2417	55	2682	57		296
2218	8	2418	291	2686	107	2789	2
2219	11	2420	161	2692	32	2790	2
2232	60	2431	18	2693	282	2805	187
2238	69		19	2710	123	2809	193
2249	65	2451	229	2713	74	2810	62
2253	113	2471	238	2717	49	2821	248
2256	85	2480	213		25	2831	203
2262	114	2491	129	2757	51	2842	228
2265	115	2504	6		52	2862	328
2271	210	2515	34		195	2871	19
2279	158	2516	54			2872	93
2281	161	2531	194		9	2873	94
2284	178	2538	230		58	2874	150
2290	179	2545	156		88	2876	273
2294	219	2564	314	2761	105	2979	326
2296	204	2570	45		127	2984	169
2297	205	2572	251		157		215
2302	212	2574	322		186	3018	252
					195		296

DOT ID Number Index (Continued)

DOT ID #	Page	DOT ID #	Page	DOT ID #	Page	DOT ID #	Page
3051	13	3083	246	3364	259	9191	59
3054	83	3141	19	3413	262	9192	146
3064	229	3155	243	3414	282	9202	54
3079	199	3293	166	3453	254	9260	12

Chemical, Synonym, and Trade Name Index

(Primary chemical names appear in blue text.)

Name	Page	Name	Page
AA	10	Acridine	74
AAF	5	Acroleic acid	8
2-AAF	5	**Acrolein**	**7**
Abate®	296	Acrylaldehyde	7
Acetaldehyde	**2**	**Acrylamide**	**7**
2-Acetaminofluorene	5	Acrylamide monomer	7
Acetic acid	**2**	**Acrylic acid**	**8**
Acetic acid (aqueous)	2	Acrylic aldehyde	7
Acetic acid anhydride	3	Acrylic amide	7
Acetic aldehyde	2	**Acrylonitrile**	**8**
Acetic anhydride	**3**	Acrylonitrile monomer	8
Acetic ester	131	Actinolite	22
Acetic ether	131	Actinolite asbestos	22
Acetic oxide	3	**Adiponitrile**	**9**
Acetone	**3**	AGE	11
Acetone cyanohydrin	**4**	Alcohol	132
Acetonitrile	**4**	**Aldrin**	**9**
3-(α-Acetonyl)-benzyl-4-hydroxycoumarin	334	Aliphatic petroleum naphtha	247
		Allyl alcohol	**10**
2-Acetoxybenzoic acid	6	Allyl aldehyde	7
o-Acetoxybenzoic acid	6	**Allyl chloride**	**10**
1-Acetoxyethylene	329	Allylene	197
2-Acetylaminofluorene	**5**	**Allyl glycidyl ether**	**11**
N-Acetyl-2-aminofluorene	5	Allylic alcohol	10
Acetylene	**5**	1-Allyloxy-2,3-epoxypropane	11
Acetylene black	52	**Allyl propyl disulfide**	**11**
Acetylene dichloride	99	Allyl trichloride	317
cis-Acetylene dichloride	99	Alumina	12
trans-Acetylene dichloride	99	**α-Alumina**	**12**
Acetylene tetrabromide	**6**	**Aluminum**	**12**
Acetylene tetrachloride	300	Aluminum metal	12
Acetyl mercaptan	306	Aluminum oxide [**α-Alumina**]	12
Acetyl oxide	3	Aluminum oxide [**Emery**]	126
2-Acetyl propane	213	Aluminum powder	12
Acetylsalicyclic acid	**6**	**Aluminum (pyro powders and welding fumes, as Al)**	**13**
Acheson graphite	155		
Acraldehyde	7		

Chemical, Synonym, and Trade Name Index (Continued)

(Primary chemical names appear in blue text.)

Name	Page
Aluminum (soluble salts and alkyls, as Al)	**13**
Aluminum trioxide [**α-Alumina**]	12
Aluminum trioxide [**Emery**]	126
Amidocyanogen	81
4-Aminoaniline	249
ortho-Aminoanisole	18
para-Aminoanisole	19
Aminobenzene	18
4-Aminobiphenyl	14
p-Aminobiphenyl	14
1-Aminobutane	41
Aminocaproic lactam	50
Aminocyclohexane	85
Aminodimethylbenzene	337
4-Amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one	216
4-Aminodiphenyl	**14**
p-Aminodiphenyl	14
Aminoethane	133
N-(2-Aminoethyl)-1,2-ethanediamine	107
2-Aminoethanol	129
β-Aminoethyl alcohol	129
bis(2-Aminoethyl)amine	107
Aminoethylene	138
Aminohexahydrobenzene	85
Aminomethane	200
1,3-bis(Aminomethyl)benzene	337
3-Amino-1-methylbenzene	312
1-Aminonaphthalene	222
2-Aminonaphthalene	222
para-Aminonitrobenzene	226
1-Aminophenylmethane	312
2-Aminopropane	181
2-Aminopyridine	**14**
α-Aminopyridine	14
Aminotoluene [**m-Toluidine**]	312
Aminotoluene [**o-Toluidine**]	313
Aminotoluene [**p-Toluidine**]	313
2-Aminotoluene	313
4-Aminotoluene	313
m-Aminotoluene	312
o-Aminotoluene	313
Aminotriazole	15
3-Aminotriazole	15
2-Amino-1,3,4-triazole	15
3-Amino-1,2,4-triazole	15
4-Amino-3,5,6-trichloropicolinic acid	258
4-Amino-3,5,6-trichloro-2-picolinic acid	258
Aminoxylene	337
Amitrole	**15**
Ammate® herbicide	16
Ammonia	**15**
Ammonium amidosulfonate	16
Ammonium chloride	16
Ammonium chloride fume	**16**
Ammonium muriate fume	16
Ammonium sulfamate	**16**
Amosite	22
AMS [**Ammonium sulfamate**]	16
AMS [**α-Methyl styrene**]	216
n-Amyl acetate	**17**
sec-Amyl acetate	**17**
Amyl acetic ester	17
Amyl acetic ether	17
Amyl aldehyde	327
Amyl ethyl ketone	210
Amyl hydrosulfide	245
Amyl mercaptan	245
Amyl methyl ketone	201
n-Amyl methyl ketone	201
Amyl sulfhydrate	245
AN	8
Anhydrous ammonia	15

Name	Page	Name	Page
Anhydrous borax	30	Aroclor® 1254	64
Anhydrous calcium sulfate	49	Arsenia	20
Anhydrous gypsum	49	Arsenic hydride	21
Anhydrous hydrogen bromide	167	**Arsenic (inorganic compounds, as As)**	**20**
Anhydrous hydrogen chloride	167		
Anhydrous hydrogen fluoride	168	Arsenic metal	20
Anhydrous sulfate of lime	49	**Arsenic (organic compounds, as As)**	**21**
Aniline (and homologs)	**18**		
Aniline oil	18	Arsenic trihydride	21
Anilinobenzene	122	Arseniuretted hydrogen	21
2-Anilinonaphthalene	251	Arsenous hydride	21
o-Anisidine	**18**	**Arsine**	**21**
p-Anisidine	**19**	Artificial barite	25
2-Anisidine	18	Artificial graphite	155
Anol	84	**Asbestos**	**22**
Anone	84	**Asphalt fumes**	**22**
Antabuse®	124	Asphaltum	22
Anthracite coal dust	73	Aspirin	6
Anthophyllite	22	Asymmetrical dichloroethane	99
Anthophyllite asbestos	22	Asymmetrical trimethylbenzene	320
Anthracene	74	ATCP	258
Antimony	**19**	**Atrazine**	**23**
Antimony hydride	285	Aurum paradoxum	295
Antimony metal	19	Azabenzene	272
Antimony powder	19	Azide	281
Antimony trihydride	285	Azimethylene	92
ANTU	**20**	Azine	272
Aprocarb®	267	**Azinphos-methyl**	**23**
Aqua ammonia	15	Azirane	138
Aqua fortis	225	Aziridine	138
Aqueous acrylic acid	8	Azium	281
Aqueous ammonia	15	Azodrin®	219
Aqueous hydrogen bromide	167	Azomethylene	92
Aqueous hydrogen chloride	167	Azophos®	215
Aqueous hydrogen fluoride	168	Bacillus subtilis	287
Argentum	280	Bacillus subtilis BPN	287
Aroclor® 1242	64	Bacillus subtilis Carlsburg	287

Name	Page
Banana oil	175
Barite	25
Barium chloride (as Ba)	**24**
Barium dichloride	24
Barium dinitrate	24
Barium(II) nitrate (1:2)	24
Barium nitrate (as Ba)	**24**
Barium salt of nitric acid	24
Barium salt of sulfuric acid	25
Barium sulfate	**25**
Barytes	25
Basudin®	92
Battery acid	290
Baytex	144
BCME	65
Beet sugar	288
Benomyl	**25**
Benzenamine	18
Benzene	**26**
Benzene chloride	62
1,4-Benzenediamine	249
1,3-Benzenedicarbonitrile	258
1,2-Benzenedicarboxylic anhydride	257
1,3-Benzenedimethanamine	337
1,2-Benzenediol	56
o-Benzenediol	56
1,3-Benzenediol	273
m-Benzenediol	273
1,4-Benzenediol	170
p-Benzenediol	170
Benzene hexahydride	83
Benzene tetrahydride	85
Benzenethiol	**26**
1,2,4-Benzenetricarboxylic anhydride	319
Benzidine	**27**
Benzidine-based dyes	27
Benzoepin	127
Benzol	26
Benzo(a)pyrene	74
Benzoperoxide	27
1,4-Benzoquinone	272
p-Benzoquinone	272
Benzoyl peroxide	**27**
Benzyl chloride	**28**
Beryllium & beryllium compounds (as Be)	**28**
Beryllium metal	28
BGE	42
BHC	186
BHT	94
4,4'-Bianiline	27
Bidrin®	103
Bicyclopentadiene	104
Biethylene	35
Biotite	217
Biphenyl	121
4,4'-Biphenyldiamine	27
1,1'-Biphenyl-4,4'-diamine	27
Bismuth sesquitelluride	29
Bismuth telluride	29
Bismuth telluride, doped with Selenium sulfide (as Bi_2Te_3)	**29**
Bismuth telluride, undoped	**29**
Bismuth tritelluride	29
Bitumen	22
Bituminous coal dust	73
Bivinyl	35
Black copper oxide fume	77
Black lead	154
Bladafum®	294
Bolstar®	292
Bottled gas	187
Borates, tetra, sodium salts (Anhydrous)	**30**

Name	Page	Name	Page
Borates, tetra, sodium salts (Decahydrate)	**30**	**n-Butane**	**35**
		normal-Butane	35
Borates, tetra, sodium salts (Pentahydrate)	**31**	Butanedinitrile	288
		Butanenitrile	44
Borax	30	Butanethiol	43
Borax decahydrate	30	1-Butanethiol	43
Borax dehydrated	30	n-Butanethiol	43
Borax pentahydrate	31	1-Butanol	39
Boroethane	93	2-Butanol	40
Boron bromide	32	n-Butanol	39
Boron fluoride	32	**2-Butanone**	**36**
Boron hydride	93	2-Butanone peroxide	209
Boron oxide	**31**	2-Butenal	80
Boron tribromide	**32**	cis-Butenedioic anhydride	189
Boron trifluoride	**32**	**2-Butoxyethanol**	**36**
Bottled gas	263	**2-Butoxyethanol acetate**	**37**
BPL	265	2-Butoxyethyl acetate	37
Bromacil	**33**	Butter yellow	112
Bromine	**33**	Butyl acetate	37
Bromine fluoride	34	**n-Butyl acetate**	**37**
Bromine pentafluoride	**34**	**sec-Butyl acetate**	**38**
5-Bromo-3-sec-butyl-6-methyluracil	33	**tert-Butyl acetate**	**38**
Bromochloromethane	63	**Butyl acrylate**	**39**
1-Bromo-1-chloro-2,2,2-trifluoroethane	156	n-Butyl acrylate	39
2-Bromo-2-chloro-1,1,1-trifluoroethane	156	Butyl alcohol	39
Bromoethane	134	**n-Butyl alcohol**	**39**
Bromoethene	330	**sec-Butyl alcohol**	**40**
Bromoethylene	330	**tert-Butyl alcohol**	**40**
Bromoform	**34**	Butylamine	41
Bromomethane	201	**n-Butylamine**	**41**
5-Bromo-6-methyl-3-(1-methylpropyl)uracil	33	Butylated hydroxytoluene	94
		Butyl Cellosolve®	36
Bromotrifluoromethane	318	Butyl Cellosolve® acetate	37
Burned lime	48	4-t-Butyl-2-chlorophenylmethyl methylphosphoramidate	80
Burnt lime	48		
Butadiene	35	**tert-Butyl chromate**	**41**
1,3-Butadiene	**35**	Butylene hydrate	40

Chemical, Synonym, and Trade Name Index (Continued)

(Primary chemical names appear in blue text.)

Name	Page	Name	Page
n-Butyl ester of acetic acid	37	**Calcium cyanamide**	**47**
sec-Butyl ester of acetic acid	38	Calcium hydrate	47
tert-Butyl ester of acetic acid	38	Calcium hydrosilicate	48
Butyl ester of acrylic acid	39	**Calcium hydroxide**	**47**
di-tert-Butyl ester of chromic acid	41	Calcium metasilicate	48
Butyl ester of 2-hydroxypropanoic acid	42	Calcium monosilicate	48
Butyl ester of lactic acid	42	**Calcium oxide**	**48**
Butyl ethanoate	37	Calcium salt (2:3) of arsenic acid	46
Butyl ethyl ketone	134	Calcium salt of carbonic acid	46
n-Butyl glycidyl ether	**42**	Calcium salt of silicic acid	48
Butyl glycol acetate	37	Calcium salt of sulfuric acid	49
Butyl hydride	35	**Calcium silicate**	**48**
Butyl lactate	42	**Calcium sulfate**	**49**
n-Butyl lactate	**42**	Calcium(II) sulfate dihydrate	155
n-Butyl mercaptan	**43**	Calcium sulfate hemihydrate	260
Butyl methyl ketone	164	2-Camphonone	49
Butyl oxitol	36	**Camphor (synthetic)**	**49**
2-sec-Butylphenol	43	Cane sugar	288
o-sec-Butylphenol	**43**	**Caprolactam**	**50**
Butyl phosphate	314	epsilon-Caprolactam	50
Butyl-2-propenoate	39	Captane	51
4-tert-Butyltoluene	44	**Captafol**	**50**
p-tert-Butyltoluene	**44**	**Captan**	**51**
tert-Butyl valone	259	Captofol	50
Butyrone	123	Carbamaldehyde	149
Butyronitrile	44	**Carbaryl**	**51**
n-Butyronitrile	**44**	Carbicron®	103
Cadmium dust (as Cd)	**45**	Carbimide	81
Cadmium fume (as Cd)	**45**	Carbinol	200
Cadmium metal	45	Carbodiimide	81
Cadmium monoxide	45	**Carbofuran**	**52**
Cadmium oxide fume	45	Carbolic acid	248
Calcium arsenate (as As)	**46**	Carbomethene	185
Calcium carbimide	47	2-Carbomethoxy-1-methylvinyl dimethyl phosphate	253
Calcium carbonate	**46**		
Calcium carbonate [**Limestone**]	186	Carbonate magnesium	188
Calcium carbonate [**Marble**]	192	Carbon bisulfide	53

Name	Page	Name	Page
Carbon black	**52**	Cemented WC	325
Carbon bromide	54	Cesium hydrate	57
Carbon chloride	55	**Cesium hydroxide**	**57**
Carbon difluoride oxide	55	Cesium hydroxide dimer	57
Carbon dioxide	**53**	Cetyl mercaptan	160
Carbon disulfide	**53**	CFC 113	317
Carbon fluoride oxide	55	Channel black	52
Carbon hexachloride	159	China clay	183
Carbonic acid gas	53	Chlorcyan	82
Carbon monoxide	**54**	Chlordan	57
Carbon nitride	82	**Chlordane**	**57**
Carbon oxide	54	Chlordano	57
Carbon oxychloride	253	Chlordecone	184
Carbon oxyfluoride	55	**Chlorinated camphene**	**58**
Carbon silicide	279	**Chlorinated diphenyl oxide**	**58**
Carbon tet	55	**Chlorine**	**59**
Carbon tetrabromide	**54**	Chlorine cyanide	82
Carbon tetrachloride	**55**	**Chlorine dioxide**	**59**
Carbonyl chloride	253	Chlorine fluoride	60
Carbonyl dichloride	253	Chlorine fluoride oxide	246
Carbonyl difluoride	55	Chlorine oxide	59
Carbonyl fluoride	**55**	Chlorine oxyfluoride	246
di-mu-Carbonylhexacarbonyldicobalt	74	Chlorine peroxide	59
Carborundum®	279	**Chlorine trifluoride**	**60**
Carboxyethane	266	**Chloroacetaldehyde**	**60**
4-Carboxyphthalic anhydride	319	Chloroacetaldehyde (40% aqueous solution)	60
Catechol	**56**		
Caustic lime	47	2-Chloroacetaldehyde	60
Caustic soda	284	Chloroacetic acid chloride	61
CB	63	Chloroacetic chloride	61
CBM	63	2-Chloroacetophenone	61
Cellosolve®	130	**α-Chloroacetophenone**	**61**
Cellosolve® acetate	131	**Chloroacetyl chloride**	**61**
Cellulose	**56**	3-Chloroallyl chloride	101
Celtium	156	2-Chlorobenzalmalonitrile	62
Cement	262	**Chlorobenzene**	**62**
Cemented tungsten carbide	325	Chlorobenzol	62

Name	Page	Name	Page
o-Chlorobenzylidene malononitrile	**62**	Chloromethyl ether	65
Chlorobromomethane	**63**	**bis-Chloromethyl ether**	**65**
Chlorobutadiene	68	**Chloromethyl methyl ether**	**66**
2-Chloro-1,3-butadiene	68	Chloromethyl phenyl ketone	61
Chlorocamphene	58	4-Chloronitrobenzene	227
Chlorochromic anhydride	72	p-Chloronitrobenzene	227
Chlorocyanide	82	1-Chloro-4-nitrobenzene	227
Chlorocyanogen	82	**1-Chloro-1-nitropropane**	**66**
1-Chloro-2,3-dibromopropane	93	**Chloropentafluoroethane**	**67**
Chlorodifluoromethane	**63**	**Chloropicrin**	**67**
2-Chloro-1-(difluoromethoxy)-1,1,2-trifluoroethane	128	Chloroprene	68
		β-Chloroprene	**68**
Chlorodimethyl ether	66	1-Chloro-2-propene	10
Chlorodiphenyl (42% chlorine)	**64**	3-Chloropropene	10
Chlorodiphenyl (54% chlorine)	**64**	3-Chloropropylene	10
1-Chloro-2,3-epoxypropane	128	2-Chloropropylene oxide	128
Chloroethane	135	γ-Chloropropylene oxide	128
2-Chloroethanal	60	Chlorpyrifos-ethyl	70
2-Chloroethanol	135	2-Chlorostyrene	68
Chloroethene	330	**o-Chlorostyrene**	**68**
1-Chloro-2-ethenylbenzene	68	ortho-Chlorostyrene	68
2-Chloroethyl alcohol	135	Chlorothene	203
2-Chloro-4-ethylamino-6-isopropylamino-s-triazine	23	2-Chlorotoluene	69
		o-Chlorotoluene	**69**
Chloroethylene	330	α-Chlorotoluene	28
bis(2-Chloroethyl)ether	100	**2-Chloro-6-trichloromethyl pyridine**	**69**
6-Chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine	23	2-Chloro-6-(trichloromethyl)pyridine	69
		Chlorotrifluoride	60
Chlorofluorocarbon 113	317	2-Chloro-1,1,2-trifluoroethyl difluoromethyl ether	128
Chloroform	**65**		
Chloroformic acid dimethylamide	114	**Chlorpyrifos**	**70**
Chloroformyl chloride	253	Chrome	72
Chloromethane	203	Chromic acid (CrO_3)	70
Chloromethoxymethane	66	**Chromic acid and chromates**	**70**
Chloromethylbenzene	28	Chromic anhydride	70
1-Chloro-2-methylbenzene	69	Chromic oxide	70
2-Chloro-1-methylbenzene	69	Chromic oxychloride	72

Name	Page	Name	Page
Chromium	72	**Copper (dusts and mists, as Cu)**	**76**
Chromium chloride oxide	72	Copper fume	77
Chromium(II) compounds (as Cr)	**71**	**Copper fume (as Cu)**	**77**
Chromium(III) compounds (as Cr)	**71**	Copper metal dusts	76
Chromium dichloride dioxide	72	Copper metal fumes	76
Chromium dioxide dichloride	72	Copper monoxide fume	77
Chromium dioxychloride	72	Copper(II) oxide	77
Chromium metal	**72**	Corn starch	285
Chromium(VI) oxide (1:3)	70	Corundum	126
Chromium trioxide	70	**Cotton dust (raw)**	**77**
Chromyl chloride	**72**	Coyden®	73
Chrysene	74	**Crag® herbicide**	**78**
Chrysotile	22	Crag® herbicide No. 1	78
CI-2	206	2-Cresol	79
Cinerin I or II	271	3-Cresol	78
Clay	183	4-Cresol	79
Clopidol	**73**	**m-Cresol**	**78**
bis-CME	65	meta-cresol	78
CMME	66	**o-Cresol**	**79**
Coal dust	**73**	ortho-Cresol	79
Coal tar	74	**p-Cresol**	**79**
Coal tar pitch volatiles	**74**	para-Cresol	79
Cobalt carbonyl (as Co)	**74**	Creosote	74
Cobalt hydrocarbonyl (as Co)	**75**	m-Cresylic acid	78
Cobalt metal dust	75	o-Cresylic acid	79
Cobalt metal dust and fume (as Co)	**75**	p-Cresylic acid	79
Cobalt metal fume	75	Cristobalite	278
Cobalt octacarbonyl	74	Crocidolite	22
Cobalt tetracarbonyl dimer	74	**Crotonaldehyde**	**80**
Coke oven emissions	**76**	Crude solvent coal tar naphtha	220
Colloidal manganese	191	**Crufomate**	**80**
Colloidal mercury	193	Cryocide	281
Cologne spirit	132	Cryodust	281
Columbian spirits	200	Cryolite	281
Combustion Improver-2	206	CS	62
Compressed petroleum gas	187	Cucumber dust	46
Confectioner's sugar	288	**Cumene**	**81**

Name	Page
psi-Cumene	320
Cummingtonite-grunerite	22
Cumol	81
Cupric oxide	77
Cyanamide	**81**
Cyanamide [**Calcium cyanamide**]	47
Cyanamide (Hydrogen cyanamide)	81
Cyanoacetonitrile	190
Cyanoethane	266
Cyanoethylene	8
Cyanogen	**82**
Cyanogen chloride	**82**
Cyanogen nitride	81
Cyanohydrin-2-propanone	4
Cyanomethane	4
Cyanomethanol	153
1-Cyanopropane	44
2-Cyano-2-propanol	4
2-Cyanopropene-1	199
2-Cyano-1-propene	199
1,4-Cyclohexadiene dioxide	272
Cyclohexane	**83**
Cyclohexanethiol	**83**
Cyclohexanol	**84**
Cyclohexanone	**84**
Cyclohexene	**85**
Cyclohexyl alcohol	84
Cyclohexylamine	**85**
Cyclohexyl ketone	84
Cyclohexylmercaptan	83
Cyclohexylmethane	204
Cyclohexylthiol	83
Cyclonite	**86**
Cyclopentadiene	**86**
1,3-Cyclopentadiene	86
bis(Cyclopentadienyl)iron	104
Cyclopentadienylmanganese tricarbonyl	191
Cyclopentadienyl tricarbonyl manganese	191
Cyclopentane	**87**
Cyclotrimethylenetrinitramine	86
Cyhexatin	**87**
2,4-D	**88**
DAB	112
DACPM	207
Dactin	98
Dalapon	102
Dasanit®	143
DBCP	93
DBP	95
DCA	96
o-DCB	96
p-DCB	97
1,1-DCE	332
DCP	101
DCPD	104
DDH	98
DDT	**88**
p,p'-DDT	88
DDVP	103
DEA	106
Decaborane	**89**
Decaboron tetradecahydride	89
Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta(cd)pentalen-2-one	184
Decachlorooctahydro-kepone-2-one	184
Decachlorotetrahydro-4,7-methanoindeneone	184
1-Decanethiol	**89**
Decylmercaptan	89
n-Decylmercaptan	89
DEHP	120

Name	Page	Name	Page
DEK	108	Dibenzothiazine	248
Delnav®	121	Dibenzoyl peroxide	27
Demeton	**90**	DIBK	110
Demeton methyl	206	**Diborane**	**93**
DEP	108	Diboron hexahydride	93
DETA	107	Dibrom®	114
DGE	109	Dibromochloropropane	93
Diacetone	90	**1,2-Dibromo-3-chloropropane**	**93**
Diacetone alcohol	**90**	1,2-Dibromo-2,2-dichloroethyl dimethyl phosphate	114
Diallyl ether dioxide	109		
Diamine	166	Dibromodifluoromethane	109
2,4-Diaminoanisole (and its salts)	**91**	1,2-Dibromoethane	136
1,4-Diaminobenzene	249	Dibutyl acid o-phosphate	95
p-Diaminobenzene	249	Dibutylaminoethanol	94
4,4'-Diaminobiphenyl	27	2-Dibutylaminoethanol	94
4,4'-Diamino-3,3'-dichlorobiphenyl	97	**2-N-Dibutylaminoethanol**	**94**
2,2'-Diaminodiethylamine	107	2-Di-N-butylaminoethanol	94
4,4'-Diamino-3,3'-dimethylbiphenyl	310	2-Di-N-butylaminoethyl alcohol	94
p-Diaminodiphenyl	27	Dibutylated hydroxytoluene	94
4,4'-Diaminodiphenylmethane	209	Dibutyl-1,2-benzene-dicarboxylate	95
para, para'-Diaminodiphenyl-methane	209	**2,6-Di-tert-butyl-p-cresol**	**94**
Diaminoditolyl	310	N,N-Dibutylethanolamine	94
1,2-Diaminoethane	136	Di-n-butyl hydrogen phosphate	95
1,3-Diamino-4-methoxy benzene	91	**Dibutyl phosphate**	**95**
Diaminotoluene	311	Dibutyl phosphoric acid	95
Dianilinomethane	209	**Dibutyl phthalate**	**95**
Dianisidine	91	Di-n-butyl phthalate	95
3,3'-Dianisidine	91	**Dichloroacetylene**	**96**
o-Dianisidine	**91**	1,2-Dichlorobenzene	96
Diatomaceous earth	277	1,4-Dichlorobenzene	97
Diatomaceous silica	277	**o-Dichlorobenzene**	**96**
Diatomite	277	ortho-Dichlorobenzene	96
Diazide®	92	**p-Dichlorobenzene**	**97**
Diazinon®	**92**	para-Dichlorobenzene	97
Diazirine	92	**3,3'-Dichlorobenzidine (and its salts)**	**97**
Diazomethane	**92**		
Dibasic zinc stearate	339	Dichlorobenzidine base	97

Name	Page
o,o'-Dichlorobenzidine	97
o-Dichlorobenzol	96
3,3'-Dichlorobiphenyl-4,4'-diamine	97
3,3'-Dichloro-4,4'-biphenyldiamine	97
3,3'-Dichloro-4,4'-diaminobiphenyl	97
3,3'-Dichloro-4,4'-diaminodiphenylmethane	206
2,2'-Dichlorodiethyl ether	100
2,2-Dichloro-1,1-difluoroethyl methyl ether	196
Dichlorodifluoromethane	**98**
2,2-Dichloro-1,1-difluoro-1-methoxyethane	196
Dichlorodimethyl ether	65
1,3-Dichloro-5,5-dimethylhydantoin	**98**
3,5-Dichloro-2,6-dimethyl-4-pyridinol	73
Dichlorodioxochromium	72
Dichlorodiphenyltrichloroethane	88
1,1-Dichloroethane	**99**
1,2-Dichloroethane	137
1,1-Dichloroethene	332
1,1-Dichloroethylene	332
1,2-Dichloroethylene	**99**
sym-Dichloroethylene	99
Dichloroethyl ether	**100**
2,2'-Dichloroethyl ether	100
Dichloroethyne	96
Dichlorofluoromethane	100
Dichloromethane	208
Dichloromethyl ether	65
Dichloromonofluoromethane	**100**
Dichloronitroethane	101
1,1-Dichloro-1-nitroethane	**101**
3-(3,4-Dichlorophenyl)-1,1-dimethylurea	125
Dichlorophenoxyacetic acid	88
2,4-Dichlorophenoxyacetic acid	88
2-(2,4-Dichlorophenoxy)ethyl sodium sulfate	78
Dichloro-1,2-propane	268
1,2-Dichloropropane	268
2,2-Dichloropropanoic acid	102
1,3-Dichloropropene	**101**
1,3-Dichloro-1-propene	101
2,2-Dichloropropionic acid	**102**
α,α-Dichloropropionic acid	102
1,3-Dichloropropylene	101
1,2-Dichlorotetrafluoroethane	102
Dichlorotetrafluoroethane	**102**
2,2-Dichlorovinyl dimethyl phosphate	103
Dichlorvos	**103**
Dicobalt carbonyl	74
Dicobalt octacarbonyl	74
Dicrotophos	**103**
Dicyan	82
1,3-Dicyanobenzene	258
m-Dicyanobenzene	258
1,4-Dicyanobutane	9
1,2-Dicyanoethane	288
Dicyanogen	82
Dicyanomethane	190
Dicyclohexylmethane 4,4'-diisocyanate	207
Dicyclopentadiene	**104**
1,3-Dicyclopentadiene dimer	104
Dicyclopentadienyl iron	**104**
Dieldrin	**105**
Di(2,3-epoxypropyl) ether	109
Diesel exhaust	**105**
Diethamine	106
Diethanolamine	**106**
Diethyl	35
Diethylamine	**106**
N,N-Diethylamine	106

Name	Page
Diethylaminoethanol	107
2-Diethylaminoethanol	**107**
2-Diethylaminoethyl alcohol	107
Diethyl benzene	125
Diethyl (dimethoxyphosphinothioylthio) succinate	189
Diethylene dioxide	120
Diethylene ether	120
Diethylene imidoxide	220
Diethylene oxide	302
Diethylene oximide	220
Diethylenetriamine	**107**
Diethyl ester of phthalic acid	108
N,N-Diethylethanolamine	107
Diethyl ether	140
O-O-Diethyl-O(and S)-2-(ethylthio) ethyl phosphorothioate mixture	90
O,O-Diethyl S-2-(ethylthio)-ethyl phosphorodithioate	124
O,O-Diethyl S-(ethylthio) methylphosphorodithioate	252
O,O-Diethyl S-ethylthiomethylthiothionophosphate	252
Di(2-ethylhexyl) phthalate	120
Diethyl-(2-hydroxyethyl)amine	107
O,O-Diethyl-O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate	92
Diethyl ketone	**108**
Diethylmethylmethane	163
O,O-Diethyl O-(p-methylsulfinyl) phenyl)phosphorothioate	143
O,O-Diethyl-O(p-nitrophenyl) phosphorothioate	241
Diethyl oxide	140
Diethyl parathion	241
Diethyl phthalate	**108**
bis(Diethylthiocarbamoyl) disulfide	124
O,O-Diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate	70
Difluorine monoxide	239
Difluorochloromethane	63
Difluorodibromomethane	**109**
Difluorodichloromethane	98
1,1-Difluoroethene	332
Difluoro-1,1-ethylene	332
1,1-Difluoroethylene	332
1,2-Difluoro-1,1,2,2-tetrachloroethane	299
2,2-Difluoro-1,1,1,2-tetrachloroethane	299
Difolatan®	50
Diglycidyl ether	**109**
2,3-Dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate	52
Dihydroxybenzene	170
1,2-Dihydroxybenzene	56
1,3-Dihydroxybenzene	273
1,4-Dihydroxybenzene	170
m-Dihydroxybenzene	273
o-Dihydroxybenzene	56
2,2'-Dihydroxydiethyamine	106
1,2-Dihydroxyethane	137
Di(2-hydroxyethyl)amine	106
2,4-Dihydroxy-2-methylpentane	165
Diisobutyl ketone	**110**
1,6-Diisocyanatohexane	161
1,5-Diisocyanatonaphthalene	221
Diisopropyl	163
sym-Diisopropyl acetone	110
Diisopropylamine	**110**
Diisopropyl ether	182
Diisopropyl oxide	182
Dimazine	115
3,3'-Dimethoxybenzidine	91
p,p'-Dimethoxydiphenyltrichloroethane	195
Dimethoxymethane	199

Name	Page
Dimethyl acetamide	**111**
N,N-Dimethyl acetamide	111
Dimethylacetone	108
Dimethylamine	**111**
Dimethylamine (anhydrous)	111
Dimethylaminobenzene	337
4-Dimethylaminoazobenzene	**112**
p-Dimethylaminoazobenzene	112
N,N-Dimethyl-4-aminoazobenzene	112
bis(2-(Dimethylamino)ethyl)ether	**112**
Dimethylaminopropionitrile	**113**
3-(Dimethylamino)propionitrile	113
N,N-Dimethylamino-3-propionitrile	113
N,N-Dimethylaniline	**113**
Dimethylaniline [**N,N-Dimethylaniline**]	113
Dimethylaniline [**Xylidine**]	337
2,4-Dimethylaniline	337
1,2-Dimethylbenzene	336
1,3-Dimethylbenzene	335
1,4-Dimethylbenzene	336
N,N-Dimethylbenzeneamine	113
3,3'-Dimethylbenzidine	310
1,1'-Dimethyl-4,4'-bipyridinium dichloride	240
N,N'-Dimethyl-4,4'-bipyridinium dichloride	240
2,2-Dimethylbutane	163
2,3-Dimethylbutane	163
1,3-Dimethylbutyl acetate	165
Dimethylcarbamic chloride	114
Dimethyl carbamoyl chloride	**114**
N,N-Dimethylcarbamoyl chloride	114
Dimethyl carbinol	181
Dimethylchloroether	66
Dimethyl-1,2-dibromo-2,2-dichlorethyl phosphate	**114**
2-Dimethyl-cis-2-dimethylcarbamoyl-1-methylvinylphosphate	103
3,3'-Dimethyl-4,4'-diphenyldiamine	310
tris(Dimethyldithiocarbamato)iron	144
Dimethyleneimine	138
Dimethylene oxide	139
Dimethylenimine	138
Dimethyl ester of 1,2-benzenedicarboxylic acid	116
Dimethyl ester of sulfuric acid	116
O,O-Dimethyl 2-ethylmercaptoethyl thiophosphate	206
Dimethyl formamide	115
Dimethylformamide	**115**
N,N-Dimethylformamide	115
2,6-Dimethyl-4-heptanone	110
1,1-Dimethylhydrazine	**115**
Dimethylketone	3
N,N-Dimethylmethanamine	319
Dimethyl methane	263
O,O-Dimethyl O-3-methyl-4-methylthiophenyl phosphorothioate	144
Dimethylnitromethane	231
O,O-Dimethyl-O-p-nitrophenylphosphorothioate	215
Dimethylnitrosoamine	232
N,N-Dimethylnitrosamine	232
O,O-Dimethyl-S-4-oxo-1,2,3-benzotri-azin-3(4H)-ylmethyl phosphorodithioate	23
N,N-Dimethylphenylamine	113
Dimethylphthalate	**116**
Dimethyl sulfate	**116**
Dimethylsulfate	116
bis(Dimethylthiocarbamoyl) disulfide	307
O,O-Dimethyl O-(2,4,5-trichlorophenyl) phosphorothioate	274
Dinile	288

Name	Page	Name	Page
Dinitolmide	**117**	N,N-Diphenylaniline	323
1,2-Dinitrobenzene	118	N,N-Diphenylbenzenamine	323
1,3-Dinitrobenzene	117	1,2-Diphenylbenzene	297
1,4-Dinitrobenzene	118	1,3-Diphenylbenzene	297
m-Dinitrobenzene	**117**	1,4-Diphenylbenzene	298
meta-Dinitrobenzene	117	m-Diphenylbenzene	297
o-Dinitrobenzene	**118**	o-Diphenylbenzene	297
ortho-Dinitrobenzene	118	p-Diphenylbenzene	298
p-Dinitrobenzene	**118**	Diphenyl ether	249
para-Dinitrobenzene	118	4,4'-Diphenylmethanediamine	209
Dinitro-o-cresol	**119**	4,4'-Diphenylmethane diisocyanate	208
4,6-Dinitro-o-cresol	119	Diphenyl oxide	249
Dinitrogen monoxide	234	Diphenyl oxide-diphenyl mixture	250
Dinitrogen tetroxide	228	**Dipropylene glycol methyl ether**	**122**
3,5-Dinitro-2-hydroxytoluene	119	Dipropylene glycol monomethyl ether	122
4,6-Dinitro-2-methyl phenol	119	**Dipropyl ketone**	**123**
3,5-Dinitro-o-toluamide	117	Diquat dibromide	123
Dinitrotoluene	**119**	**Diquat (Diquat dibromide)**	**123**
Dinitrotoluol	119	Direx®	125
Di-sec octyl phthalate	**120**	Disodium pyrosulfite	284
Diolamine	106	Disodium salt of boric acid	30
Dioxan	120	Disodium tetrabromate	30
Dioxane	**120**	**Disulfiram**	**124**
1,4-Dioxane	120	**Disulfoton**	**124**
p-Dioxane	120	Disulfur decafluoride	291
p-Dioxane-2,3-diyl ethyl phosphorodithioate	121	Di-Syston®	124
		4,5-Dithia-1-octene	11
Dioxane phosphate	121	Dithion®	294
2,3-p-Dioxanethiol-S,S-bis(O,O-diethyl phosphoro-dithioate)	121	**Diuron**	**125**
		Divanadium pentoxide dust	328
Dioxathion	**121**	Divanadium pentoxide fume	328
Dioxin	298	Divinyl	35
Dioxine	298	**Divinyl benzene**	**125**
1,3-Dioxo-2-pivaloy-lindane	259	DMAC	111
DIPA	110	DMCC	114
Diphenyl	**121**	DMF	115
Diphenylamine	**122**	DMH	115

Name	Page	Name	Page
DMNA	232	Ektasolve EB®	36
DMP	116	Ektasolve EB® acetate	37
DMDI	207	Elemental hafnium	156
DMDT	195	Elemental nickel	224
DNC	119	Elemental phosphorus	255
DNOC	119	Elemental rhodium	273
DNT	119	Elemental selenium	276
1-Dodecanethiol	**126**	Elemental silicon	278
Dodecyl mercaptan	126	**Emery**	**126**
1-Dodecyl mercaptan	126	ENB	141
n-Dodecyl mercaptan	126	**Endosulfan**	**127**
DOP	120	Endosulphan	127
Doped bismuth sesquitelluride	29	**Endrin**	**127**
Doped bismuth telluride	29	**Enflurane**	**128**
Doped bismuth tritelluride	29	Engravers acid	225
Doped tellurobismuthite	29	Entex	144
Dowanol® EB	36	**Epichlorohydrin**	**128**
Dowanol® 50B	122	**EPN**	**129**
Dowco® 132	80	1,4-Epoxybutane	302
Dowtherm® 209	269	1,2-Epoxy-3-butoxypropane	42
Dowtherm® A	250	1,2-Epoxy ethane	139
DPA	122	1-Epoxyethyl-3,4-epoxy-cyclohexane	331
DPK	123	1,2-Epoxy-3-isopropoxypropane	183
Dried calcium sulfate	260	1,2-Epoxy-3-phenoxy propane	250
Dry cleaning safety solvent	286	1,2-Epoxy propane	270
Dry ice	53	2,3-Epoxy-1-propanol	153
Dursban®	70	Epoxypropyl alcohol	153
DVB	125	2-Epoxypropyl ether	109
Dyfonate®	147	bis(2,3-Epoxypropyl) ether	109
Dyphonate	147	Erythrene	35
EGBE	36	Essence of mirbane	226
EGBEA	37	Ethanal	2
EGDN	138	Ethanecarboxylic acid	266
EGEE	130	1,2-Ethanediamine	136
EGEEA	131	Ethanedinitrile	82
EGME	202	Ethanedioic acid	238
EGMEA	202	1,2-Ethanediol	137

Name	Page
1,2-Ethanediol dinitrate	138
Ethane hexachloride	159
Ethane pentachloride	242
Ethanethiol	141
Ethane trichloride	315
Ethanoic acid	2
Ethanoic anhydride	3
Ethanol	132
Ethanolamine	**129**
Ethenone	185
Ethenyl acetate	329
Ethenyl benzene	287
Ethenyl ethanoate	329
Ethenylmethylbenzene	333
Ether	140
Ethine	5
Ethion	**130**
S-[1,2-bis(ethoxycarbonyl) ethyl]O,O-dimethyl phosphorodithioate	189
2-Ethoxyethanol	**130**
2-Ethoxyethyl acetate	**131**
Ethrane®	128
Ethyl acetate	**131**
Ethyl acetone	245
Ethyl acrylate	**132**
Ethyl acrylate (inhibited)	132
Ethyl alcohol	**132**
Ethyl aldehyde	2
Ethylamine	**133**
Ethylamine (anhydrous)	133
Ethyl amyl ketone	210
Ethyl benzene	**133**
Ethylbenzol	133
Ethyl bromide	**134**
Ethyl butyl ketone	**134**
Ethyl carbinol	268
Ethyl chloride	**135**
Ethyl cyanide	266
1,1'-Ethylene-2,2'-bipyridyllium dibromide	123
Ethylene bromide	136
Ethylenecarboxylic acid	8
Ethylene chlorhydrin	135
Ethylene chloride	137
Ethylene chlorohydrin	**135**
Ethylene cyanide	288
Ethylenediamine	**136**
Ethylenediamine (anhydrous)	136
Ethylene dibromide	**136**
Ethylene dichloride	**137**
Ethylene dicyanide	288
Ethylene dinitrate	138
Ethylene glycol	**137**
Ethylene glycol dinitrate	**138**
Ethylene glycol isopropyl ether	180
Ethylene glycol monobutyl ether	36
Ethylene glycol monobutyl ether acetate	37
Ethylene glycol monoethyl ether	130
Ethylene glycol monoethyl ether acetate	131
Ethylene glycol monomethyl ether	202
Ethylene glycol monomethyl ether acetate	202
Ethyleneimine	**138**
Ethylene monochloride	330
Ethylene nitrate	138
Ethylene oxide	**139**
Ethylene thiourea	**139**
1,3-Ethylene-2-thiourea	139
N,N-Ethylenethiourea	139
Ethylene trichloride	316
Ethylenimine	138
Ethyl ester of acetic acid	131

Name	Page
Ethyl ester of acrylic acid	132
Ethyl ester of formic acid	140
N-Ethylethanamine	106
Ethyl ethanoate	131
Ethyl ether	**140**
Ethyl formate	**140**
Ethylformic acid	266
bis-(2-Ethylhexyl)phthalate	120
5-Ethylidenebicyclo(2.2.1)hept-2-ene	141
Ethylidene norbornene	**141**
5-Ethylidene-2-norbornene	141
Ethylidene chloride	99
1,1-Ethylidene dichloride	99
Ethylimine	138
Ethyl ketone	108
Ethyl mercaptan	**141**
Ethyl methanoate	140
Ethyl methyl ketone	36
Ethyl methyl ketone peroxide	209
Ethyl 3-methyl-4-(methylthio)phenyl-(1-methylethyl)phosphoramidate	143
O-Ethyl O-(4-methylthio)phenyl S-propylphosphorodithioate	292
4-Ethylmorpholine	142
N-Ethylmorpholine	**142**
Ethyl nitrile	4
Ethyl p-nitrophenyl benzenethionophosphonate	129
O-Ethyl O-(4-nitrophenyl) phenylphosphonothioate	129
Ethylolamine	129
Ethyl orthosilicate	142
Ethyl oxide	140
Ethyl parathion	241
Ethyl phthalate	108
O-Ethyl-S-phenyl ethylphosphorothioate	147
Ethyl propenoate	132
Ethyl pyrophosphate	296
Ethyl silicate	**142**
Ethyl silicate (condensed)	142
Ethyl sulfhydrate	141
Ethyne	5
EtOH	132
ETU	139
Expanded perlite	247
FAA	5
2-FAA	5
Fenamiphos	**143**
Fenothiazine	248
Fensulfothion	**143**
Fenthion	**144**
Fenylfosfin	252
Ferbam	**144**
Fermentation amyl alcohol	175
Ferric chloride	174
Ferric dimethyl dithiocarbamate	144
Ferric nitrate	174
Ferric oxide	173
Ferric sulfate	174
Ferrocene	104
Ferrous chloride	174
Ferrous sulfate	174
Ferrovanadium	145
Ferrovanadium dust	**145**
Fusel oil	175
Fiber glas®	145
Fiberglass	145
Fibrous glass dust	**145**
Floridine	283
Flue gas	54
2-Fluorenylacetamide	5
Fluorine	**146**
Fluorine-19	146

Name	Page	Name	Page
Fluorine monoxide	239	Freon® 13B1	318
Fluorocarbon-12	98	Fuel Oil No. 1	184
Fluorocarbon-22	63	Furacarb®	52
Fluorocarbon-115	67	Furadan®	52
Fluorocarbon 1011	63	Fural	150
Fluorocarbon 1301	318	2-Furancarboxaldehyde	150
Fluorodichloromethane	100	2,5-Furanedione	189
Fluoroethene	331	**Furfural**	**150**
Fluoroethylene	331	Furfuraldehyde	150
Fluoroformyl fluoride	55	2-Furfuraldehyde	150
Fluorophosgene	55	**Furfuryl alcohol**	**150**
Fluorotrichloromethane	**146**	Furnace black	52
Fluoroxene	**147**	2-Furylmethanol	150
Fonofos	**147**	Fused borax	30
Fonophos	147	**Gasoline**	**151**
Formal	199	Genetron® 12	98
Formaldehyde	**148**	Genetron® 21	100
Formaldehyde cyanohydrin	153	Genetron® 22	63
Formaldehyde dimethylacetal	199	Genetron® 113	317
Formaldehyde solution	148	Genetron® 114	102
Formalin (as formaldehyde)	**148**	Genetron® 115	67
Formamide	**149**	Germane	151
Formic acid	**149**	Germanium hydride	151
Formic acid (85-95% in aqueous solution)	149	**Germanium tetrahydride**	**151**
		Germanomethane	151
Formonitrile	168	Glacial acetic acid	2
Freon® 10	55	Glacial acrylic acid	8
Freon® 11	146	Glass fibers	145
Freon® 12	98	Glass wool	145
Freon® 21	100	**Glutaraldehyde**	**152**
Freon® 22	63	Glutaric dialdehyde	152
Freon® 112	299	Glycerin (anhydrous)	152
Freon® 112a	299	**Glycerin (mist)**	**152**
Freon® 113	317	Glycerol	152
Freon® 114	102	Glycerol trichlorohydrin	317
Freon® 115	67	Glyceryl trichlorohydrin	317
Freon® 12B2	109	Glyceryl trinitrate	229

Name	Page	Name	Page
Glycide	153	Halon® 122	98
Glycidol	**153**	Halon® 242	102
Glycidyl phenyl ether	250	Halon® 1011	63
Glycol	137	Halon® 1202	109
Glycol alcohol	137	Halon® 1301	318
Glycol dibromide	136	**Halothane**	**156**
Glycol dichloride	137	Halowax® [**Tetrachloronaphthalene**]	301
Glycol dinitrate	138	Halowax® [**Trichloronaphthalene**]	316
Glycolic nitrile	153	Halowax® 1013	243
Glycol monoethyl ether acetate	131	Halowax® 1014	160
Glycol monomethyl ether	202	Halowax® 1051	235
Glycol monomethyl ether acetate	202	Hard metal	325
Glycolonitrile	**153**	Hard wood dust	335
Glyconitrile	153	HCBD	158
Glycyl alcohol	152	HCCPD	159
Grain alcohol	132	HCH	186
Grain dust (oat, wheat, barley)	**154**	HDI	161
Graphite (natural)	**154**	Heavy mineral oil mist	237
Graphite (synthetic)	**155**	Hemellitol	320
Gum camphor	49	Hemihydrate gypsum	260
Gumspirits	325	Hemimellitene [**1,2,3-Trimethylbenzene**]	320
Gum turpentine	325		
Guthion®	23	Hemimellitene [**1,2,4-Trimethylbenzene**]	320
Gypsum	**155**		
Gypsum hemihydrate	260	HEOD	105
Gypsum stone	155	**Heptachlor**	**157**
Hafnium	**156**	1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene	157
Hafnium metal	156		
Halane	98	Heptane	157
Halocarbon 112	299	**n-Heptane**	**157**
Halocarbon 112a	299	normal-Heptane	157
Halocarbon 113	317	**1-Heptanethiol**	**158**
Halocarbon 1132A	332	Heptan-4-one	123
Halocarbon 115	67	2-Heptanone	201
Halocarbon 13B1	318	3-Heptanone	134
Halon® 104	55	4-Heptanone	123
Halon® 112	100	Heptyl mercaptan	158

Name	Page
n-Heptyl mercaptan	158
Hexachlorobutadiene	**158**
Hexachloro-1,3-butadiene	158
1,3-Hexachlorobutadiene	158
γ-Hexachlorocyclohexane	186
1,2,3,4,5,6-Hexachlorocyclohexane, gamma isomer of	186
Hexachlorocyclopentadiene	**159**
Hexachloro-1,3-cyclopentadiene	159
1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene	159
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	127
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	105
Hexachloroethane	**159**
6,7,8,9,10-Hexachloro-1,5,5a,6,9,9a-hexachloro-6,9-methano-2,4,3-benzo-dioxathiepin-3-oxide	127
1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-endo-1,4-exo-5,8-dimethanonaphthalene	9
Hexachloronaphthalene	**160**
Hexadecanethiol-1	160
1-Hexadecanethiol	**160**
n-Hexadecanethiol	160
Hexadecyl mercaptan	160
Hexadrin®	127
Hexafluoroacetone	**161**
Hexafluoro-2-propanone	161
1,1,1,3,3,3-Hexafluoro-2-propanone	161
Hexahydroaniline	85
Hexahydro-2H-azepin-2-one	50
Hexahydrobenzenamine	85
Hexahydrobenzene	83
Hexahydrocresol	205
Hexahydromethylphenol	205
Hexahydrophenol	84
Hexahydrotoluene	204
Hexahydro-1,3,5-trinitro-s-triazine	86
Hexalin	84
Hexamethylene	83
Hexamethylene diisocyanate	**161**
Hexamethylene-1,6-diisocyanate	161
1,6-Hexamethylene diisocyanate	161
Hexamethyl phosphoramide	**162**
Hexamethylphosphoric triamide	162
Hexamethylphosphorotriamide	162
Hexanaphthene	83
Hexane	162
n-Hexane	**162**
normal-Hexane	162
Hexanedinitrile	9
Hexane isomers (excluding n-Hexane)	**163**
1-Hexanethiol	163
n-Hexanethiol	**163**
2-Hexanone	**164**
Hexone	**164**
sec-Hexyl acetate	**165**
Hexylene glycol	**165**
Hexyl hydride	162
Hexyl mercaptan	163
n-Hexyl mercaptan	163
n-Hexylthiol	163
HFA	161
HF-A	168
HHDN	9
High solvent naphtha	220
High-strength hydrogen peroxide	169
HMDI	161
HMPA	162

Name	Page	Name	Page
HPA	171	**Hydrogen sulfide**	**170**
Hydralin	84	Hydromagnesite	188
Hydrated aluminum silicate	183	Hydroperoxide	169
Hydrated calcium sulfate	155	**Hydroquinone**	**170**
Hydrated lime	47	Hydroquinone monomethyl ether	196
Hydraulic cement	262	Hydrosulfuric acid	170
Hydrazine	**166**	Hydrous magnesium silicate	293
Hydrazine (anhydrous)	166	Hydroxyacetonitrile	153
Hydrazine base	166	p-Hydroxyanisole	196
Hydrazinobenzene	251	Hydroxybenzene	248
Hydrite	183	1-Hydroxybutane	39
Hydroacrylic acid	265	2-Hydroxybutane	40
Hydrochloric acid	167	Hydroxycellulose	56
Hydrochloric ether	135	Hydroxycyclohexane	84
Hydrocobalt tetracarbonyl	75	2-Hydroxyethylamine	129
Hydrocyanic acid	168	bis(2-Hydroxyethyl)amine	106
Hydrofluoric acid	168	β-Hydroxyethyl isopropyl ether	180
Hydrogen antimonide	285	α-Hydroxyisobutyronitrile	4
Hydrogen arsenide	21	3-Hydroxy-β-lactone	265
Hydrogenated diphenylbenzenes	166	1-Hydroxy-2-methylbenzene	79
Hydrogenated MDI	207	1-Hydroxy-3-methylbenzene	78
Hydrogenated phenylbiphenyls	166	1-Hydroxy-4-methylbenzene	79
Hydrogenated terphenyls	**166**	3-Hydroxy-N-methylcrotonamide dimethylphosphate	219
Hydrogenated triphenyls	166		
Hydrogen bromide	**167**	Hydroxymethyl ethylene oxide	153
Hydrogen carboxylic acid	149	2-Hydroxymethylfuran	150
Hydrogen chloride	**167**	2-Hydroxymethyl oxiran	153
Hydrogen cyanamide	81	4-Hydroxy-4-methyl-2-pentanone	90
Hydrogen cyanide	**168**	2,2-bis(Hydroxymethyl)-1,3-propanediol	244
Hydrogen dioxide	169		
Hydrogen fluoride	**168**	2-Hydroxy-2-methyl-propionitrile	4
Hydrogen nitrate	225	4-Hydroxy-3-(3-oxo-1-phenyl butyl)-2H-1-benzopyran-2-one	334
Hydrogen peroxide	**169**		
Hydrogen peroxide (aqueous)	169	2-Hydroxyphenol	56
Hydrogen phosphide	254	3-Hydroxyphenol	273
Hydrogen selenide	**169**	m-Hydroxyphenol	273
Hydrogen sulfate	290		

Chemical, Synonym, and Trade Name Index (Continued)

(Primary chemical names appear in blue text.)

Name	Page	Name	Page
3-Hydroxy-1-propanesulphonic acid sultone	264	**Iron pentacarbonyl (as Fe)**	**174**
		Iron salts (soluble, as Fe)	**174**
3-Hydroxy-propionic acid	265	Iron(II) sulfate	174
2-Hydroxypropyl acrylate	**171**	Iron(III) sulfate	174
β-Hydroxypropyl acrylate	171	Isoacetophorone	179
3-Hydroxypropylene oxide	153	**Isoamyl acetate**	**175**
2-Hydroxytoluene	79	**Isoamyl alcohol (primary)**	**175**
3-Hydroxytoluene	78	**Isoamyl alcohol (secondary)**	**176**
4-Hydroxytoluene	79	Isoamyl methyl ketone	212
2-Hydroxytriethylamine	107	**Isobutane**	**176**
Hyponitrous acid anhydride	234	Isobutanol	177
IBA	177	Isobutenyl methyl ketone	194
IGE	183	**Isobutyl acetate**	**177**
2-Imidazolidine-2-thione	139	**Isobutyl alcohol**	**177**
2,2'-Iminodiethanol	106	Isobutyl carbinol	175
Impure corundum	126	Isobutyl ester of acetic acid	177
Indene	**171**	Isobutylmethylcarbinol	212
Indium	**172**	Isobutyl methyl ketone	164
Indium metal	172	**Isobutyronitrile**	**178**
Indonaphthene	171	bis(4-Isocyanatocyclohexyl)methane	207
Inert dusts	241	3-Isocyanatomethyl-3,5,5-trimethylcyclohexyl-isocyanate	179
Iodine	**172**		
Iodine crystals	172	Isohexane	163
Iodoform	**173**	Isooctanol	178
Iodomethane	211	**Isooctyl alcohol**	**178**
N-IPA	182	Isopentyl acetate	175
IPDI	179	Isopentyl alcohol	175
Iron carbonyl	174	Isopentyl methyl ketone	212
Iron dicyclopentadienyl	104	**Isophorone**	**179**
Iron(II) chloride	174	Isophorone diamine diisocyanate	179
Iron(III) chloride	174	**Isophorone diisocyanate**	**179**
Iron(III) nitrate	174	Isophthalodinitrile	258
Iron oxide dust and fume (as Fe)	**173**	Isoprene cyanide	199
Iron(III) oxide [**Iron oxide dust and fume (as Fe)**]	173	Isopropanol	181
		Isopropenyl benzene	216
Iron(III) oxide [**Rouge**]	276	Isopropenylnitrile	199
Iron oxide red	276	**2-Isopropoxyethanol**	**180**

Name	Page
Isopropoxymethyl oxirane	183
o-Isopropoxyphenyl-N-methylcarbamate	267
2-Isopropoxy propane	182
Isopropyl acetate	**180**
Isopropyl alcohol	**181**
Isopropylamine	**181**
Isopropylaniline	182
N-Isopropylaniline	**182**
Isopropyl benzene	81
Isopropylcarbinol	177
Isopropyl Cellosolve®	180
Isopropyl cyanide	178
Isopropyl ester of acetic acid	180
Isopropyl ether	**182**
Isopropyl glycidyl ether	**183**
Isopropyl glycol	180
Isopropylideneacetone	194
Isopropyl methyl ketone	213
Isovalerone	110
Jasmolin I or II	271
Jeffersol EB	36
Kaolin	**183**
Karmex®	125
Kepone	**184**
Kerosene	**184**
Ketene	**185**
Keto-ethylene	185
Ketone propane	3
Korax®	66
β-Lactone	265
Lannate®	195
Lamp black	52
Lanstan®	66
Laughing gas	234
Laurel camphor	49
Lauryl mercaptan	126
n-Lauryl mercaptan	126
Lead	**185**
Lead metal	185
Lead tetraethyl	302
Lead tetramethyl	303
Lepidolite	217
Lignite coal dust	73
Ligroin	333
Lime	48
Lime nitrogen	47
Limestone	**186**
Lindane	**186**
Liquefied hydrocarbon gas	187
Liquefied petroleum gas	187
Lithium hydride	**187**
Lithium monohydride	187
LPG	187
L.P.G.	**187**
Lye [**Potassium hydroxide**]	263
Lye [**Sodium hydroxide**]	284
MA	219
Mace®	61
Magnesia fume	188
Magnesite	**188**
Magnesium carbonate	188
Magnesium(II) carbonate	188
Magnesium oxide fume	**188**
Malathion	**189**
Maleic acid anhydride	189
Maleic anhydride	**189**
Malonaldehyde	**190**
Malonic aldehyde	190
Malonic dinitrile	190
Malonodialdehyde	190
Malononitrile	**190**
Manganese-55	191

Name	Page
Manganese compounds and fume (as Mn)	**191**
Manganese cyclopentadienyl tricarbonyl (as Mn)	**191**
Manganese metal	191
Manganese oxide	192
Manganese tetroxide (as Mn)	**192**
Manganese tricarbonylmethylcyclopentadienyl	206
Manganomanganic oxide	192
Manmade mineral fibers	217
MAPP gas	198
Marble	**192**
Margarite	217
Massive talc	280
MBK	164
MBOCA	207
MCB	62
MCT	191
MDA	209
MDI	208
Mecrylate	204
MEK	36
MEKP	209
MEK peroxide	209
Mequinol	196
Mercaptoacetate	306
Mercaptoacetic acid	306
2-Mercaptoacetic acid	306
Mercaptobenzene	26
1-Mercaptobutane	43
1-Mercaptodecane	89
1-Mercaptododecane	126
Mercaptoethane	141
Mercaptomethane	214
1-Mercaptononane	235
1-Mercaptooctadecane	236
1-Mercaptooctane	237
3-Mercaptopropane	264
Mercury compounds [except (organo) alkyls] (as Hg)	**193**
Mercury metal	193
Mercury (organo) alkyl compounds (as Hg)	**193**
Mesitylene	321
Mesityl oxide	**194**
Metacetone	108
Metacetonic acid	266
Metallic mercury	193
Metallic tin	308
Metallum problematum	295
Metasystox®	206
Methacrylate monomer	214
Methacrylic acid	**194**
Methacrylic acid (glacial)	194
Methacrylic acid (inhibited)	194
α-Methacrylic acid	194
Methacrylonitrile	199
Methanal	148
Methanamide	149
Methanecarboxylic acid	2
Methane tetrabromide	54
Methane tetramethylol	244
Methanethiol	214
Methane trichloride	65
Methanoic acid	149
Methanol	200
Methoflurane	196
Methomyl	**195**
o-Methoxyaniline	18
p-Methoxyaniline	19
4-Methoxy-1,3-benzene-diamine	91
Methoxycarbonylethylene	198
Methoxychlor	**195**

Name	Page	Name	Page
Methoxy-DDT	195	**Methyl (n-amyl) ketone**	**201**
2-Methoxyethanol	202	2-Methylaniline	313
2-Methoxyethyl acetate	202	3-Methylaniline	312
Methoxyfluorane	196	4-Methylaniline	313
Methoxyflurane	**196**	N-Methyl aniline	219
1-Methoxy-2-hydroxypropane	269	o-Methylaniline	313
2-Methoxy-1-methylethanol	269	Methyl azinphos	23
Methoxymethyl methyl ether	199	2-Methylaziridine	270
4-Methoxyphenol	**196**	Methyl benzene	311
p-Methoxyphenol	196	3-Methylbenzenamine	312
4-Methoxy-m-phenylene-diamine	91	4-Methylbenzenamine	313
2,2-bis(p-Methoxyphenyl)-1,1,1-trichloroethane	195	Methyl benzol	311
		Methyl bromide	**201**
1-Methoxy-2-propanol	269	3-Methyl-1-butanol	175
Methyl acetate	**197**	3-Methyl-2-butanol	176
Methyl acetic acid	266	3-Methyl-1-butanol acetate	175
Methyl acetone	36	3-Methyl-2-butanone	213
Methyl acetylene	**197**	3-Methyl butan-2-one	213
Methyl acetylene-allene mixture	198	1-Methylbutyl acetate	17
Methyl acetylene-propadiene mixture	**198**	1-Methyl-4-tert-butylbenzene	44
		Methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate	25
Methyl acetylene-propadiene mixture (stabilized)	198		
		3-Methylbutyl ester of acetic acid	175
β-Methyl acrolein	80	3-Methylbutyl ethanoate	175
Methyl acrylate	**198**	Methyl butyl ketone	164
2-Methylacrylic acid	194	Methyl n-butyl ketone	164
Methylacrylonitrile	**199**	**Methyl Cellosolve®**	**202**
α-Methylacrylonitrile	199	**Methyl Cellosolve® acetate**	**202**
Methylal	**199**	**Methyl chloride**	**203**
Methyl alcohol	**200**	Methyl chlorobromide	63
Methyl aldehyde	148	**Methyl chloroform**	**203**
Methylamine	**200**	Methylchloromethyl ether	66
Methylamine (anhydrous)	200	Methyl cyanide	4
Methylamine (aqueous)	200	Methyl cyanoacrylate	204
(Methylamino)benzene	219	**Methyl-2-cyanoacrylate**	**204**
1-Methyl-2-aminobenzene	313	Methyl α-cyanoacrylate	204
Methyl amyl alcohol	212	**Methylcyclohexane**	**204**

Name	Page	Name	Page
Methylcyclohexanol	**205**	1-Methylethyl ester of acetic acid	180
2-Methylcyclohexanone	205	Methyl ethyl ketone	36
o-Methylcyclohexanone	**205**	Methyl ethyl ketone hydroperoxide	209
2-Methylcyclopentadienyl manganese tricarbonyl	206	**Methyl ethyl ketone peroxide**	**209**
		Methylethylmethane	35
Methyl cyclopentadienyl manganese tricarbonyl (as Mn)	**206**	N-(1-Methylethyl)-2-propanamine	110
		Methyl formate	**210**
Methyl demeton	**206**	3-Methyl-5-heptanone	210
4-Methyl-2,6-di-tert-butyl phenol	94	**5-Methyl-3-heptanone**	**210**
2-Methyl-3,5-dinitrobenzamide	117	2-Methyl-5-hexanone	212
Methyl dinitrobenzene	119	5-Methyl-2-hexanone	212
4,4'-Methylenebis(2-chloroaniline)	**207**	**Methyl hydrazine**	**211**
4,4'-Methylenebis(o-chloroaniline)	207	**Methyl iodide**	**211**
4,4'-Methylenebis(2-chloro-benzenamine)	207	Methylisoamyl acetate	165
		Methyl isoamyl ketone	**212**
Methylene bis(4-cyclohexyl-isocyanate)	**207**	Methyl isobutenyl ketone	194
		Methyl isobutyl carbinol	**212**
Methylene bisphenyl isocyanate	**208**	Methyl isobutyl ketone	164
Methylene chloride	**208**	**Methyl isocyanate**	**213**
4,4'-Methylenedianiline	**209**	N-Methyl-2-isopropoxyphenyl-carbamate	267
Methylene dichloride	208		
Methylene dimethyl ether	199	**Methyl isopropyl ketone**	**213**
Methylene di-p-phenylene ester of isocyanic acid	208	2-Methyllactonitrile	4
		Methyl mercaptan	**214**
Methylene oxide	148	Methyl mercaptophos	206
Methylene bis(4-phenyl isocyanate)	208	**Methyl methacrylate**	**214**
Methyl ester of acetic acid	197	N-Methylmethanamine	111
Methyl ester of acrylic acid	198	Methyl methanoate	210
Methyl ester of 2-cyanoacrylic acid	204	Methyl N-((methylamino)carbonyl) oxy)ethanimidothioate	195
Methyl ester of formic acid	210		
Methyl ester of isocyanic acid	213	S-Methyl-N-(methylcarbamoyloxy) thioacetimidate	195
Methyl ester of methacrylic acid	214		
Methyl ethanoate	197	Methyl-2-methyl-2-propenoate	214
N-(1-Methylethyl)-benzenamine	182	2-Methylnitrobenzene	233
Methyl ethyl carbinol	40	3-Methylnitrobenzene	232
2-Methylethyleneimine	270	4-Methylnitrobenzene	233
Methyl ethylene oxide	270	o-Methylnitrobenzene	233

Name	Page	Name	Page
m-Methylnitrobenzene	232	**Methyl silicate**	**215**
p-Methylnitrobenzene	233	Methylstyrene	333
N-Methyl-N-nitroso-methanamine	232	**α-Methyl styrene**	**216**
Methyl orthosilicate	215	Methyl sulfate	116
Methyloxirane	270	Methyl sulfhydrate	214
Methyl parathion	**215**	Methyl systox®	206
2-Methylpentane	163	N-Methyl-N,2,4,6-tetranitroaniline	305
3-Methylpentane	163	Methyl tribromide	34
2-Methyl-2,4-pentanediol	165	1-Methyl-2,4,6-trinitrobenzene	322
4-Methyl-2,4-pentanediol	165	Methyl yellow	112
2-Methylpentane-2,4-diol	165	**Metribuzin**	**216**
4-Methyl-2-pentanol	212	Mevinphos	253
2-Methyl-2-pentanol-4-one	90	MIAK	212
4-Methyl 2-pentanone	164	MIBC	212
4-Methyl-3-penten-2-one	194	MIBK	164
2-Methyl phenol	79	MIC	213
3-Methyl phenol	78	**Mica (containing less than 1% quartz)**	**217**
4-Methyl phenol	79		
Methylphenylamine	219	Mineral carbon	154
Methylphenylene diamine	311	Mineral spirits	286
1-Methyl-1-phenylethylene	216	Mineral white	155
Methyl phosphite	321	**Mineral wool fiber**	**217**
2-Methylpropane	176	MIPK	213
2-Methylpropanenitrile	178	MMH	211
2-Methyl-1-propanol	177	MMT	206
2-Methyl-2-propanol	40	MOCA	207
2-Methylpropenenitrile	199	Molecular bromine	33
Methyl propenoate	198	Molecular chlorine	59
2-Methylpropenoic acid	194	Molecular iodine	172
2-Methylpropionitrile	178	**Molybdenum**	**218**
1-Methylpropyl acetate	38	Molybdenum metal	218
2-Methylpropyl acetate	177	**Molybdenum (soluble compounds, as Mo)**	**218**
2-Methylpropyl ester of acetic acid	177		
β-Methylpropyl ethanoate	177	Monoammonium salt of sulfamic acid	16
Methyl propyl ketone	245	Monobromoethane	134
2-(1-Methylpropyl)phenol	43	Monobromoethylene	330
3-(1-Methyl-2-pyrrolidyl)pyridine	224	Monobromomethane	200

Name	Page	Name	Page
Monobromotrifluoromethane	318	MXDA	337
Monochloroacetyl chloride	61	Naled	114
Monochlorobenzene	62	Naphtha	220
Monochlorodifluoromethane	63	**Naphtha (coal tar)**	**220**
Monochloroethane	135	**Naphthalene**	**221**
Monochloroethene	330	**Naphthalene diisocyanate**	**221**
Monochloroethylene	330	1,5-Naphthalene diisocyanate	221
Monochloromethane	203	1,5-Naphthalene ester of isocyanic acid	221
Monochloropentafluoroethane	67		
Monocron	219	Naphthalin	221
Monocrotophos	**219**	1-Naphthylamine	222
Monoethanolamine	129	2-Naphthylamine	222
Monoethylamine	133	**α-Naphthylamine**	**222**
Monoethylene glycol	137	**β-Naphthylamine**	**222**
Monofluoroethylene	331	1-Naphthyl N-Methyl-carbamate	51
Monofluorotrichloromethane	146	α-Naphthyl N-methyl-carbamate	51
Monogermane	151	β-Naphthylphenylamine	251
Monohydroxybenzene	248	α-Naphthyl thiocarbamide	20
Monoiodomethane	211	1-Naphthyl thiourea	20
Monoisopropylamine	181	α-Naphthyl thiourea	20
Monomethylamine	200	Natural aluminum oxide	126
Monomethyl aniline	**219**	Natural calcium carbonate [**Limestone**]	186
Monomethyl ether hydroquinone	196		
Monomethylhydrazine	211	Natural calcium carbonate [**Marble**]	192
Mononitrogen monoxide	225	Natural gasoline	151
Monopentaerythritol	244	Navadel®	121
Monophenylhydrazine	251	NDI	221
Monosilane	279	NDMA	232
Monosodium salt of sulfurous acid	282	Nemacur®	143
Monoxide	54	NG	229
Morpholine	**220**	NIAX® A99	112
Motor fuel	151	NIAX® Catalyst A1	112
Motor spirits	151	**Niax® Catalyst ESN**	**223**
MPK	245	Nibren wax [**Tetrachloronaphthalene**]	301
Muriatic acid	167		
Muriatic ether	135	Nibren wax [**Trichloronaphthalene**]	316
Muscovite	217	Nickel catalyst	224

Name	Page
Nickel carbonyl	**223**
Nickel metal	224
Nickel metal and other compounds (as Ni)	**224**
Nickel tetracarbonyl	222
Nicotine	**224**
Nitramine	305
Nitrapyrin	69
Nitric acid	**225**
Nitric oxide	**225**
4-Nitroaniline	226
p-Nitroaniline	**226**
4-Nitrobenzenamine	226
Nitrobenzene	**226**
Nitrobenzol	226
4-Nitrobiphenyl	**227**
p-Nitrobiphenyl	227
Nitrocarbol	230
4-Nitrochlorobenzene	227
p-Nitrochlorobenzene	**227**
Nitrochloroform	67
4-Nitrodiphenyl	227
p-Nitrodiphenyl	227
Nitroetan	228
Nitroethane	**228**
Nitrogen dioxide	**228**
Nitrogen fluoride	229
Nitrogen lime	47
Nitrogen monoxide	225
Nitrogen peroxide	228
Nitrogen trifluoride	**229**
Nitroglycerine	**229**
Nitroglycol	138
Nitromethane	**230**
2-Nitronaphthalene	**230**
β-Nitronaphthalene	230
p-Nitrophenylamine	226
Nitropropane	231
1-Nitropropane	**231**
2-Nitropropane	**231**
iso-Nitropropane	231
N-Nitrosodimethylamine	**232**
N-Nitroso-N,N-dimethylamine	232
2-Nitrotoluene	233
3-Nitrotoluene	232
4-Nitrotoluene	233
m-Nitrotoluene	**232**
meta-Nitrotoluene	232
o-Nitrotoluene	**233**
ortho-Nitrotoluene	233
p-Nitrotoluene	**233**
para-Nitrotoluene	233
Nitrotrichloromethane	67
Nitrous oxide	**234**
Nonane	**234**
n-Nonane	234
1-Nonanethiol	**235**
Nonyl hydride	234
n-Nonyl mercaptan	235
Nonylthiol	235
1-NP	231
2-NP	231
N-serve®	69
Nuisance dusts	241
Nux vomica	286
OCBM	62
Octacarbonyldicobalt	74
Octachlorocamphene	58
Octachloronaphthalene	**235**
1,2,3,4,5,6,7,8-Octachloronaphthalene	235
1,2,4,5,6,7,8,8-Octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane	57
1-Octadecanethiol	**236**
Octadecyl mercaptan	236

Name	Page	Name	Page
Octalene	9	Paraquat dichloride	240
Octane	**236**	**Paraquat (Paraquat dichloride)**	**240**
n-Octane	236	**Parathion**	**241**
normal-Octane	236	Parathion-ethyl	241
1-Octanethiol	**237**	Parathion methyl	215
n-Octyl mercaptan	237	**Particulates not otherwise regulated**	**241**
Octyl phthalate	120		
Octylthiol	237	PBNA	251
1-Octylthiol	237	PCB [**Chlorodiphenyl (42% chlorine)**]	64
Oil mist (mineral)	**237**		
Oil of mirbane	226	PCB [**Chlorodiphenyl (54% chlorine)**]	64
Oil of vitriol	290		
Onion oil	11	PCM	246
Orthophosphoric acid	254	PCNB	227
Osmic acid anhydride	238	PCP	243
Osmium oxide	238	m-PDN	258
Osmium tetroxide	**238**	PE	244
Oxalic acid	**238**	Pebble lime	48
Oxalic acid (aqueous)	238	Penta	243
Oxalic acid dihydrate	238	**Pentaborane**	**242**
Oxalonitrile	82	Pentaboron nonahydride	242
2-Oxetanone	265	Pentacarbonyl iron	174
Oxirane	139	**Pentachloroethane**	**242**
2-Oxohexamethyleneimine	50	**Pentachloronaphthalene**	**243**
Oxooctyl alcohol	178	1,2,3,4,5-Pentachloronaphthalene	243
Oxybis(chloromethane)	65	**Pentachlorophenol**	**243**
2,2'-Oxybis(N,N-dimethyl ethylamine)	112	2,3,4,5,6-Pentachlorophenol	243
Oxygen difluoride	**239**	Pentachlorophosphorus	256
Oxygen fluoride	239	**Pentaerythritol**	**244**
Ozone	**239**	Pentalin	242
Painters naphtha	333	Pentamethylene	87
PAN	257	Pentanal	327
Paraffin fume	240	Pentane	244
Paraffin oil mist	237	**n-Pentane**	**244**
Paraffin scale fume	240	normal-Pentane	244
Paraffin wax fume	**240**	1,5-Pentanedial	152
Paraquat chloride	240	**1-Pentanethiol**	**245**

Name	Page	Name	Page
1-Pentanol acetate	17	Phenylamine	18
2-Pentanol acetate	17	2-Phenylaminonaphthalene	251
2-Pentanone	**245**	Phenylaniline	122
3-Pentanone	108	4-Phenylaniline	14
Penthrane	196	N-Phenylaniline	122
Pentyl ester of acetic acid	17	N-Phenylbenzenamine	122
Pentyl mercaptan	245	Phenyl benzene	121
Perchlorobutadiene	158	2-Phenylbiphenyl	297
Perchlorocyclopentadiene	159	3-Phenylbiphenyl	297
Perchloroethane	159	4-Phenylbiphenyl	298
Perchloroethylene	301	Phenyl chloride	62
Perchloromethyl mercaptan	**246**	Phenyl chloromethyl ketone	61
Perchloronaphthalene	235	1,4-Phenylene diamine	249
Perchloryl fluoride	**246**	**p-Phenylene diamine**	**249**
Perfluoroacetone	161	m-Phenylenebis(methylamine)	337
Perk	301	Phenyl 2,3-epoxypropyl ether	250
Perlite	**247**	Phenylethane	133
Peroxide	169	**Phenyl ether (vapor)**	**249**
Petrol	151	**Phenyl ether-biphenyl mixture (vapor)**	**250**
Petroleum asphalt	22		
Petroleum bitumen	22	Phenylethylene	287
Petroleum distillates (naphtha)	**247**	**Phenyl glycidyl ether**	**250**
Petroleum ether	333	**Phenylhydrazine**	**251**
Petroleum naphtha	247	Phenyl hydride	26
Petroleum solvent	286	Phenyl hydroxide	248
Petroleum spirit	333	N-Phenylisopropylamine	182
PF	252	Phenyl mercaptan	26
PGDN	269	Phenyl methane	311
PGE	250	N-Phenylmethylamine	219
Phenacyl chloride	61	Phenyl-β-naphthylamine	251
Phenamiphos	143	**N-Phenyl-β-naphthylamine**	**251**
Phenanthrene	74	4-Phenylnitrobenzene	227
Phenol	**248**	p-Phenylnitrobenzene	227
Phenol trinitrate	259	Phenyl oxide	249
Phenothiazine	**248**	Phenyl phosphate	323
Phenoxy benzene	249	**Phenylphosphine**	**252**
Phenyl alcohol	248	2-Phenyl propane	81

Name	Page	Name	Page
2-Phenyl propylene	216	Pivalyl	259
Phlogopite	217	2-Pivalyl-1,3-inandione	259
Phorate	**252**	**Plaster of Paris**	**260**
Phosdrin®	**253**	**Platinum**	**261**
Phosgene	**253**	Platinum black	261
Phosphaniline	252	Platinum metal	261
Phosphine	**254**	**Platinum (soluble salts, as Pt)**	**261**
Phosphorated hydrogen	254	Platinum sponge	261
Phosphoric acid	**254**	Plumbago	154
Phosphoric acid (aqueous)	254	Plumbum	185
Phosphoric chloride	256	PMM	246
Phosphorus chloride [**Phosphorus oxychloride**]	255	PNA	226
		PNB	227
Phosphorus chloride [**Phosphorus trichloride**]	257	PNCB	227
		PNOR	240
Phosphorus hydride	254	Polychlorinated biphenyl [**Chlorodiphenyl (42% chlorine)**]	64
Phosphorus oxytrichloride	255		
Phosphorus perchloride	256	Polychlorinated biphenyl [**Chlorodiphenyl (54% chlorine)**]	64
Phosphorus persulfide	256		
Phosphorus sulfide	256	Polychlorocamphene	58
Phosphorus trihydride	254	Porcelain clay	183
Phosphorus (yellow)	**255**	**Portland cement**	**262**
Phosphorus oxychloride	**255**	Portland cement silicate	262
Phosphorus pentachloride	**256**	**Potassium cyanide (as CN)**	**262**
Phosphorus pentasulfide	**256**	Potassium hydrate	263
Phosphorus trichloride	**257**	**Potassium hydroxide**	**263**
Phosphoryl chloride	255	Potassium salt of hydrocyanic acid	262
Phthalic acid anhydride	257	Precipitated amorphous silica	277
Phthalic anhydride	**257**	Primary amyl acetate	17
m-Phthalodinitrile	**258**	Primary isoamyl alcohol	175
Picloram	**258**	Propadiene-methyl acetylene	198
Picric acid	**259**	**Propane**	**263**
Pimelic ketone	84	n-Propane	263
Pindone	**259**	Propanedial	190
Piperazine dihydrochloride	**260**	1,3-Propanedial	190
Piperazine hydrochloride	260	Propanenitrile	266
Pival®	259	**Propane sultone**	**264**

Name	Page	Name	Page
1,3-Propane sultone	264	Propyl alcohol	268
Propane-1-thiol	264	**n-Propyl alcohol**	**268**
1-Propanethiol	**264**	sec-Propyl alcohol	181
1,2,3-Propanetriol	152	Propyl allyl disulfide	11
1,2,3-Propanetriol trinitrate	229	2-Propylamine	181
Propanoic acid	266	sec-Propylamine	181
1-Propanol	268	n-Propyl carbinol	39
2-Propanol	181	Propyl cyanide	44
n-Propanol	268	n-Propyl cyanide	44
2-Propanone	3	Propylene aldehyde	80
Propargyl alcohol	**265**	**Propylene dichloride**	**268**
Propellant 12	98	**Propylene glycol dinitrate**	**269**
Propenal	7	Propylene glycol-1,2-dinitrate	269
2-Propenal	7	1,2-Propylene glycol dinitrate	269
Propenamide	7	Propylene glycol methyl ether	269
2-Propenamide	7	Propylene glycol monoacrylate	171
Propenenitrile	8	**Propylene glycol monomethyl ether**	**269**
2-Propenenitrile	8	**Propylene imine**	**270**
Propene oxide	270	Propyleneimine	270
2-Propenoic acid	8	Propylene imine (inhibited)	270
Propenol	10	**Propylene oxide**	**270**
1-Propen-3-ol	10	1,2-Propylene oxide	270
2-Propenol	10	Propylenimine	270
[(2-Propenyloxy)methyl] oxirane	11	n-Propyl ester of acetic acid	267
2-Propenyl propyl disulfide	11	Propyl ester of nitric acid	271
Propine	197	Propyl hydride	263
3-Propiolactone	265	Propyl ketone	123
β-Propiolactone	**265**	Propyl mercaptan	264
Propione	108	n-Propyl mercaptan	264
Propionic acid	**266**	**n-Propyl nitrate**	**271**
Propionic nitrile	266	Propyne	197
Propionitrile	**266**	1-Propyne	197
Propiononitrile	266	Propyne-allene mixture	198
Propoxur	**267**	Propyne-propadiene mixture	198
Propylacetate	267	1-Propyn-3-ol	265
2-Propyl acetate	180	2-Propyn-1-ol	265
n-Propyl acetate	**267**	2-Propynyl alcohol	265

Name	Page	Name	Page
Proteolytic enzymes	287	Refrigerant 13B1	318
Prussic acid	168	**Resorcinol**	**273**
Pseudocumene	320	RFNA	225
Pyrene	74	Rhodium metal	273
Pyrethrin I	271	**Rhodium (metal fume and insoluble compounds, as Rh)**	**273**
Pyrethrin II	271		
Pyrethrum	**271**	**Rhodium (soluble compounds, as Rh)**	**274**
Pyrethrum I	271		
Pyrethrum II	271	Rice starch	285
Pyridine	**272**	Riebeckite	22
α-Pyridylamine	14	Road asphalt	22
Pyrocatechol	56	Rock candy	288
Pyrocellulose	56	Rockwool	217
Pyroligneous spirit	200	**Ronnel**	**274**
Pyrophosphate	304	Roofing asphalt	22
Quartz	278	Roscoelite	217
Quick lime	48	**Rosin core solder, pyrolysis products (as formaldehyde)**	**275**
Quicksilver	193		
Quinol	170	Rosin flux pyrolysis products	275
Quinone	**272**	Rosin core soldering flux pyrolysis products	275
p-Quinone	272		
Range oil	184	Ro-Sulfiram®	124
Raw cotton dust	77	**Rotenone**	**275**
RDX	86	**Rouge**	**276**
Red fuming nitric acid (RFNA)	225	Rubber solvent	247
Red iron oxide	276	Rubbing alcohol	181
Red oxide	276	Ruelene®	80
Reduced MDI	207	Rutile	310
Refined solvent naphtha	333	Saccarose	288
Refrigerant 11	146	Sal ammoniac fume	16
Refrigerant 12	98	Saturated MDI	207
Refrigerant 21	100	Secondary isoamyl alcohol	176
Refrigerant 22	63	Seekay wax [**Tetrachloronaphthalene**]	301
Refrigerant 112	299		
Refrigerant 112a	299	Seekay wax [**Trichloronaphthalene**]	316
Refrigerant 113	317	**Selenium**	**276**
Refrigerant 114	102	Selenium alloy	276

Name	Page	Name	Page
Selenium dihydride	169	Sodium borate pentahydrate	31
Selenium hexafluoride	**277**	**Sodium cyanide (as CN)**	**282**
Selenium fluoride	277	**Sodium fluoride (as F)**	**283**
Selenium hydride	169	**Sodium fluoroacetate**	**283**
Sesone	78	Sodium hexafluoroaluminate	281
Sevin®	51	Sodium hydrate	284
Sewer gas	170	Sodium hydrogen sulfite	282
SFA	283	**Sodium hydroxide**	**284**
Silane	279	**Sodium metabisulfite**	**284**
Silica, amorphous	**277**	Sodium metabisulphite	284
Silica, crystalline (as respirable dust)	**278**	Sodium monofluoride	283
		Sodium monofluoroacetate	283
Silica gel	277	Sodium pyrophosphate	304
Silicane	279	Sodium pyrosulfite	284
Silicon	**278**	Sodium salt of hydrazoic acid	281
Silicon carbide	**279**	Sodium salt of hydrocyanic acid	282
Silicon dioxide (amorphous)	277	Sodium tetraborate	30
Silicon monocarbide	279	Sodium tetraborate decahydrate	30
Silicon tetrahydride	**279**	Sodium tetraborate pentahydrate	31
Silver graphite	154	Soft wood dust	335
Silver metal	280	Solvent ether	140
Silver (metal dust and soluble compounds, as Ag)	**280**	Sorghum gum	285
		Spectracide®	92
Silver nitrate	280	Spirits of turpentine	325
Slag wool	217	Spotting naphtha	286
Slaked lime	47	Stannic oxide	309
Soapstone (containing less than 1% quartz)	**280**	Stannous oxide	309
		Starch	**285**
Soapstone silicate	280	α-Starch	284
Soda lye	284	Starch gum	285
Sodium acid bisulfite	282	Stearyl mercaptan	236
Sodium aluminum fluoride (as F)	**281**	Steatite	280
Sodium azide	**281**	Steatite talc	293
Sodium bisulfite	**282**	Steam distilled turpentine	325
Sodium bisulphite	282	**Stibine**	**285**
Sodium borate (anhydrous)	30	Stibium	19
Sodium borate decahydrate	30	**Stoddard solvent**	**286**

Name	Page	Name	Page
Stove black	154	**Sulprofos**	**292**
Strychnine	**286**	Symmetrical tetrabromoethane	6
Styrene	**287**	Symmetrical tetrachloroethane	300
Styrene monomer	287	Symmetrical trimethylbenzene	321
Styrol	287	Synthetic camphor	49
Subtilisin BPN	287	Synthetic vitreous fibers	217
Subtilisin Carlsburg	287	Systox®	90
Subtilisins	**287**	**2,4,5-T**	**293**
Succinic dinitrile	288	Table sugar	288
Succinonitrile	**288**	**Talc (containing no asbestos and less than 1% quartz)**	**293**
Sucrose	**288**		
Sugar	288	Tantalum-181	294
Sulfamate	16	Tantalum metal	294
Sulfate wood turpentine	325	**Tantalum (metal and oxide dust, as Ta)**	**294**
Sulfinyl chloride	307		
Sulfotepp	294	Tapioca starch	285
Sulfur chloride	290	Tar camphor	221
Sulfur chloride oxide	307	TBE	6
Sulfur decafluoride	291	TBP	314
Sulfur difluoride dioxide	292	TCA	314
Sulfur dioxide	**289**	TCDBD	298
Sulfuretted hydrogen	170	TCDD	298
Sulfur fluoride	289	2,3,7,8-TCDD	298
Sulfur hexafluoride	**289**	TCE	316
Sulfuric acid	**290**	TCHH	87
Sulfuric acid (aqueous)	290	TCP	322
Sulfur monochloride	**290**	TDA	311
Sulfurous acid anhydride	289	TDI	312
Sulfurous dichloride	307	2,4-TDI	312
Sulfurous oxide	289	TEA	318
Sulfurous oxychloride	307	Tear gas	61
Sulfur oxide	289	**TEDP**	**294**
Sulfur pentafluoride	**291**	TEL	302
Sulfur phosphide	256	**Tellurium**	**295**
Sulfur subchloride	290	Tellurium fluoride	295
Sulfur tetrafluoride	**291**	**Tellurium hexafluoride**	**295**
Sulfuryl fluoride	**292**	Tellurobismuthite	29

Name	Page
Telone®	101
Temefos	296
Temephos	**296**
TEPP	**296**
Terracur P®	143
1,2-Terphenyl	297
1,3-Terphenyl	297
1,4-Terphenyl	298
m-Terphenyl	**297**
meta-Terphenyl	297
o-Terphenyl	**297**
ortho-Terphenyl	297
p-Terphenyl	**298**
para-Terphenyl	298
Tetan	304
TETD	124
Tetrabromoacetylene	6
Tetrabromoethane	6
1,1,2,2-Tetrabromoethane	6
Tetrabromomethane	54
Tetracarbonylhydridocobalt	75
Tetracarbonylhydrocobalt	75
Tetracarbonyl nickel	222
2,3,7,8-Tetrachloro-dibenzo-p-dioxin	**298**
1,1,1,2-Tetrachloro-2,2-difluoroethane	**299**
1,1,2,2-Tetrachloro-1,2-difluoroethane	**299**
1,1,1,2-Tetrachloroethane	**300**
1,1,2,2-Tetrachloroethane	**300**
Tetrachloroethylene	**301**
N-((1,1,2,2-Tetrachloroethyl)thio)-4-cyclohexene-1,2-dicarboximide	50
Tetrachloromethane	55
Tetrachloronaphthalene	**301**
2,2,2,6-Tetrachloro-2-picoline	69
Tetraethoxysilane	142
Tetraethyl dithionopyrophosphate	294
Tetraethyl dithiopyrophosphate	294
Tetraethyl lead (as Pb)	**302**
O,O,O',O'-Tetraethyl S,S'-methylene di(phosphorodithioate)	130
Tetraethyl orthosilicate	142
Tetraethylplumbane	302
Tetraethyl pyrophosphate	296
Tetraethyl silicate	142
Tetraethylthiuram disulfide	124
Tetrafluorosulfurane	291
Tetrahydrobenzene	85
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	275
Tetrahydrofuran	**302**
3a,4,7,7a-Tetrahydro-4,7-methanoindene	104
Tetrahydro-1,4-oxazine	220
Tetrahydro-p-oxazine	220
Tetrahydroxymethylolmethane	244
Tetramethoxysilane	215
Tetramethylene cyanide	9
Tetramethylene oxide	302
Tetramethyl ester of silicic acid	215
Tetramethyl lead (as Pb)	**303**
Tetramethylolmethane	244
Tetramethylplumbane	303
Tetramethyl silicate	215
Tetramethyl succinodinitrile	303
Tetramethyl succinonitrile	**303**
O,O,O'O'-Tetramethyl O,O'-thiodi-p-phenylene phosphorothioate	296
Tetramethylthiuram disulfide	307
Tetranitromethane	**304**
Tetrasodium diphosphate	304
Tetrasodium pyrophosphate	**304**

Name	Page	Name	Page
Tetrasodium pyrophosphate (anhydrous)	304	TMA	319
		TMAN	319
Tetron®	296	TML	303
Tetryl	**305**	TMSN	303
2,4,6-Tetryl	305	TNM	304
Thallium (soluble compounds, as Tl)	**305**	TNT	322
		TOCP	322
Thermal black	52	3,3'-Tolidine	310
THF	302	**o-Tolidine**	**310**
Thimet	252	**Toluene**	**311**
4,4'-Thiobis(6-tert-butyl-m-cresol)	**306**	**Toluenediamine**	**311**
4,4'-Thiobis(3-methyl-6-tert-butylphenol)	306	Toluenediamine isomers	311
		Toluene-2,4-diisocyanate	**312**
1,1'-Thiobis(2-methyl-4-hydroxy-5-tert-butylbenzene)	306	2,4-Toluene diisocyanate	312
		3-Toluidine	312
Thiodan®	127	4-Toluidine	313
Thiodemeton	124	**m-Toluidine**	**312**
Thiodiphenylamine	248	meta-Toluidine	312
Thioglycolic acid	**306**	**o-Toluidine**	**313**
Thionyl chloride	**307**	ortho-Toluidine	313
Thionyl dichloride	307	**p-Toluidine**	**313**
Thiophenol	26	para-Toluidine	313
Thiosulfurous dichloride	290	Toluol	311
Thiotepp®	294	Tolyethylene	333
Thiram	**307**	m-Tolylamine	312
Timet	252	o-Tolylamine	313
Tin	**308**	p-Tolylamine	313
Tin flake	308	o-Tolyl chloride	69
Tin metal	308	Tolylenediamine	311
Tin (organic compounds, as Sn)	**308**	Tordon®	258
Tin(II) oxide (as Sn)	**309**	Toxaphene	58
Tin(IV) oxide (as Sn)	**309**	Toxilic anhydride	189
Tin powder	308	TPP	323
Tin protoxide	309	Tremolite	22
Titanium dioxide	**310**	Tremolite asbestos	22
Titanium oxide	310	Triatomic oxygen	239
Titanium peroxide	310	Tribromoborane	32

Name	Page	Name	Page
Tribromomethane	34	Tricyclohexylhydroxytin	87
Tributyl ester of phosphoric acid	314	Tricyclohexylstannium hydroxide	87
Tributyl phosphate	**314**	Tricyclohexyltin hydroxide	87
Tri-n-butyl phosphate	314	Tridymite	278
Tricalcium arsenate	46	**Triethylamine**	**318**
Tricalcium ortho-arsenate	46	Trifluoramine	229
Trichloroacetic acid	**314**	Trifluorammonia	229
1,2,4-Trichlorobenzene	**315**	Trifluoroborane	32
unsym-Trichlorobenzene	315	1,1,1-Trifluoro-2-bromo-2-chloro-ethane	156
1,2,4-Trichlorobenzol	315		
1,1,1-Trichloro-2,2-bis(p-chloro-phenyl)ethane	88	2,2,2-Trifluoro-1-bromo-1-chloro-ethane	156
1,1,1-Trichloroethane	203	**Trifluorobromomethane**	**318**
1,1,1-Trichloroethane (stabilized)	203	2,2,2-Trifluoroethoxyethene	147
1,1,2-Trichloroethane	**315**	2,2,2-Trifluoroethyl vinyl ether	147
β-Trichloroethane	315	Trifluoromonobromomethane	318
Trichloroethanoic acid	314	Trihydroxypropane	152
Trichloroethene	316	Triiodomethane	173
Trichloroethylene	**316**	Trilene	316
Trichlorofluoromethane	146	Trimanganese tetraoxide	192
Trichlorohydrin	317	Trimanganese tetroxide	192
Trichloromethane	65	Trimellic acid anhydride	319
Trichloromethane sulfenyl chloride	246	**Trimellitic anhydride**	**319**
1,1,1-Trichloro-2,2-bis-(p-methoxy-phenyl)ethane	195	Trimethoxyphosphine	321
		Trimethylamine	**319**
N-Trichloromethylmercapto-4-cyclohexene-1,2-dicarboximide	51	**1,2,3-Trimethylbenzene**	**320**
		1,2,4-Trimethylbenzene	**320**
Trichloromethyl sulfur chloride	246	**1,3,5-Trimethylbenzene**	**321**
Trichloromonofluoromethane	146	sym-Trimethylbenzene	321
Trichloronaphthalene	**316**	Trimethyl carbinol	40
Trichloronitromethane	67	3,5,5-Trimethyl-2-cyclohexenone	179
2,4,5-Trichlorophenoxyacetic acid	293	3,5,5-Trimethyl-2-cyclo-hexen-1-one	179
1,2,3-Trichloropropane	**317**	Trimethylenetrinitramine	86
1,1,2-Trichloro-1,2,2-trifluoroethane	**317**	Trimethyl ester of phosphorous acid	321
Tri-o-cresyl ester of phosphoric acid	322	**Trimethyl phosphite**	**321**
Tri-o-cresyl phosphate	322	Trinitroglycerine	229
Tricyclohexylhydroxystannane	87	2,4,6-Trinitrophenol	259

Name	Page
2,4,6-Trinitrophenyl-N-methylnitramine	305
Trinitrotoluene	322
2,4,6-Trinitrotoluene	**322**
sym-Trinitrotoluene	322
Trinitrotoluol	322
1,3,5-Trinitro-1,3,5-triazacyclohexane	86
Triorthocresyl phosphate	**322**
Trioxychlorofluoride	246
m-Triphenyl	297
o-Triphenyl	297
p-Triphenyl	298
Triphenylamine	**323**
Triphenyl ester of phosphoric acid	323
Triphenyl phosphate	**323**
Tripoli	278
Tris(dimethylamino)phosphine oxide	162
TSPP	304
TTE	317
Tungsten	**324**
Tungsten (soluble compounds, as W)	**324**
Tungsten carbide (cemented)	**325**
Tungsten metal	324
Turpentine	**325**
Turps	325
UDMH	115
1-Undecanethiol	**326**
Undecyl mercaptan	326
Unslaked lime	48
Unsymmetrical dimethylhydrazine	115
Uranium I	326
Uranium (insoluble compounds, as U)	**326**
Uranium metal	326
Uranium (soluble compounds, as U)	**327**
VAC	329
Valeral	327
Valeraldehyde	327
n-Valeraldehyde	**327**
Valeric aldehyde	327
Valerone	110
Vanadic anhydride dust	328
Vanadic anhydride fume	328
Vanadium dust	**328**
Vanadium fume	**328**
Vanadium oxide dust	328
Vanadium oxide fume	328
Vanadium pentaoxide dust	328
Vanadium pentaoxide fume	328
Varnish makers' & painters' naptha	333
VC	330
VCM	330
VCN	8
VDC	332
VDF	332
Vegetable mist	329
Vegetable oil mist	**329**
Vikane®	292
Vinyl acetate	**329**
Vinyl acetate monomer	329
Vinyl benzene	287
Vinyl bromide	**330**
Vinyl carbinol	10
Vinyl chloride	**330**
Vinyl chloride monomer (VCM)	330
Vinyl cyanide	8
4-Vinylcyclohexene diepoxide	331
Vinyl cyclohexene dioxide	**331**
4-Vinyl-1-cyclohexene dioxide	331
Vinyl ethanoate	329
Vinylethylene	35
Vinyl fluoride	**331**
Vinyl fluoride monomer	331
Vinylidene chloride	**332**

Name	Page	Name	Page
Vinylidene chloride monomer	332	meta-Xylene	335
Vinylidene dichloride	332	**o-Xylene**	**336**
Vinylidene difluoride	332	ortho-Xylene	336
Vinylidene fluoride	**332**	**p-Xylene**	**336**
Vinylstyrene	125	para-Xylene	336
Vinyl toluene	**333**	**m-Xylene-α,α'-diamine**	**337**
Vinyl trichloride	315	**Xylidine**	**337**
VM & P Naphtha	**333**	m-Xylol	335
WARF	334	o-Xylol	336
Warfarin	**334**	p-Xylol	336
Welding fumes	**334**	m-Xylylenediamine	337
Western red cedar dust	335	**Yttrium**	**338**
WFNA	225	Yttrium metal	338
White fuming nitric acid (WFNA)	225	Zimmwaldite	217
White mineral oil mist	236	**Zinc chloride fume**	**338**
White phosphoric acid	254	Zinc chromate	70
White phosphorus	255	Zinc dichloride fume	338
White tar	221	Zinc distearate	339
White tin oxide	309	**Zinc oxide**	**339**
Wolfram	324	Zinc peroxide	339
Wollastonite	48	Zinc salt of stearic acid	339
Wood alcohol	200	**Zinc stearate**	**339**
Wood dust	**335**	Zoalene	117
Wood naphtha	200	Zirconium	340
Wood spirit	200	**Zirconium compounds (as Zr)**	**340**
Wood turpentine	325	Zirconium metal	340
m-Xylene	**335**		