Documentation for Immediately Dangerous To Life or Health Concentrations (IDLHs)

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This publication documents the criteria and information sources that have been used by the National Institute for Occupational Safety and Health (NIOSH) to determine immediately dangerous to life or health concentrations (IDLHs). IDLHs were originally determined for 387 substances in the mid-1970's as part of the Standards Completion Program (SCP), a joint project by NIOSH and the Occupational Safety and Health Administration (OSHA), for use in assigning respiratory protection equipment. NIOSH is currently evaluating the scientific adequacy of the criteria and procedures used during the SCP for establishing IDLHs. In the interim, the IDLHs have been reviewed and, if appropriate, revised. In this document, IDLHs are listed with the basis and references for the current values as well as with the original IDLHs and their documentation (as paraphrased from the SCP draft technical standards).
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ABBREVIATIONS

A1 confirmed human carcinogen (ACGIH)
A2 suspected human carcinogen (ACGIH)
A3 animal carcinogen (ACGIH)
A4 not classifiable as a human carcinogen (ACGIH)
A5 not suspected as a human carcinogen (ACGIH)
ACGIH American Conference of Governmental Industrial Hygienists
AIHA American Industrial Hygiene Association
CAS Chemical Abstract Service
CF correction factor for LC data
CFR Code of Federal Regulations
EEGL emergency exposure guidance level (NRC)
ERPG emergency response planning guideline (AIHA)
IDLH immediately dangerous to life or health concentration value
i.p. intraperitoneal
i.v. intravenous
kg kilogram
LC lethal concentration
LC₅₀ concentration causing death in 50%
LC₉₀ lowest concentration causing death
LD lethal dose
LD₅₀ dosage causing death in 50%
LD₉₀ lowest dosage causing death
LEL lower explosive limit
mg/kg milligrams per kilogram of body weight
mg/m³ milligrams per cubic meter of air
mmHg millimeters of mercury (pressure measurement)
mppcf millions of particles per cubic foot of air
NIOSH National Institute for Occupational Safety and Health
NRC National Research Council
OSHA Occupational Safety and Health Administration
PEL permissible exposure limit (OSHA)
ppm parts per million parts of air
RD₅₀ concentration producing a 50% decrease in respiratory rate following a 10-minute exposure
REL recommended exposure limit (NIOSH)
s.c. subcutaneous
SCP Standards Completion Program (NIOSH/OSHA)
SPEGL short-term public emergency guidance level (NRC)
STELE short-term exposure limit
TC₉₀ lowest concentration resulting in a toxic effect
TD₉₀ lowest dose resulting in a toxic effect
TLV threshold limit value (ACGIH)
TWA time-weighted average
### ABBREVIATIONS OF JOURNAL TITLES

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<td>Archives des Maladies Professionnelles de Medecine du Travail et de Securite Sociale (Paris)</td>
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<td>Int J Abnorm Develop</td>
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<td>Int Polymer Sci Tech</td>
<td>International Polymer Science and Technology</td>
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<td>J Agri Food Chem</td>
<td>Journal of Agriculture and Food Chemistry</td>
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<td>J Air Pollut Control Assoc</td>
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<td>JAMA</td>
<td>Journal of the American Medical Association</td>
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<td>Journal of the American College of Toxicology</td>
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<td>J Am Pharm Assoc</td>
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<td>J Appl Physiol</td>
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<td>J Econ Entomol</td>
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<td>J Environ Pathol Toxicol</td>
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<td>J Eur Toxicol</td>
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<td>J Fire Sci</td>
<td>Journal of Fire Sciences</td>
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<td>J Haz Mat</td>
<td>Journal of Hazardous Materials</td>
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<td>J Hyg</td>
<td>Journal of Hygiene (London)</td>
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<td>J Hym Epidemiol Microbial Immunol</td>
<td>Journal of Hygiene, Epidemiology, Microbiology, and Immunology (Prague)</td>
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<td>J Lab Clin Med</td>
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<td>J Osaka Cty Med Cntr</td>
<td>Journal of the Osaka City Medical Center</td>
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<tr>
<td>J Pathol Bacteriol</td>
<td>Journal of Pathology and Bacteriology (London)</td>
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ABBREVIATIONS OF JOURNAL TITLES (Continued)

J Pharmacol | Journal de Pharmacologie (Paris)
J Pharmacol Exp Ther | Journal of Pharmacology and Experimental Therapeutics
J Pharm Pharmacol | Journal of Pharmacy and Pharmacology (London)
J Pharm Sci | Journal of Pharmaceutical Sciences
J Royal Army Med Corps | Journal of the Royal Army Medical Corps
J Toxicol Environ Health | Journal of Toxicology and Environmental Health
J Toxicol Sci | Journal of Toxicological Sciences (Japan)
Kosm Biol Aviak Med | Kosmicheskaya Biologiya i Aviakomicheskaya Meditsina (Space Biology and Aerospace Medicine) (Moscow)
Kuma Med J | Kumamoto Medical Journal (Japan)
Med Lav | Medicina del Lavoro (Industrial Medicine) (Milan)
Med Pr | Medycyna Pracy (Medical Practice) (Warsaw)
Milit Med | Military Medicine
Mutat Res | Mutation Research (Amsterdam)
Neurotoxicol | Neurotoxicology
NIH Bulletin | National Institutes of Health Bulletin
N Z Med J | New Zealand Medical Journal (Dunedin)
Pest Biochem Physiol | Pesticide Biochemistry and Physiology
Pharmaceut J | Pharmaceutical Journal
Pharmacol Rev | Pharmacological Review
Pharmacol Res Commun | Pharmacological Research Communications
Pharmacol Ther | Pharmacology and Therapeutics
Pharm Chem J | Pharmaceutical Chemistry Journal
Proc Eur Soc St Drug Tox | Proceedings of the European Society for the Study of Drug Toxicity
Proc Eur Soc Toxicol | Proceedings of the European Society of Toxicology
Prog Exp Tumor Res | Progress in Experimental Tumor Research
Prom Toksikol Klin | Promyshlennaya Toksikologiya Klinika
Public Health Rep | Public Health Reports
QBulletin Assoc Food Drug Off U.S. | Quarterly Bulletin of the Association of Food and Drug Officials of the U.S.
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<td>Voprosy Kommunal'noi Gigieny (Problems of Communal Hygiene)</td>
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ACKNOWLEDGMENTS

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INTRODUCTION

The "immediately dangerous to life or health air concentration values (IDLHs)" used by the National Institute for Occupational Safety and Health (NIOSH) as respirator selection criteria were first developed in the mid-1970's. The Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs) is a compilation of the rationale and sources of information used by NIOSH during the original determination of 387 IDLHs and their subsequent review and revision in 1994.

Background

Immediately Dangerous to Life or Health Conditions and Respirator Selection

The concept of using respirators to protect workers in situations that are immediately dangerous to life or health was discussed at least as early as the 1940's. The following is from a U.S. Department of Labor bulletin:

The situations for which respiratory protection is required may be designated as, (1) nonemergency and (2) emergency. Nonemergency situations are the more or less normal ones that involve exposure to atmospheres that are not immediately dangerous to health and life, but will produce marked discomfort, sickness, permanent harm, or death after a prolonged exposure or with repeated exposure. Emergency situations are those that involve actual or potential exposure to atmospheres that are immediately harmful and dangerous to health or life after comparatively short exposures. [Yant 1944]

The Occupational Safety and Health Administration (OSHA) defines an immediately dangerous to life or health concentration in their hazardous waste operations and emergency response regulation as follows:

An atmospheric concentration of any toxic, corrosive or asphyxiating substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere. [29 CFR 1910.120]

In the OSHA regulation on permit-required confined spaces, an immediately dangerous to life or health condition is defined as follows:

Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a dangerous atmosphere. Note: Some materials—hydrogen fluoride gas and cadmium vapor, for example—may produce immediate transient effects that, even if severe,
may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately dangerous to life or health." [29 CFR 1910.146]

As part of their current respiratory protection standard [29 CFR 1910.134(e)], OSHA requires that a standby person be present with suitable rescue equipment when self-contained breathing apparatus or hose masks with blowers are used in atmospheres immediately dangerous to life or health. Furthermore, persons using air-line respirators in atmospheres immediately hazardous to life or health must be equipped with safety harnesses and safety lines for lifting or removing workers from hazardous atmospheres.

The Standards Completion Program

In 1974, NIOSH and OSHA jointly initiated the development of occupational health standards consistent with Section 6(b) of the Occupational Safety and Health Act of 1970 for substances with then-existing OSHA permissible exposure limits (PELs). This joint effort was called the Standards Completion Program (SCP) and involved the cooperative efforts of personnel from various divisions within NIOSH and OSHA, and several contractors. The SCP developed 387 substance-specific draft standards with supporting documentation that contained technical information and recommendations needed for the promulgation of new occupational health regulations. Although new standards were not promulgated at that time, these data became the original basis for the NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards [NIOSH/OSHA 1981].

As part of the respirator selection process for each draft technical standard, an IDLH was determined. The definition for an IDLH that was derived during the SCP was based on the definition stipulated in 30 CFR 11.3(t). The purpose for establishing this IDLH was to determine a concentration from which a worker could escape without injury or without irreversible health effects in the event of respiratory protection equipment failure (e.g., contaminant breakthrough in a cartridge respirator or stoppage of air flow in a supplied-air respirator) and a concentration above which only "highly reliable" respirators would be required. In determining IDLHs, the ability of a worker to escape without loss of life or irreversible health effects was considered along with severe eye or respiratory irritation and other deleterious effects (e.g., disorientation or incoordination) that could prevent escape. Although in most cases, egress from a particular worksite could occur in much less than 30 minutes, as a safety margin, IDLHs were based on the 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 following the failure of respiratory protection equipment; in fact, EVERY EFFORT SHOULD BE MADE TO EXIT IMMEDIATELY!

IDLHs were determined for each substance during the SCP on a case-by-case basis, taking into account the toxicity data available at the time. Whenever possible, IDLHs were determined using health effects data from studies of humans exposed for short durations. However, in most instances, a lack of human data necessitated the use of animal toxicity data. When inhalation studies of animals exposed for short durations (i.e., 0.5 to 4 hours) were the only health effects
data available, IDLHs were based on the lowest exposure causing death or irreversible health effects in any species. When lethal dose (LD) data from animals were used, IDLHs were estimated on the basis of an equivalent exposure to a 70-kg worker breathing 10 cubic meters of air.

Since chronic exposure data may have little relevance to acute effects, these types of data were used in determining IDLHs only when no acute toxicity data were available and only in conjunction with competent scientific judgment. In a number of instances when no relevant human or animal toxicity data were available, IDLHs were based on analogies with other substances with similar toxic effects.

Discussion of Original IDLHs

The basis for each of the 387 IDLHs determined during the SCP were reviewed and paraphrased from the individual draft technical standards for this publication. Also included is a complete listing of references cited in the SCP; in many cases where only secondary references were cited, the original sources have also been added. Whenever available, the references (secondary and primary) were obtained to verify the information cited in the SCP. However, a few of the original references such as personal communications and foreign reports could not be located.

Although 387 substances were originally included in the SCP, IDLHs were not specifically determined for all of them. The published data at that time for 40 of these substances (e.g., DDT and triphenyl phosphate) showed no evidence that an acute exposure to high concentrations would impede escape or cause any irreversible health effects following a 30-minute exposure and the designation "NO EVIDENCE" was used in the listing of IDLHs. For all of these substances, respirators were selected on the basis of assigned protection factors. For some (e.g., copper fume and tetryl), an assigned protection factor of 2,000 times the PEL was arbitrarily used to determine the concentration above which only the "most protective" respirators were permitted. However, for most particulate substances for which evidence for establishing an IDLH did not exist (e.g., ferbam and oil mist), the use of an assigned protection factor of 2,000 would have resulted in the assignment of respirators at concentrations that were not likely to be encountered in the occupational environment. In addition, exposure concentrations greater than 500 times the PEL for many airborne particulates could result in exposures that would hamper vision. Therefore, it was decided as part of the SCP (and during the review and revision of the IDLHs) that for such particulate substances, only the "most protective" respirators would be permitted for use in concentrations exceeding 500 times the PEL.

IDLHs could not be determined during the SCP for 22 substances (e.g., bromoform and calcium oxide) because of a lack of relevant toxicity data and therefore the designation "UNKNOWN" was used in the IDLH listing. For most of these substances, the concentrations above which only the "most protective" respirators were allowed were based arbitrarily on assigned protection factors that ranged from 10 to 2,000 times the PEL, depending on the substance.
There were also 10 substances (e.g., n-pentane and ethyl ether) for which it was determined only that the IDLHs were in excess of the lower explosive limits (LELs). Therefore, the LEL was selected as the IDLH with the designation "LEL" added in the IDLH listing. For these substances, only the "most protective" respirators were permitted above the LEL in the SCP draft technical standards.

For 14 substances (e.g., beryllium and endrin), the IDLHs determined during the SCP were greater than the concentrations permitted based on assigned respiratory protection factors. In most instances the IDLHs for these substances were set at concentrations 2,000 times the PEL.

**Current NIOSH Use of IDLHs**

The current NIOSH definition for an immediately dangerous to life or health condition, as given in the *NIOSH Respirator Decision Logic* [NIOSH 1987], is a situation "that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment."

It is also stated that the purpose of establishing an IDLH is to "ensure that the worker can escape from a given contaminated environment in the event of failure of the respiratory protection equipment." The NIOSH respirator decision logic uses an IDLH as one of several respirator selection criteria. Under the NIOSH respirator decision logic, "highly reliable" respirators (i.e., the most protective respirators) would be selected for emergency situations, fire fighting, exposure to carcinogens, entry into oxygen-deficient atmospheres, entry into atmospheres that contain a substance at a concentration greater than 2,000 times the NIOSH REL or OSHA PEL, and for entry into immediately dangerous to life or health conditions. These "highly reliable" respirators include either a self-contained breathing apparatus (SCBA) that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or 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.

When the IDLHs were developed in the mid-1970's, only limited toxicological data were available for many of the substances. NIOSH has recently requested information on the current uses of IDLHs in the workplace and on the scientific adequacy of the criteria and procedures originally used for establishing them [Federal Register, Volume 58, Number 229, p. 63379, Wednesday, December 1, 1993]. The information received in response to the Federal Register announcement is being evaluated and will be used to establish future actions concerning IDLHs. In the interim, however, NIOSH decided to review the existing IDLHs, and revise them as appropriate.

This document includes IDLHs for 85 substances (e.g., benzene and methylene chloride) determined by NIOSH to meet the OSHA definition of "potential occupational carcinogen" as given in 29 CFR 1990.103. For all of these substances, except ethylene oxide and crystalline silica, NIOSH recommends that the "most protective" respirators be worn by workers exposed at concentrations above the NIOSH REL, or at any detectable concentration when there is no REL. For ethylene oxide and crystalline silica, NIOSH recommends that the "most protective" respirators be worn in concentrations exceeding 5 ppm and 25 mg/m³, respectively [NIOSH 1989, 1994].
Revised Criteria for Determining IDLHs

The criteria utilized to determine the adequacy of existing IDLHs were a combination of those used during the SCP and a newer methodology developed by NIOSH. These criteria form a tiered approach with acute human toxicity data being used preferentially, followed next by acute animal inhalation toxicity data, and then finally by acute animal oral toxicity data to determine an updated IDLH. When relevant acute toxicity data were insufficient or unavailable, then the use of chronic toxicity data or an analogy to a chemical with similar toxic effects was considered. In order to facilitate the revision process, secondary toxicological data were primarily used. Once a preliminary IDLH was developed, it was compared to the existing IDLH and to several other factors (e.g., existing short-term exposure guidelines and lower explosive limits).

The following “hierarchy” was followed to develop a “preliminary” value for the revised IDLH:

A. Human acute toxicity data were used if sufficient to determine a concentration that for up to 30 minutes does not cause death, serious or irreversible health effects, or does not impair or impede the ability to escape.

B. Animal acute lethal concentration (LC) data were considered next. The only animal lethal concentration data used involved mammals; the vast majority of the data was from studies of rats, mice, guinea pigs, and hamsters. It was decided to generally use the lowest reliable LC data, with LC_{50} data preferred. If acute LC data determined during a 30-minute period were not available, then the data, based on a study by ten Berge et al. [1986], were "adjusted" to an equivalent 30-minute value using the following relationship:

\[
\text{Adjusted } \text{LC}_{50} (30 \text{ minutes}) = \text{LC}_{50}(t) \times \left(\frac{t}{0.5}\right)^{n}
\]

where: \( \text{LC}_{50}(t) = \text{LC}_{50} \) determined over \( t \) hours

\( n = \text{constant}^* \)

*Note: ten Berge et al. [1986] determined the relationship shown above based on experimental data. The constant "n" was determined by ten Berge et al. to be less than 3.0 for 18 of the 20 substances studied. Although the individual "n" values determined by ten Berge et al. [1986] were utilized when applicable during the review and revision of the original IDLHs, as a conservative estimate, an "n" = 3.0 was assumed when "adjusting" the LC data to 30 minutes for all other substances.
This equation with an "n" = 3.0 results in the following correction factors:

<table>
<thead>
<tr>
<th>t(hours)</th>
<th>correction factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>1.25</td>
</tr>
<tr>
<td>2</td>
<td>1.6</td>
</tr>
<tr>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>4</td>
<td>2.0</td>
</tr>
<tr>
<td>5</td>
<td>2.15</td>
</tr>
<tr>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>7</td>
<td>2.4</td>
</tr>
<tr>
<td>8</td>
<td>2.5</td>
</tr>
</tbody>
</table>

The LC values (after "adjusting" if necessary to 30 minutes) were divided by a safety factor of 10 to determine a "preliminary" IDLH for comparison purposes.

C. Animal lethal dose (LD) data were considered next. As was the case with the lethal concentration data, the only animal lethal dose data used involved mammals; the vast majority of the data were from studies of rats, mice, guinea pigs, and hamsters. It was decided to generally use the lowest LD data with oral LD₅₀ data preferred. The LD data was used to determine the equivalent total dose to a 70-kg worker and, as was done during the SCP, the air concentration containing this dose was determined by dividing by 10 cubic meters. [Note: A worker breathing at a rate of 50 liters per minute for 30 minutes would inhale 1.5 cubic meters of air.] A "preliminary" IDLH for comparison purposes was determined by dividing these air concentrations by a safety factor of 10.

D. Chronic toxicity data were considered if no relevant acute toxicity data existed. However, the fact that chronic exposures may have limited relevance to acute effects was taken into consideration.

E. When relevant toxicity data applying specifically to the chemicals in question were lacking, and if it was determined to be justified, then analogies to substances with similar acute toxic effects were considered.

F. All "preliminary" IDLHs derived during this update were checked against the following factors prior to establishing the final "revised" IDLH:

1. Lower explosive limit (LEL): It was decided to restrict the "routine" entry into a possible explosive atmosphere to concentrations no greater than 10% of the LEL. [Note: SCP-derived IDLHs were set at 100% of the LELs if there were no known serious health hazards below these values. However, OSHA considers concentrations in excess of 10% of the LEL to be a hazardous atmosphere in confined spaces [29 CFR 1910.146(b)].]
2. **RD<sub>50</sub> data**: An RD<sub>50</sub> is defined as the 10-minute exposure concentration producing a 50% respiratory rate decrease in mice or rats and can be used to estimate severe respiratory irritation. Prolonged exposure to an RD<sub>50</sub> concentration has been shown to produce respiratory tract lesions consistent with irritation [Alarie 1981; Buckley et al. 1984].

3. Other short-term exposure guidelines such as the American Industrial Hygiene Association's emergency response planning guidelines (ERPGs) and the National Research Council's emergency exposure guidance levels (EGLs) and short-term public emergency guidance levels (SPEGLs), and occupational exposure standards or recommendations such as OSHA PELs, NIOSH RELs, or the American Conference of Governmental Industrial Hygienists (ACGIH) TLVs.

4. Based on the NIOSH respirator decision logic, the revised IDLHs could not be greater than 2,000 times the NIOSH REL (or OSHA PEL).

5. The revised IDLHs would not be greater than the original IDLHs derived during the SCP.

Anyone who is aware of additional published data that may affect the IDLHs determined for particular substances is encouraged to make this information available to NIOSH. All data will be reviewed and consideration will be made regarding subsequent revision of the IDLHs.

**References**


Acetaldehyde

CAS number ................................................. 75-07-0
NIOSH REL ......................................................... None established; NIOSH considers acetaldehyde to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ................................................. 200 ppm (360 mg/m²) TWA
1989 OSHA PEL ..................................................... 100 ppm (180 mg/m³) TWA, 150 ppm (270 mg/m³) STEL
1993-1994 ACGIH TLV ........................................... 25 ppm (45 mg/m³) CEILING, A3

Description of substance ........................................ Colorless liquid or gas (above 69°F) with a pungent, fruity odor.
LEL ........................................................................... 4.0% (10% LEL, 4,000 ppm)
Original (SCP) IDLH ................................................. 10,000 ppm
Basis for original (SCP) IDLH ........................................ The chosen IDLH is based on the statements by Patty [1963] and ACGIH [1971] that all rats survived a 4-hour exposure to 8,000 ppm, but all rats died from a 16,000 ppm exposure [Smyth 1956].

Short-term exposure guidelines ..................................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Appelman et al. 1982</td>
<td>13,000</td>
<td>---</td>
<td>4 hr</td>
<td>26,000 ppm (2.0)</td>
<td>2,600 ppm</td>
</tr>
<tr>
<td>Hamster</td>
<td>Feron 1979</td>
<td>17,000</td>
<td>---</td>
<td>4 hr</td>
<td>34,000 ppm (2.0)</td>
<td>1,400 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Skog 1950</td>
<td>20,000</td>
<td>---</td>
<td>30 min</td>
<td>20,000 ppm (1.0)</td>
<td>2,000 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Skog 1950</td>
<td>20,536</td>
<td>---</td>
<td>30 min</td>
<td>26,536 ppm (1.0)</td>
<td>2,054 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................................. RD₅₀ (mouse), 4,946 ppm [Alarie 1981].
Human data ............................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 ppm

Basis for revised IDLH: The revised IDLH for acetaldehyde is 2,000 ppm based on acute inhalation toxicity data in animals [Alarie 1981; Skog 1950]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for acetaldehyde at any detectable concentration.]

REFERENCES:

Acetic acid

CAS number .................................. 64-19-7
NIOSH REL .................................. 
Current OSHA PEL ............................ 10 ppm (25 mg/m³) TWA, 15 ppm (37 mg/m³) STEL
1989 OSHA PEL ............................. Same as current PEL
1993-1994 ACGIH TLV ................. 10 ppm (25 mg/m³) TWA, 15 ppm (37 mg/m³) STEL

Description of substance
Colorless liquid or crystals with a sour, vinegar-like odor.

LEL ......................................... 4.0% (10% LEL, 4,000 ppm)
Original (SCP) IDLH ..................... 1,000 ppm
Basis for original (SCP) IDLH ........... The chosen IDLH is based on the statement by Patty [1963] that Ghiringhelli and DiFabio [1957] determined a 1-hour LC₀ of about 5,000 ppm for guinea pigs and mice. AIHA [1972] reported that 1 of 6 rats died following a 4-hour exposure to 16,000 ppm [Smyth et al. 1951]. However, the Standards Completion Program Respirator Committee felt that a worker might have difficulty escaping from 5,000 ppm due to the irritation effects, and reduced the IDLH to 1,000 ppm to allow escape without injury. According to AIHA [1972], workers have repeatedly sustained exposures up to about 200 ppm.

Short-term exposure guidelines ........ None developed

ACUTE TOXICITY DATA
Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Ghiringhelli and DiFabio 1957</td>
<td>5,620</td>
<td>1 hr</td>
<td>7,025 ppm (1.25)</td>
<td>703 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>16,000</td>
<td>1 hr</td>
<td>12,000 ppm (2.0)</td>
<td>3,200 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data
RDₐ (mouse), 163 ppm [DeCesuriez et al. 1981].
Human data
Marked irritation of the eyes, nose, and upper respiratory tract which could not be tolerated for more than 3 minutes was noted at 816 to 1,226 ppm [von Oettingen 1960]. It has been reported that 50 ppm or more is intolerable to most persons due to intense lacrimation and irritation of the eyes, nose, and throat [AIHA]. It has also been stated that repeated exposures to high concentrations may produce respiratory tract irritation with pharyngeal edema and chronic bronchitis [AIHA 1972].

Revised IDLH: 50 ppm

Basis for revised IDLH: The revised IDLH for acetic acid is 50 ppm based on acute inhalation toxicity data in humans [AIHA 1972].

REFERENCES:
Acetic anhydride

CAS number ................................................. 108-24-7
NIOSH REL .................................................. 5 ppm (20 mg/m³) CEILING
Current OSHA PEL ........................................ 5 ppm (20 mg/m³) TWA
1989 OSHA PEL ............................................ 5 ppm (20 mg/m³) CEILING
1993-1994 ACGIH TLV ..................................... 5 ppm (21 mg/m³) TWA

Description of substance .................................. Colorless liquid with a strong, pungent, vinegar-like odor.
LEL ..................................................................... 2.7% (10% LEL, 2,700 ppm)
Original (SCP) IDLH ........................................ 1,000 ppm
Basis for original (SCP) IDLH ......................... According to AIHA [1971], all rats exposed for 4 hours to
2,000 ppm were dead within 14 days while all rats exposed for
4 hours to 1,000 ppm survived the 14-day observation period
[Capellini and Sartorelli 1967]. Because 2,000 ppm is obviously
too high to be selected as the IDLH, 1,000 ppm has been
chosen.

Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Deichmann and Gerarde 1969</td>
<td>2,000</td>
<td>----</td>
<td>4 hr</td>
<td>2,000 ppm (2.0)</td>
<td>200 ppm</td>
</tr>
</tbody>
</table>

Human data ................................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 200 ppm

Basis for revised IDLH: The revised IDLH for acetic anhydride is 200 ppm based on acute inhalation toxicity data in
animals [Deichmann and Gerarde 1969]. This may be a conservative value due to the lack of relevant acute toxicity data
for workers.

REFERENCES:

Acetone

CAS number: 57-84-1
NIOSH REL: 250 ppm (690 mg/m³) TWA
Current OSHA PEL: 1,000 ppm (2,400 mg/m³) TWA
1988 OSHA PEL: 760 ppm (1,800 mg/m³) TWA, 1,000 ppm (2,400 mg/m³) STEL
1993-1994 ACGIH TLV: 750 ppm (1,780 mg/m³) TWA, 1,000 ppm (2,380 mg/m³) STEL

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

LEL: 2.5% (10% LEL, 2,500 ppm)

Original (SCP) IDLH: 20,000 ppm

There is no evidence in the available toxicological data that acetone presents an IDLH hazard below the lower explosive limit (LEL) of 25,000 ppm. Because Patty [1963] reported that a 1.5-hour exposure to 20,256 ppm is narcotic for mice, 20,000 ppm has been chosen as the IDLH.

National Research Council (NRC 1984) Emergency Exposure Guidance Levels (EEGLs):

1-hour EEGL: 8,500 ppm
24-hour EEGL: 1,000 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₃ₐ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Flury and Wirth 1933</td>
<td>20,702</td>
<td>45.455</td>
<td>1 hr</td>
<td>56.816 ppm (1.25)</td>
<td>5.682 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1959</td>
<td>52,755 ppm (2.5)</td>
<td>52,755 ppm (2.5)</td>
<td>51.76 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₃ₐ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Freeman and Hayea 1985</td>
<td>oral</td>
<td>5.800</td>
<td>16,777 ppm</td>
<td>1.678 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Molodykh et al. 1980</td>
<td>oral</td>
<td>3.000</td>
<td>8,678 ppm</td>
<td>860 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>WHO 1970</td>
<td>oral</td>
<td>5.340</td>
<td>15,446 ppm</td>
<td>1,545 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data:

RD₅₀ (mouse), 77,516 ppm [Alerie 1981].

Human data:

Volunteers experienced slight irritation at 300 ppm but 500 ppm was tolerated [Nelson et al. 1943]. Eye irritation, headache, lightheadedness, nasal irritation, and throat irritation were noted in workers exposed to concentrations considerably in excess of 1,000 ppm and perhaps as high as 6,500 ppm [Raleigh and McGee 1972]. No indications of toxicity were reported following exposures to 2,100 ppm for 8 hours/day [Haggard et al. 1944].

Revised IDLH: 2,500 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Haggard et al. 1944; Raleigh and McGee 1972] and animals [Flury and Wirth 1933; Pozzani et al. 1959], a value of about 5,000 ppm would have been appropriate for acetone. However, the revised IDLH for acetone is 2,500 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 2.5%).
REFERENCES:

Acetonitrile

CAS number .............................................. 75-05-8
NIOSH REL ................................................ 20 ppm (34 mg/m³) TWA
Current OSHA PEL ....................................... 40 ppm (70 mg/m³) TWA
1989 OSHA PEL ........................................... 40 ppm (70 mg/m³ TWA), 60 ppm (105 mg/m³) STEL
1993-1994 ACGIH TLV ................................... 40 ppm (67 mg/m³) TWA, 60 ppm (101 mg/m³) STEL
Description of substance ............................... Colorless liquid with an aromatic odor.
LEL .......................................................... 3.0% (10% LEL, 3,000 ppm)
Original (SCP) IDLH ...................................... 4,000 ppm
Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the UCC [1965] report that a 4-hour exposure to 4,000 ppm killed 3 of 30 rats, 8,000 ppm killed 10 of 30 rats, and 16,000 ppm killed 17 of 30 rats. It is also based on the statement by AIHA [1960] that some deaths occurred in rats, dogs, and guinea pigs at 4,000 ppm, but no deaths occurred at 1,000 ppm. Pozzani et al. [1959] reported that a 53,000 ppm exposure was lethal to 3 of 6 rats in 30 minutes.

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀ (ppm)</th>
<th>LC₀₂ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Pozzani et al. 1959</td>
<td>5,655</td>
<td>-----</td>
<td>4 hr</td>
<td>11,310 ppm (2.0)</td>
<td>1,111 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Pozzani et al. 1959</td>
<td>-----</td>
<td>15,000</td>
<td>4 hr</td>
<td>22,000 ppm (2.0)</td>
<td>3,200 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Pozzani et al. 1959</td>
<td>2,828</td>
<td>-----</td>
<td>4 hr</td>
<td>5,656 ppm (2.0)</td>
<td>566 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1959</td>
<td>53,000</td>
<td>-----</td>
<td>30 min</td>
<td>53,000 ppm (1.0)</td>
<td>5,300 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1959</td>
<td>7,500</td>
<td>-----</td>
<td>8 hr</td>
<td>18,750 ppm (3.5)</td>
<td>1,875 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Willhite 1981</td>
<td>2,693</td>
<td>-----</td>
<td>1 hr</td>
<td>3,366 ppm (1.25)</td>
<td>337 ppm</td>
</tr>
</tbody>
</table>

Human data ................................................. Exposures to 160 ppm for 4 hours has caused flushing of the face and a feeling of constriction in the chest; exposures to 500 ppm for brief (undefined) time periods has resulted in only irritation to the nose and throat [Deichmann and Gerarde 1969].

Revised IDLH: 500 ppm

Basis for revised IDLH: The revised IDLH for acetonitrile is 500 ppm based on acute inhalation toxicity data in humans [Deichmann and Gerarde 1969]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 500 ppm.

REFERENCES:

Acetylene tetrabromide

CAS number .................................. 79-27-5
NIOSH REL .................................. The 1989 OSHA PEL may not be protective to workers.
Current OSHA PEL ............................ 1 ppm (14 mg/m³) TWA
1989 OSHA PEL ............................ Same as current PEL
1993-1994 ACGIH TLV ......................... 1 ppm (14 mg/m³) TWA
Description of substance ....................... Pale-yellow liquid with a pungent odor similar to camphor or iodoform.

LEL ......................................... Noncombustible Liquid
Original (SCP) IDLH .......................... 10 ppm
Basis for original (SCP) IDLH .................. Van Haaf ten [1969] reported that a chemist who had been exposed to 1 to 2 ppm for 7.5 hours, with only a single 10-minute exposure at 16 ppm, almost died from liver damage. Because the TLV is 1 ppm [ACGIH 1976], it is assumed that exposure to 1 to 2 ppm would be a safe concentration for the 7.5 hours the worker was exposed. Therefore, the injury must have been produced by the 10-minute exposure to 16 ppm, and the IDLH would be expected to fall between 2 ppm and 15 ppm. For this draft technical standard, an IDLH of 10 ppm is assumed. This is an extremely toxic substance.

Short-term exposure guideline .................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>38</td>
<td>-----</td>
<td>4 hr</td>
<td>76 ppm (2.0)</td>
<td>7.6 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Gray 1950</td>
<td>oral</td>
<td>400</td>
<td>-----</td>
<td>195 ppm</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Gray 1950</td>
<td>oral</td>
<td>400</td>
<td>-----</td>
<td>195 ppm</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>265</td>
<td>-----</td>
<td>152 ppm</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Paustovskaya et al. 1967</td>
<td>oral</td>
<td>1,200</td>
<td>-----</td>
<td>585 ppm</td>
<td>20 ppm</td>
</tr>
</tbody>
</table>

Human data .................................. Severe acute intoxication was reported in a chemist after exposure to 16 ppm for about 10 minutes and to 1 to 2 ppm for most of the day [Van Haaf ten 1969].

Revised IDLH: 8 ppm
Basis for revised IDLH: The revised IDLH for acetylene tetrabromide is 8 ppm based on acute inhalation toxicity data in animals [Izmerov et al. 1982].

REFERENCES:

Acrolein

CAS number .................................. 107-02-6
NIOSH REL .................................. 0.1 ppm (0.25 mg/m³) TWA, 0.3 ppm (0.8 mg/m³) STEL
Current OSHA PEL ............................ 0.1 ppm (0.25 mg/m³) TWA
1989 OSHA PEL .............................. 0.1 ppm (0.25 mg/m³) TWA, 0.3 ppm (0.8 mg/m³) STEL
1993-1994 ACGIH TLV ......................... 0.1 ppm (0.23 mg/m³) TWA, 0.3 ppm (0.87 mg/m³) STEL

Description of substance......................... Colorless or yellow liquid with a piercing, disagreeable odor.

ACUTE TOXICITY DATA

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Albin 1962</td>
<td>875</td>
<td>----</td>
<td>1 min</td>
<td>280 ppm (0.32)</td>
<td>28 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Albin 1962</td>
<td>175</td>
<td>----</td>
<td>10 min</td>
<td>121 ppm (0.69)</td>
<td>12 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Albin 1962</td>
<td>150</td>
<td>----</td>
<td>10 min</td>
<td>150 ppm (1.0)</td>
<td>15 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>8</td>
<td>----</td>
<td>4 hr</td>
<td>16 ppm (2.0)</td>
<td>1.6 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Catlini et al. 1966</td>
<td>375</td>
<td>----</td>
<td>10 min</td>
<td>259 ppm (0.69)</td>
<td>26 ppm</td>
</tr>
<tr>
<td>Hamster</td>
<td>Kruysse 1971</td>
<td>25.4</td>
<td>----</td>
<td>4 hr</td>
<td>31 ppm (2.0)</td>
<td>5.1 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Pettite and Collumina 1956</td>
<td>10.5</td>
<td>----</td>
<td>6 hr</td>
<td>24 ppm (2.3)</td>
<td>2.4 ppm</td>
</tr>
<tr>
<td>G. Pig</td>
<td>Pettite and Collumina 1956</td>
<td>10.5</td>
<td>----</td>
<td>6 hr</td>
<td>24 ppm (2.3)</td>
<td>2.4 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Pettite and Collumina 1956</td>
<td>10.5</td>
<td>----</td>
<td>6 hr</td>
<td>24 ppm (2.3)</td>
<td>2.4 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Philippin et al. 1970</td>
<td>66</td>
<td>----</td>
<td>6 hr</td>
<td>152 ppm (2.3)</td>
<td>15 ppm</td>
</tr>
<tr>
<td>Hamster</td>
<td>Sangyo Igaku 1977</td>
<td>1,000</td>
<td>10 min</td>
<td>690 ppm (0.69)</td>
<td>69 ppm</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Skog 1950</td>
<td>674</td>
<td>2 hr</td>
<td>1,078 ppm (1.6)</td>
<td>108 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Skog 1950</td>
<td>131</td>
<td>10 min</td>
<td>131 ppm (1.0)</td>
<td>13 ppm</td>
<td></td>
</tr>
</tbody>
</table>

**Other animal data:**

RD₉₅ (mouse) . 1.88 [Alarie 1981].

It has been reported that 5.5 ppm results in intense irritation and marked lacrimation, after 60 seconds [Henderson and Haggard 1943]. Exposures to 1.8 ppm result in slight eye irritation after 1 minute and profuse lacrimation after 4 minutes [NRC 1961]. In volunteers exposed for 5 minutes, concentrations of 2 to 2.3 ppm produced severe irritation [Darley et al. 1960]. A 10-minute exposure at 8 ppm and a 5-minute exposure at 1.2 ppm elicited extreme irritation described as "only just tolerable" [Sim and Pattie 1957].
Revised IDLH: 2 ppm

Basis for revised IDLH: The revised IDLH for acrolein is 2 ppm based on acute inhalation toxicity data in humans [Darley et al. 1960; Henderson and Haggard 1943; NRC 1981; Sim and Pattie 1957].

REFERENCES:

Acrylamide

CAS number .................................. 79-06-1
NIOSH REL .................................. 
Current OSHA PEL ............................ 
1989 OSHA PEL ................................ 
1993-1994 ACGIH TLV ........................ 
Description of substance ...................... White crystalline, odorless solid.
LEL ........................................... 
Original (SCP) IDLH* ......................... Unknown [*Note: "Effective" IDLH = 600 mg/m³ -- see discussion below.]

Basis for original (SCP) IDLH ............... Very little data are available on which to base an IDLH for acrylamide. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 0.3 mg/m³ (i.e., 600 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 600 mg/m³. Calculations based on an oral LD₅₀ of 150 to 190 mg/kg for guinea pigs, rabbits, and rats [McCollister et al. 1964] indicate that a worker should be able to escape within 30 minutes without injury or irreversible health effects from 600 mg/m³.

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Hashimoto 1979</td>
<td>oral</td>
<td>100-200</td>
<td></td>
<td>700-1,400 mg/m³</td>
<td>70-140 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Hashimoto et al. 1981</td>
<td>oral</td>
<td>107</td>
<td></td>
<td>740 mg/m³</td>
<td>75 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>McCollister et al. 1964</td>
<td>oral</td>
<td>150</td>
<td></td>
<td>1,050 mg/m³</td>
<td>105 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>McCollister et al. 1964</td>
<td>oral</td>
<td>150</td>
<td></td>
<td>1,050 mg/m³</td>
<td>105 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Paulet and Vidal 1975</td>
<td>oral</td>
<td>124</td>
<td></td>
<td>668 mg/m³</td>
<td>87 mg/m³</td>
</tr>
</tbody>
</table>

Human data ................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 60 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for acrylamide. Based on acute oral toxicity data in animals [Hashimoto 1979], a value of about 70 mg/m³ would have been appropriate. However, the revised IDLH for acrylamide is 60 mg/m³ based on being 2,000 times the OSHA PEL of 0.03 mg/m³ that was promulgated in 1989 (2,000 is an assigned protection factor for respirators; only the most reliable respirators are recommended above 2,000 times the OSHA PEL). [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for acrylamide at concentrations above 0.03 mg/m³.]

REFERENCES:

Acrylonitrile

CAS number: 107-13-1
NIOSH REL: 1 ppm TWA, 10 ppm 15-minute CEILING [skin]; NIOSH considers acrylonitrile to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1990).
Current OSHA PEL: 2 ppm TWA, 10 ppm 15-minute CEILING [skin]
1989 OSHA PEL: Same as current PEL
1983-1984 ACGIH TLV: 2 ppm (4.3 mg/m^3) TWA [skin], A2

Description of substance:
Colorless to pale-yellow liquid with an unpleasant odor.

LEL: 3.0% (10% LEL, 3,000 ppm)

Basis for original (SCP) IDLH: The chosen IDLH is based on the statement by Spector [1956] about a rat 4-hour LC50 of 500 ppm [Carpenter et al. 1946].

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>500</td>
<td>-----</td>
<td>4 hr</td>
<td>3,635 ppm (7.27)</td>
<td>364 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Dudley and Neal 1942</td>
<td>-----</td>
<td>260</td>
<td>1 hr</td>
<td>2,850 ppm (7.27)</td>
<td>189 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Dudley and Neal 1942</td>
<td>-----</td>
<td>575</td>
<td>4 hr</td>
<td>4,180 ppm (7.27)</td>
<td>418 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Dudley and Neal 1942</td>
<td>925</td>
<td>-----</td>
<td>4 hr</td>
<td>2,374 ppm (7.27)</td>
<td>228 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Jaeger et al. 1974</td>
<td>425</td>
<td>-----</td>
<td>4 hr</td>
<td>3,090 ppm (7.27)</td>
<td>309 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Patty 1963</td>
<td>-----</td>
<td>636</td>
<td>4 hr</td>
<td>4,624 ppm (7.27)</td>
<td>462 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Schwanecke 1966</td>
<td>-----</td>
<td>452</td>
<td>1 hr</td>
<td>850 ppm (1.88)</td>
<td>85 ppm</td>
</tr>
</tbody>
</table>

Note: Conversion factor (CF) was determined with "n" = 1.1 [ten Berge et al. 1988].

Other human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 85 ppm

Basis for revised IDLH: The revised IDLH for acrylonitrile is 85 ppm based on acute inhalation toxicity data in humans [Schwanecke 1966]. (Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for acrylonitrile at concentrations above 1 ppm. OSHA currently requires in 29 CFR 1919.1045 that workers be provided with and required to wear and use the "most protective" respirators in concentrations exceeding 4,000 ppm (i.e., 2,000 x the PEL).)

REFERENCES:

Aldrin

CAS number ........................................ 309-00-2
NIOSH REL ........................................
Current OSHA PEL ................................
1989 OSHA PEL ................................
1993-1994 ACGIH TLV ........................
Description of substance ..........................
Colorless to dark-brown crystalline solid with a mild chemical odor:
Noncombustible Solid

Original (SCP) IDLH ..............................
Basis for original (SCP) IDLH ....................

Short-term exposure guidelines ..................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>$L_{C_{50}}$</th>
<th>$L_{C_{10}}$</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>4 hr</td>
<td>5.0 mg/m³</td>
<td>12 mg/m³ (2.0)</td>
<td>1.2 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>$L_{D_{50}}$ (mg/kg)</th>
<th>$L_{D_{10}}$ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>50</td>
<td>350 mg/m³</td>
<td>35 mg/m³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>33</td>
<td>231 mg/m³</td>
<td>23 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Kenaga and Morgan 1978</td>
<td>oral</td>
<td>39</td>
<td>273 mg/m³</td>
<td>27 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Kenaga and Morgan 1978</td>
<td>oral</td>
<td>44</td>
<td>308 mg/m³</td>
<td>31 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................ No effects were noted after exposure to 18 mg/m³ for 1 day

Revised IDLH: 25 mg/m³

Basis for revised IDLH: The revised IDLH for aldrin is 25 mg/m³ based on acute toxicity data in humans [Deichmann 1973; Ottolenghi et al. 1974]. [Note: NIOSH recommends as part of its carcinogen policy that the “most protective” respirators be worn for aldrin at concentrations above 0.25 mg/m³.]

REFERENCES:


4. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 73.


Allyl alcohol

CAS number ............................................. 107-18-6
NIOSH REL ........................................... 150 ppm
Current OSHA PEL ..................................... 2 ppm (5 mg/m³) TWA (10 mg/m³) STEL [skin]
1989 OSHA PEL ......................................... 2 ppm (5 mg/m³) TWA (10 mg/m³) STEL [skin]
1983-1986 ACGIH TLV .................................. 2 ppm (4.8 mg/m³) TWA, 4 ppm (0.5 mg/m³) STEL [skin]
Description of substance ................................ Colorless liquid with a pungent, mustard-like odor.
LEL .............................................................. 2.5% (10% LEL, 2,500 ppm)
Original (SCP) IDLH .................................... 150 ppm
Basis for original (SCP) IDLH ............................... The chosen IDLH is based on the statement by AIHA [1963] that from animal experiments, a single 1-hour exposure to 150 ppm might be fatal, while the same exposure to 100 ppm would probably allow survival [Dunlap et al. 1958].

Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉⁰ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>1 hr</td>
<td>1,250 ppm</td>
<td>130 ppm</td>
<td>1 hr</td>
<td>1,250 ppm (1.25)</td>
<td>125 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>8 hr</td>
<td>330 ppm</td>
<td>33 ppm</td>
<td>3 hr</td>
<td>1,910 ppm (1.91)</td>
<td>191 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>2 hr</td>
<td>1,000 ppm</td>
<td>190 ppm</td>
<td>2 hr</td>
<td>1,060 ppm (1.06)</td>
<td>190 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>3.5 hr</td>
<td>1,910 ppm</td>
<td>130 ppm</td>
<td>3.5 hr</td>
<td>1,910 ppm (1.91)</td>
<td>191 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>4 hr</td>
<td>1,910 ppm</td>
<td>130 ppm</td>
<td>4 hr</td>
<td>1,910 ppm (1.91)</td>
<td>191 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>8 hr</td>
<td>1,910 ppm</td>
<td>130 ppm</td>
<td>8 hr</td>
<td>1,910 ppm (1.91)</td>
<td>191 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ Severe eye irritation is reported to result from exposure at 25 ppm [Dunlap et al. 1958].

Revised IDLH: 20 ppm
Basis for revised IDLH: The revised IDLH for allyl alcohol is 20 ppm based on acute inhalation toxicity data in humans [Dunlap et al. 1958] and animals [Dunlap et al. 1958; Smyth and Carpenter 1948].

REFERENCES:

4. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 17.
Allyl chloride

CAS number ........................................ 107-05-1
NIOSH REL ........................................... 1 ppm (3 mg/m³) TWA, 2 ppm (8 mg/m³) STEL
Current OSHA PEL .................................. 1 ppm (3 mg/m³) TWA
1989 OSHA PEL ...................................... 1 ppm (3 mg/m³) TWA
1993-1994 ACGIH TLV .............................. 1 ppm (3 mg/m³) TWA, 2 ppm (8 mg/m³) STEL

Description of substance .......................... Colorless, brown, yellow, or purple liquid with a pungent, unpleasant odor.

LEL ................................................... 2.9% (10% LEL, 2,900 ppm)
Original (SCP) IDLH ................................ 300 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statement by Deichmann and Gerarde (1969) that a 1-hour exposure to 300 ppm might cause serious effects.

Short-term exposure guidelines .................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Boqin et al. 1982</td>
<td>11,000 mg/m³</td>
<td>-----</td>
<td>2 hr</td>
<td>4.127 ppm (1.25)</td>
<td>434 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Boqin et al. 1982</td>
<td>11,500 mg/m³</td>
<td>-----</td>
<td>2 hr</td>
<td>4.520 ppm (1.25)</td>
<td>454 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Boqin et al. 1982</td>
<td>5,800 mg/m³</td>
<td>-----</td>
<td>2 hr</td>
<td>2,240 ppm (1.25)</td>
<td>224 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Boqin et al. 1982</td>
<td>22,500 mg/m³</td>
<td>-----</td>
<td>2 hr</td>
<td>8,844 ppm (1.25)</td>
<td>884 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Boqin et al. 1982</td>
<td>19,500 mg/m³</td>
<td>-----</td>
<td>2 hr</td>
<td>4,127 ppm (1.25)</td>
<td>434 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................... It has been stated that a 1-hour exposure to 300 ppm might cause serious effects [Deichmann and Gerarde 1969].

Revised IDLH: 250 ppm
Basis for revised IDLH: The revised IDLH for allyl chloride is 250 ppm based on acute inhalation toxicity data in humans [Deichmann and Gerarde 1969] and animals [Boqin et al. 1982].

REFERENCES:

Allyl glycidyl ether

CAS number .................................. 106-92-3
NIOSH REL  .................................. 5 ppm (22 mg/m³) TWA, 10 ppm (44 mg/m³) STEL [skin]
Current OSHA PEL  ........................... 5 ppm (22 mg/m³) TWA, 10 ppm (44 mg/m³) STEL
1989 OSHA PEL ................................ 10 ppm (45 mg/m³) CEILING
1993-1994 ACGIH TLV  ......................... 5 ppm (22 mg/m³) TWA, 10 ppm (44 mg/m³) STEL

Description of substance  ....................... Colorless liquid with a pleasant odor.
LEL ......................................... Unknown

Basis for original (SCP) IDLH .................. 270 ppm

The chosen IDLH is based on the mouse 4-hour LC₅₀ of 270 ppm (Hine et al. 1956) cited in ACGIH [1971], AIHA [1965], and Patty [1963].

Short-term exposure guidelines  ................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Hine et al. 1956</td>
<td>270</td>
<td>4 hr</td>
<td>540 ppm (2.0)</td>
<td>54 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1956</td>
<td>670</td>
<td>8 hr</td>
<td>1,575 ppm (2.5)</td>
<td>168 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data  ................................  None relevant for determining the revised IDLH.

Revised IDLH: 50 ppm

Basis for revised IDLH: The revised IDLH for allyl glycidyl ether is 50 ppm based on acute inhalation toxicity data in animals [Hine et al. 1956]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

2-Aminopyridine

CAS number .................................. 504-29-0
NIOSH REL .................................. 
Current OSHA PEL .......................... 0.5 ppm (2 mg/m³) TWA
1989 OSHA PEL ................................ 
Same as current PEL
1993-1994 ACGIH TLV ....................... 0.5 ppm (1.9 mg/m³) TWA
Description of substance ..................... White powder, leaflets, or crystals with a characteristic odor.
LEL .......................................... Unknown
Original (SCP) IDLH .......................... 5 ppm
Basis for original (SCP) IDLH ............... Very little quantitative data are available on which to base an IDLH for 2-aminopyridine. The chosen IDLH is based on the statement by ACGIH [1971] that a 5-hour exposure to about 5 ppm produced headache, increased blood pressure, and nausea in a worker [Watrous and Schulz 1950].

Short-term exposure guidelines ............. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LLD₅₀ (mg/kg)</th>
<th>LLD₁₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Marhold 1986</td>
<td>oral</td>
<td>200</td>
<td></td>
<td>100 ppm</td>
<td>39 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Verschueren 1983</td>
<td>oral</td>
<td>50</td>
<td></td>
<td>90 ppm</td>
<td>9 ppm</td>
</tr>
</tbody>
</table>

Human data .................................. A 5-hour exposure to approximately 5 ppm caused severe headache, increased blood pressure, flushing of the extremities, and nausea [Watrous and Schulz 1950].

Revised IDLH: 5 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Watrous and Schulz 1950], the original IDLH for 2-aminopyridine (5 ppm) is not being revised at this time. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 5 ppm.

REFERENCES:

Ammonia

CAS number .......................................................... 7664-41-7
NIOSH REL ............................................................... 25 ppm (18 mg/m³) TWA, 35 ppm (27 mg/m³) STEL
Current OSHA PEL ..................................................... 50 ppm (35 mg/m³) TWA
1989 OSHA PEL ......................................................... 35 ppm (27 mg/m³) STEL
1993-1994 ACGIH TLV ................................................. 25 ppm (17 mg/m³) TWA, 35 ppm (24 mg/m³) STEL
Description of substance .............................................. Colorless gas with a pungent, suffocating odor.
NIOSH REL ............................................................... 25 ppm (18 mg/m³) TWA, 35 ppm (27 mg/m³) STEL
Current OSHA PEL ..................................................... 50 ppm (35 mg/m³) TWA
1989 OSHA PEL ......................................................... 35 ppm (27 mg/m³) STEL
1993-1994 ACGIH TLV ................................................. 25 ppm (17 mg/m³) TWA, 35 ppm (24 mg/m³) STEL

Acute Toxicity Data

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{10} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Alarie 1981</td>
<td>40,200</td>
<td>-----</td>
<td>10 min</td>
<td>22,374 ppm (0.56)</td>
<td>2,337 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Alarie 1981</td>
<td>28,955</td>
<td>-----</td>
<td>26 min</td>
<td>23,468 ppm (0.82)</td>
<td>2,335 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Alarie 1981</td>
<td>20,300</td>
<td>-----</td>
<td>46 min</td>
<td>23,345 ppm (1.16)</td>
<td>2,335 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Alarie 1981</td>
<td>11,590</td>
<td>-----</td>
<td>1 hr</td>
<td>16,342 ppm (1.41)</td>
<td>1,634 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Beck et al. 1972</td>
<td>7,318</td>
<td>-----</td>
<td>1 hr</td>
<td>10,347 ppm (1.41)</td>
<td>1,035 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Beck et al. 1972</td>
<td>4,857</td>
<td>-----</td>
<td>1 hr</td>
<td>6,820 ppm (3.41)</td>
<td>682 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Boyd et al. 1944</td>
<td>6,859</td>
<td>-----</td>
<td>1 hr</td>
<td>13,901 ppm (3.41)</td>
<td>1,309 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Boyd et al. 1944</td>
<td>9,859</td>
<td>-----</td>
<td>1 hr</td>
<td>13,901 ppm (3.41)</td>
<td>1,309 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann and Gerarde 1969</td>
<td>2,000</td>
<td>-----</td>
<td>4 hr</td>
<td>5,600 ppm (2.83)</td>
<td>566 ppm</td>
</tr>
<tr>
<td>Mammal</td>
<td>Flury 1928</td>
<td>-----</td>
<td>5,000</td>
<td>5 min</td>
<td>2,050 ppm (0.41)</td>
<td>205 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Kapelius et al. 1982</td>
<td>4,230</td>
<td>-----</td>
<td>1 hr</td>
<td>5,964 ppm (2.41)</td>
<td>596 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1933</td>
<td>-----</td>
<td>5,000</td>
<td>5 min</td>
<td>2,050 ppm (0.41)</td>
<td>205 ppm</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 2.0 [ten Berge et al. 1986].

Other animal data .................................................. RO_{90} (mouse), 303 ppm [Appelman et al. 1962].

Existing short-term exposure guidelines

The chosen IDLH is based on the statement by AIHA [1971] that 300 to 500 ppm for 30 to 60 minutes have been reported as a maximum short exposure tolerance [Henderson and Haggard 1943]. AIHA [1971] also reported that 5,000 to 10,000 ppm are reported to be fatal [Mulder and Van der Zahm 1967] and exposures for 30 minutes to 2,500 to 6,000 ppm are considered dangerous to life [Smyth 1956].

1988 American Industrial Hygiene Association (AIHA)
Emergency Response Planning Guidelines (ERPGs)

ERPG-1: 25 ppm
ERPG-2: 200 ppm
ERPG-3: 1,000 ppm

National Research Council [NRC 1987] Emergency Exposure Guidance Levels (EEGLs)

1-hour EEGL: 100 ppm
24-hour EEGL: 100 ppm


Continuous exposure (60 days): 25 ppm
1 hour: 400 ppm

*Note: Conversion factor (CF) was determined with "n" = 2.0 [ten Berge et al. 1986].

Other animal data .................................................. RO_{90} (mouse), 303 ppm [Appelman et al. 1962].
Ammonia (continued)

Other human data ........................................ The maximum short exposure tolerance has been reported as being 300 to 500 ppm for 0.5 to 1 hour [Henderson and Haggard 1943]. A change in respiration rate and moderate to severe irritation has been reported in 7 subjects exposed to 500 ppm for 30 minutes [Silverman et al. 1946].

Revised IDLH: 300 ppm
Basis for revised IDLH: The revised IDLH for ammonia is 300 ppm based on acute inhalation toxicity data in humans [Henderson and Haggard 1943; Silverman et al. 1946].

REFERENCES:

14. Tab Blut Per [1933]: 8231-289 (in German).
Ammonium sulfamate

CAS number ........................................... 7773-06-0
NIOSH REL ............................................
Current OSHA PEL ...................................
1989 OSHA PEL ........................................
1993-1994 ACGIH TLV .................................

Description of substance
Colorless to white crystalline, odorless solid.

LEL ..................................................
Original (SCP) IDLH ..................................
Basis for original (SCP) IDLH ...........
The chosen IDLH is based on the rat intraperitoneal LD₅₀ of 800 mg/kg cited by NIOSH [1976] from Ambrose (1943). This compound has a low toxicity.

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₈₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Ball 1956</td>
<td>oral</td>
<td>2,000</td>
<td>-----</td>
<td>14,000 mg/m³</td>
<td>1,400 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Zabol 1963</td>
<td>oral</td>
<td>3,100</td>
<td>-----</td>
<td>21,700 mg/m³</td>
<td>2,170 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>3,900</td>
<td>-----</td>
<td>27,300 mg/m³</td>
<td>2,730 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>5,780</td>
<td>-----</td>
<td>40,320 mg/m³</td>
<td>4,032 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 1,500 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for ammonium sulfamate. Therefore, the revised IDLH for ammonium sulfamate is 1,500 mg/m³ based on the acute oral toxicity data in animals [Ball 1956]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

n-Amyl acetate

CAS number .................................. 628-63-7
NIOSH REL .................................. 
Current OSHA PEL ........................................ 100 ppm (525 mg/m³) TWA
1989 OSHA PEL ............................................ Same as current PEL
1993-1994 ACGIH TLV ......................... 100 ppm (532 mg/m³) TWA

Description of substance .................................. Colorless liquid with a persistent banana-like odor.

LEL ........................................ 1.1% (10% LEL, 1,100 ppm)
Original (SCP) IDLH ............................ 4,000 ppm

The chosen IDLH is based on the statement by Browning [1965] that exposure to 4,000 ppm of a mixture of n-amyl acetate and isooamyl acetate produced complete loss of reflexes in rabbits within an hour [Koelsch 1912], and on the statement by Sax [1975] that 5,000 ppm n-amyl acetate produced deep narcosis in cats in 30 minutes.

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>5,200</td>
<td>5,200</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Marhold 1986</td>
<td>oral</td>
<td>7,400</td>
<td>6,500</td>
<td>9,575 ppm</td>
<td>958 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>oral</td>
<td>6,500</td>
<td>6,500</td>
<td>8,410 ppm</td>
<td>841 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................. RDL₅₀ (mouse), 1,531 ppm [Alarie 1981].

Human data ..................................... Somnolence has been reported after exposure to 952 ppm for 30 minutes [Lehmann 1913].

Revised IDLH: 1,000 ppm

Basis for revised IDLH: The revised IDLH for n-amyl acetate is 1,000 ppm based on acute toxicity data in humans [Lehmann 1913] and animals [Alarie 1981; Marhold 1986].

REFERENCES:

sec-Amyl acetate

CAS number .................................................. 626-38-0
NIOSH REL .....................................................
Current OSHA PEL ...........................................
1989 OSHA PEL ................................................
1993-1994 ACGIH TLV ......................................
Description of substance ................................. Colorless liquid with a mild odor.
LEL .......................................................... 1% (10% LEL, 1,000 ppm)
Original (SCP) IDLH ........................................... 9,000 ppm
Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the statement by ACGIH [1971] that 8,200 ppm was lethal to guinea pigs in 7 hours [Patty et al. 1936]. This is the only data on acute inhalation toxicity available on which to base the IDLH.

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (ppm)</th>
<th>LC&lt;sub&gt;10&lt;/sub&gt; (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Patty et al. 1936</td>
<td>9.200</td>
<td>10,000</td>
<td>7 hr</td>
<td>22,080 ppm (2.4)</td>
<td>2,208 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>von Oettingen 1960</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Human data ...................................................... It has been stated that exposure to 1,000 ppm for an hour may be expected to produce serious toxic effects [von Oettingen 1960].

Revised IDLH: 1,000 ppm

Basis for revised IDLH: The revised IDLH for sec-amyl acetate is 1,000 ppm based on acute inhalation toxicity data in humans [von Oettingen 1960] and the similarity of the toxic effects of sec-amyl acetate to those of n-amyl acetate (which also has a revised IDLH of 1,000 ppm).

REFERENCES:

Aniline

CAS number ........................................... 62-53-3
NIOSH REL ............................................. None established; NIOSH considers aniline to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1990).
Current OSHA PEL .................................. 5 ppm (19 mg/m³) TWA [skin]
1989 OSHA PEL ....................................... 2 ppm (8 mg/m³) TWA [skin]
1993-1994 ACGIH TLV ................................ 2 ppm (7.8 mg/m³) TWA [skin]
Description of substance ................................ Colorless to brown, oily liquid with an aromatic amine-like odor.
LEL ................................................... 1.3% (10% LEL, 1,300 ppm)
Original (SCP) IDLH .................................. 100 ppm

Basis for original (SCP) IDLH ........................ The chosen IDLH is based on the statement by Henderson and Haggard (1943) that 100 to 160 ppm is the maximum concentration that can be inhaled for 1 hour without serious disturbance. AIHA (1955) reported that 50 to 100 ppm can probably be tolerated for 60 minutes.

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Back et al. 1972</td>
<td>175</td>
<td></td>
<td>7 hr</td>
<td>420 ppm (2.4)</td>
<td>42 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>250</td>
<td>4 hr</td>
<td>500 ppm (2.0)</td>
<td>50 ppm</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>von Oettingen 1941</td>
<td>180</td>
<td>8 hr</td>
<td>450 ppm (2.5)</td>
<td>45 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Back et al. 1972</td>
<td>oral</td>
<td>195</td>
<td>353 ppm</td>
<td>35 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Dieke et al. 1947</td>
<td>oral</td>
<td>250</td>
<td>452 ppm</td>
<td>45 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Zabel 1969</td>
<td>oral</td>
<td>464</td>
<td>839 ppm</td>
<td>84 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Jacobsen 1972</td>
<td>oral</td>
<td>440</td>
<td>786 ppm</td>
<td>80 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Kodak 1984</td>
<td>oral</td>
<td>400</td>
<td>724 ppm</td>
<td>72 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ............................................. Volunteers tolerated 1-hour exposures ranging from 100-160 ppm with only moderate adverse health effects (undefined) (von Oettingen 1941). It has also been reported that 100 to 160 ppm is the maximum concentration that can be inhaled for 1 hour without serious consequence (Henderson and Haggard 1943) and that 50 to 100 ppm can probably be tolerated for 60 minutes (AIHA 1955).

Revised IDLH: 100 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans (AIHA 1955; Henderson and Haggard 1943; von Oettingen 1941), the original IDLH for aniline of 100 ppm is not being revised at this time. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for aniline at any detectable concentration.]
Aniline (continued)

REFERENCES:

o-Anisidine

CAS number .................................................. 90-04-0
NIOSH REL .................................................... 0.5 mg/m³ TWA [skin]; NIOSH considers o-anisidine to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ........................................... 0.5 mg/m³ TWA [skin]
1989 OSHA PEL .............................................. Same as current PEL
1993-1994 ACGIH TLV ...................................... 0.1 ppm (0.5 mg/m³) TWA [skin]
Description of substance .................................... Red or yellow, oily liquid with an amine-like odor.
LEL .................................................................... Unknown
Original (SCP) IDLH ........................................... 50 mg/m³
Basis for original (SCP) IDLH................................ Because no data on acute inhalation toxicity are available for anisidine (o-, p-isomers), the chosen IDLH is based on chronic data. ACGIH [1971] reported that mice survived exposures to 10 to 30 mg/m³ for 2 hours/day, 6 days/week for 1 month; a decrease in the excitability of nerves was noted [Zaeva and Fedorova 1962]. Because mice survived 30 mg/m³, 2 hours/day, 6 days/week for 1 month, a worker should be able to escape from 50 mg/m³ without injury or irreversible health effects.

Short-term exposure guidelines .............................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>IARC 1982</td>
<td>oral</td>
<td>2,000</td>
<td></td>
<td>14,000 mg/m³</td>
<td>1,400 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>IARC 1982</td>
<td>oral</td>
<td>1,400</td>
<td></td>
<td>9,800 mg/m³</td>
<td>980 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>IARC 1982</td>
<td>oral</td>
<td>470</td>
<td></td>
<td>6,090 mg/m³</td>
<td>609 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data ............................................. Mice have survived exposures to concentrations of 10 to 30 mg/m³ for 2 hours/day, 6 days/week for 1 month with only a decrease in the excitability of nerves noted [Zaeva and Fedorova 1962].

Human data ..................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 50 mg/m³ [Unchanged]

Basis for revised IDLH: Based on subchronic inhalation toxicity data in animals [Zaeva and Fedorova 1962], the original IDLH for o-anisidine (50 mg/m³) is not being revised at this time. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirator be worn for o-anisidine at concentrations above 0.5 mg/m³.]

REFERENCES:

p-Anisidine

CAS number ................................................. 104-94-9
NIOSH REL .................................................. 
Current OSHA PEL ......................................... 0.5 mg/m³ TWA [skin]
1989 OSHA PEL ............................................. Same as current PEL
1993-1994 ACGIH TLV ..................................... 0.1 ppm (0.5 mg/m³) TWA [skin]
Description of substance .................................. Yellow to brown, crystalline solid with an amine-like odor.
LEL ...................................................................... Unknown
Original (SCP) IDLH ............................................ 50 mg/m³
Basis for original (SCP) IDLH .............................. Because no data on acute inhalation toxicity are available for anisidine (o-, p-isomers), the chosen IDLH is based on chronic data. ACGIH [1971] reported that mice survived exposures to 10 to 30 mg/m³ for 2 hours/day, 6 days/week for 1 month; a decrease in the excitability of nerves was noted [Zaeva and Fedorova 1962]. Because mice survived 30 mg/m³, 2 hours/day, 6 days/week for 1 month, a worker should be able to escape from 50 mg/m³ without injury or irreversible health effects.

Short-term exposure guidelines ............................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>IARC 1982</td>
<td>oral</td>
<td>2,900</td>
<td>-----</td>
<td>20,300 mg/m³</td>
<td>2,030 mg/m³</td>
</tr>
<tr>
<td>House</td>
<td>IARC 1982</td>
<td>oral</td>
<td>1,300</td>
<td>-----</td>
<td>9,100 mg/m³</td>
<td>910 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Nippon 1956</td>
<td>oral</td>
<td>-----</td>
<td>1,000</td>
<td>7,000 mg/m³</td>
<td>700 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Sziza and Podragyai 1957</td>
<td>oral</td>
<td>1,400</td>
<td>-----</td>
<td>9,800 mg/m³</td>
<td>980 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data ........................................... Mice have survived exposures to concentrations of 10 to 30 mg/m³ for 2 hours/day, 6 days/week for 1 month with a only decrease in the excitability of nerves noted [Zaeva and Fedorova 1962].

Human data ............................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 50 mg/m³ [Unchanged]

Basis for revised IDLH: Based on subchronic inhalation toxicity data in animals [Zaeva and Fedorova 1982], the original IDLH for p-anisidine of 50 mg/m³ is not being revised at this time.

REFERENCES:

Antimony compounds (as Sb)

CAS number .................................. 7440-36-0 (Metal)
NIOSH REL .................................. 
Current OSHA PEL ............................ 0.5 mg Sb/m³ TWA
1989 OSHA PEL ................................ Same as current PEL
1993-1994 ACGIH TLV ....................... 0.5 mg Sb/m³ TWA
Description of substance ....................... Varies
Original (SCP) IDLH .......................... 80 mg Sb/m³
Basis for original (SCP) IDLH ................ 

AIHA [1959] reported that the severity of hazard is moderate to high for both acute and chronic exposures to antimony and its compounds. Brieger et al. [1954] noted an apparent increase in heart abnormalities in workers chronically exposed to antimony trisulfide (0.6 to 5.5 mg/m³) and demonstrated heart injury in experimental animals. The chosen IDLH is based on the report by Taylor [1966] that slightly delayed gastrointestinal disorders, including abdominal pain and persistent anorexia, were noted in workers briefly exposed to air containing up to 73 mg/m³ of antimony.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SbCl₅</td>
<td>Chekinova and Minkina 1987</td>
<td>720 mg/m³</td>
<td>-----</td>
<td>?</td>
<td>469 mg Sb/m³</td>
<td>47 mg Sb/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Ismerov et al. 1982</td>
<td>720 mg/m³</td>
<td>-----</td>
<td>2 hr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sb</td>
<td>Coulston and Korte 1975</td>
<td>oral</td>
<td>7,500</td>
<td>-----</td>
<td>49,000 mg Sb/m³</td>
<td>4,900 mg Sb/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth and Carpenter 1948</td>
<td>oral</td>
<td>&gt;20,000</td>
<td>-----</td>
<td>&gt;117,600 mg Sb/m³</td>
<td>&gt;11,760 mg Sb/m³</td>
</tr>
<tr>
<td>SbCl₅</td>
<td>Arzamastev 1964</td>
<td>oral</td>
<td>1,115</td>
<td>-----</td>
<td>3,179 mg Sb/m³</td>
<td>318 mg Sb/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Arzamastev 1964</td>
<td>oral</td>
<td>900</td>
<td>-----</td>
<td>2,556 mg Sb/m³</td>
<td>257 mg Sb/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Arzamastev 1964</td>
<td>oral</td>
<td>900</td>
<td>-----</td>
<td>2,556 mg Sb/m³</td>
<td>257 mg Sb/m³</td>
</tr>
</tbody>
</table>

Human data .................................... Antimony pentfluoride (SbF₅) is considered to be the most toxic of the antimony chlorides [ACGIH 1993]. The American Conference of Governmental Industrial Hygienists (ACGIH) TLV for antimony is based on an analogy to hydrogen chloride [ACGIH 1993].

Revised IDLH: 50 mg Sb/m³

Basis for revised IDLH: The revised IDLH for antimony compounds is 50 mg Sb/m³ based on acute inhalation toxicity data in animals [Ismerov et al. 1982] and an analogy to hydrogen chloride (ACGIH 1993) which has a revised IDLH of 50 ppm (75 mg/m³).
REFERENCES:


ANTU

CAS number .................................. 68-88-4
NIOSH REL .................................. 0.3 mg/m³ TWA
Current OSHA PEL ........................... 0.3 mg/m³ TWA
1989 OSHA PEL .............................. Same as current PEL
1993-1994 ACGIH TLV ......................... 0.3 mg/m³ TWA

Description of substance
White crystalline or gray, odorless powder.

LEL ......................................... Noncombustible Solid

Original (SCP) IDLH .......................... 100 mg/m³
Basis for original (SCP) IDLH .............. No useful acute inhalation toxicity data are available on which to base the IDLH for ANTU. The chosen IDLH, therefore, has been estimated from the fatal human oral dose of 1 gram given by Stolman [1969]. According to ACGIH [1971], McClosky and Smith [1945] reported that the acute oral toxicity varies greatly among different species, with rats and dogs being the most susceptible (LD₅₀ of 30 to 50 mg/kg) and rabbits the least susceptible (LD₅₀ of 1,000 mg/kg).

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>0.38</td>
<td>-----</td>
<td>2.7 mg/m³</td>
<td>0.3 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Lehman 1952</td>
<td>oral</td>
<td>6</td>
<td>-----</td>
<td>42 mg/m³</td>
<td>4.2 mg/m³</td>
</tr>
<tr>
<td>Monkey</td>
<td>Perkow 1971/76</td>
<td>oral</td>
<td>4,250</td>
<td>-----</td>
<td>29,750 mg/m³</td>
<td>2,975 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Yakkyoku 1977</td>
<td>oral</td>
<td>5</td>
<td>-----</td>
<td>35 mg/m³</td>
<td>3.5 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data

It has been reported that the mean oral lethal dose is 4,000 mg/kg in monkeys and is presumably much the same in man [Gosselin et al. 1964].

Human data

The fatal oral dose has been reported to be 1,000 mg [Stolman 1969]. [Note: An oral dose of 1,000 mg is equivalent to a worker being exposed to 650 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 100 mg/m³ [Unchanged]
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for ANTU. However, based on acute oral toxicity data in humans [Stolman 1969] and animals [Gosselin et al. 1984; Perkow 1971/76], the original IDLH for ANTU (100 mg/m³) is not being revised at this time.

REFERENCES:
Arsenic (inorganic compounds, as As)

CAS number ........................................... 7440-38-2 (Metal)
NIOSH REL ........................................ 0.002 mg As/m³ 15-minute CEILING; NIOSH considers inorganic arsenic compounds to be potential occupational carcinogens as defined by the OSHA carcinogen policy [29 CFR 1910].
Current OSHA PEL ................................ 0.010 mg As/m³ TWA
1989 OSHA PEL .................................. Same as current PEL
1993-1994 ACGIH TLV ....................... 0.01 mg As/m³ TWA, A1
Description of substance ....................... Varies

Original (SCP) IDLH ............................... 100 mg As/m³
Basis for original (SCP) IDLH ................. The chosen IDLH is based on the cat 1-hour LC₅₀ of 100 mg/m³ for arsenic trichloride [Flury 1921 cited by NIOSH 1976].

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AsCl₃, Cat</td>
<td>Flury 1921</td>
<td>100 mg/m³</td>
<td>1 hr</td>
<td>52 mg As/m³ (1.25)</td>
<td>5.2 mg As/m³</td>
<td></td>
</tr>
<tr>
<td>AsCl₃, Cat</td>
<td>Spector 1955</td>
<td>200 mg/m³</td>
<td>30 min</td>
<td>79 mg As/m³ (0.96)</td>
<td>7.9 mg As/m³</td>
<td></td>
</tr>
<tr>
<td>AsCl₃, Mouse</td>
<td>Spector 1955</td>
<td>338 ppm</td>
<td>10 min</td>
<td>726 mg As/m³ (0.69)</td>
<td>73 mg As/m³</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀</th>
<th>LD₉₅</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>Davydova et al. 1987</td>
<td>oral</td>
<td>763</td>
<td>-----</td>
<td>5,341 mg As/m³</td>
<td>534 mg As/m³</td>
</tr>
<tr>
<td>As</td>
<td>Davydova et al. 1987</td>
<td>oral</td>
<td>145</td>
<td>-----</td>
<td>1,015 mg As/m³</td>
<td>102 mg As/m³</td>
</tr>
<tr>
<td>AsCl₃, Rat</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>20</td>
<td>-----</td>
<td>53 mg As/m³</td>
<td>5.3 mg As/m³</td>
</tr>
<tr>
<td>AsCl₃, Mouse</td>
<td>MacBwen and Vemot 1972</td>
<td>oral</td>
<td>794</td>
<td>-----</td>
<td>2,090 mg As/m³</td>
<td>209 mg As/m³</td>
</tr>
<tr>
<td>AsCl₃, Rabbit</td>
<td>Muehlberger 1930</td>
<td>oral</td>
<td>50</td>
<td>-----</td>
<td>132 mg As/m³</td>
<td>13 mg As/m³</td>
</tr>
<tr>
<td>AsCl₃, Dog</td>
<td>Perkow 1971/1976</td>
<td>oral</td>
<td>10</td>
<td>-----</td>
<td>100 mg As/m³</td>
<td>10 mg As/m³</td>
</tr>
<tr>
<td>Pb₃(AsO₃)₂, Rabbit</td>
<td>Muehlberger 1930</td>
<td>oral</td>
<td>75</td>
<td>-----</td>
<td>88 mg As/m³</td>
<td>8.8 mg As/m³</td>
</tr>
</tbody>
</table>

Human data ...................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 10 mg As/m³

Basis for revised IDLH: The revised IDLH for inorganic arsenic compounds is 10 mg As/m³ based on acute inhalation toxicity data in animals [Flury 1921; Spector 1955]. This may be a conservative value due to the lack of relevant acute toxicity data for workers. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for inorganic arsenic compounds at concentrations above 0.002 mg As/m³. OSHA currently requires in 29 CFR 1910.1018 that workers be provided with and required to wear and use the "most protective" respirators in concentrations exceeding 20 mg As/m³ (i.e., 2,000 x the PEL).]
REFERENCES:

Arsine

CAS number ............................................ 7784-42-1
NIOSH REL .............................................
Current OSHA PEL ..................................... 0.002 mg/m³ 15-minute CEILING; NIOSH considers arsine to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].
1989 OSHA PEL ....................................... 0.05 ppm (0.2 mg/m³) TWA
1993-1994 ACGIH TLV ............................... Same as current PEL
Description of substance ......................... Colorless gas with a mild, garlick-like odor.
LEL ....................................................... 5.1% (10% LEL, 5,100 ppm)
Original (SCP) IDLH ................................. 6 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statement by Petty [1963] that 6 to 30 ppm is the maximum concentration that can be inhaled in 1 hour without serious consequences [Henderson and Haggard 1943]. The chosen IDLH falls within the range of 1 to 10 ppm, which AIHA [1965] suggested might be dangerous for a 1-hour exposure [Elkins 1959; Kipling and Fothergill 1964].

Existing short-term exposure guidelines ........

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gates et al. 1946</td>
<td>120</td>
<td>----</td>
<td>10 min</td>
<td>83 ppm (0.69)</td>
<td>8.3 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gates et al. 1946</td>
<td>77</td>
<td>----</td>
<td>10 min</td>
<td>53 ppm (0.69)</td>
<td>5.3 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Gates et al. 1946</td>
<td>202</td>
<td>----</td>
<td>10 min</td>
<td>138 ppm (0.69)</td>
<td>14 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Gates et al. 1946</td>
<td>108</td>
<td>----</td>
<td>10 min</td>
<td>75 ppm (0.69)</td>
<td>7.5 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Henderson and Haggard 1943</td>
<td>----</td>
<td>250</td>
<td>30 min</td>
<td>250 ppm (1.0)</td>
<td>25 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1933</td>
<td>----</td>
<td>302</td>
<td>5 min</td>
<td>165 ppm (0.55)</td>
<td>17 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Teitelbaum and Kier 1969</td>
<td>----</td>
<td>25</td>
<td>30 min</td>
<td>25 ppm (1.0)</td>
<td>2.5 ppm</td>
</tr>
</tbody>
</table>

Other animal data ..................................
RO₉₀ (mouse), 13 ppm [Peterson and Bhattacharyya 1985]. It has been reported that poisoning symptoms occur after a few hours exposure to 3 to 10 ppm [Henderson and Haggard 1943]. It has been suggested that 1 to 10 ppm might be dangerous for a 1 hour exposure [AIHA 1965] and that 8 to 30 ppm is the maximum concentration that can be inhaled in 1 hour without serious consequences [Henderson and Haggard 1943]. It has been estimated that 1,543 ppm for 2 minutes and 52 ppm for 30 minutes are minimal disabling exposures [Gates et al. 1946].

Other human data ..................................

Revised IDLH: 3 ppm
Basis for revised IDLH: The revised IDLH for arsine is 3 ppm based on acute inhalation toxicity data in humans [AIHA 1965; Henderson and Haggard 1943; Teitelbaum and Kier 1969]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for arsine at concentrations above 0.002 mg As/m³.]

40
REFERENCES:

Azinphos-methyl

CAS number ............................................ 86-50-0
NIOSH REL ........................................... .
Current OSHA PEL .................................... 0.2 mg/m³ TWA [skin]
Current OSHA PEL .................................... 0.2 mg/m³ TWA [skin]
1993-1994 ACGIH TLV .................................. 0.2 mg/m³ TWA [skin]

Description of substance: Colorless crystals or a brown, waxy solid.
LEL ....................................................... .

Original (SCP) IDLH .................................... 20 mg/m³

Short-term exposure guidelines: Based on no useful data on acute inhalation toxicity are available concerning the toxic effects produced by azinphos-methyl, the chosen IDLH has been based on an analogy with parathion, which has an IDLH of 20 mg/m³.

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Newell and Dilley 1978</td>
<td>69 mg/m³</td>
<td>-----</td>
<td>1 hr</td>
<td>86 mg/m³ (1.25)</td>
<td>8.6 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Sanderson 1961</td>
<td>79 mg/m³</td>
<td>-----</td>
<td>1 hr</td>
<td>99 mg/m³ (1.25)</td>
<td>9.9 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₁₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>DuBois et al. 1957</td>
<td>oral</td>
<td>16</td>
<td>-----</td>
<td>115 mg/m³</td>
<td>11.5 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gaines 1960</td>
<td>oral</td>
<td>11</td>
<td>-----</td>
<td>77 mg/m³</td>
<td>7.7 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gaines 1960</td>
<td>oral</td>
<td>13</td>
<td>-----</td>
<td>91 mg/m³</td>
<td>9.1 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Murphy et al. 1976</td>
<td>oral</td>
<td>8.4</td>
<td>-----</td>
<td>60 mg/m³</td>
<td>6.0 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Sanderson 1961</td>
<td>oral</td>
<td>7</td>
<td>-----</td>
<td>49 mg/m³</td>
<td>4.9 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Sato 1959</td>
<td>oral</td>
<td>8</td>
<td>-----</td>
<td>56 mg/m³</td>
<td>5.6 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Worthing 1991</td>
<td>oral</td>
<td>10</td>
<td>-----</td>
<td>70 mg/m³</td>
<td>7.0 mg/m³</td>
</tr>
</tbody>
</table>

Human data: Eight workers exposed to concentrations as high as 9.6 mg/m³ (no time period given) showed no signs or symptoms of illness [Jegler 1964].

Revised IDLH: 10 mg/m³

REFERENCES:
Barium (soluble compounds, as Ba)

CAS number .................................................. 7440-39-3 (Metal)
NIOSH REL .................................................. 7440-39-3 (Metal)
Current OSHA PEL .......................................... 0.5 mg Ba/m³ TWA
1989 OSHA PEL ............................................. Same as current PEL
1993-1994 ACGIH TLV ....................................... 0.5 mg Ba/m³ TWA

Description of substance ........................................ Varieties

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀</th>
<th>LD₆₀</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BaCl₂</td>
<td>Barnes and Eltherington 1973</td>
<td>oral</td>
<td>------</td>
<td>112 mg Ba/kg</td>
<td>785 mg Ba/m³</td>
<td>79 mg Ba/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Barnes and Eltherington 1973</td>
<td>oral</td>
<td>------</td>
<td>59 mg Ba/kg</td>
<td>416 mg Ba/m³</td>
<td>42 mg Ba/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Calvery 1942</td>
<td>oral</td>
<td>78 mg Ba/kg</td>
<td>------</td>
<td>545 mg Ba/m³</td>
<td>55 mg Ba/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Calvery 1942</td>
<td>oral</td>
<td>50 mg Ba/kg</td>
<td>------</td>
<td>350 mg Ba/m³</td>
<td>35 mg Ba/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Coulston and Korte 1975</td>
<td>oral</td>
<td>------</td>
<td>46 mg Ba/kg</td>
<td>323 mg Ba/m³</td>
<td>32 mg Ba/m³</td>
</tr>
<tr>
<td>Ba(NO₃)₂</td>
<td>Marhold 1972</td>
<td>oral</td>
<td>187 mg Ba/kg</td>
<td>------</td>
<td>1,106 mg Ba/m³</td>
<td>131 mg Ba/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Yakkyoku 1980</td>
<td>oral</td>
<td>------</td>
<td>79 mg Ba/kg</td>
<td>552 mg Ba/m³</td>
<td>55 mg Ba/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Yakkyoku 1980</td>
<td>oral</td>
<td>------</td>
<td>421 mg Ba/kg</td>
<td>2,944 mg Ba/m³</td>
<td>294 mg Ba/m³</td>
</tr>
</tbody>
</table>

Human data .................................................... It has been reported that the lethal oral dose is 43 to 57 mg Ba/kg [Reeves 1976]. (Note: An oral dose of 43 to 57 mg Ba/kg is equivalent to a 70-kg worker being exposed to 2,007 to 2,660 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.)

From the standpoint of deriving an appropriate IDLH, the soluble Ba compounds BaCl₂ and Ba(NO₃)₂ prove to be the most acutely toxic. Browning [1969] reported that the toxic dose of BaCl₂ for man was 200 to 500 mg [Lydtin et al. 1965]; Patty [1963] cited 800 to 900 mg of BaCl₂ (550 to 600 mg as Ba) as the fatal dose for man [Sollman 1953]. Acute toxicity data in animals show Ba(NO₃)₂ equally as toxic as BaCl₂. As no data on the acute inhalation toxicity of either of these two barium compounds exist, the IDLH is based on a calculated dose for a 30-minute exposure for man required to attain an intake of 200 mg BaCl₂ (as Ba). However, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 500 x the OSHA PEL of 0.5 mg Ba/m³ (i.e., 250 mg Ba/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 250 mg Ba/m³. None developed.
Barium (soluble compounds, as Ba) (continued)

Revised IDLH: 50 mg Ba/m²

Basis for revised IDLH: Basis for "Revised" IDLH: No inhalation toxicity data are available on which to base an IDLH for soluble barium compounds. Therefore, the revised IDLH for soluble barium compounds is 50 mg Ba/m² based on acute oral toxicity data in humans [Reeve 1979] and animals [Barnes and Etherington 1973; Calvery 1942; Coulston and Korte 1975; Yakkyoku 1980]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 50 mg/m².

REFERENCES:

Benzene

CAS number ........................................ 71-43-2
Chemical name ..................................... Benzene
NIOSH REL ........................................ 0.1 ppm TWA, 1 ppm STEL; NIOSH considers benzene to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].
Current OSHA PEL .................................. 1 ppm TWA, 5 ppm STEL
1989 OSHA PEL .................................... Same as current PEL
1993-1994 ACGIH TLV .................................. 10 ppm (32 mg/m³) TWA, A2
Description of substance ............................... Colorless to light-yellow liquid with an aromatic odor.
LEL ................................................. 1.2% (10% LEL, 1,200 ppm)
Original (SCP) IDLH .................................. 3,000 ppm
Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the report in Patty [1963] that for man, a single exposure to 3,000 ppm is endurable for 0.5 to 1 hour [Flury 1928].

<table>
<thead>
<tr>
<th>Duration</th>
<th>EEGL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-hour EEGL</td>
<td>50 ppm</td>
</tr>
<tr>
<td>24-hour EEGL</td>
<td>2 ppm</td>
</tr>
</tbody>
</table>

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Carpenter et al. 1944</td>
<td>45,000</td>
<td>45,000 ppm (1.0)</td>
<td>30 min</td>
<td>4,500 ppm</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>Spector 1955</td>
<td>44,923</td>
<td>7</td>
<td>44,923 ppm (1.0)</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Spector 1955</td>
<td>52,308</td>
<td>7</td>
<td>52,308 ppm (1.0)</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>Tab. Biol. Per 1933</td>
<td>30,000</td>
<td>12,000 ppm (0.5)</td>
<td>5 min</td>
<td>1,100 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other human data .................................. It has been stated that 3,000 ppm is endurable for 0.5 to 1 hour [Flury 1928]. It has also been stated that exposure at 19,000 to 20,000 ppm for 5 to 10 minutes is fatal; exposure at 7,500 ppm for 30 minutes is dangerous; exposure at 1,500 ppm for 60 minutes induces serious symptoms; exposure at 500 ppm for 60 minutes leads to symptoms of illness; exposure at 50 to 150 ppm for 5 hours produces headache, lassitude, and weakness; and exposure at 25 ppm for 8 hours has no effect [Gerarde 1960].

Revised IDLH: 500 ppm
Basis for revised IDLH: The revised IDLH for benzene is 500 ppm based on acute inhalation toxicity data in humans [Gerarde 1960]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for benzene at concentrations above 0.1 ppm. OSHA currently requires in 29 CFR 1910.1028 that workers be provided with and required to wear and use the "most protective" respirators in concentrations exceeding 1,000 ppm (i.e., 1,000 × the PEL).]

REFERENCES:

Benzene (continued)

7. Tab Bioi Per [1933]; 3:231 (in German).
Benzoyl peroxide

CAS number: 94-36-3
NIOSH REL: 5 mg/m³ TWA
Current OSHA PEL: 5 mg/m³ TWA
1989 OSHA PEL: Same as current PEL
1993-1994 ACGIH TLV: 5 mg/m³ TWA

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

LEL: Original (SCP) IDLH: 7,000 mg/m³
Basis for original (SCP) IDLH: The chosen IDLH is based on the estimated mouse 4-hour LC₅₀ of 700 ppm (7,000 mg/m³) for benzoyl peroxide cited by ACGIH [1971]. However, this concentration is not an actual LC₅₀ value for benzoyl peroxide; it was estimated by ACGIH [1971] by analogy from data concerning LC₅₀ values for other related organic peroxides [Floyd and Stokinger 1958].

Short-term exposure guidelines: Revised IDLH: 1,500 mg/m³
Basis for revised IDLH: The revised IDLH for benzoyl peroxide is 1,500 mg/m³ based on acute inhalation toxicity data in animals [Floyd and Stokinger 1958].

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Floyd and Stokinger 1958</td>
<td>7,000 mg/m³</td>
<td>------</td>
<td>4 hr</td>
<td>14,000 mg/m³ (2.0)</td>
<td>1,400 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>ARCO 1982</td>
<td>oral</td>
<td>7,710</td>
<td>5,970</td>
<td>5,397 mg/m³</td>
<td>1,597 mg/m³</td>
</tr>
</tbody>
</table>

Human data: Concentrations of 12 mg/m³ and higher have resulted in pronounced irritation of the nose and throat [Moskowitz and Grabois 1950].

REFERENCES:

Benzyl chloride

CAS number ........................................... 100-44-7
NIOSH REL ............................................... 1 ppm (5 mg/m³); 15-minute CEILING
Current OSHA PEL ..................................... 1 ppm (5 mg/m³) TWA
1989 OSHA PEL ......................................... Same as current PEL
1993-1994 ACGIH TLV .................................. 1 ppm (5.2 mg/m³) TWA

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

LEL .................................................. 1.1% (10% LEL; 1,100 ppm)

Original (SCP) IDLH .................................. 10 ppm

Basis for original (SCP) IDLH: Very little data are available on the acute effects of exposure to benzyl chloride. ACGIH [1971] reported that in 1 minute an exposure to 16 ppm is intolerable to man [Flury and Zemik 1931]. ILO [1971] reported that 20 ppm will render the atmosphere irrespirable in 1 minute. ILO [1971] reported that 50 to 100 mg/m³ (10 to 19 ppm) immediately causes weeping and twitching of the eyelids, while 160 mg/m³ (30 ppm) causes effects that are intolerable to the eyes and nasal mucous membranes. Based on this data, an IDLH of 10 ppm is assumed in order to avoid difficulties in escape in the event of respirator failure.

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>IARC 1976</td>
<td>150</td>
<td>-----</td>
<td>2 hr</td>
<td>280 ppm (1.6)</td>
<td>24 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>IARC 1976</td>
<td>80</td>
<td>-----</td>
<td>2 hr</td>
<td>128 ppm (1.6)</td>
<td>13 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>NIOSH 1978</td>
<td>180</td>
<td>150</td>
<td>8 hr</td>
<td>950 ppm (2.5)</td>
<td>95 ppm</td>
</tr>
</tbody>
</table>

Other animal data: RD₅₀ (mouse); 17 ppm [DeCeaurriz et al. 1981].

Human data: It has been reported that an exposure to 16 ppm for 1 minute is intolerable [Flury and Zemik 1931]. It has also been reported that 10 to 19 ppm immediately causes weeping and twitching of the eyelids [ILO 1971].

Revised IDLH: 10 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Flury and Zemik 1931; ILO 1971], the original IDLH for benzyl chloride (10 ppm) is not being revised at this time.

REFERENCES:

Beryllium compounds (as Be)

- CAS number: 7440-41-7 (Metal)
- NIOSH REL: Not to exceed 0.0005 mg/m³; NIOSH considers beryllium compounds to be potential occupational carcinogens as defined by the OSHA carcinogen policy [29 CFR 1990].
- Current OSHA PEL: 0.002 mg/m³ TWA, 0.005 mg/m³ CEILING, 0.025 mg/m³ 30-minute MAXIMUM PEAK
- 1989 OSHA PEL: 0.002 mg/m³ TWA, A2
- 1993-1994 ACGIH TLV: Same as current PEL

Description of Substance: 10 mg Be/m³ [Note: "Effective" IDLH = 4 mg Be/m³ – see discussion below.]

Basis for original (SCP) IDLH: This IDLH is based on the statement by Patty [1963] that 10 mg/m³ of beryllium fluoride was lethal to several species in 15 days. However, respirators have been assigned on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 0.002 mg/m³ (i.e., 4 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 4 mg Be/m³.

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BeF₂</td>
<td>Blair 1951</td>
<td>oral</td>
<td>90</td>
<td>-----</td>
<td>158 mg Be/m³</td>
<td>16 mg Be/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Blair 1951</td>
<td>oral</td>
<td>100</td>
<td>-----</td>
<td>161 mg Be/m³</td>
<td>16 mg Be/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Tabershaw 1972</td>
<td>oral</td>
<td>82</td>
<td>-----</td>
<td>49 mg Be/m³</td>
<td>4.9 mg Be/m³</td>
</tr>
<tr>
<td>BeB₄</td>
<td>Sazhina 1965</td>
<td>oral</td>
<td>80</td>
<td>-----</td>
<td>48 mg Be/m³</td>
<td>4.8 mg Be/m³</td>
</tr>
</tbody>
</table>

Other animal data: It has been reported that 10 mg/m³ of beryllium fluoride (i.e., 2.3 mg Be/m³) was lethal to several species in 15 days [Patty 1963].

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 4 mg Be/m³
Basis for revised IDLH: Based on acute toxicity data in animals [Patty 1963; Sazhina 1965], a value of about 5 mg Be/m³ would have been appropriate. However, the revised IDLH for beryllium compounds is 4 mg Be/m³ based on being 2,000 times the OSHA PEL of 0.002 mg Be/m³ (2,000 is an assigned protection factor for respirators; only the "most reliable" respirators are recommended for exposures greater than 2,000 times the OSHA PEL). [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for beryllium compounds at concentrations above 0.0005 mg Be/m³.]

REFERENCES:
Boron oxide

Description of Substance
Colorless, semitransparent lumps or hard, white, odorless crystals.

LEL
Noncombustible Solid

Original (SCP) IDLH*
No Evidence (Note: "Effective" IDLH = 7,500 mg/m³ — see discussion below.)

Basis for original (SCP) IDLH
No evidence exists in the available toxicological data that an acute exposure to a high concentration of boron oxide would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 × the OSHA PEL; in the case of boron oxide, 500 × the OSHA PEL of 15 mg/m³ is 7,500 mg/m³.

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₀ (mg/kg)</th>
<th>Adjusted LD (mg/m³)</th>
<th>Derived value (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>3.163</td>
<td>---</td>
<td>22,141</td>
<td>2,214</td>
</tr>
</tbody>
</table>

Other animal data
Rats exposed for 6 hours/day, 5 days/week for 10 weeks to a concentration of 470 mg/m³ showed no signs of intoxication other than mild nasal irritation [Wilding et al. 1959].

Human data
None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 mg/m³

Basis for revised IDLH: The revised IDLH for boron oxide is 2,000 mg/m³ based on acute toxicity data in animals [Izmerov et al. 1982; Wilding et al. 1959].

REFERENCES:
1. Izmerov NF, Senotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 27.
Boron trifluoride

CAS number ............................................. 7637-07-2
NIOSH REL ............................................. 1 ppm (3 mg/m³) CEILING
Current OSHA PEL ....................................... 1 ppm (3 mg/m³) CEILING
1989 OSHA PEL .......................................... Same as current PEL
1993-1994 ACGIH TLV .................................... 1 ppm (2.8 mg/m³) CEILING
Description of Substance ................................. Colorless gas with a pungent, suffocating odor.
LEL .......................................................... Nonflammable Gas
Original (SCP) IDLH ....................................... 100 ppm
Basis for original (SCP) IDLH ............................ Because no useful data on acute inhalation toxicity are available on which to base the IDLH, the chosen IDLH is based on chronic toxicity data (i.e., repeated exposure to 100 ppm resulted in a uniformly high mortality rate in six laboratory species [Stokinger et al. 1953 cited by ACGIH 1971]). The only acute inhalation toxicity data available was not used to establish the IDLH because in 5.5 hours 10 of 10 guinea pigs succumbed to an exposure of 750 ppm [Livinskas 1964].

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Farmakol Toksikol 1972</td>
<td>1,277</td>
<td>-----</td>
<td>2 hr</td>
<td>1,963 ppm (1.6)</td>
<td>196 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Farmakol Toksikol 1972</td>
<td>39</td>
<td>-----</td>
<td>4 hr</td>
<td>77 ppm (2.0)</td>
<td>84 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>418</td>
<td>-----</td>
<td>4 hr</td>
<td>837 ppm (2.0)</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ......................................... Exposure to a concentration of 100 ppm resulted in a uniformly high mortality rate in six laboratory species, and 15 ppm was occasionally fatal in 30-day studies [Stokinger et al. 1953]. Rats exposed 6 hours/day to 24 ppm or 2 weeks to 9 ppm showed signs of respiratory irritation, depression of body weight, increased lung weights, and depressed liver weights [Rusch et al. 1986].

Human data .................................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 25 ppm

Basis for revised IDLH: The revised IDLH for boron trifluoride is 25 ppm based on subchronic inhalation toxicity data in animals [Rusch et al. 1986].

REFERENCES:

3. Izmerov RF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNZ, p. 27.
Bromine

CAS number .............................................. 7725-95-8
NIOSH REL ......................................................
Current OSHA PEL .............................. 0.1 ppm (0.7 mg/m³) TWA
1989 OSHA PEL ..............................................
1993-1994 ACGIH TLV .............................. 0.1 ppm (0.56 mg/m³) TWA
Description of Substance .......................... Dark reddish-brown, fuming liquid with suffocating, irritating fumes.

LEL ................................................................ Noncombustible Liquid
Original (SCP) IDLH ...................................... 10 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statement by AIHA [1958] that concentrations of 10 ppm or above cause such severe upper respiratory irritation that such concentrations will not be voluntarily borne [MCA 1988]. AIHA [1958] also reported that even brief exposures of 40 to 60 ppm are dangerous for humans [Henderson and Haggard 1943].

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₆₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF*)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Bitron and Aharoon 1978</td>
<td>750</td>
<td>-----</td>
<td>9 min</td>
<td>415 ppm (0.58)</td>
<td>44 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Bitron and Aharoon 1978</td>
<td>240</td>
<td>-----</td>
<td>2 hr</td>
<td>451 ppm (1.68)</td>
<td>45 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Ivanov et al. 1976</td>
<td>467</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Spector 1955</td>
<td>-----</td>
<td>180</td>
<td>6.5 hr</td>
<td>578 ppm (3.21)</td>
<td>58 ppm</td>
</tr>
</tbody>
</table>

Note: Conversion factor (CF) was determined with "n" = 2.2 [ten Berge et al. 1986].

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gig Sanit 1970</td>
<td>oral</td>
<td>2,600</td>
<td>-----</td>
<td>2,741 ppm</td>
<td>274 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Sanit 1970</td>
<td>oral</td>
<td>3,100</td>
<td>-----</td>
<td>3,268 ppm</td>
<td>327 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Gig Sanit 1970</td>
<td>oral</td>
<td>4,160</td>
<td>-----</td>
<td>4,346 ppm</td>
<td>439 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Gig Sanit 1970</td>
<td>oral</td>
<td>5,500</td>
<td>-----</td>
<td>5,798 ppm</td>
<td>580 ppm</td>
</tr>
</tbody>
</table>

Human data .................................................. It has been reported that 10 ppm and above cause such severe upper respiratory irritation that exposures will not be voluntarily borne [MCA 1968]. Also, it has been reported that 0.75 ppm caused no symptoms in 8 hours [Flury and Zemik 1931]. Further, 4 ppm has been recommended as the maximum concentration allowable for 0.5 to 1 hour, with 40 to 60 ppm dangerous for brief exposures [Henderson and Haggard 1943]. It has also been stated that respiratory damage occurs at 10 ppm [NFPA 1978]. It has been reported that 1.7 to 3.5 ppm produces severe choking, 4.5 to 9 ppm is extremely dangerous, and 30 ppm would prove fatal in a short time [ILO 1971].
Bromine (continued)

Revised IDLH: 3 ppm

Basis for revised IDLH: The revised IDLH for bromine is 3 ppm based on acute inhalation toxicity data in humans [Flury and Zemik 1931; Henderson and Haggard 1943; ILO 1971; MCA 1968; NFPA 1978].

REFERENCES:

Bromoform

CAS number .......................................................... 75-25-2
NIOSH REL .......................................................... 0.5 ppm (5 mg/m³) TWA [skin]
Current OSHA PEL .................................................. 0.5 ppm (5 mg/m³) TWA [skin]
1989 OSHA PEL ....................................................... Same as current PEL
1993-1994 ACGIH TLV .............................................. 0.5 ppm (5.2 mg/m³) TWA [skin]

Description of Substance .............................................. Colorless to yellow liquid with a chloroform-like odor.

LEL ................................................................. Noncombustible Liquid

Original (SCP) IDLH* ................................................. Unknown [*Note: “Effective” IDLH = 1,000 ppm -- see discussion below.]

Grant [1974] reported that bromoform is a heavy liquid which resembles chloroform physically, chemically, and pharmacologically but is more toxic to the liver and more irritant on inhalation, causing tearing and salivation [Ferrell 1957]. AIHA [1965] reported that a concentration of chloroform immediately dangerous to life or health has not been established, but that a concentration of 14,000 to 16,000 ppm will cause rapid loss of consciousness in man [Patty 1963]. Lower concentrations of chloroform (4,100 ppm or less) may cause disorientation serious enough to result in falls or other mechanical accidents [Patty 1963]. However, for this draft technical standard, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 "the OSHA PEL of 0.5 ppm (i.e., 1,000 ppm); only the "most protective" respirators are permitted for use in concentrations exceeding 1,000 ppm.

Short-term exposure guidelines ........................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>4,282</td>
<td>4,892</td>
<td>4 hr</td>
<td>8,564 ppm</td>
<td>856 ppm</td>
</tr>
<tr>
<td>Mammal</td>
<td>Lublinov and Rabolnikova 1974</td>
<td>1,151</td>
<td>1,151</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Dog</td>
<td>Patty 1963</td>
<td>7,000</td>
<td>1,147</td>
<td>1 hr</td>
<td>8,750 ppm</td>
<td>875 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Bowman et al. 1978</td>
<td>oral</td>
<td>1,460</td>
<td>1,147</td>
<td>932 ppm</td>
<td>93 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Chu et al. 1980</td>
<td>oral</td>
<td>1,147</td>
<td>1,147</td>
<td>764 ppm</td>
<td>76 ppm</td>
</tr>
</tbody>
</table>

Human data .......................................................... It has been reported that 14,000 to 16,000 ppm will cause rapid loss of consciousness [Patty 1963]. The reported lethal oral dose is 143 mg/kg [Deichmann and Gerarde 1969]. [Note: An oral dose of 143 mg/kg is equivalent to a 70-kg worker being exposed to about 835 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 850 ppm

Basis for revised IDLH: The revised IDLH for bromoform is 850 ppm based on acute inhalation toxicity data in animals [Izmerov et al. 1982]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations between 850 and 14,000 ppm.

54
REFERENCES:

7. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 28.
1,3-Butadiene

CAS number ........................................ 106-99-0

NIOSH REL ........................................ None established; NIOSH considers 1,3-butadiene to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1980).

Current OSHA PEL ........................................ 1.000 ppm (2,200 mg/m³) TWA

1989 OSHA PEL ........................................ Same as current PEL

1993-1994 ACGIH TLV ........................................ 19 ppm (22 mg/m³) TWA, A2

Description of Substance ........................................ Colorless gas with a mild aromatic or gasoline-like odor.

LEL .......................................................... 20.0% (10% LEL, 2,000 ppm)

Original (SCP) IDLH ........................................ AIHA [1963] reported that narcosis did not occur in 2 humans inhaling 8,000 ppm during an 8-hour period [Carpenter et al. 1944]. AIHA [1963] also reported that inhalation of 6,700 ppm for 7.5 hours/day, 6 days/week for 8 months resulted in no significant chronic effects in rats, guinea pigs, rabbits, and dogs; some growth retardation and light cloudy swelling of livers did occur [Carpenter et al. 1944]. From the data given above, acutely toxic concentrations are obviously well above the lower explosive limit (LEL) of 20,000 ppm. For this draft technical standard, therefore, the LEL is used as the IDLH (i.e., the concentration above which only the "most protective" respirators are permitted).


- ERPG-1: 10 ppm (60-minute)
- ERPG-2: 50 ppm (60-minute)
- ERPG-3: 5,000 ppm (60-minute)

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Carpenter et al. 1944</td>
<td>250,000</td>
<td>30 min</td>
<td>250,000 ppm (1.0)</td>
<td>25,000 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Dow 1941</td>
<td>115,111</td>
<td>30 min</td>
<td>200,000 ppm (1.0)</td>
<td>20,000 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Dow 1941</td>
<td>122,000</td>
<td>30 min</td>
<td>195,200 ppm (1.6)</td>
<td>19,500 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Shugaev 1968</td>
<td>126,667</td>
<td>2 hr</td>
<td>253,334 ppm (2.0)</td>
<td>25,232 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>von Giettingen 1940</td>
<td>130,000</td>
<td>4 hr</td>
<td>260,000 ppm (2.5)</td>
<td>26,000 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ........................................ Exposures to 6,700 ppm for 7.5 hours/day, 6 days/week for 8 months caused no progressive injury in rats, guinea pigs, rabbits, or 1 dog [Carpenter et al. 1944].

Human data ........................................ Narcosis did not occur in volunteers exposed to 8,000 ppm for 8 hours [Carpenter et al. 1944]. Exposure to 10,000 ppm for 5 minutes has resulted in slight irritation and dryness of the nose and mouth with some increase in pulse rate but no effect on blood pressure or respiration [Shugaev 1968].

Revised IDLH: 2,000 ppm (LEL)

Based on health considerations and acute inhalation toxicity data in humans [Carpenter et al. 1944; Von Giettingen 1940] and animals [Carpenter et al. 1944; Dow 1941; Shugaev 1968; von Giettingen 1940], a value between 10,000 and 20,000 ppm would have been appropriate. However, the revised IDLH for 1,3-butadiene is 2,000 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 2%). [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for 1,3-butadiene at any detectable concentration.]
1,3-Butadiene (continued)

REFERENCES:

2-Butanone

CAS number ........................................... 78-89-3
NIOSH REL ............................................
Current OSHA PEL ................................. 200 ppm (590 mg/m³) TWA, 300 ppm (885 mg/m³) STEL
1989 OSHA PEL ....................................... 200 ppm (590 mg/m³) TWA
1993-1994 ACGIH TLV ............................... 200 ppm (590 mg/m³) TWA, 300 ppm (885 mg/m³) STEL
Description of Substance .......................... Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor.

LEL(@200°F) ........................................... 1.4% (10% LEL(@200°F), 1,400 ppm)
Original (SCP) IDLH ................................ 3,000 ppm
Basis for original (SCP) IDLH ....................... The chosen IDLH is based on the statement by Patty [1963] that a 2-hour exposure of rats to 2,000 ppm caused no deaths, but 4 of 6 rats exposed to 4,000 ppm for a 2-hour period died [Smyth 1956].

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LCₐₐ₉ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Bain and Vlgergaus 1986</td>
<td>12,667</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1992</td>
<td>13,333</td>
<td>-----</td>
<td>2 hr</td>
<td>21,333 ppm (1.6)</td>
<td>2,121 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1959</td>
<td>7,833</td>
<td>-----</td>
<td>8 hr</td>
<td>15,583 ppm (2.5)</td>
<td>1,968 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>L₃₀: 4,000</td>
<td>-----</td>
<td>2 hr</td>
<td>6,400 ppm (1.6)</td>
<td>640 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LDₐₐ₉ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kimura et al. 1971</td>
<td>oral</td>
<td>2,737</td>
<td>-----</td>
<td>6,386 ppm</td>
<td>639 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Tanii et al. 1986</td>
<td>oral</td>
<td>4,050</td>
<td>-----</td>
<td>9,450 ppm</td>
<td>945 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................... It has been reported that 3,000 ppm is irritating to the eyes and nose [Patty et al. 1935].

Revised IDLH: 3,000 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Patty et al. 1935], the original IDLH for 2-butane (3,000 ppm) is not being revised at this time.

REFERENCES:

2. Izmerov NF, Saniokav IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKN, p. 83.
2-Butoxyethanol

CAS number ........................................ 111-76-2
NIOSH REL ...........................................
Current OSHA PEL ...................................
1989 OSHA PEL ......................................
1993-1994 ACGIH TLV ..............................

Description of Substance: Colorless liquid with a mild, ether-like odor.
LEL @ 200°F ........................................ 1.1% (10% LEL @ 200°F, 1,100 ppm)
Basis for original (SCP) IDLH ................. 700 ppm

Short-term exposure guidelines ................. 

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{90} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Dodd et al. 1963</td>
<td>450</td>
<td>700</td>
<td>4 hr</td>
<td>900 ppm (2.0)</td>
<td>90 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Werner et al. 1943</td>
<td>700</td>
<td>700</td>
<td>7 hr</td>
<td>1,680 ppm (2.4)</td>
<td>168 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{90} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Carpenter et al. 1956</td>
<td>oral</td>
<td>1,230</td>
<td>1,754 ppm</td>
<td>175 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Dow 1986</td>
<td>oral</td>
<td>470</td>
<td>670 ppm</td>
<td>67 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Dow 1986</td>
<td>oral</td>
<td>300</td>
<td>428 ppm</td>
<td>43 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth et al. 1941</td>
<td>oral</td>
<td>1,200</td>
<td>1,711 ppm</td>
<td>171 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1941</td>
<td>oral</td>
<td>1,490</td>
<td>2,110 ppm</td>
<td>211 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ................................ RD_{50} (mouse), 2,824 ppm [Alarie 1981].

Human data ........................................ It has been stated that humans would be able to tolerate saturated concentrations (i.e., about 1,000 ppm) for 1 hour without experiencing any significant nonreversible effects [Carpenter et al. 1956].

Revised IDLH: 700 ppm [Unchanged]

Based on acute inhalation toxicity data in humans [Carpenter et al. 1956], a value of about 1,000 ppm would have been appropriate for 2-butoxyethanol. However, the original IDLH for 2-butoxyethanol (700 ppm) is not being revised at this time.

REFERENCES:

2-Butoxyethanol (continued)

n-Butyl acetate

CAS number .......................................................... 123-98-4
NIOSH REL .............................................................. 150 ppm (710 mg/m³) TWA, 200 ppm (950 mg/m³) STEL
Current OSHA PEL ..................................................... 150 ppm (710 mg/m³) TWA
1989 OSHA PEL ......................................................... 150 ppm (710 mg/m³) TWA, 200 ppm (950 mg/m³) STEL
1993-1994 ACGIH TLV ................................................ 150 ppm (713 mg/m³) TWA, 200 ppm (950 mg/m³) STEL

Description of Substance ............................................. Colorless liquid with a fruity odor.

LEL ................................................................. 1.1% (10% LEL, 1.760 ppm)

Original (SCP) IDLH .................................................. 10,000 ppm

Basis for original (SCP) IDLH ........................................ The chosen IDLH is based on the statement by ACGIH [1971] that a 4-hour exposure to 10,000 ppm killed 0 rats, but an 8-hour exposure to 10,000 ppm killed all 8 rats [Smyth 1987].

Short-term exposure guidelines ...................................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>EPR 1987</td>
<td>160</td>
<td>----------</td>
<td>4 hr</td>
<td>320 ppm (2.0)</td>
<td>32 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Flury and Wirth 1933</td>
<td>24.079</td>
<td>4 hr</td>
<td>18,866 ppm (1.34)</td>
<td>1,887 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Food Cosmet Toxicol 1979</td>
<td>13.872</td>
<td>4 hr</td>
<td>27,744 ppm (2.0)</td>
<td>2,774 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>2,000</td>
<td>4 hr</td>
<td>4,000 ppm (2.0)</td>
<td>400 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>25,000</td>
<td>8 hr</td>
<td>25,000 ppm (2.5)</td>
<td>2,500 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>UCC 1987</td>
<td>782</td>
<td>4 hr</td>
<td>782 ppm (2.0)</td>
<td>78 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Yakkyoku 1981</td>
<td>1,242</td>
<td>2 hr</td>
<td>1,242 ppm (1.6)</td>
<td>19 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .................................................. A 4-hour exposure to 10,000 ppm was not lethal to rats [Smyth 1985].

Human data .......................................................... Severe irritation of the throat has been reported in volunteers exposed to 300 ppm for 3 to 5 minutes [Nelson et al. 1943]. However, it has also been reported that irritation of the eyes and nose is first objectionable at 3,300 ppm and that higher concentrations cause tearing and hyperemia of the conjunctiva [Grant 1974].

Revised IDLH: 1,700 ppm (LEL)

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Grant 1974], a value of about 3,300 ppm would have been appropriate for n-butyl acetate. However, the revised IDLH for n-butyl acetate is 1,700 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.7%).

REFERENCES:

5. Grant WM [1974]. Toxicology of the eye. 2nd ed. Springfield, IL: C.C. Thomas, pp. 210-211.
sec-Butyl acetate

CAS number ................................................. 105-48-4
NIOSH REL ................................................. None
Current OSHA PEL ........................................... 200 ppm (950 mg/m³) TWA
1989 OSHA PEL ............................................... Same as current PEL
1993-1994 ACGIH TLV ....................................... 200 ppm (950 mg/m³) TWA
Description of Substance ..................................... Colorless liquid with a pleasant, fruity odor.
LEL ............................................................. 1.7% (10% LEL, 1.700 ppm)
Original (SCP) IDLH .......................................... 10,000 ppm
Basis for original (SCP) IDLH ................................. The chosen IDLH is based on an analogy with n-butyl acetate which has an IDLH of 10,000 ppm.
Short-term exposure guidelines .............................. None developed

ACUTE TOXICITY DATA

Animal data ...................................................... None relevant for use in determining the revised IDLH.
Human data ...................................................... The vapor of sec-butyl acetate is reportedly less irritating than that of n-butyl acetate [Richmond and Pagnotto 1965].

Revised IDLH: 1,700 ppm (LEL)
Basis for revised IDLH: Based on health considerations and an analogy to n-butyl acetate [Richmond and Pagnotto 1965], a value of about 2,500 ppm would have been appropriate for sec-butyl acetate. However, the revised IDLH for sec-Butyl acetate is 1,700 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.7%).

REFERENCE:

tert-Butyl acetate

CAS number ........................................... 540-68-5
NIOSH REL .............................................. 200 ppm (950 mg/m$^3$) TWA
Current OSHA PEL .................................... 200 ppm (950 mg/m$^3$) TWA
1993-1994 ACGIH TLV ................................. 200 ppm (950 mg/m$^3$) TWA

Description of Substance ................................. Colorless liquid with a fruity odor.

LEL .................................................. 1.5% (10% LEL, 1,500 ppm)

Original (SCP) IDLH .................................... 10,000 ppm

Basis for original (SCP) IDLH .......................... The chosen IDLH is based on an analogy with n-butyl acetate for which an IDLH of 10,000 ppm was chosen. No other data on acute inhalation toxicity are available on which to base the IDLH for tert-butyl acetate.

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Animal data .............................................. None relevant for use in determining the revised IDLH.

Human data .............................................. Exposures of 200 to 300 ppm cause slight irritation of the eyes and nose, and short exposures to 3,300 ppm cause extreme irritation of the eyes and nose [ILO 1983].

Revised IDLH: 1,500 ppm [LEL]

Basis for revised IDLH: Based on health considerations, acute inhalation toxicity data in humans [ILO 1983], and an analogy to n-butyl acetate, a value of about 2,500 ppm would have been appropriate for tert-butyl acetate. However, the revised IDLH for tert-butyl acetate is 1,500 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.5%).

REFERENCE:

n-Butyl alcohol

CAS number ........................................ 71-36-3
NIOSH REL ........................................
Current OSHA PEL ............................... 100 ppm (300 mg/m³) TWA
1989 OSHA PEL ................................. 50 ppm (150 mg/m³) CEILING [skin]
1993-1994 ACGIH TLV ........................... 50 ppm (152 mg/m³) CEILING [skin]

Description of Substance
Colorless liquid with a strong, characteristic, mildly alcoholic odor.

LEL .................................. 1.4% (10% LEL, 1,400 ppm)
Original (SCP) IDLH ......................... 8,000 ppm

Baala for original (SCP) IDLH ................. None developed

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ₐ (ppm)</th>
<th>LC₅₀ₐ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Bain and Vigdergauz 1986</td>
<td>9,221</td>
<td>8,000</td>
<td>7</td>
<td>16,000 ppm (2.0)</td>
<td>1,600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td></td>
<td></td>
<td>4 hr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>3,484</td>
<td>7,918</td>
<td>792 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Purchase 1969</td>
<td>oral</td>
<td>790</td>
<td>1,795</td>
<td>180 ppm</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>Wurtz 1975</td>
<td>oral</td>
<td>1,700</td>
<td>4,000</td>
<td>400 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ..................................................................
RD₅₀ (mouse), 4,784 ppm [Alarie 1981].

Human data ..........................................................................
It has been reported that corneal irritation was occasionally observed in workers exposed to 200 ppm [Siemer et al. 1949].

Revised IDLH: 1,400 ppm (LEL)

Seals for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals [NPIRI 1974], a value of about 1,600 ppm would have been appropriate for n-butyl alcohol. However, the revised IDLH for n-butyl alcohol is 1,400 ppm based strictly on safety considerations (i.e., being 10% if the lower explosive limit of 1.4%).

REFERENCES:

n-Butyl alcohol (continued)

sec-Butyl alcohol

CAS number ........................................ 78-92-2
NIOSH REL ........................................... 78-92-2
Current OSHA PEL ................................ 100 ppm (305 mg/m³) TWA
1989 OSHA PEL ...................................... 100 ppm (305 mg/m³) TWA
1993-1994 ACGIH TLV ............................... 100 ppm (303 mg/m³) TWA

Description of Substance .......................... Colorless liquid with a strong, pleasant odor.
LEL(212°F) .............................................. 1.7% (10% LEL(212°F), 1,700 ppm)
Original (SCP) IDLH ................................. 10,000 ppm

Basis for original (SCP) IDLH ....................... The chosen IDLH is based on the statements by Patty [1963] that 10,670 ppm for 225 minutes and 15,000 ppm for 180 minutes were fatal for mice [Weese 1928]. According to Patty [1963], at 20,000 ppm it took 12 to 20 minutes to produce prostration in mice and 40 minutes to produce narcosis; no deaths occurred [Starrek 1938]. The chosen IDLH is probably conservative.

Short-term exposure guidelines .................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₆₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Shell 1985</td>
<td>----</td>
<td>16,000</td>
<td>4 hr</td>
<td>20,000 ppm (2.0)</td>
<td>2.200 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Weese 1928</td>
<td>10,670</td>
<td>16,000</td>
<td>2.67 hr</td>
<td>28,000 ppm (1.79)</td>
<td>2.800 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................. The limited acute toxicity data indicate that sec-butyl alcohol is less toxic than n-butyl alcohol [ACGIH 1991].

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 ppm

Basis for revised IDLH: The revised IDLH for sec-butyl alcohol is 2,000 ppm based on acute inhalation toxicity data in animals [Weese 1928]. This value also approximates 10% of the lower explosive limit (LEL) of 1.7% (which was determined at 212°F) and the revised IDLH for n-butyl alcohol. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

tert-Butyl alcohol

CAS number ........................................... 75-65-0
NIOSH REL ..........................................
Current OSHA PEL ................................. 100 ppm (300 mg/m³) TWA, 150 ppm (450 mg/m³) STEL
1989 OSHA PEL ..................................... 100 ppm (300 mg/m³) TWA
1993-1994 ACGIH TLV ............................. 100 ppm (300 mg/m³) TWA

Description of Substance
Colorless solid or liquid (above 77°F) with a camphor-like odor.
LEL ..................................................... 2.4% (10% LEL, 2,400 ppm)

Original (SCP) IDLH ................................. 8,000 ppm

Basis for original (SCP) IDLH

No data on acute inhalation toxicity are available on which to base the IDLH for tert-butyl alcohol, but Patty [1963] reported that the signs of intoxication on the part of animals exposed to its vapors are similar to those induced by the other butyl alcohols [Weese 1928]. For this draft technical standard, therefore, the IDLH is based on an analogy with isobutyl alcohol and n-butyl alcohol, which have IDLHs of 8,000 ppm.

Short-term exposure guidelines

None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg)</th>
<th>LD&lt;sub&gt;90&lt;/sub&gt; (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>3.559</td>
<td>3.500</td>
<td>8.089 ppm</td>
<td>805 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Schaffarzick and Brown 1952</td>
<td>oral</td>
<td>3.500</td>
<td>7.955 ppm</td>
<td>796 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data

It has been reported that inhalation toxicity for tert-butyl alcohol is similar to that induced by the other butyl alcohols [Weese 1928].

Human data

None relevant for use in determining the revised IDLH.

Revised IDLH: 1,600 ppm

Basis for revised IDLH: The revised IDLH for tert-butyl alcohol is 1,600 ppm based on analogies [Weese 1928] to isobutyl alcohol and n-butyl alcohol.

REFERENCES:

n-Butylamine

CAS number ........................................ 109-73-9
NIOSH REL ........................................ 5 ppm (15 mg/m³) CEILING [skin]
Current OSHA PEL .................................. 5 ppm (15 mg/m³) CEILING [skin]
1988 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ............................ 5 ppm (15 mg/m³) CEILING [skin]
Description of Substance ................................. Colorless liquid with a fishy, ammonia-like odor.
LEL ............................................. 1.7% (10% LEL, 1,700 ppm)

Original (SCP) IDLH ........................................ 2,000 ppm

Same as current PEL ............................... 5 ppm (15 mg/m³) CEILING [skin]

Colortess liquid with a fishy, ammonia-like odor.

Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the statement by AIHA (1960) that no rats died after a 4-hour exposure to 2,000 ppm [Smyth 1956], but 3 of 3 rats died after a 50-minute exposure to 3,100 ppm [Temaat]. No other data on acute inhalation toxicity are available on which to base the IDLH.

Short-term exposure guidelines .......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC100 (ppm)</th>
<th>LC50 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>AIHA 1960</td>
<td>LC100: 3,100</td>
<td>LC50: 500</td>
<td>50 min</td>
<td>1,658 ppm (1.18)</td>
<td>366 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>-----</td>
<td>4,000</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>-----</td>
<td>263</td>
<td>2 hr</td>
<td>410 ppm (1.6)</td>
<td>41 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>LC100: 4,000</td>
<td>LC50: 3,400</td>
<td>2-5 min</td>
<td>1,600-2,200 ppm (0.4/0.5)</td>
<td>160-220 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50 (mg/kg)</th>
<th>LD100 (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Cheever et al. 1982</td>
<td>oral</td>
<td>366</td>
<td>-----</td>
<td>843 ppm</td>
<td>84 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Trubko 1975</td>
<td>oral</td>
<td>430</td>
<td>-----</td>
<td>990 ppm</td>
<td>99 ppm</td>
</tr>
<tr>
<td>O. pig</td>
<td>Trubko 1975</td>
<td>oral</td>
<td>430</td>
<td>-----</td>
<td>990 ppm</td>
<td>99 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................. Rats have survived a 4-hour exposure to 2,000 ppm [Cheever et al. 1982]. It has been stated that butylamine is more than twice as toxic as ethylamine by the respiratory route [ACGIH 1991].

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 300 ppm

Basis for revised IDLH: The revised IDLH for n-butylamine is 300 ppm based on acute inhalation toxicity data in animals [AIHA 1960; Smyth 1958] and an analogy [ACGIH 1991] to ethylamine which has a revised IDLH of 600 ppm.

REFERENCES:

5. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 28.
n-Butylamine (continued)

tert-Butyl chromate

CAS number ................................. 1189-85-1
NIOSH REL .................................
Current OSHA PEL .............................
1989 OSHA PEL .............................
1993-1994 ACGIH TLV ..........................
Description of Substance ....................... Liquid.
LEL ......................................... Unknown
Original (SCP) IDLH ........................... 30 mg CrO₃/m³
Basis for original (SCP) IDLH ..................
Very little toxicological data are available concerning the effects produced by exposure to tert-butyl chromate. Because AIHA (1965) reported that the severity of the health hazard is low for acute exposure to chromic acid, by analogy it is assumed that the hazard is also low for acute exposure to tert-butyl chromate. Therefore, the chosen IDLH is based on an analogy with chromic acid and chromates, which have an IDLH of 30 mg/m³ (as CrO₃).

Revised IDLH: 15 mg Cr(VI)/m³ [Unchanged]
Basis for revised IDLH: Due to the lack of toxicity data specifically for tert-butyl chromate, the revised IDLH for tert-butyl chromate is 15 mg Cr(VI)/m³ (which is roughly equivalent to the original IDLH of 30 mg CrO₃/m³) based on an analogy to chromic acid and other chromates which have a revised IDLH of 15 mg Cr(VI)/m³. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for tert-butyl chromate at concentrations above 0.001 mg Cr(VI)/m³.]

Short-term exposure guidelines .................. None developed

ACUTE TOXICITY DATA

Animal or human data .......................... None relevant for use in determining the revised IDLH.

REFERENCE

n-Butyl glycidyl ether

CAS number ........................................... 2425-08-8
NIOSH REL .............................................. 5.6 ppm (30 mg/m³) 15-minute CEILING
Current OSHA PEL ...................................... 50 ppm (270 mg/m³) TWA
1989 OSHA PEL ......................................... 25 ppm (135 mg/m³) TWA
1993-1994 ACGIH TLV ................................. 25 ppm (133 mg/m³) TWA
Description of Substance ............................... Colorless liquid with an irritating odor.
LEL ....................................................... Unknown
Original (SCP) IDLH .................................... 3,500 ppm
Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the statement by ACGIH [1971] that the mouse 4-hour LC₅₀ was greater than 3,500 ppm [Hine et al. 1956]

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LCₙ₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Hine et al. 1956</td>
<td>&gt;3,500</td>
<td>-----</td>
<td>4 hr</td>
<td>&gt;7,000 ppm (2.0)</td>
<td>&gt;700 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1956</td>
<td>1,030</td>
<td>-----</td>
<td>8 hr</td>
<td>2,575 ppm (2.5)</td>
<td>258 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LDₙ₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Hine et al. 1956</td>
<td>oral</td>
<td>1,530</td>
<td>-----</td>
<td>1,980 ppm</td>
<td>138 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>oral</td>
<td>3,850</td>
<td>-----</td>
<td>2,652 ppm</td>
<td>245 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 250 ppm
Basis for revised IDLH: The revised IDLH for n-butyl glycidyl ether is 250 ppm based on acute inhalation toxicity data in animals [Hine et al. 1956]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

**n-Butyl mercaptan**

CAS number ........................................ 109-79-5
NIOSH REL .......................................... 0.5 ppm (1.8 mg/m³) 15-minute CEILING
Current OSHA PEL .................................. 10 ppm (35 mg/m³) TWA
1989 OSHA PEL .................................... 0.5 ppm (1.5 mg/m³) TWA
1993-1994 ACGIH TLV .......................... 0.5 ppm (1.8 mg/m³) TWA

Description of Substance ......................... Colorless liquid with a strong, garlic-, cabbage-, or skunk-like odor.

LEL .................................................. Unknown
Original (SCP) IDLH .............................. 2,500 ppm
Basis for original (SCP) IDLH .................. The chosen IDLH is based on the mouse 4-hour LC₅₀ of 2,500 ppm [Fairchild and Stokinger 1958] cited by ACGIH [1971]. It was also chosen to make the IDLH for butyl mercaptan consistent with the IDLH of 2,500 ppm for ethyl mercaptan, a compound with similar acute toxicity.

Short-term exposure guidelines ................ None developed

**ACUTE TOXICITY DATA**

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Fairchild and Stokinger 1958</td>
<td>4,020</td>
<td>----</td>
<td>4 hr</td>
<td>8,040 ppm (2.0)</td>
<td>804 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Fairchild and Stokinger 1958</td>
<td>2,500</td>
<td>----</td>
<td>4 hr</td>
<td>5,000 ppm (2.0)</td>
<td>500 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Marhold 1986</td>
<td>770</td>
<td>----</td>
<td>60 min</td>
<td>770 ppm (1.0)</td>
<td>77 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ Accidental exposure for 1 hour to an estimated concentration of 50 to 500 ppm has been reported to cause muscular weakness, malaise, sweating, nausea, vomiting, headache, and confusion [Gobbato and Terribile 1968].

**Revised IDLH: 500 ppm**

**Basis for revised IDLH:** The revised IDLH for n-butyl mercaptan is 500 ppm based on acute inhalation toxicity data in workers [Gobbato and Terribile 1968] and animals [Fairchild and Stokinger 1958], and to be consistent with ethyl mercaptan which has a revised IDLH of 500 ppm.

**REFERENCES:**

1. ACGIH [1971]. n-Butyl mercaptan (n-butanethiol). In: Documentation of the threshold limit values for substances in workplace air. 3rd ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, p. 34.
p-tert-Butyltoluene

CAS number .................................................. 98-51-1
NIOSH REL .................................................. 10 ppm (60 mg/m³) TWA, 20 ppm (120 mg/m³) STEL
Current OSHA PEL .......................................... 10 ppm (60 mg/m³) TWA
1988 OSHA PEL .............................................. 10 ppm (60 mg/m³) TWA, 20 ppm (120 mg/m³) STEL
1993-1994 ACGIH TLV ...................................... 1 ppm (8.1 mg/m³) TWA

Description of Substance
Colorless liquid with a distinct aromatic odor, somewhat like gasoline.

LEL ............................................................. Unknown
Original (SCP) IDLH ......................................... 1,000 ppm
Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the female rat 1-hour LC₅₀ of 934 ppm reported by Hine et al. [1954].

Short-term exposure guidelines ........................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Hine et al. 1954</td>
<td>934</td>
<td>1,168</td>
<td>2 hr</td>
<td>1,168 ppm (1.25)</td>
<td>127 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1954</td>
<td>734</td>
<td>1,174</td>
<td>2 hr</td>
<td>1,174 ppm (1.6)</td>
<td>117 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1954</td>
<td>248</td>
<td>496</td>
<td>4 hr</td>
<td>496 ppm (2.0)</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1954</td>
<td>165</td>
<td>413</td>
<td>8 hr</td>
<td>413 ppm (2.5)</td>
<td>41 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Hine et al. 1954</td>
<td>248</td>
<td>496</td>
<td>4 hr</td>
<td>496 ppm (2.0)</td>
<td>50 ppm</td>
</tr>
</tbody>
</table>

Other animal data .......................................... \( \text{RD}_{50} \) (mouse), 360 ppm [Nielsen and Alarie 1982].

Human data .................................................. Giddiness and altered respiration have been reported in volunteers exposed to 150 ppm for 15 minutes [Hine et al. 1954].

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for p-tert-butyltoluene is 100 ppm based on acute inhalation toxicity data in humans [Hine et al. 1954].

REFERENCES:

### Cadmium compounds (as Cd)

<table>
<thead>
<tr>
<th>CAS number</th>
<th>7440-43-9 (Metal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>None established; NIOSH considers cadmium compounds to be potential occupational carcinogens as defined by the OSHA carcinogen policy (29 CFR 1990).</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>0.005 mg/m³ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>0.01 mg/m³ (total dust) TWA</td>
</tr>
<tr>
<td></td>
<td>0.002 mg/m³ (respirable dust) TWA, A2</td>
</tr>
<tr>
<td>Description of Substance</td>
<td>Varies</td>
</tr>
<tr>
<td>Original (SCP) IDLH for cadmium dust</td>
<td>50 mg Cd/m³</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>Data on the dose-response relationship for cadmium are scarce and uncertain. Friberg et al. (1974) reported a rabbit 30-minute LC₅₀ of about 8,000 mg-min/m³ (mg-min/m³ is the product of the concentration in mg/m³ and the exposure time in minutes); this represents a concentration of about 266 mg/m³ for 30 minutes. As serious irreversible renal cortical changes can precede death when renal cortical concentrations exceed 0.4 mg/g (tissue wet-weight), an IDLH of 50 mg/m³ is appropriate. This concentration would result in a human lung cadmium burden in 30 minutes of no more than 8 or 9 mg. This concentration is approximately that at which incipient morphologic changes occur in the kidneys of cadmium-exposed workers.</td>
</tr>
<tr>
<td>Original (SCP) IDLH for Cadmium fume</td>
<td>9 mg Cd/m³</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>The chosen IDLH is based on the statement by ACGIH (1971) that an exposure to 9 mg/m³ cadmium fume for 5 hours is a lethal dose (Beton et al., 1969). AIHA (1982) reported that the lethal dose (single exposure) for man of thermally-generated cadmium oxide fume is not over 2,900 mg-min/m³ (mg-min/m³ is the product of the concentration in mg/m³ and the exposure time in minutes); this represents a concentration of about 50 mg/m³ for 1 hour. The concentration of 50 mg/m³ has not been chosen as the IDLH, however, because AIHA (1982) also reported that the doses which caused incapacitation must have been considerably lower (Barrett and Card 1947).</td>
</tr>
<tr>
<td>Short-term exposure guidelines</td>
<td>None developed</td>
</tr>
</tbody>
</table>
Cadmium compounds (as Cd) (continued)

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50}</th>
<th>LC_{50}</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cd: Rat</td>
<td>Yoshikawa and Komma 1974</td>
<td>25 mg/m³</td>
<td>----</td>
<td>30 min</td>
<td>25 mg Cd/m³ (1.0)</td>
<td>2.5 mg Cd/m³</td>
</tr>
<tr>
<td>Cd: Rat</td>
<td>Barrett et al. 1947</td>
<td>500 mg/m³</td>
<td>----</td>
<td>10 min</td>
<td>2,528 mg Cd/m³ (0.69)</td>
<td>302 mg Cd/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Barrett et al. 1947</td>
<td>3,000 mg/m³</td>
<td>----</td>
<td>10 min</td>
<td>2,128 mg Cd/m³ (0.69)</td>
<td>233 mg Cd/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Barrett et al. 1947</td>
<td>4,000 mg/m³</td>
<td>----</td>
<td>10 min</td>
<td>2,429 mg Cd/m³ (0.69)</td>
<td>243 mg Cd/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gates et al. 1946</td>
<td>780 mg/m³</td>
<td>----</td>
<td>10 min</td>
<td>473 mg Cd/m³ (0.69)</td>
<td>47 mg Cd/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gates et al. 1946</td>
<td>340 mg/m³</td>
<td>----</td>
<td>10 min</td>
<td>206 mg Cd/m³ (0.69)</td>
<td>21 mg Cd/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Gates et al. 1946</td>
<td>3,300 mg/m³</td>
<td>----</td>
<td>15 min</td>
<td>2,086 mg Cd/m³ (0.79)</td>
<td>209 mg Cd/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Gates et al. 1946</td>
<td>3,300 mg/m³</td>
<td>----</td>
<td>15 min</td>
<td>2,086 mg Cd/m³ (0.79)</td>
<td>209 mg Cd/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Gekkan Yakuji 1980</td>
<td>400 mg/m³</td>
<td>----</td>
<td>10 min</td>
<td>243 mg Cd/m³ (0.69)</td>
<td>24 mg Cd/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{50} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cd: Rat</td>
<td>Kotsonis and Kiss an 1977</td>
<td>oral</td>
<td>225</td>
<td>----</td>
<td>1,575 mg/kg</td>
<td>158 mg Cd/kg</td>
</tr>
<tr>
<td>Mouse</td>
<td>Tarasenko 1978</td>
<td>oral</td>
<td>60</td>
<td>----</td>
<td>6,230 mg/kg</td>
<td>623 mg Cd/kg</td>
</tr>
<tr>
<td>Cd: Rat</td>
<td>Gekkan 1980</td>
<td>oral</td>
<td>72</td>
<td>----</td>
<td>444 mg/kg</td>
<td>44 mg Cd/kg</td>
</tr>
<tr>
<td>Mouse</td>
<td>Tarasenko 1978</td>
<td>oral</td>
<td>72</td>
<td>----</td>
<td>444 mg/kg</td>
<td>44 mg Cd/kg</td>
</tr>
<tr>
<td>CdCl₂: Mouse</td>
<td>Engstrom 1981</td>
<td>oral</td>
<td>60</td>
<td>----</td>
<td>683 mg/kg</td>
<td>65 mg Cd/kg</td>
</tr>
<tr>
<td>Rat</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>68</td>
<td>----</td>
<td>376 mg/kg</td>
<td>38 mg Cd/kg</td>
</tr>
</tbody>
</table>

Other animal data

A rabbit 30-minute LC₅₀ of about 8,000 mg·min/m³ for cadmium dust has been reported [Friberg et al. 1974], which is equivalent to about 250 mg Cd/m³ for 30 minutes.

Human data

It has been reported that exposure to 9 mg/m³ of cadmium fume for 5 hours is a lethal dose [Beton et al. 1966]. Fatalities have resulted from exposures to concentrations estimated to be 40 to 50 mg/m³ for 1 hour [Barrett and Card 1947; Bulmer et al. 1938; Rein 1961]. The lethal dose of thermally generated cadmium oxide fume of not more than 2,900 mg·min/m³ has been reported [Barrett and Card 1947], which is equivalent to about 85 mg Cd/m³ for 30 minutes. It has been reported that 39 mg Cd/m³ was a fatal exposure after 20 minutes [Zavon and Meadows 1970].

Revised IDLH: 9 mg Cd/m³

Base for revised IDLH: Based on acute inhalation toxicity data in workers [Barrett and Card 1947; Beton et al. 1966; Bulmer et al. 1938; Rein 1961; Zavon and Meadows 1970], the revised IDLH for cadmium compounds is 9 mg Cd/m³ which was the original IDLH for cadmium fume. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for cadmium compounds at any detectable concentration.]

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REFERENCES:

Calcium arsenate (as As)

CAS number ............................................ 7778-44-1
NIOSH REL ............................................. 0.002 mg/m³ 15-minute CEILING; NIOSH considers calcium arsenate to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1980].

Current OSHA PEL ......................................
1989 OSHA PEL ......................................
1993-1994 ACGIH TLV ................................. 0.01 mg/m³ TWA, A1

Description of Substance ............................ Colorless to white, odorless solid.

LEL .......................................................... Noncombustible Solid

Original (SCP) IDLH .................................... 100 mg As/m³
Basis for original (SCP) IDLH ......................... Because no data on acute inhalation toxicity are available for calcium arsenate, the chosen IDLH is based on an analogy with arsenic and compounds (as As) which has an IDLH of 100 mg As/m³.

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Beck et al. 1972</td>
<td>oral</td>
<td>812</td>
<td>-----</td>
<td>2,103 mg As/m³</td>
<td>21.0 mg As/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>20</td>
<td>-----</td>
<td>52 mg As/m³</td>
<td>5.2 mg As/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>MacEwen and Vernot 1972</td>
<td>oral</td>
<td>794</td>
<td>-----</td>
<td>2,056 mg As/m³</td>
<td>206 mg As/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Muehlberger 1930</td>
<td>oral</td>
<td>50</td>
<td>-----</td>
<td>132 mg As/m³</td>
<td>13.0 mg As/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Perkow 1971/1976</td>
<td>oral</td>
<td>38</td>
<td>-----</td>
<td>98 mg As/m³</td>
<td>9.8 mg As/m³</td>
</tr>
</tbody>
</table>

Human data .............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 5 mg As/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for calcium arsenate. Therefore, the revised IDLH for calcium arsenate is 5 mg As/m³ based on acute oral toxicity data in animals [Lehman 1951] and to be consistent with the revised IDLH for other inorganic arsenic compounds which have a revised IDLH of 5 mg As/m³. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for calcium arsenate at concentrations above 0.002 mg As/m³. OSHA currently requires in 29 CFR 1919.1018 that workers be provided with and required to wear and use the "most protective" respirators in concentrations exceeding 20 mg As/m³ (i.e., 2.000 times the PEL).]

REFERENCES:

Calcium oxide

CAS number ............................................. 1305-78-8
NIOSH REL ...................................................... 2 mg/m³ TWA
Current OSHA PEL ............................................. 5 mg/m³ TWA
1989 OSHA PEL .................................................. Same as current PEL
1993-1994 ACGIH TLV ........................................... 2 mg/m³ TWA
Description of Substance ............................................ White or gray, odorless lumps or granular powder.
LEL ............................................................... Noncombustible Solid
Original (SCP) IDLH* ........................................... Unknown
Basis for original (SCP) IDLH ................................. No data on acute inhalation toxicity are available on which to base an IDLH for calcium oxide. Because Patty [1963] reported that inhalation of the dust can cause chemical pneumonia and severe respiratory tract irritation, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 50 x the OSHA PEL of 5 mg/m³ (i.e., 250 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 250 mg/m³. The available toxicological data indicate that severe respiratory irritation could inhibit escape. None developed

Short-term exposure guidelines ............................... None developed

ACUTE TOXICITY DATA

Animal data ........................................................ None relevant for use in determining the revised IDLH.
Human data ........................................................ Strong nasal irritation has been reported to result from exposures to about 25 mg/m³, but exposures to 9 to 10 mg/m³ resulted in no observable irritation [ACGIH 1991].

Revised IDLH: 25 mg/m³
Basis for revised IDLH: The revised IDLH for calcium oxide is 25 mg/m³ based on acute inhalation toxicity data in humans [ACGIH 1991]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 25 mg/m³.

REFERENCES:

Camphor (synthetic)

CAS number .................................................. 78-22-2
NIOSH REL .......................................................... 2 mg/m³ TWA
Current OSHA PEL ........................................... 2 mg/m³ TWA
1989 OSHA PEL .............................................. Same as current PEL
1993-1994 ACGIH TLV ..................................... 12 mg/m³ (2 ppm) TWA, 16 mg/m³ (3 ppm) STEL

Description of Substance: Colorless or white crystals with a penetrating, aromatic odor.

LEL ................................................................. 0.5% (10% LEL, 3,600 mg/m³)
Original (SCP) IDLH ....................................... 200 mg/m³

Basis for original (SCP) IDLH: No data on acute inhalation toxicity are available on which to base an IDLH for camphor. For this draft technical standard, therefore, the chosen IDLH is based on a report by Gronka et al. [1969] concerning the camphor processing and packaging area of a plant. Concentrations of camphor ranging from 3 to 194 mg/m³ produced nose and sinus irritation among workers in this plant [Gronka et al. 1969].

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Nikolaeva 1957</td>
<td>400 mg/m³</td>
<td>720 mg/m³ (1.8)</td>
<td>3 hr</td>
<td></td>
<td>72 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>600</td>
<td>5,600 mg/kg</td>
<td>560 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Horikawa and Okada 1975</td>
<td>oral</td>
<td>1,310</td>
<td>9,170 mg/kg</td>
<td>917 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Smith and Margolis 1954</td>
<td>oral</td>
<td>2,000</td>
<td>14,000 mg/kg</td>
<td>1,400 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

Human data: It has been reported that concentrations during camphor processing and packaging ranged from 33 to 194 mg/m³; workers had no complaints other than slight eye irritation and afternoon drowsiness [Gronka et al. 1969].

Revised IDLH: 200 mg/m³ [Unchanged]

Basis for revised IDLH: Based on chronic inhalation toxicity data in workers [Gronka et al. 1969], the original IDLH for synthetic camphor (200 mg/m³) is not being revised at this time.

REFERENCES:

Carbaryl

CAS number ........................................ 63-25-2
NIOSH REL ............................................. 5 mg/m³ TWA
Current OSHA PEL .................................... 5 mg/m³ TWA
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV .................................. 5 mg/m³ TWA

Description of Substance ............................................. White or gray, odorless solid.

LEL ............................................. Noncombustible Solid

Original (SCP) IOLH ............................................. 600 mg/m³

Because no useful data on acute inhalation toxicity are available for carbaryl, the chosen IDLH is based on the rat oral LD₅₀ of 89 mg/kg [Boyd and Taylor 1971 cited by NIOSH 1974]. In addition, ACGIH (1971) reported that female rats may occasionally be killed by a single oral dose of 100 mg/kg [Gaines 1969].

Short-term exposure guidelines ..................................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>710</td>
<td>4,970 mg/m³</td>
<td>497 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Q. pig</td>
<td>Benson and Dorough 1984</td>
<td>oral</td>
<td>250</td>
<td>1,750 mg/m³</td>
<td>175 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>Buck 1979</td>
<td>oral</td>
<td>759</td>
<td>5,210 mg/m³</td>
<td>511 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Gaines 1960</td>
<td>oral</td>
<td>850</td>
<td>5,350 mg/m³</td>
<td>525 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Gig Sant 1967</td>
<td>oral</td>
<td>500</td>
<td>3,500 mg/m³</td>
<td>345 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Stevens et al. 1972</td>
<td>oral</td>
<td>500</td>
<td>3,500 mg/m³</td>
<td>345 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Weiss and Orzel 1967</td>
<td>oral</td>
<td>230</td>
<td>1,610 mg/m³</td>
<td>156 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ........................................... A concentration of about 75 mg/m³ produced typical poisoning in dogs within 5 hours [Carpenter et al. 1961].

Human data ............................................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 100 mg/m³

Basis for revised IDLH: The revised IDLH for carbaryl is 100 mg/m³ based on acute toxicity data in animals [Carpenter et al. 1961; Gig Sant 1967; Stevens et al. 1972].

REFERENCES:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
<td>1333-86-4</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>3.5 mg/m³ TWA; 0.1 mg PAHs/m³ TWA</td>
</tr>
<tr>
<td>Note:</td>
<td>NIOSH considers carbon black in the presence of polycyclic aromatic hydrocarbons (PAHs) to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td></td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>3.5 mg/m³ TWA</td>
</tr>
<tr>
<td>Description of Substance</td>
<td>Black, odorless solid.</td>
</tr>
<tr>
<td>LEL</td>
<td>solid</td>
</tr>
<tr>
<td>Original (SCP) IDLH*</td>
<td>No Evidence</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td></td>
</tr>
<tr>
<td>Short-term exposure guidelines</td>
<td>None developed</td>
</tr>
<tr>
<td>ACUTE TOXICITY DATA</td>
<td></td>
</tr>
<tr>
<td>Animal or human data</td>
<td>None indicating that high concentrations of carbon black would have significant health effects to workers within 30 minutes.</td>
</tr>
</tbody>
</table>

Revised IDLH: 1,750 mg/m³
Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of carbon black would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for carbon black is 1,750 mg/m³ based on being 500 times the NIOSH REL and OSHA PEL of 3.5 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).
Carbon dioxide

<table>
<thead>
<tr>
<th>Description of Substance</th>
<th>LEL</th>
<th>Original (SCP) IDLH</th>
<th>Basis for original (SCP) IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorless, odorless gas.</td>
<td></td>
<td>50,000 ppm</td>
<td>The chosen IDLH is based on the statements by ACGIH [1971] that a 30-minute exposure at 50,000 ppm produces signs of intoxication, and a few minutes of exposure at 70,000 ppm and 100,000 ppm produces unconsciousness [Flury and Zemik 1931]. AIHA [1971] reported that 100,000 ppm is the atmospheric concentration immediately dangerous to life. In addition, Hunter [1975] noted that exposure to 100,000 ppm for only a few minutes can cause loss of consciousness. None developed.</td>
</tr>
</tbody>
</table>

Short-term exposure guidelines

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>( LC_{50} ) (ppm)</th>
<th>( LC_{95} ) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Tab Biol Per 1933</td>
<td>50,000</td>
<td>49,500 ppm (0.55)</td>
<td>4,950 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other human data.

Signs of intoxication have been produced by a 30-minute exposure at 50,000 ppm [Aero 1953], and a few minutes exposure at 70,000 to 100,000 ppm produces unconsciousness [Flury and Zemik 1931]. It has been reported that submarine personnel exposed continuously at 30,000 ppm were only slightly affected, provided the oxygen content of the air was maintained at normal concentrations [Schaefer 1951]. It has been reported that 100,000 ppm is the atmospheric concentration immediately dangerous to life [AIHA 1971] and that exposure to 100,000 ppm for only a few minutes can cause loss of consciousness [Hunter 1975].

Revised IDLH: 40,000 ppm

**Basis for revised IDLH:** The revised IDLH for carbon dioxide is 40,000 ppm based on acute inhalation toxicity data in humans [Aero 1953; Flury and Zemik 1931; Schaefer 1951].

**REFERENCES:**

7. Tab Biol Per (1933); 3:231 (in German).
Carbon disulfide

CAS number ................................................. 75-15-0
NIOSH REL ......................................................
Current OSHA PEL ..............................................
1988 OSHA PEL ..................................................
1993-1994 ACGIH TLV .........................................
Description of Substance ......................................
LEL .....................................................................
Original (SCP) IDLH .............................................
Basis for original (SCP) IDLH ...................................

Existing short-term exposure guidelines: ......................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>AIHA 1992</td>
<td>&gt;1,670</td>
<td>---</td>
<td>1 hr</td>
<td>&gt;2,088 ppm (1.25)</td>
<td>&gt;208 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>AIHA 1992</td>
<td>15,500</td>
<td>---</td>
<td>2 hr</td>
<td>19,275 ppm (1.25)</td>
<td>1,938 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>AIHA 1992</td>
<td>3,000</td>
<td>---</td>
<td>4 hr</td>
<td>6,000 ppm (2.0)</td>
<td>600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>AIHA 1992</td>
<td>3,500</td>
<td>---</td>
<td>4 hr</td>
<td>7,000 ppm (2.0)</td>
<td>700 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Ismerov et al. 1982</td>
<td>7,511</td>
<td>---</td>
<td>2 hr</td>
<td>12,658 ppm (1.6)</td>
<td>1,268 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Ismerov et al. 1982</td>
<td>5,063</td>
<td>---</td>
<td>2 hr</td>
<td>5,063 ppm (1.6)</td>
<td>506 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Lefaux 1968</td>
<td>4,000</td>
<td>30 min</td>
<td>4,000 ppm (1.0)</td>
<td>400 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .............................................

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Carbon disulfide (continued)

Other human data

Symptoms have occurred after 30 minutes of exposure to concentrations ranging from 420 to 510 ppm while exposure to 4,800 ppm for 30 minutes causes coma and may be fatal [Flury and Zemik 1931]. Severe symptoms and unconsciousness may occur within 30 minutes at 1,100 ppm [Perry 1963]. It has been reported that 760 ppm causes an immediate headache that lasts for hours [Browning 1953]. It has also been reported that minor symptoms are induced after several hours of exposure to 300 ppm, distinct signs of poisoning at 400 ppm, severe poisoning after 30 minutes at 1,150 ppm, and life-threatening health effects at 3,200 to 3,800 ppm [Bittersohl et al. 1972]. It has been reported that exposure at 2,000 to 3,300 ppm leads to narcosis in 30 minutes, and death occurs after 30 to 60 minutes of exposure at 5,000 ppm [Paluch 1954].

Revised IDLH: 500 ppm [Unchanged]

Based on acute inhalation toxicity data in humans [Bittersohl et al. 1972; Browning 1953; Flury and Zemik 1931; Lefaux 1968], the original IDLH for carbon disulfide (500 ppm) is not being revised at this time.

REFERENCES:

Carbon monoxide

CAS number ........................................... 630-08-0
NIO SH REL .............................................

Current OSHA PEL ........................................ 35 ppm (40 mg/m³) TWA, 200 ppm (229 mg/m³) CEILING

1989 OSHA PEL ........................................... 50 ppm (55 mg/m³) TWA

1983-1984 ACGIH TLV .................................. 35 ppm (40 mg/m³) TWA, 200 ppm (229 mg/m³) CEILING

Description of Substance ...........................................

LEL .......................................................... 12.5% (10% LEL, 12,500 ppm)

Original (SCP) IDLH ......................................... 1,500 ppm

Basis for original (SCP) IDLH .............................. The chosen IDLH is based on the statement by Patty [1963] that a 1-hour exposure to 1,000 to 1,200 ppm would cause unpleasant, but no dangerous symptoms [Henderson et al. 1921]. Patty [1963] also reported that 1,500 to 2,000 ppm might be a dangerous concentration for an exposure of 1 hour [Henderson et al. 1921].


- 10-minute EEGL: 1,500 ppm
- 30-minute EEGL: 800 ppm
- 60-minute EEGL: 400 ppm
- 24-hour EEGL: 50 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Hartzell et al. 1985</td>
<td>8,636</td>
<td>-----</td>
<td>15 min</td>
<td>6,822 ppm (0.79)</td>
<td>682 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hartzell et al. 1985</td>
<td>5,207</td>
<td>-----</td>
<td>30 min</td>
<td>5,207 ppm (3.0)</td>
<td>521 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Lefaux 1968</td>
<td>-----</td>
<td>4,000</td>
<td>30 min</td>
<td>4,000 ppm (1.0)</td>
<td>400 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Rose et al. 1970</td>
<td>1,784</td>
<td>-----</td>
<td>4 hr</td>
<td>3,568 ppm (2.0)</td>
<td>357 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Rose et al. 1970</td>
<td>2,414</td>
<td>-----</td>
<td>4 hr</td>
<td>4,828 ppm (2.0)</td>
<td>482 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Rose et al. 1970</td>
<td>1,847</td>
<td>-----</td>
<td>4 hr</td>
<td>11,294 ppm (2.0)</td>
<td>1,129 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab. Biol. Per 1933</td>
<td>5,000</td>
<td>2,750</td>
<td>5 min</td>
<td>2,750 ppm (0.55)</td>
<td>275 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................... The median effective concentrations to produce incapacitation (EC₅₀) in rats have been determined to be 2,667 ppm and 1,450 ppm in 15 and 30 minutes, respectively [Hartzell et al. 1985].

Other human data ........................................... It has been stated that a 1-hour exposure to 1,000 to 1,200 ppm would cause unpleasant but no dangerous symptoms, but that 1,500 to 2,000 ppm might be a dangerous concentration after 1 hour [Henderson et al. 1921a, 1921b]. In general, a carboxyhemoglobin (COHb) level of 10-20% will only cause slight headaches [NIOSH 1972] and a COHb of 11-13% will have no effect on hand and foot reaction time, hand steadiness, or coordination [Stewart and Peterson 1970]. At a COHb of 35%, manual dexterity is impaired [Stewart 1975]. At 40% COHb, mental confusion, added to increasing incoordination, precludes driving an automobile [Stewart 1975]. A 30-minute exposure to 1,200 ppm will produce a COHb of 10-13% [NIOSH 1972].
**Carbon monoxide (continued)**

Revised IDLH: 1,200 ppm  
**Basis for revised IDLH:** The revised IDLH for carbon monoxide is 1,200 ppm based on acute inhalation toxicity data in humans [Henderson et al. 1921a, 1921b; NIOSH 1972; Stewart and Peterson 1970].

<table>
<thead>
<tr>
<th>REFERENCES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Tab Biol Per [1933]; 3:231 (in German).</td>
</tr>
</tbody>
</table>
Carbon tetrachloride

CAS number ............................................ 56-23-5
NIOSH REL ............................................. 2 ppm (12.6 mg/m^3) 60-minute STEL; NIOSH considers carbon tetrachloride to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1980].
Current OSHA PEL ................................... 10 ppm TWA, 25 ppm CEILING,
1989 OSHA PEL ....................................... 200 ppm 5-min MAXIMUM PEAK in any 4 hours
1983-1994 ACGIH TLV ........................... 2 ppm (12.6 mg/m^3) TWA,
5 ppm (31 mg/m^3) STEL (skin), A3
Description of Substance .......................... Colorless liquid with a characteristic ether-like odor.
LEL ...................................................... Noncombustible Liquid
Original (SCP) IDLH ................................. 300 ppm
Basis for original (SCP) IDLH ..................... ACGIH [1971] reported that a severe case of human poisoning has been observed after a 3-hour exposure to concentrations ranging from 75 to 600 ppm and averaging about 210 ppm [Barnes and Jones 1987]. AIHA [1981] reported that exposures for 0.5 to 1 hour to 1,000 to 2,000 ppm have caused human fatalities from acute kidney damage [Fassett]. Kirk-Othmer [1964] reported that a 30-minute exposure to about 300 ppm causes symptoms of intoxication. Based on these data, an IDLH of 300 ppm is chosen.

Short-term exposure guidelines .................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_50 (ppm)</th>
<th>LC_100 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF*)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>AAPCO 1966</td>
<td>1,000</td>
<td></td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>G. Pig</td>
<td>Clayton 1967</td>
<td>20,000</td>
<td>2 hr</td>
<td>32,807 ppm (3.64)</td>
<td>2,281 ppm</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Flury and Zernik 1935</td>
<td>36,310</td>
<td>2 hr</td>
<td>62,800 ppm (3.64)</td>
<td>6,250 ppm</td>
<td></td>
</tr>
<tr>
<td>Mammal</td>
<td>Gig Tr Prof Zabol 1980</td>
<td>5,400</td>
<td></td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>16,800</td>
<td>4 hr</td>
<td>16,800 ppm (2.10)</td>
<td>1,680 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Svirbely et al. 1947</td>
<td>25,625 ppm (2.69)</td>
<td>25,625 ppm (2.69)</td>
<td>2,563 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1933</td>
<td>26,374 ppm (0.53)</td>
<td>5 min</td>
<td>39,328 ppm (3.69)</td>
<td>3,933 ppm</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>von Oettingen 1969</td>
<td>16,800</td>
<td>8 hr</td>
<td>16,800 ppm (2.10)</td>
<td>1,680 ppm</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 2.8 [ten Berge et al. 1986].

Other human data .................................. A severe case of poisoning was observed after a 3-hour exposure to concentrations ranging from 75 to 600 ppm and averaging about 210 ppm [Barnes and Jones 1967]. It has been reported that exposures to 1,000 to 2,000 ppm for 0.5 to 1 hour have caused human fatalities from acute kidney damage [AIHA 1981]. It has also been reported that a 30-minute exposure to about 300 ppm causes symptoms of intoxication [Kirk-Othmer 1964].

Revised IDLH: 200 ppm
Basis for revised IDLH: The revised IDLH for carbon tetrachloride is 200 ppm based on acute inhalation toxicity data in humans [AIHA 1981; Barnes and Jones 1967; Kirk-Othmer 1964]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for carbon tetrachloride at concentrations above 2 ppm.]
REFERENCES:

Chlordane

CAS number ........................................... 57-74-8
NIOSH REL ........................................... 0.5 mg/m³ TWA [skin]; NIOSH considers chlordane to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ...................................... 0.5 mg/m³ TWA [skin]
1989 OSHA PEL ......................................... Same as current PEL
1993-1994 ACGIH TLV .................................. 0.5 mg/m³ TWA [skin]

Description of Substance .................................. Amber-colored, viscous liquid with a pungent, chlorine-like odor. Noncombustible liquid

Original (SCP) IDLH ................................ 500 mg/m³

Short-term exposure guidelines .. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>100</td>
<td>-----</td>
<td>700 mg/m³</td>
<td>70 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Ambrose et al. 1953</td>
<td>oral</td>
<td>590</td>
<td>-----</td>
<td>4,130 mg/m³</td>
<td>413 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Ambrose et al. 1953</td>
<td>oral</td>
<td>430</td>
<td>-----</td>
<td>3,010 mg/m³</td>
<td>301 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Ambrose et al. 1953</td>
<td>oral</td>
<td>300</td>
<td>-----</td>
<td>2,100 mg/m³</td>
<td>210 mg/m³</td>
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<tr>
<td>Mouse</td>
<td>PCRB 1966</td>
<td>oral</td>
<td>165</td>
<td>-----</td>
<td>1,015 mg/m³</td>
<td>102 mg/m³</td>
</tr>
<tr>
<td>Hamster</td>
<td>Truhaut et al. 1974</td>
<td>oral</td>
<td>1,720</td>
<td>-----</td>
<td>12,040 mg/m³</td>
<td>1,204 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>von Schwebe and Wendling 1967</td>
<td>oral</td>
<td>200</td>
<td>-----</td>
<td>1,400 mg/m³</td>
<td>140 mg/m³</td>
</tr>
</tbody>
</table>

Human data ............................................... The fatal oral dose has been estimated to be about 6 grams [Derbes et al. 1955] or to range from 6 to 60 grams [Pennsylvania 1969]. (Note: An oral dose of 6 grams is equivalent to a worker being exposed to about 4,000 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.)

Revised IDLH: 100 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for chlordane. Therefore, the revised IDLH for chlordane is 100 mg/m³ based on acute oral toxicity data in humans [Derbes et al. 1955; Pennsylvania 1969] and animals [AAPCO 1966; PCRB 1966; von Schwebe and Wendling 1967]. (Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for chlordane at concentrations above 0.5 mg/m³.)

REFERENCES:

Chlorinated camphene

CAS number ............................................. 8001-35-2
NIOSH REL .................................. None established; NIOSH considers chlorinated camphene to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ............................ 0.5 mg/m³ TWA [skin]
1988 OSHA PEL ......................... 0.5 mg/m³ TWA, 1 mg/m³ STEL [skin]
1993-1994 ACGIH TLV ..................... 0.5 mg/m³ TWA, 1 mg/m³ STEL [skin]

Description of Substance .................. Amber, waxy solid with a mild, piney, chlorine- and camphor-like odor.

LEL ......................................... Noncombustible Solid
Original (SCP) IDLH ......................... 200 mg/m³

Basis for original (SCP) IDLH ............. The chosen IDLH has been estimated from the statement by Patty [1963] from the Council on Pharmacy and Chemistry [1952], Deichmann and Gerasde [1969], Stolman [1968], Thiennes and Haley [1972], and Sax [1968] that the human oral lethal dose is about 2 to 7 grams.

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 6.8-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Werner 1952</td>
<td>2,000 mg/m³</td>
<td>2 hr</td>
<td>3,200 mg/m³ (1.6)</td>
<td>120 mg/m³</td>
<td></td>
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</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Hartley and Kidd 1983-86</td>
<td>oral</td>
<td>75</td>
<td>525 mg/kg</td>
<td>53 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Kenaga and Morgan 1976</td>
<td>oral</td>
<td>112</td>
<td>784 mg/kg</td>
<td>78 mg/kg</td>
<td></td>
</tr>
<tr>
<td>G. Pig</td>
<td>Park 1971/76</td>
<td>oral</td>
<td>250</td>
<td>1,750 mg/kg</td>
<td>175 mg/kg</td>
<td></td>
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<tr>
<td>Rat</td>
<td>von Schwabe and Wendling 1967</td>
<td>oral</td>
<td>50</td>
<td>350 mg/kg</td>
<td>35 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

Human data ................................. No toxic responses were noted in 25 volunteers exposed to 500 mg/m³ for 30 minutes/day for 10 consecutive days [Shelansky 1947]. The oral lethal dose has been reported to be about 2 to 7 grams [Thiennes and Haley 1972]. [Note: An oral dose of 2 to 7 grams is equivalent to a worker being exposed to about 1,300 to 4,700 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 200 mg/m³ [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Shelansky 1947], a value of about 500 mg/m³ would have been appropriate. However, the original IDLH of 200 mg/m³ is not being revised at this time.

[Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for chlorinated camphene at any detectable concentration.]
Chlorinated camphene (continued)

REFERENCES:

Chlorinated diphenyl oxide

CAS number ........................................... 31242-93-0
NIOSH REL ...........................................
Current OSHA PEL ................................... 0.5 mg/m³ TWA
1989 OSHA PEL ....................................... Same as current PEL
1993-1994 ACGIH TLV .............................. 0.5 mg/m³ TWA
Description of Substance ......................... Light-yellow, very viscous, waxy liquid.
LEL .................................................... Unknown [*Note: "Effective" IDLH = 5 mg/m³ -- see discussion below.]
Original (SCP) IDLH* ............................. Unknown
Basis for original (SCP) IDLH ........................ No quantitative data are available concerning the toxic effects produced by the inhalation of chlorinated diphenyl oxide. Therefore, for this draft technical standard, using an analogy with the chloronaphthalenes, the respirators have been selected on the basis of the assigned protection factor afforded by each device up to 10 x the OSHA PEL of 0.5 mg/m³ (i.e., 5 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 5 mg/m³.

Short-term exposure guidelines .................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>G. pig Clayton and Clayton 1981</td>
<td>oral</td>
<td>600</td>
<td>4,200 mg/m³</td>
<td>420 mg/m³</td>
<td></td>
</tr>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>G. pig Clayton and Clayton 1981</td>
<td>oral</td>
<td>1,000</td>
<td>7,000 mg/m³</td>
<td>700 mg/m³</td>
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</tr>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>G. pig Clayton and Clayton 1981</td>
<td>oral</td>
<td>1,200</td>
<td>8,400 mg/m³</td>
<td>840 mg/m³</td>
<td></td>
</tr>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>G. pig Clayton and Clayton 1981</td>
<td>oral</td>
<td>50</td>
<td>500 mg/m³</td>
<td>50 mg/m³</td>
<td></td>
</tr>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>G. pig Clayton and Clayton 1981</td>
<td>oral</td>
<td>100</td>
<td>10 mg/m³</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>G. pig Clayton and Clayton 1981</td>
<td>oral</td>
<td>50</td>
<td>500 mg/m³</td>
<td>50 mg/m³</td>
<td></td>
</tr>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>Rat HAS 1953</td>
<td>oral</td>
<td>500</td>
<td>3,500 mg/m³</td>
<td>350 mg/m³</td>
<td></td>
</tr>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>Rat HAS 1953</td>
<td>oral</td>
<td>500</td>
<td>3,500 mg/m³</td>
<td>350 mg/m³</td>
<td></td>
</tr>
<tr>
<td>C₁₀H₁₂C₁₀</td>
<td>Rat HAS 1953</td>
<td>oral</td>
<td>500</td>
<td>3,500 mg/m³</td>
<td>350 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.
Chlorinated diphenyl oxide (continued)

Revised IDLH: 5 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for chlorinated diphenyl oxide. Based on acute oral toxicity data in animals [Clayton and Clayton 1981], a value of about 35 mg/m³ would have been appropriate for chlorinated diphenyl oxide. However, the revised IDLH for chlorinated diphenyl oxide is 5 mg/m³ based on being 10 times the NIOSH REL and OSHA PEL of 0.5 mg/m³ (10 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for chlorinated diphenyl oxide).

REFERENCES:

Chlorine

CAS number ........................................ 7782-50-5
NIOSH REL ........................................
Current OSHA PEL .................................. 1 ppm (3 mg/m³) CEILING
1989 OSHA PEL ....................................... 0.5 ppm (1.5 mg/m³) TWA, 1 ppm (3 mg/m³) STEL
1993-1994 ACGIH TLV ............................... 0.5 ppm (1.5 mg/m³) TWA, 1 ppm (2.9 mg/m³) STEL
Description of Substance .......................... Greenish-yellow gas with a pungent, irritating odor.
LEL .................................................. Nonflammable Gas
Basis for original (SCP) IDLH ...................... 30 ppm

The chosen IDLH is based on the statement by ILO [1971] that exposure to 30 ppm will cause intense coughing fits, and exposure to 40 to 60 ppm for 30 to 60 minutes or more may cause serious damage.

1-hour EEGL: 3 ppm
24-hour EEGL: 0.5 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₆₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CP)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Back et al. 1972</td>
<td>293</td>
<td>-----</td>
<td>1 hr</td>
<td>187 ppm (1.22)</td>
<td>16 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Back et al. 1972</td>
<td>137</td>
<td>-----</td>
<td>1 hr</td>
<td>187 ppm (1.22)</td>
<td>17 ppm</td>
</tr>
<tr>
<td>Guinea</td>
<td>Lehmann 1987</td>
<td>1,200</td>
<td>3,200</td>
<td>3 hr</td>
<td>5,342 ppm (1.67)</td>
<td>534 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Prentiss 1937</td>
<td>888</td>
<td>888</td>
<td>10 min</td>
<td>888 ppm (1.0)</td>
<td>84 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab Buhl Per 1933</td>
<td>550</td>
<td>550</td>
<td>5 min</td>
<td>330 ppm (0.60)</td>
<td>33 ppm</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 3.5 [ten Berge et al. 1986].

Other animal data .................................. R₅₀₅₀ (mouse), 9.34 ppm [Alarie 1981].
Other human data ................................... Exposures to 30 ppm have been reported to cause intense coughing fits and exposure to 40 to 60 ppm for 30 to 60 minutes or more may cause serious damage [ILO 1971]. A concentration of 34 to 51 ppm has been reported to be lethal in 1 to 1.5 hours [Freitag 1941] while 14 to 21 ppm has been suggested as being dangerous within 0.5 to 1 hour [NPIRI 1983].

Revised IDLH: 10 ppm

Basis for revised IDLH: The revised IDLH for chlorine is 10 ppm based on acute inhalation toxicity data in humans [Freitag 1941; ILO 1971; NPIRI 1983].

REFERENCES:

Chlorine (continued)


9. Tab Biot Per [1933]; 3:231 (in German).

Chlorine dioxide

CAS number .............................................. 10049-04-4
NIOSH REL ..............................................
Current OSHA PEL ...................................... 0.1 ppm (0.3 mg/m³) TWA
1989 OSHA PEL ...................................... 0.1 ppm (0.3 mg/m³) TWA
1993-1994 ACGIH TLV ................................. 0.1 ppm (0.28 mg/m³) TWA, 0.3 ppm (0.83 mg/m³) STEL

Description of Substance
Yellow to red gas or a red-brown liquid (below 52°F) with an unpleasant odor similar to chlorine and nitric acid.

LEL ......................................................
Original (SCP) IDLH ..................................... 10 ppm
Basis for original (SCP) IDLH .......................... AlHA [1958] reported that rats exposed repeatedly to about 10 ppm for 4 hours daily died, whereas those exposed to about 0.1 ppm, 5 hours daily for 10 weeks, showed no detectable effects [Dalhamn 1957]. AlHA [1958] also reported that animals survived 2-hour exposures to 20 ppm, though some species exhibited symptoms [Gloemme and Lundgren 1957]. Elkins [1950] stated that 5 ppm is definitely irritating and 2 cases of illness (1 fatal) resulted from exposure to less than 19 ppm. AlHA [1958] reported that delayed deaths occur in animals after single exposures to 150 to 200 ppm for less than 1 hour [Gloemme and Lundgren 1957]. Based on the data cited above, an IDLH of 10 ppm is chosen.

Basis for revised IDLH: The revised IDLH is 5 ppm based on acute inhalation toxicity data in humans [Elkins 1950].

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Dalhamn 1957</td>
<td>260</td>
<td>416 ppm</td>
<td>2 hr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Abdel-Rahman et al. 1982</td>
<td>oral</td>
<td>292</td>
<td>729 ppm</td>
<td>73 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data
It has been reported that 5 ppm is definitely irritating and that 19 ppm caused the death of one worker inside a tank (time of exposure not specified) [Elkins 1950].

REFERENCES:
Chlorine trifluoride

CAS number ........................................ 7790-91-2
NIOSH REL ..........................................
Current OSHA PEL ................................ 0.1 ppm (0.4 mg/m³) CEILING
1989 OSHA PEL ..................................... Same as current PEL
1993-1994 ACGIH TLV ............................. 0.1 ppm (0.38 mg/m³) CEILING

Description of Substance .............................. Colorless gas or a greenish-yellow liquid (below 53°F) with a
somewhat sweet, suffocating odor.
Nonflammable Gas

LEL ................................................................
Original (SCP) IDLH .................................... 20 ppm
Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the following data presented by
Hom and Weir [1955] concerning the inhalation toxicology of
chlorine trifluoride. Two dogs and 20 rats were exposed
6 hours/day for 2 days to 21 ppm. No mortality occurred among
the animals, but during the first day's exposure, the dogs
became nauseated, coughed up a small quantity of mucous
material, and had rapid respiration and salivation. Both the rats
and the dogs had a singed feel to their fur. This is probably
a conservative IDLH because Deichmann and Gerarde [1969]
made the statement that 50 ppm or more may be fatal in 0.5 to
2 hours.

Guidance Levels (EEGLs):
- 10-min EEGL: 7 ppm
- 30-min EEGL: 3 ppm
- 60-min EEGL: 1 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Dost et al. 1974</td>
<td>LC₅₀: 600</td>
<td>LC₉₅: 100</td>
<td>15 min</td>
<td>622 ppm (0.79)</td>
<td>63 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Dost et al. 1974</td>
<td>LC₅₀: 400</td>
<td>LC₉₅: 100</td>
<td>35 min</td>
<td>420 ppm (1.05)</td>
<td>42 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Horn and Weir 1955</td>
<td>95</td>
<td>1 hr</td>
<td>190 ppm (2.0)</td>
<td>19 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>MacEwen and Vemot 1970</td>
<td>278</td>
<td>1 hr</td>
<td>223 ppm (1.25)</td>
<td>22 ppm</td>
<td></td>
</tr>
<tr>
<td>Monkey</td>
<td>MacEwen and Vemot 1970</td>
<td>230</td>
<td>1 hr</td>
<td>288 ppm (1.25)</td>
<td>29 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Vemot et al. 1977</td>
<td>209</td>
<td>1 hr</td>
<td>374 ppm (1.25)</td>
<td>37 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .................................... No mortality occurred among 2 dogs and rats exposed to 21 ppm
for 6 hours but the dogs became nauseated, coughed up a small
amount of mucous material, and had rapid respiration and
salivation [Horn and Weir 1955].

Human data ............................................. It has been reported that 50 ppm or more may be fatal in
30 minutes to 2 hours [Deichmann and Gerarde 1969].

Revised IDLH: 20 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Deichmann and Gerarde 1969] and animals
[Horn and Weir 1955; MacEwen and Vemot 1970], the original IDLH for chlorine trifluoride (20 ppm) is not being revised
at this time.

REFERENCES:

Chlorine trifluoride (continued)

Chloroacetaldehyde

<table>
<thead>
<tr>
<th>CAS number</th>
<th>107-20-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>1 ppm (3 mg/m³) CEILING</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>1 ppm (3 mg/m³) CEILING</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>1 ppm (3.2 mg/m³) CEILING</td>
</tr>
<tr>
<td>Description of Substance</td>
<td>Colorless liquid with an acrid, penetrating odor.</td>
</tr>
<tr>
<td>LEL</td>
<td>Unknown</td>
</tr>
<tr>
<td>Original (SCP) IDLH</td>
<td>100 ppm</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>The chosen IDLH is based on an analogy with crotonaldehyde. Rinehart [1967] found 100 ppm crotonaldehyde to be a lethal concentration for rats for a 4-hour exposure; the LC₅₀ for 30 minutes was 600 ppm. Human subjects found 45 ppm crotonaldehyde very disagreeable and conjunctival irritation was observed [Dow 1962 as cited by ACGIH 1971]. Based on the data cited above for crotonaldehyde, an IDLH of 100 ppm is chosen for chloroacetaldehyde.</td>
</tr>
</tbody>
</table>

**Short-term exposure guidelines**

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>EPA 1987</td>
<td>200</td>
<td>---</td>
<td>1 hr</td>
<td>250 ppm (1.25)</td>
<td>25 ppm</td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Lawrence et al. 1972</td>
<td>oral</td>
<td>89</td>
<td>---</td>
<td>192 ppm</td>
<td>19 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Lawrence et al. 1972</td>
<td>oral</td>
<td>82</td>
<td>---</td>
<td>176 ppm</td>
<td>16 ppm</td>
</tr>
</tbody>
</table>

**Human data**

Volunteers found 45 ppm to be very disagreeable and conjunctival irritation was observed [Dow 1962].

**Revised IDLH:** 45 ppm

**Basis for revised IDLH:** The revised IDLH for chloroacetaldehyde is 45 ppm based on acute inhalation toxicity data in humans [Dow 1962]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 45 ppm.

**REFERENCES:**

2. Dow [1962]. Personal communication to an ACGIH TLV Committee member from the Dow Chemical Company, Biochemical Research Department.
α-Chloroacetophenone

CAS number .............................................. 532-27-4
NIOSH REL ..............................................
Current OSHA PEL ......................................
1989 OSHA PEL ........................................
1993-1994 ACGIH TLV .................................
Description of Substance ............................. Colorless to gray crystalline solid with a sharp, irritating odor.
LEL .......................................................... Unknown
Original (SCP) IDLH .................................... 100 mg/m³
Basis for original (SCP) IDLH .............................

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Ballantyne and Swanston 1978</td>
<td>417</td>
<td>325</td>
<td>25 min</td>
<td>325 mg/m³ (0.79)</td>
<td>33 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Ballantyne and Swanston 1978</td>
<td>600</td>
<td>474</td>
<td>15 min</td>
<td>474 mg/m³ (0.79)</td>
<td>47 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Ballantyne and Swanston 1978</td>
<td>465</td>
<td>405</td>
<td>20 min</td>
<td>405 mg/m³ (0.87)</td>
<td>41 mg/m³</td>
</tr>
<tr>
<td>O. pig</td>
<td>Ballantyne and Swanston 1978</td>
<td>490</td>
<td>490</td>
<td>10 min</td>
<td>490 mg/m³ (1.0)</td>
<td>49 mg/m³</td>
</tr>
<tr>
<td>Human</td>
<td>Deichmann and Gerarde 1969</td>
<td>159</td>
<td>128</td>
<td>20 min</td>
<td>128 mg/m³ (0.87)</td>
<td>16 mg/m³</td>
</tr>
<tr>
<td>Human</td>
<td>Prentiss 1977</td>
<td>850</td>
<td>687</td>
<td>10 min</td>
<td>687 mg/m³ (0.69)</td>
<td>99 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data ........................................ R₀₉₀ (mouse), 8.2 mg/m³ [Alarie 1981].
Other human data ......................................... It has been reported that 31 mg/m³ is intolerable after 3 minutes [Punte et al. 1982].

Revised IDLH: 15 mg/m³
Basis for revised IDLH: The revised IDLH for α-chloroacetophenone is 15 mg/m³ based on acute inhalation toxicity data in humans [Deichmann and Gerarde 1969; Punte et al. 1982].

REFERENCES:
Chlorobenzene

CAS number ........................................ 108-90-7
NIOSH REL ........................................ None
Current OSHA PEL ................................. 75 ppm (350 mg/m³) TWA
1989 OSHA PEL .................................... Same as current PEL
1993-1994 ACGIH TLV ............................. 10 ppm (46 mg/m³) TWA
Description of Substance ......................... Colorless liquid with an almond-like odor.
LEL .............................................. 1.3% (10% LEL, 1,300 ppm)
Original (SCP) IDLH ...................... 2,400 ppm
Basis for original (SCP) IDLH .................. AIHA [1964] reported that 8,000 ppm was fatal to cats in 30 minutes [Patty 1963; Flury and Zemik 1931]. Patty [1963] reported that the exposure of cats for 1 hour to 2,400 to 2,900 ppm causes unsteadiness, tremor, and twitching [Flury and Zemik 1931]. Based on the data cited above, an IDLH of 2,400 ppm is chosen for this draft technical standard.

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY exposure guidelines:

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Eastman 1978</td>
<td>LC₉₀</td>
<td>22,000</td>
<td>2.3 hr</td>
<td>36,520 ppm (1.66)</td>
<td>3,652 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Eastman 1978</td>
<td>LC₉₅</td>
<td>9,000</td>
<td>3 hr</td>
<td>16,200 ppm (1.8)</td>
<td>1,620 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Flury and Zemik 1931</td>
<td>8,000</td>
<td>3 hr</td>
<td>8,000 ppm (1.0)</td>
<td>800 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Clayton and Clayton 1981</td>
<td>oral</td>
<td>2,290</td>
<td>-----</td>
<td>3,425 ppm</td>
<td>343 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Clayton and Clayton 1981</td>
<td>oral</td>
<td>2,250</td>
<td>-----</td>
<td>3,365 ppm</td>
<td>337 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>2,300</td>
<td>-----</td>
<td>3,440 ppm</td>
<td>344 ppm</td>
</tr>
<tr>
<td>O. pig</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>2,250</td>
<td>-----</td>
<td>3,365 ppm</td>
<td>337 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................ RD₉₀ (mouse), 1,054 ppm [DeCeaurriz et al. 1981].

Human data ...................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 1,000 ppm

Basis for revised IDLH: The revised IDLH for chlorobenzene is 1,000 ppm based on acute inhalation toxicity data in animals [DeCeaurriz et al. 1981; Flury and Zemik 1931].

REFERENCES:

6. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of Industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNIT, p. 34.
**o-Chlorobenzylidene malononitrile**

CAS number ............................................. 2698-41-1
NIOSH REL ............................................. 0.05 ppm (0.4 mg/m³) CEILING [skin]
Current OSHA PEL ..................................... 0.05 ppm (0.4 mg/m³) TWA
1989 OSHA PEL ........................................ 0.05 ppm (0.4 mg/m³) CEILING [skin]
1993-1994 ACGIH TLV ................................ 0.05 ppm (0.39 mg/m³) CEILING [skin]

Description of Substance ................................ White crystalline solid with a pepper-like odor.

**Short-term exposure guidelines** ................................ None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>( LC_{50} ) (ppm)</th>
<th>( LC_{90} ) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Ballantyne and Swanston 1978</td>
<td>1,800 mg/m³</td>
<td>2,059 mg/m³ (1.14)</td>
<td>45 min</td>
<td>206 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Ballantyne and Swanston 1978</td>
<td>2,753 mg/m³</td>
<td>3,643 mg/m³ (0.96)</td>
<td>20 min</td>
<td>264 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Ballantyne and Swanston 1978</td>
<td>1,842 mg/m³</td>
<td>1,243 mg/m³ (0.69)</td>
<td>10 min</td>
<td>124 mg/m³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Ballantyne and Swanston 1978</td>
<td>2,326 mg/m³</td>
<td>1,665 mg/m³ (0.69)</td>
<td>10 min</td>
<td>161 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

**Other animal data** .................................. \( RD_50 \) (mouse), 4.06 mg/m³ [Alarie 1981].

**Human data** ........................................ It has been reported that median incapacitating concentrations range from 12 to 20 mg/m³ after about 20 seconds of exposure [U.S. Dept of Army and Air Force 1963] and that a 2-minute exposure to concentrations between 2 and 10 mg/m³ was considered "intolerable" by 6 of 15 persons. Grant [1974] reported that human volunteers have found concentrations greater than 10 mg/m³ to be extremely irritating, intolerable for more than 30 seconds because of burning and pain in the eyes and chest [Punta et al. 1963]. Exposures above 14 mg/m³ for 1 hour produced extreme irritation, erythema, and vesication of the skin of volunteers [Weigand 1969].

**Revised IDLH:** 2 mg/m³ [Unchanged]

**References:**

Chlorobromomethane

CAS number ......................................... 74-97-5
NIOSH REL ..................................
Current OSHA PEL .... 200 ppm (1,050 mg/m³) TWA
OSHA PEL ............................
1989 OSHA PEL .... Same as current PEL
1993-1994 ACGIH TLV ...... 200 ppm (1,060 mg/m³) TWA

Description of Substance

Colorless to pale-yellow liquid with a chloroform-like odor.
LEL .........................................
Original (SCP) IDLH ........................... 5,000 ppm
Basis for original (SCP) IDLH ................ None developed

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 2.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Comstock et al. 1952</td>
<td>28,000</td>
<td>15 min</td>
<td>18,720 ppm (0.65)</td>
<td>1,472 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Comstock and Oberst 1953</td>
<td>29,000</td>
<td>15 min</td>
<td>18,850 ppm (0.65)</td>
<td>1,495 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Comstock and Oberst 1953</td>
<td>27,000</td>
<td>15 min</td>
<td>17,850 ppm (0.65)</td>
<td>1,755 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Matson and Dufour 1948</td>
<td>LC₅₀: 27,000</td>
<td>2 hr</td>
<td>47,600 ppm (2.38)</td>
<td>4,760 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Matson and Dufour 1948</td>
<td>LC₅₀: 27,000</td>
<td>2 hr</td>
<td>19,040 ppm (2.38)</td>
<td>1,904 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Svirbely et al. 1947</td>
<td>3,000</td>
<td>7 hr</td>
<td>15,600 ppm (5.2)</td>
<td>1,560 ppm</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 1.6 [van Berge et al. 1988].

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Deichmann and Gerarde 1969</td>
<td>oral</td>
<td>5,000</td>
<td>-----</td>
<td>6,506 ppm</td>
<td>651 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Svirbely et al. 1947</td>
<td>oral</td>
<td>4,300</td>
<td>-----</td>
<td>5,595 ppm</td>
<td>560 ppm</td>
</tr>
</tbody>
</table>

Human data ...................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 ppm
Basis for revised IDLH: The revised IDLH for chlorobromomethane is 2,000 ppm based on acute inhalation toxicity data in animals [Comstock et al. 1952; Comstock and Oberst 1953; Matson and Dufour 1948]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.
Chlorobromomethane (continued)

REFERENCES:

Chlorodiphenyl

CAS numbers ................................. 53469-21-9 (42% CI); 11097-69-1 (54% CI)
NIOSH REL ..................................
Current OSHA PEL ............................
1989 OSHA PEL ..............................
1983-1994 ACGIH TLV ....................... 1 mg/m³ TWA [skin]; 0.5 mg/m³ TWA [skin] (54% CI)

Description of Substance ..................... Colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.

LEL ............................................ Noncombustible Liquid

Original (SCP) IDLH for chlorodiphenyl (42% CI) .... 10 mg/m³
Basis for original (SCP) IDLH ................ In the absence of any other toxicological data, the chosen IDLH is based on the human TCLO (resulting in an irritant effect) of 10 mg/m³ [Elkins 1959 cited by NIOSH 1976].

Original (SCP) IDLH for chlorodiphenyl (54% CI) .... 5 mg/m³
Basis for original (SCP) IDLH ................ In the absence of human exposure data or data on acute animal exposure, data on chronic animal exposures were used to determine the IDLH. The chosen IDLH is based on inhalation exposure data reported by AIHA (1965) that indicated liver damage occurs in rats chronically exposed (7 hours/day for 83 exposures during 121 days) to 5.4 mg/m³ chlorodiphenyl (54% chlorine) [Treon et al. 1956].

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorodiphenyl Mouse</td>
<td>Tanaka et al. 1969</td>
<td>oral</td>
<td>1,900</td>
<td>-----</td>
<td>13,300 mg/m³</td>
<td>1,330 mg/m³</td>
</tr>
<tr>
<td>Chlorodiphenyl (42% CI) Rat</td>
<td>Bruckner et al. 1973</td>
<td>oral</td>
<td>4,250</td>
<td>-----</td>
<td>29,750 mg/m³</td>
<td>2,975 mg/m³</td>
</tr>
<tr>
<td>Chlorodiphenyl (54% CI) Rat</td>
<td>Garihoff et al. 1982</td>
<td>oral</td>
<td>1,010</td>
<td>-----</td>
<td>7,070 mg/m³</td>
<td>707 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data ................. Chlorodiphenyl (42% CI) had no discernable effects in cats, rabbits, guinea pigs, rats, and mice after 150 seven-hour exposures to 1.9 mg/m³ over 7 months [Treon et al. 1956]; 17 seven-hour exposures over 24 days at 8.8 mg/m³ also appeared to be noninjurious [Treon et al. 1956]. Slight, reversible, nonspecific liver injury was noted in cats, rabbits, guinea pigs, rats, and mice exposed to 1.5 mg/m³ of chlorodiphenyl (54% CI) for 7 hours/day for 150 days; 5.4 mg/m³ resulted in more extensive but reversible liver damage [Treon et al. 1956].

Human data .............................. It has been reported that concentrations above 10 mg/m³ were unbearably irritating [Elkins 1959]. Several deaths due to atrophy of the liver have occurred among workers chronically exposed to the fumes of chlorodiphenyls and chloronaphthalenes [von Wedel et al. 1943].
Chlorodiphenyl (continued)

Revised IDLH: 5 mg/m³

The revised IDLH for chlorodiphenyl is 5 mg/m³ based on acute inhalation toxicity data in humans [Elkins 1959] and animals [Treon et al., 1956]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for chlorodiphenyl at concentrations above 0.001 mg/m³.]

REFERENCES:

Chloroform

CAS number ................................................. 56-56-3
NIOSH REL ..................................................... 2 ppm (9.76 mg/m³) 60-minute STEL; NIOSH considers chloroform to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ........................................ 50 ppm (240 mg/m³) CEILING
1989 OSHA PEL ............................................... 2 ppm (9.76 mg/m³) TWA
1993-1994 ACGIH TLV ....................................... 10 ppm (49 mg/m³) TWA, A2

Description of Substance .................................. Colorless liquid with a pleasant odor.

Noncombustible Liquid

Original (SCP) IDLH ........................................ 1,000 ppm

Basis for original (SCP) IDLH .............................. The chosen IDLH is based on the statement by Patty [1963] that 1,024 ppm produced dizziness, intracranial pressure, and nausea after 7 minutes with definite after-effects [Lehmann and Flury 1943]. Also, Lehmann et al. [1936] reported that a 2-minute exposure to 1,107 ppm caused dizziness and vertigo. Because a person may become disoriented at concentrations greater than 1,000 ppm and be unable to escape, 1,000 ppm is chosen as the IDLH.

Existing short-term exposure guidelines ................. National Research Council (NRC 1984) Emergency Exposure Guidance Levels (EEGLs):

- 1-hour EEGL: 100 ppm
- 24-hour EEGL: 30 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LCₙₐ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Clayton 1967</td>
<td>20,000</td>
<td>20,000</td>
<td>2 hr</td>
<td>32,000 ppm (2.4)</td>
<td>3,320 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Lehmann and Flury 1943</td>
<td>9,617</td>
<td>9,617</td>
<td>4 hr</td>
<td>19,230 ppm (2.0)</td>
<td>1,924 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Lehmann et al. 1936</td>
<td>7,056</td>
<td>7,056</td>
<td>4 hr</td>
<td>14,113 ppm (2.0)</td>
<td>1,411 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1933</td>
<td>25,000</td>
<td>25,000</td>
<td>5 min</td>
<td>13,750 ppm (0.55)</td>
<td>1,375 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................... It has been reported that inhalation of 10,000 ppm has produced clinical anesthesia [NIOSH 1974] and that exposure for 2 minutes to 1,107 ppm has caused dizziness and vertigo [Lehmann et al. 1936]. Workers exposed 4 hours/day to concentrations of 57 to 71 ppm complained of lassitude, loss of appetite, and nausea [Challen et al. 1958]. Exposures to 350 ppm were tolerated for 30 minutes without complaint, whereas 1,030 ppm resulted in dizziness, intracranial pressure, and nausea in 7 minutes, with headache for several hours [Lehmann and Flury 1943].

Revised IDLH: 500 ppm

Basis for revised IDLH: The revised IDLH for chloroform is 500 ppm based on acute inhalation toxicity data in humans [Lehmann and Flury 1943]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for chloroform at concentrations above 2 ppm.]

REFERENCES:


9. Tab Bioi Per (1933); 3:231 (in German).
1-Chloro-1-nitropropane

CAS number ........................................ 600-25-9
NIOSH REL ........................................
Current OSHA PEL .............................. 2 ppm (10 mg/m³) TWA
1989 OSHA PEL .............................. 2 ppm (10 mg/m³) TWA
1993-1994 ACGIH TLV ...................... 2 ppm (10 mg/m³) TWA

Description of Substance ...................... Colorless liquid with an unpleasant odor.
LEL .................................................. Unknown
Original (SCP) IDLH .......................... 2,000 ppm
Basis for original (SCP) IDLH .............. The chosen IDLH is based on the statement in Patty [1963] that 1 of 2 guinea pigs died following a 1-hour exposure to 2,178 ppm; no rabbits died from this exposure, and no rabbits or guinea pigs died from a 1-hour exposure to 1,069 ppm [Machle et al. 1945].

Short-term exposure guidelines .............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Machle et al. 1945</td>
<td>2,178</td>
<td>-----</td>
<td>1 hr</td>
<td>2,723 ppm (1.25)</td>
<td>272 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1945</td>
<td>-----</td>
<td>389</td>
<td>6 hr</td>
<td>895 ppm (2.3)</td>
<td>90 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1945</td>
<td>LC₅₀: 2.574</td>
<td>-----</td>
<td>6 hr</td>
<td>5,920 ppm (2.3)</td>
<td>592 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Machle et al. 1945</td>
<td>-----</td>
<td>3,502</td>
<td>2 hr</td>
<td>5,603 ppm (1.6)</td>
<td>560 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Neklesova and Kudrina 1969</td>
<td>12,840</td>
<td>-----</td>
<td>3 hr</td>
<td>22,112 ppm (1.8)</td>
<td>2,211 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1945</td>
<td>oral</td>
<td>68</td>
<td>68 ppm</td>
<td>68 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Marhold 1996</td>
<td>oral</td>
<td>68</td>
<td>68 ppm</td>
<td>68 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Neklesova and Kudrina 1969</td>
<td>oral</td>
<td>695 ppm</td>
<td>695 ppm</td>
<td>695 ppm</td>
</tr>
</tbody>
</table>

Human data ....................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 100 ppm
Basis for revised IDLH: The revised IDLH for 1-chloro-1-nitropropane is 100 ppm based on acute inhalation toxicity data in animals [Machle et al. 1945].

REFERENCES:

Chloropicrin

CAS number ........................................... 76-06-2
NIOSH REL ...........................................
Current OSHA PEL ........................................
Same as current PEL
1989 OSHA PEL ........................................
1993-1994 ACGIH TLV ....................................
0.1 ppm (0.67 mg/m³) TWA

Description of Substance
Colorless to faint-yellow, oily liquid with an intensely irritating odor.

LEL .......................................................... Noncombustible Liquid

Original (SCP) IDLH ........................................ 4 ppm

Basis for original (SCP) IDLH

The chosen IDLH is based on the statement by Flury and Zemik [1931] cited in ACGIH [1971] and Patty [1963], and by Prentiss [1937] cited in ILO [1971] that a few seconds exposure to 4 ppm renders a man unfit for action. According to Patty [1963], a 10-minute exposure to 7.5 ppm is intolerable [Flury and Zemik 1931; Prentiss 1937]; therefore, a concentration this high might impede escape within 30 minutes.

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{90} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Deichmann and Gerarde 1969</td>
<td>293</td>
<td>10 min</td>
<td>202 ppm (0.69)</td>
<td>20 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Okada et al. 1970</td>
<td>340</td>
<td>2 min</td>
<td>109 ppm (0.32)</td>
<td>12 ppm</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Rilpop 1939</td>
<td>117</td>
<td>20 min</td>
<td>102 ppm (0.87)</td>
<td>10 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Sangyo Igaku 1973</td>
<td>9.7</td>
<td>4 hr</td>
<td>19 ppm (2.0)</td>
<td>2 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Sine 1993</td>
<td>117</td>
<td>20 min</td>
<td>102 ppm (0.87)</td>
<td>10 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Toshida et al. 1991</td>
<td>14.6</td>
<td>4 hr</td>
<td>29 ppm (2.0)</td>
<td>3 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ......................................... RD_{50} (mouse), 7.98 ppm [Alarie 1981].
Other human data ........................................... It has been reported that 4 ppm for a few seconds renders a worker unfit for activity and that a 10-minute exposure to 7.5 ppm is intolerable [Flury and Zemik 1931].

Revised IDLH: 2 ppm
Basis for revised IDLH: The revised IDLH for chloropicrin is 2 ppm based on acute inhalation toxicity data in workers [Flury and Zemik 1931] and animals [Sangyo Igaku 1973].

REFERENCES:

Chloropicrin (continued)

B-Chloroprene

CAS number ........................................ 126-99-8
NIOSH REL ........................................... 1 ppm (3.8 mg/m³) 15-minute CEILING; NIOSH considers
B-chloroprene to be a potential occupational carcinogen as
defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL .................................. 25 ppm (90 mg/m³) TWA [skin]
1989 OSHA PEL ..................................... 10 ppm (35 mg/m³) TWA [skin]
1993-1994 ACGIH TLV ............................... 10 ppm (36 mg/m³) TWA [skin]

Description of Substance: Colorless liquid with a pungent, ether-like odor.
LEL ...................................................... 4.0% (10% LEL, 4,000 ppm)

Original (SCP) IDLH .................................. 400 ppm

Basis for original (SCP) IDLH: The chosen IDLH is based on the statement by Patty [1963] that
no mice died from a 1-hour exposure to 277 ppm, but all mice
died from a 1-hour exposure to 829.2 ppm [von Oettingen
et al. 1936].

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>3,207</td>
<td>-----</td>
<td>4 hr</td>
<td>6,414 ppm (2.0)</td>
<td>641 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>von Oettingen et al. 1936</td>
<td>LC₅₀, 829</td>
<td>1,052</td>
<td>8 hr</td>
<td>2,623 ppm (2.5)</td>
<td>263 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>von Oettingen et al. 1936</td>
<td>-----</td>
<td>350</td>
<td>8 hr</td>
<td>876 ppm (2.5)</td>
<td>88 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>von Oettingen et al. 1936</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
</tbody>
</table>

Human data: Exposure to 973 ppm has resulted in nausea and giddiness in
volunteers in 10 to 15 minutes [Nystrom 1948]. Extreme fatigue
and unbearable chest pain has occurred following a month of
exposure to concentrations ranging from 56 to 334 ppm
[Nystrom 1948].

Revised IDLH: 300 ppm

Basis for revised IDLH: The revised IDLH for B-chloroprene is 300 ppm based on acute inhalation toxicity data in
humans [Nystrom 1948]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective"
respirators be worn for B-chloroprene at concentrations above 1 ppm.]

REFERENCES:

1. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single
exposure. Moscow, Russia: Centre of International Projects, GKN, p. 38.
219):5-125.
Chromic acid and chromates

CAS number ........................................... 1338-82-0 (CrO₃)
NIOSH REL .............................................. 0.001 mg Cr(VI)/m³ TWA; NIOSH considers chromic acid and chromates to be potential occupational carcinogens as defined by the OSHA carcinogen policy [29 CFR 1990].
Current OSHA PEL ...................................... 0.1 mg CrO₃/m³ CEILING
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ................................ Water soluble: 0.05 mg CrO₃/m³ TWA;
Certain water insoluble: 0.05 mg CrO₃/m³ TWA, A1

Description of Substance

Original (SCP) IDLH .................................... 30 mg/m³ (as CrO₃)
Basis for original (SCP) IDLH ....................... Very little quantitative data are available concerning the acute toxicity produced by the inhalation of chromic acid and chromates. AIHA [1956] reported that both the short exposure tolerance to chromic acid and the atmospheric concentration immediately dangerous to life are unknown. The chosen IDLH is based on the statements by ILO [1971] that “a man exposed for several days to concentrations of chromic acid mist of about 20 to 30 mg/m³ experienced cough, headache, dyspnea, and substernal pain; the signs persisted for 2 weeks. Another man working on the same process was similarly but less severely affected.” No other useful data are available on which to base the IDLH.

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂CrO₄, 2Na</td>
<td>Gad et al. 1986</td>
<td>oral</td>
<td>51.9</td>
<td>---</td>
<td>113 mg Cr(VI)/m³</td>
<td>11 mg Cr(VI)/m³</td>
</tr>
<tr>
<td>CrO₃</td>
<td>Chi J Prev Med 1980</td>
<td>oral</td>
<td>127</td>
<td>80</td>
<td>462 mg Cr(VI)/m³</td>
<td>46 mg Cr(VI)/m³</td>
</tr>
<tr>
<td></td>
<td>Kobayashi et al. 1976</td>
<td>oral</td>
<td>80</td>
<td>80</td>
<td>291 mg Cr(VI)/m³</td>
<td>29 mg Cr(VI)/m³</td>
</tr>
</tbody>
</table>

Human data ................................................. A worker exposed for several days to concentrations of chromic acid mist of about 20 to 30 mg/m³ (equivalent to about 10 to 15 mg Cr(VI)/m³) experienced cough, headache, dyspnea, and substernal pain; the signs persisted for 2 weeks [ILO 1971]. Another man working on the same process was similarly but less severely affected [ILO 1971]. The fatal oral dose of chromium has been reported to be 1 to 3 grams [Seiler et al. 1988]. [Note: An oral dose of 1 to 3 grams is equivalent to a 70-kg worker being exposed to 867 to 2,000 mg CrO₃/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 15 mg Cr(VI)/m³ [Unchanged]

Basis for revised IDLH: Based on toxicity data in humans [ILO 1971; Seiler et al. 1988], the original IDLH for chromic acid and chromates is not being revised at this time. However, instead of 30 mg/m³ (as CrO₃), the IDLH is being expressed as its equivalent, 15 mg Cr(VI)/m³. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for chromic acid and chromates at concentrations above 0.001 mg Cr(VI)/m³.]
REFERENCES:

Chromium(II) compounds [as Cr(II)]

<table>
<thead>
<tr>
<th>CAS number</th>
<th>NIOSH REL</th>
<th>Current OSHA PEL</th>
<th>1989 OSHA PEL</th>
<th>1993-1994 ACGIH TLV</th>
<th>Description of Substance</th>
<th>Original (SCP) IDLH*</th>
<th>Basis for original (SCP) IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Same as current PEL</td>
<td>0.5 mg/m³ TWA</td>
<td>No Evidence [<em>Note: &quot;Effective&quot; IDLH = 250 mg Cr(II)/m³ — see discussion below.]</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Same as current PEL</td>
<td>0.5 mg/m³ TWA</td>
<td>Same as current PEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Same as current PEL</td>
<td>0.5 mg/m³ TWA</td>
<td>Varies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrCl₂</td>
<td>Smyth et al. 1969</td>
<td>oral</td>
<td>1.870</td>
<td>---</td>
<td>5.528 mg Cr(II)/m³</td>
<td>553 mg Cr(II)/m³</td>
</tr>
</tbody>
</table>

Human data

It has been reported that divalent chromium compounds (i.e., chromous salts) have a low order of toxicity and provide little industrial hazard [ACGIH 1971; Akatsuka and Fairhall 1934; Clayton and Clayton 1981].

Revised IDLH: 250 mg Cr(II)/m³

Revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of chromium(II) compounds would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for chromium(II) compounds is 250 mg Cr(II)/m³ based on being 500 times the NIOSH REL of 0.5 mg Cr(II)/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).

REFERENCES:

Chromium(III) compounds [as Cr(III)]

<table>
<thead>
<tr>
<th>CAS number</th>
<th>Varias</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>0.5 mg/m³ TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>0.5 mg/m³ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>0.5 mg/m³ TWA</td>
</tr>
</tbody>
</table>

**Description of Substance**

**Original (SCP) IOLH**

No Evidence [Note: “Effective” IDLH = 250 mg Cr(III)/m³ – see discussion below.]

ACGIH [1971] noted that early studies indicated trivalent chromium to be essentially nontoxic [Akatsuka and Fairhall 1934]. The available toxicological data show no evidence that an acute exposure to a high concentration of soluble chromic salts would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the “most protective” respirators are permitted for use in concentrations exceeding 500 × the OSHA PEL; in the case of chromium(III) compounds, 500 × the OSHA PEL of 0.5 mg Cr(III)/m³ is 250 mg Cr(III)/m³.

**Short-term exposure guidelines**

**ACUTE TOXICITY DATA**

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrCl₂, Rat</td>
<td>Gekkan Yakuji 1980</td>
<td>oral</td>
<td>1,870</td>
<td>-----</td>
<td>4,320 mg Cr(III)/m³</td>
<td>432 mg Cr(III)/m³</td>
</tr>
<tr>
<td>Cr₂, G. pig</td>
<td>Gekkan Yakuji 1980</td>
<td>oral</td>
<td>150</td>
<td>-----</td>
<td>500 mg Cr(III)/m³</td>
<td>50 mg Cr(III)/m³</td>
</tr>
<tr>
<td>Cr(SO₄)₂, Rat</td>
<td>Gekkan Yakuji 1980</td>
<td>oral</td>
<td>2,250</td>
<td>-----</td>
<td>4,961 mg Cr(III)/m³</td>
<td>496 mg Cr(III)/m³</td>
</tr>
<tr>
<td></td>
<td>Sangyo Igaku 1978</td>
<td>oral</td>
<td>110</td>
<td>-----</td>
<td>168 mg Cr(III)/m³</td>
<td>17 mg Cr(III)/m³</td>
</tr>
</tbody>
</table>

**Human data**

It has been reported that trivalent chromium compounds (i.e., chromic salts) have a low order of toxicity and provide little industrial hazard [ACGIH 1971; Akatsuka and Fairhall 1934; Clayton and Clayton 1981].

**Revised IDLH: 25 mg Cr(III)/m³**

**Basis for revised IDLH:** No inhalation toxicity data are available on which to base an IDLH for chromium(III) compounds. Therefore, the revised IDLH for chromium(III) compounds is 25 mg Cr(III)/m³ based on acute oral toxicity data in animals [Gekkan Yakuji 1980; Sangyo Igaku 1978]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 25 mg Cr(III)/m³.
Chromium(III) compounds [as Cr(III)] (continued)

REFERENCES:

Chromium metal (as Cr)

CAS number ................................................................. 7440-47-3
NIOSH REL ................................................................. 0.5 mg/m³ TWA
Current OSHA PEL ......................................................... 1 mg/m³ TWA
1989 OSHA PEL .............................................................. Same as current PEL
1993-1994 ACGIH TLV ...................................................... 0.5 mg/m³ TWA
Description of Substance .................................................. Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.
LEL ................................................................. Noncombustible Solid
Original (SCP) IDLH* ....................................................... No Evidence [*Note: "Effective" IDLH = 500 mg Cr/m³ - see discussion below.]

The available toxicological data show no evidence that an acute exposure to a high concentration of chromium metal would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL of 1 mg Cr/m³, or 500 mg Cr/m³.

None developed

Short-term exposure guidelines ............................................

ACUTE TOXICITY DATA

Animal or human data ........................................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 250 mg Cr/m³

Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of chromium metal would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for chromium metal is 250 mg Cr/m³ based on being 500 times the NIOSH REL of 0.5 mg Cr/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).
Coal tar pitch volatiles

CAS number ........................................... 65996-93-2
NIOSH REL ........................................... 0.1 mg/m³ (cyclohexane-extractable fraction) TWA; NIOSH considers coal tar pitch volatiles to be potential occupational carcinogens as defined by the OSHA carcinogen policy [29 CFR 1990].
Current OSHA PEL ..................................... 0.2 mg/m³ (benzene-soluble fraction) TWA
1989 OSHA PEL ......................................... Same as current PEL
1993-1994 ACGIH TLV .................................. 0.2 mg/m³ (benzene-soluble fraction) TWA, A1
Description of Substance .................................. Black or dark-brown amorphous residue.
LEL .............................................................. Unknown
Original (SCP) IDLH ........................................... 700 mg/m³ [Note: "Effective" IDLH = 400 mg/m³ — see discussion below.]
Basis for original (SCP) IDLH ................................. Redmond et al. [1972] have shown that the major health effects resulting from long-term repeated exposure to coal tar pitch volatiles (CTPV) are cancer of the lung, kidney, and skin; however, no studies have been made on carcinogenic effects by any route from single short-term exposure to CTPV that could relate to a 30-minute IDLH. Therefore, reliance must be placed on comparative data of single versus repeated carcinogenic doses of benzo(a)pyrene (B(a)P), a known component of CTPV. Bingham [1971] reported that B(a)P applied in a single dose of 2 mg to the skin of mice yielded tumors in 10% to 20% of the animals whereas 0.01 mg B(a)P applied in a noncarcinogenic solvent applied to the skin 3 times/week for 50 weeks yielded tumors in 50% of the animals. Thus, a single dose producing about 1/3 the number of tumors was 200 times the repeated 3 times/week dose. Using this factor and the value of 0.6 mg/m³ CTPV reported by Mazumdar et al. [1975] as safe for coke oven workers, a total dose IDLH of 120 mg CTPV (as benzene solubles) is calculated; by using 7.5 liters as the minute volume of coke oven workers and a 75% lung retention of CTPV a 30-minute IDLH is calculated to be about 700 mg/m³ (as benzene solubles). However, because of the assigned protection factor afforded by each device, 400 mg/m³ (i.e., 2,000 x the PEL) is the concentration above which only the "most protective" respirators are permitted.
Short-term exposure guidelines ................................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>Potapov et al. 1971</td>
<td>370 mg/m³</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
Coal tar pitch volatiles (continued)

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg)</th>
<th>LD&lt;sub&gt;90&lt;/sub&gt; (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>Potapova et al. 1972</td>
<td>oral</td>
<td>2,700</td>
<td>----</td>
<td>18,900 mg/m³</td>
<td>1,890 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Potapova et al. 1971</td>
<td>oral</td>
<td>800</td>
<td>----</td>
<td>5,600 mg/m³</td>
<td>560 mg/m³</td>
</tr>
<tr>
<td>Anthracene</td>
<td>Nogochy 1969</td>
<td>oral</td>
<td>----</td>
<td>&gt;17,00</td>
<td>&gt;119,000 mg/m³</td>
<td>&gt;11,900 mg/m³</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>Rakhmanina 1964</td>
<td>oral</td>
<td>700</td>
<td>----</td>
<td>4,900 mg/m³</td>
<td>490 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data

The major health effects resulting from long-term repeated exposure to coal tar pitch volatiles (CTPV) are cancer of the lung, kidney, and skin [Redmond et al. 1972]; however, no studies have been made on carcinogenic effects by any route from single short-term exposure to CTPV that could relate to a 30-minute IDLH. Therefore, reliance must be placed on comparative data of single versus repeated carcinogenic doses of benzo(a)pyrene [B(a)P], a known component of CTPV. It has been reported that B(a)P applied in a single dose of 2 mg to the skin of mice yielded tumors in 10% to 20% of the animals whereas 0.01 mg B(a)P applied in a noncarcinogenic solvent applied to the skin 3 times/week for 50 weeks yielded tumors in 50% of the animals [Bingham 1971]. Thus, a single dose producing about 1/3 the number of tumors was 200 times the repeated 3 times/week dose. Using this factor and the value of 0.6 mg/m³ CTPV reported as safe for coke oven workers [Mazumdar et al. 1975], a total dose IDLH of 120 mg CTPV (as benzene solubles) is calculated; by using 50 liters as the minute volume of workers and 100% lung retention of CTPV, a 30-minute IDLH is calculated to be about 80 mg/m³ (as benzene solubles).

Human data

None relevant for use in determining the revised IDLH.

Revised IDLH: 80 mg/m³ (as the benzene-soluble fraction)

Based on toxicity data in animals [Bingham 1971; Mazumdar et al. 1975; Redmond et al. 1972] (see discussion above).

[Note: NIOSH recommends as part of its carcinogen policy that the “most protective” respirators be worn for coal tar pitch volatiles at concentrations above 0.1 mg/m³ (cyclohexane-extractable fraction).]

REFERENCES:

Cobalt metal dust and fume (as Co)

CAS number ........................................... . 7440-48-4 (Metal)
NIOSH REL ........................................... .
Current OSHA PEL .................................... . 0.05 mg/m³ TWA
1989 OSHA PEL .................................... . 0.1 mg/m³ TWA
1993-1994 ACGIH TLV .............................. . 0.05 mg/m³ TWA
Description of Substance ............................. . Varies
Original (SCP) IDLH ................................... . 20 mg Co/m³
Basis for original (SCP) IDLH ........................... .

Browning [1969] made the statement that "metallic cobalt by inhalation and soluble salts by intratracheal injection act as acute lung irritants, producing oedema, and hemorrhage with a considerable outpouring of fluid from the capillaries in the peritoneal cavity. Many of the animals subjected to intratracheal injection of a suspension of cobalt metal dust developed acute pneumonia, often rapidly fatal as an initial reaction." Because no data on acute inhalation toxicity are available on which to base an IDLH for cobalt metal fume and dust, the chosen IDLH is based on the statement by Patty [1963] that animals chronically exposed to a cobalt-metal blend at a concentration of 20 mg Co/m³ developed lesions in the lungs.

Short-term exposure guidelines ................. .

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₃₂ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>FDRL 1984</td>
<td>oral</td>
<td>6.170</td>
<td>---</td>
<td>43,190 mg Co/m³</td>
<td>4.319 mg Co/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Simesen 1939</td>
<td>oral</td>
<td>---</td>
<td>750</td>
<td>5,260 mg Co/m³</td>
<td>525 mg Co/m³</td>
</tr>
</tbody>
</table>

Other animal data ................................ . It has been reported that animals chronically exposed for 3 years to a cobalt-metal blend at a concentration of 20 mg Co/m³ developed fibrotic lesions in the lungs [Patty 1963].

Human data ........................................... . None relevant for use in determining the revised IDLH.

Revised IDLH: 20 mg Co/m³ [Unchanged]

Basis for revised IDLH: Based on chronic toxicity data in animals [Patty 1963], the original IDLH for cobalt metal dust and fume (20 mg Co/m³) is not being revised at this time. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

Copper (dusts and mists, as Cu)

CAS number ........................................... 7440-50-8 (Metal)
NIOSH REL ........................................... 1 mg/m³ TWA
1989 OSHA PEL ....................................... Same as current PEL
Current OSHA PEL .................................... 1 mg/m³ TWA
1983-1994 ACGIH TLV ................................ 1 mg/m³ TWA

Description of Substance ................................. No Evidence (*Note: "Effective" IDLH = 2,000 mg Cu/m³ — see discussion below.)

Basis for original (SCP) IDLH .......................... There is no evidence that an acute exposure to a high concentration of copper dusts and mists could impede escape within 30 minutes. Browning [1969] noted that there is little evidence that copper presents a serious industrial hazard, either from acute or chronic poisoning. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 × the OSHA PEL of 1 mg Cu/m³ (i.e., 2,000 mg Cu/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 2,000 mg Cu/m³.

Short-term exposure guidelines .......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Lc50</th>
<th>Lc10</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu(OH)₂</td>
<td>Worthing 1991</td>
<td>&gt;2,000 mg/m³</td>
<td></td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50 (mg/kg)</th>
<th>LD10 (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu(OH)₂</td>
<td>Sino 1991</td>
<td>oral</td>
<td>3,000</td>
<td>4,559</td>
<td>456 mg Cu/m³</td>
<td></td>
</tr>
<tr>
<td>CuCl</td>
<td>Coultan and Korte 1975</td>
<td>oral</td>
<td>140</td>
<td>629</td>
<td>63 mg Cu/m³</td>
<td></td>
</tr>
<tr>
<td>CuCl₂</td>
<td>Maxhold 1977</td>
<td>oral</td>
<td>595</td>
<td>1,457</td>
<td>146 mg Cu/m³</td>
<td></td>
</tr>
<tr>
<td>CuSO₄</td>
<td>Siegle and Sisler 1977</td>
<td>oral</td>
<td>300</td>
<td>836</td>
<td>84 mg Cu/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ............................................. It has been stated that there is little evidence that copper presents a serious industrial hazard, either from acute or chronic poisoning [Browning 1969]. Inhalation of copper salts can result in irritation of the nasal mucous membranes [Clayton and Clayton 1981]. A lethal oral dose of 857 mg of CuSO₄/kg (equivalent to 341 mg Cu/kg) has been reported [Csiky 1958]. [Note: An oral dose of 341 mg Cu/kg is equivalent to a 70-kg worker being exposed to 227 mg Cu/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]
Copper (dusts and mists, as Cu) (continued)

Revised IDLH: 100 mg Cu/m³

Basis for revised IDLH: The revised IDLH for copper dusts and mists is 100 mg Cu/m³ based on acute oral toxicity data in humans [Csiky 1958] and animals [Coulston and Korte 1975; Marhold 1977; Siegel and Sisler 1977]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data in workers.

REFERENCES:

Copper fume (as Cu)

<table>
<thead>
<tr>
<th>CAS number</th>
<th>1317-38-0 (CuO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>0.1 mg/m³ TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>0.1 mg/m³ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>0.2 mg/m³ TWA</td>
</tr>
</tbody>
</table>

Description of Substance: Finely divided black particulate dispersed in air.

LEL: Noncombustible Solids

Original (SCP) IDLH*: No Evidence [*Note: "Effective" IDLH = 200 mg Cu/m³ – see discussion below.]

Basis for original (SCP) IDLH: There is no evidence that an acute exposure to a high concentration of copper fume could impede escape within 30 minutes. Browning [1969] noted that there is little evidence that copper presents a serious industrial hazard, either from acute or chronic poisoning. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 0.1 mg Cu/m³ (i.e., 200 mg Cu/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 200 mg Cu/m³.

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Animal data: None relevant for use in determining the revised IDLH.

Human data: Exposure to copper fume causes upper respiratory tract irritation, metallic taste, nausea, and metal fume fever. It has been reported that no ill effects resulted from exposures to copper fumes at concentrations up to 0.4 mg Cu/m³ [Luxon 1972] and that there is little evidence that copper presents a serious industrial hazard, either from acute of chronic poisoning [Browning 1969].

Revised IDLH: 100 mg Cu/m³

Basis for revised IDLH: The revised IDLH for copper fume is 100 mg Cu/m³ based on an analogy to copper dusts and mists which have a revised IDLH of 100 mg Cu/m³. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 100 mg Cu/m³.

REFERENCES:

Cotton dust (raw)

<table>
<thead>
<tr>
<th>Description of Substance</th>
<th>Original (SCP) IDLH*</th>
<th>Basis for original (SCP) IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton dust (raw)</td>
<td>None</td>
<td>No Evidence [*Note: &quot;Effective&quot; IDLH = 500 mg/m² — see discussion below.]</td>
</tr>
</tbody>
</table>

The available toxicological data do not indicate that an acute exposure to a high concentration of cotton dust would cause death or any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances, it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL; in the case of cotton dust (raw), 500 x the OSHA PEL of 1 mg/m³ is 500 mg/m³.

None developed

### ACUTE TOXICITY DATA

<table>
<thead>
<tr>
<th>Animal or human data</th>
<th>None relevant for use in determining the revised IDLH.</th>
</tr>
</thead>
</table>

Revised IDLH: 100 mg/m³

Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of cotton dust (raw) would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for cotton dust (raw) is 100 mg/m³ based on being 500 times the NIOSH REL of 0.2 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates). [Note: The 1 mg/m³ OSHA PEL for cotton dust applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and ginning. In other sectors involving cotton, OSHA currently requires in 29 CFR 1910.1043 that workers be provided with and required to wear and use a powered, air-purifying respirator equipped with high-efficiency particulate filters in concentrations exceeding 100 x the applicable OSHA PEL of either 0.2, 0.5, or 0.75 mg/m³.]
Crag® herbicide

CAS number ................................. 136-78-7
NIOSH REL .................................
Current OSHA PEL ............................
1989 OSHA PEL ..............................
1993-1994 ACGIH TLV ........................

Description of Substance ..........
Colorless to white crystalline, odorless solid.
Noncombustible Solid

Original (SCP) IOLH ........................
According to many sources, Crag® herbicide is not very toxic to mammals. Because no acute inhalation toxicity data are available, the chosen IOLH has been estimated from the rat oral LD₅₀ of 730 mg/kg [Gunther 1962 cited by NIOSH 1976].
None developed

Short-term exposure guidelines .......... ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1961</td>
<td>oral</td>
<td>480</td>
<td>----</td>
<td>3,360 mg/m³</td>
<td>336 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gunther 1962</td>
<td>oral</td>
<td>730</td>
<td>----</td>
<td>5,210 mg/m³</td>
<td>511 mg/m³</td>
</tr>
<tr>
<td>Mammal</td>
<td>Sine 1991</td>
<td>oral</td>
<td>1,210</td>
<td>----</td>
<td>8,610 mg/m³</td>
<td>861 mg/m³</td>
</tr>
</tbody>
</table>

Human data .................................. None relevant for use in determining the revised IOLH.

Revised IOLH: 500 mg/m³

According to many sources, Crag® herbicide is not very toxic to mammals. Because no acute inhalation toxicity data are available, the chosen IOLH has been estimated from the rat oral LD₅₀ of 730 mg/kg [Gunther 1962 cited by NIOSH 1976]. This may be a conservative value due to the lack of acute toxicity data for workers.

REFERENCES:

**Cresol (o-, m-, p-isomers)**

- **CAS numbers**
  - o-Cresol: 95-48-7
  - m-Cresol: 108-39-4
  - p-Cresol: 106-44-5

- **NIOSH REL**
  - 2.3 ppm (10 mg/m³) TWA

- **Current OSHA PEL**
  - 5 ppm (22 mg/m³) TWA [skin]

- **1983-1994 ACGIH TLV**
  - Same as current PEL

- **Description of Substance**
  - White crystals with a sweet, tarry odor.

- **LEL [100% F]**
  - 1.4% (10% LEL at 30°C), 1,400 ppm

- **Current OSHA PEL**
  - 5 ppm (22 mg/m³) TWA [skin]

- **1993-1994 ACGIH TLV**
  - 5 ppm (22 mg/m³) TWA [skin]

- **Basis for original (SCP) IDLH**
  - 250 ppm

- **Basis for original (SCP) IDLH**
  - The only quantitative acute inhalation toxicity data available are those cited by Patty [1963]. Patty [1963] reported that rats exposed for 8 hours to a saturated concentration of cresol vapors survived the exposure [Smyth 1956]. The chosen IDLH is based on the isomer with the highest vapor pressure, that of o-cresol, which yields a saturated concentration of 323 ppm at 25°C. The chosen IDLH appears to be conservative because no rats died as a result of this exposure which was for 8 hours. Based on the rat oral LD₅₀ of 207 mg/kg for p-cresol [Biofax 1969 cited by NIOSH 1976], an IDLH of 250 ppm is reasonable.

- **Short-term exposure guidelines**
  - None developed

### ACUTE TOXICITY DATA

#### Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cresols</td>
<td>Back et al. 1972</td>
<td>oral</td>
<td>1,454</td>
<td>----</td>
<td>2,262 ppm</td>
<td>226 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Back et al. 1972</td>
<td>oral</td>
<td>561</td>
<td>----</td>
<td>1,139 ppm</td>
<td>134 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Kuroki et al. 1982</td>
<td>oral</td>
<td>760</td>
<td>----</td>
<td>1,802 ppm</td>
<td>118 ppm</td>
</tr>
<tr>
<td>o-Cresol</td>
<td>Biofax 1969b</td>
<td>oral</td>
<td>121</td>
<td>----</td>
<td>188 ppm</td>
<td>19 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann and Witherup 1944</td>
<td>oral</td>
<td>1,350</td>
<td>----</td>
<td>2,100 ppm</td>
<td>210 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Zabol 1974</td>
<td>oral</td>
<td>344</td>
<td>----</td>
<td>535 ppm</td>
<td>54 ppm</td>
</tr>
<tr>
<td>m-Cresol</td>
<td>Biofax 1969a</td>
<td>oral</td>
<td>242</td>
<td>----</td>
<td>376 ppm</td>
<td>38 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann and Witherup 1944</td>
<td>oral</td>
<td>2,020</td>
<td>----</td>
<td>3,142 ppm</td>
<td>324 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Zabol 1974</td>
<td>oral</td>
<td>828</td>
<td>----</td>
<td>1,288 ppm</td>
<td>129 ppm</td>
</tr>
<tr>
<td>p-Cresol</td>
<td>Biofax 1969c</td>
<td>oral</td>
<td>207</td>
<td>----</td>
<td>322 ppm</td>
<td>32 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann and Witherup 1944</td>
<td>oral</td>
<td>1,800</td>
<td>----</td>
<td>2,300 ppm</td>
<td>240 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Zabol 1974</td>
<td>oral</td>
<td>344</td>
<td>----</td>
<td>535 ppm</td>
<td>54 ppm</td>
</tr>
</tbody>
</table>

**Other animal data**
- Rats exposed to a saturated concentration of cresol vapors (about 150 to 380 ppm) survived the exposure for 8 hours [Smyth 1956].

**Human data**
- None relevant for use in determining the revised IDLH.

| Revised IDLH: 250 ppm [Unchanged] |
| basis for revised IDLH: Based on acute inhalation toxicity data in animals [Smyth 1956], the original IDLH for cresol (250 ppm) is not being revised at this time. |

**REFERENCES:**

Cresol (α-, m-, p-isomers) (continued)

Crotonaldehyde

CAS number .......................................................... 123-73-9 (trans-isomer)
NIOSH REL .................................................................
Current OSHA PEL ...................................................... 2 ppm (6 mg/m³) TWA
1989 OSHA PEL ............................................................ Same as current PEL
1993-1994 ACGIH TLV .................................................. 2 ppm (5.7 mg/m³) TWA
Description of Substance .............................................. Water-white liquid with a suffocating odor.
LEL ........................................................................ 2.1% (10% LEL, 2,100 ppm)
Original (SCP) IDLH ..................................................... 400 ppm
Basis for original (SCP) IDLH The chosen IDLH is based on the report by Rinehart [1967] that a 1-hour exposure of 400 ppm is a lethal concentration for rats. None developed
Short-term exposure guidelines ............................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (ppm)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Rinehart 1967</td>
<td>600</td>
<td>600</td>
<td>30 min</td>
<td>600 ppm (1.0)</td>
<td>60 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Rinehart 1967</td>
<td>400</td>
<td>732</td>
<td>1 hr</td>
<td>732 ppm (1.78)</td>
<td>73 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Skog 1950</td>
<td>1,575</td>
<td>1,275</td>
<td>30 min</td>
<td>1,275 ppm (2.0)</td>
<td>138 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>ten Berge et al. 1986</td>
<td>519</td>
<td>1,647</td>
<td>2 hr</td>
<td>1,647 ppm (3.17)</td>
<td>166 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Trofimov 1962</td>
<td>1,500</td>
<td>1,500</td>
<td>30 min</td>
<td>1,500 ppm (1.0)</td>
<td>150 ppm</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 1.2 [ten Berge et al. 1986].

Other animal data ...................................................... RD₅₀ (mouse), 3.53 - 4.88 ppm [Steinhagen and Barrow 1984].

Human data .............................................................. Exposure to 4.1 ppm for 15 minutes was highly irritating to the nose and upper respiratory tract and produced lacrimation in 30 seconds [Sim and Pattie 1957]. In another study, exposures to 45 ppm proved very disagreeable after a few seconds, with conjunctival irritation evident [Rinehart 1967].

Revised IDLH: 50 ppm

Basis for revised IDLH: The revised IDLH for crotonaldehyde is 50 ppm based on acute inhalation toxicity data in humans [Rinehart 1967] and animals [Rinehart 1967].

REFERENCES:

Cumene

CAS number ......................................................... 98-82-8
NIOSH REL .......................................................... 
Current OSHA PEL .................................................... 50 ppm (245 mg/m^3) TWA [skin]
1989 OSHA PEL ...................................................... Same as current PEL
1993-1994 ACGIH TLV .............................................. 50 ppm (245 mg/m^3) TWA [skin]

Description of Substance ........................................ Colorless liquid with a sharp, penetrating, aromatic odor.

LEL ........................................................................... 0.9% (10% LEL, 900 ppm)

Original (SCP) IDLH .................................................. 8.000 ppm

Basis for original (SCP) IDLH ...................................... The chosen IDLH is based on the rat 4-hour LC_{50} of 8,000 ppm [Smyth et al. 1951 cited by AIHA 1981].

Short-term exposures guidelines ................................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{50} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>8,000</td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>5,600 ppm</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Werner et al. 1944</td>
<td>2,000</td>
<td>7 hr</td>
<td>4,800 ppm (2.4)</td>
<td>480 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{50} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>Sologub 1971</td>
<td>oral</td>
<td>12,750</td>
<td>17,850 ppm</td>
<td>1,785 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Wolf et al. 1956</td>
<td>oral</td>
<td>4,900</td>
<td>1,960 ppm</td>
<td>196 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ................................................. Daily exposures of rats to 500 ppm for 5 months resulted in no significant blood changes, although hyperemia and congestion were noted in the lungs, liver, and kidneys [Clayton and Clayton 1981].

Human data .......................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 900 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals [Clayton and Clayton 1981; Smyth et al. 1951], a value of about 1,500 ppm would have been appropriate. However, the revised IDLH for cumene is 900 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 0.9%).

REFERENCES:

Cyanides (as CN)

CAS number ......................................... Varies
NIOSH REL .................................. 5 mg/m³ (4.7 ppm) 10-minute CEILING
Current OSHA PEL ............................ Same as current PEL
1989 OSHA PEL ................................ 5 mg/m³ TWA[skin]
1993·1994 ACGIH TLV ......................... Varies

Description of Substance ......................
Original (SCP) IDLH ............................. 50 mg/m³ (as CN)
Basis for original (SCP) IDLH ................. No useful acute inhalation toxicity data are available on which to base the IDLH for cyanides. For this draft technical standard, therefore, the chosen IDLH is based on an analogy with hydrogen cyanide. According to ACGIH [1971], Patty [1963] reported that hydrogen cyanide at 110 to 135 ppm (120 to 150 mg/m³) might be fatal to man after 0.5 to 1 hour or later, or dangerous to life; 45 to 54 ppm (50 to 60 mg/m³) could be tolerated for 0.5 to 1 hour without immediate or late effects [Flury and Zemik 1931; Dudley et al. 1942].

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD (as CN)</th>
<th>Derived value (as CN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaCN</td>
<td>Sheep</td>
<td>oral</td>
<td>4</td>
<td>----</td>
<td>15 mg/m³</td>
<td>1.5 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Rat</td>
<td>oral</td>
<td>6.44</td>
<td>----</td>
<td>22 mg/m³</td>
<td>2.2 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Mammal</td>
<td>oral</td>
<td>15</td>
<td>----</td>
<td>55 mg/m³</td>
<td>5.6 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Rat</td>
<td>oral</td>
<td>8</td>
<td>----</td>
<td>10 mg/m³</td>
<td>3.0 mg/m³</td>
</tr>
<tr>
<td>KCN</td>
<td>Rabbit</td>
<td>oral</td>
<td>5</td>
<td>----</td>
<td>14 mg/m³</td>
<td>1.4 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Rat</td>
<td>oral</td>
<td>10</td>
<td>----</td>
<td>28 mg/m³</td>
<td>2.8 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Mouse</td>
<td>oral</td>
<td>5</td>
<td>----</td>
<td>14 mg/m³</td>
<td>1.4 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Sheehy and May 1968</td>
<td>oral</td>
<td>8.5</td>
<td>----</td>
<td>24 mg/m³</td>
<td>2.4 mg/m³</td>
</tr>
<tr>
<td>Pb(CN)</td>
<td>Rat</td>
<td>i.p.</td>
<td>----</td>
<td>100</td>
<td>141 mg/m³</td>
<td>14 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................ Absorption of the alkali cyanides in amounts as low as 50 to 100 mg from a single, instantaneous dose may be followed by immediate collapse and cessation of respiration [Clayton and Clayton 1982]. It has been stated that although the fatal oral dose will vary considerably, depending on whether or not food is present in the stomach, it is probably in the order of 1 to 2 mg/kg [Clayton and Clayton]. [Note: An oral dose of 50 to 100 mg or 1 to 2 mg/kg is equivalent to a 70-kg worker being exposed to about 50 mg/m³ (as CN) for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 25 mg/m³ (as CN)

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for hydrogen cyanide. Therefore, the revised IDLH for cyanides is 25 mg/m³ (as CN) based on acute oral toxicity data in humans [Clayton and Clayton 1982].
REFERENCES:

Cyclohexane

CAS number ................................. 110-62-7
NIOSH REL .................................. 
Current OSHA PEL .......................... 300 ppm (1.050 mg/m³) TWA
1989 OSHA PEL ............................. Same as current PEL
1993-1994 ACGIH TLV ...................... 300 ppm (1.030 mg/m³) TWA
Description of Substance .................. Colorless liquid with a sweet, chloroform-like odor.
LEL ......................................... 1.3% (10% LEL, 1,300 ppm)
Original (SCP) IDLH ....................... The chosen IDLH is based on a statement by Patty (1963) that 12,600 ppm produced evidence of lethargy, narcosis, increased respiration rate, and convulsions in animals (Treon et al. 1943). Also, AIHA [1963] reported that 9,300 ppm for 30 minutes resulted in restlessness, impaired coordination, and exhaustion, but no narcosis or deaths in cats, rabbits, and pigs (Flury and Zemik 1931).

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (ppm)</th>
<th>LC&lt;sub&gt;10&lt;/sub&gt; (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Lazarew 1929</td>
<td>17,543</td>
<td>2 hr</td>
<td></td>
<td>27,429 ppm (1.6)</td>
<td>2,743 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1943</td>
<td>26,600</td>
<td>1 hr</td>
<td></td>
<td>33,250 ppm (1.25)</td>
<td>3,325 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg)</th>
<th>LD&lt;sub&gt;10&lt;/sub&gt; (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kimura et al. 1971</td>
<td>oral</td>
<td>12.705</td>
<td></td>
<td>25,410 ppm</td>
<td>2,541 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>NPIRI 1974</td>
<td>oral</td>
<td>8.13</td>
<td></td>
<td>1,626 ppm</td>
<td>163 ppm</td>
</tr>
</tbody>
</table>

Human data .................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 1,300 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals (Lazarew 1929; Treon et al. 1943), a value of about 3,000 ppm would have been appropriate. However, the revised IDLH for cyclohexane is 1,300 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.3%).

REFERENCES:

Cyclohexanol

CAS number .............................................. 108-93-0
NIOSH REL .............................................. 50 ppm (200 mg/m^3) TWA [skin]
Current OSHA PEL ....................................... 50 ppm (200 mg/m^3) TWA
1989 OSHA PEL ........................................... 50 ppm (200 mg/m^3) TWA [skin]
1993-1994 ACGIH TLY .................................. 50 ppm (200 mg/m^3) TWA [skin]

Description of Substance
Sticky solid or colorless to light-yellow liquid (above 77°F) with a camphor-like odor.

LEL .............................................................. Unknown
Original (SCP) IDLH ....................................... 3,500 ppm
Basis for original (SCP) IDLH ................................ No acute inhalation toxicity data are available on which to base an IDLH for cyclohexanol. The chosen IDLH, therefore, has been estimated from the rabbit oral LD_{50} of 2.2 to 2.6 g/kg [Treon et al. 1943 cited in Browning 1965]. The chosen IDLH of 3,500 ppm (14.3 g/m^3) is probably conservative, because the lower end of the range of the LD_{50} values (i.e., 2.2 g/kg) has been used to estimate the IDLH.

Basis for revised IDLH: The revised IDLH for cyclohexanol is 400 ppm based on acute oral toxicity data in animals [Bar and Griepentrog 1967; Treon et al. 1943].

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{50} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Bar and Griepentrog 1967</td>
<td>oral</td>
<td>2.060</td>
<td>-----</td>
<td>3,458 ppm</td>
<td>346 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1943</td>
<td>oral</td>
<td>2,200-2,600</td>
<td>-----</td>
<td>3,693-4,365</td>
<td>369-437 ppm</td>
</tr>
</tbody>
</table>

Human data ............................................ The estimated acceptable concentration for 8 hours was reported in volunteers to be less than 100 ppm [Nelson et al. 1943].

Revised IDLH: 400 ppm

REFERENCES:

Cyclohexanone

CAS number ................................................. 108-94-1
NIOSH REL .....................................................
Current OSHA PEL ...........................................
1989 OSHA PEL ............................................
1993-1994 ACGIH TLV ......................................

Description of Substance ................................ Water-white to pale-yellow liquid with a peppermint- or acetone-like odor.

LEL(@212°F) .................................................
Original (SCP) IDLH ........................................
Basis for original (SCP) IDLH ..............................

Short-term exposure guidelines ............................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Gupta et al. 1979</td>
<td>4,706</td>
<td>6,776</td>
<td>1.5 hr</td>
<td>6,776 ppm (1.44)</td>
<td>678 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>4,000</td>
<td>8,000</td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>1,600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>4,000</td>
<td>8,000</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................
Human data ..................................................

Revised IDLH: 700 ppm

Basis for revised IDLH: The revised IDLH for cyclohexanone is 700 ppm based on acute inhalation toxicity data in animals [Gupta et al. 1979; Smyth 1956].

REFERENCES:

135
Cyclohexene

CAS number ................................. 110-83-8
NIOSH REL .................................. 
Current OSHA PEL ......................... 300 ppm (1,015 mg/m³) TWA
1988 OSHA PEL ......................... Same as current PEL
1993-1994 ACGIH TLV .................... 300 ppm (1,010 mg/m³) TWA
Description of Substance .......... Colorless liquid with a sweet odor.
LEL ......................................... 
Original (SCP) IDLH ....................... 10,000 ppm
Basis for original (SCP) IDLH ........ Because very little data are available concerning the effects produced by acute inhalation exposure to cyclohexene, the chosen IDLH is based on an analogy with cyclohexane which has an IDLH of 10,000 ppm.

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>Lazarew 1929</td>
<td>13,196</td>
<td></td>
<td>2 hr</td>
<td>21,114 ppm</td>
<td>2,111 ppm</td>
</tr>
</tbody>
</table>

Other animal data: A chronic inhalation study (6 hours/day, 5 days/week for 6 months) in rats, guinea pigs, and rabbits at concentrations of 150, 300, and 600 ppm showed that although significant increases in alkaline phosphatase occurred in all three groups, most of the hematologic parameters measured were within normal limits [Laham 1976].

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 ppm
Basis for revised IDLH: The revised IDLH for cyclohexene is 2,000 ppm based on acute toxicity data in animals [Lazarew 1926]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

Cyclopentadiene

CAS number: 542-92-7

NIOSH REL: 75 ppm (200 mg/m³) TWA

Current OSHA PEL: 75 ppm (200 mg/m³) TWA

1989 OSHA PEL: Same as current PEL

1993-1994 ACGIH TLV: 75 ppm (203 mg/m³) TWA

Description of Substance: Colorless liquid with an irritating, terpene-like odor.

LEL: Unknown

Original (SCP) IDLH: 2,000 ppm

Basis for original (SCP) IDLH: The chosen IDLH is based on the statement by Deichmann and Gerarde [1969] that 4 of 6 rats died from a 4-hour exposure to 2,000 ppm [Smyth et al. 1954].

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Shashkina 1965</td>
<td>34,182</td>
<td>----</td>
<td>2 hr</td>
<td>22,691 ppm (1.6)</td>
<td>2,269 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Shashkina 1965</td>
<td>5,091</td>
<td>----</td>
<td>2 hr</td>
<td>8,155 ppm (1.6)</td>
<td>815 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>LC₅₀: 2,000</td>
<td>----</td>
<td>4 hr</td>
<td>4,000 ppm (2.0)</td>
<td>400 ppm</td>
</tr>
</tbody>
</table>

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 750 ppm

Basis for revised IDLH: The revised IDLH for cyclopentadiene is 750 ppm based on acute inhalation toxicity data in animals [Shashkina 1965]. [Note: It was decided to use the 2-hour lethal concentration data in mice rather than the 4-hour lethal concentration data in rats so as not to magnify the conservatism already present in the correction factors.]

REFERENCES:


2,4-D

CAS number ........................................... 94-75-7
NIOSH REL ..........................................
Current OSHA PEL .................................... 10 mg/m³ TWA
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ................................ 10 mg/m³ TWA
Description of Substance .......................... White to yellow, crystalline, odorless powder.
LEL ..................................................... Noncombustible Solid
Original (SCP) IDLH .................................. 500 mg/m³
Basis for original (SCP) IDLH ......................... The chosen IDLH has been estimated from oral data, because no useful data on acute inhalation toxicity are available. NIOSH [1976] cited a dog oral LD₅₀ of 100 mg/kg [Seabury 1963]. Dudley and Thapar [1972] estimated that the LD₅₀ for humans was between 80 and 800 mg/kg.

Short-term exposure guideline ....................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ adj (mg/m³)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamster</td>
<td>Cabral et al. 1979</td>
<td>Oral</td>
<td>500</td>
<td>3,500 mg/m³</td>
<td>350 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>Seabury 1963</td>
<td>Oral</td>
<td>100</td>
<td>700 mg/m³</td>
<td>70 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Senczuk and Pogorzelska 1980</td>
<td>Oral</td>
<td>347</td>
<td>2,429 mg/m³</td>
<td>243 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Sine 1993</td>
<td>Oral</td>
<td>699</td>
<td>4,893 mg/m³</td>
<td>489 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................... It has been reported that the lethal oral dose ranges from 80 to 800 mg/kg [Dalgaard-Mikkelsen and Poulsen 1962; Dudley and Thapar 1972]. [Note: Oral doses of 80 to 800 mg/kg are equivalent to a worker being exposed to about 3,100 to 37,000 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 100 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for 2,4-D. Therefore, the revised IDLH for 2,4-D is 100 mg/m³ based on acute oral toxicity data in humans [Dalgaard-Mikkelsen and Poulsen 1962; Dudley and Thapar 1972] and animals [Seabury 1963]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

### DDT

**CAS number**

50-29-3

**NIOSH REL**

0.5 mg/m³ TWA; NIOSH considers DDT to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

**Current OSHA PEL**

0.5 mg/m³ TWA (skin)

**1989 OSHA PEL**

Same as current PEL

**1993-1994 ACGIH TLV**

1 mg/m³ TWA (skin)

**Description of Substance**

Colorless crystals or off-white powder with a slight, aromatic odor.

**LEL**

Unknown

**Original (SCP) IDLH**

No Evidence [*Note: "Effective" IDLH = 500 mg/m³ — see discussion below.]*

**Basis for original (SCP) IDLH**

The available toxicological data show no evidence that an acute exposure to a high concentration of DDT would impede escape or cause any irreversible health effects within 30 minutes. AIHA [1959] reported that the concentration immediately hazardous to life is "probably unobtainable," and that DDT has a low order of acute toxicity by inhalation. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL; in the case of DDT, 500 x the OSHA PEL of 1 mg/m³ is 500 mg/m³.

**Short-term exposure guidelines**

**ACUTE TOXICITY DATA**

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>$LD_{50}$ (mg/kg)</th>
<th>$LD_{95}$ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>250</td>
<td>------</td>
<td>1,750 mg/m³</td>
<td>175 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Kenaga 1979</td>
<td>oral</td>
<td>87</td>
<td>------</td>
<td>609 mg/m³</td>
<td>61 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>250</td>
<td>------</td>
<td>1,750 mg/m³</td>
<td>175 mg/m³</td>
</tr>
<tr>
<td>House</td>
<td>Spencer 1953</td>
<td>oral</td>
<td>125</td>
<td>------</td>
<td>845 mg/m³</td>
<td>85 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Truhaut et al. 1974</td>
<td>oral</td>
<td>150</td>
<td>------</td>
<td>1,050 mg/m³</td>
<td>105 mg/m³</td>
</tr>
</tbody>
</table>

**Human data**

Exposure of volunteers to 423 mg/m³ for periods of 1 hour/day for 6 days has been reported to only cause eye irritation [Neal et al. 1994]. It has been reported that 500 mg/kg is the lethal oral dose [Windholz 1983]. [Note: An oral dose of 500 mg/kg is equivalent to a 70-kg worker being exposed to about 23,000 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

**Revised IDLH:** 500 mg/m³

**Basis for revised IDLH:** The revised IDLH for DDT is 500 mg/m³ based on acute toxicity data in humans [Neal et al. 1944; Windholz 1983]. This may be a conservative value due to the lack of relevant acute toxicity data in humans exposed to concentrations above 423 mg/m³. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for DDT at concentrations above 0.5 mg/m³]
REFERENCES:

Decaborane

CAS number ........................................ 17702-41-9
NIOSH REL ...................................... 0.3 mg/m³ (0.05 ppm) TWA, 0.9 mg/m³ (0.15 ppm) STEL [skin]
Current OSHA PEL ............................... 0.3 mg/m³ (0.05 ppm) TWA [skin]
1989 OSHA PEL .................................. 0.3 mg/m³ (0.05 ppm) TWA, 0.9 mg/m³ (0.15 ppm) STEL [skin]
1993-1994 ACGIH TLV .......................... 0.25 mg/m³ (0.05 ppm) TWA, 0.75 mg/m³ (0.15 ppm) STEL [skin]

Description of Substance
Colorless to white crystalline solid with an intense, bitter, chocolate-like odor.

LEL .................................................. Unknown
Original (SCP) IDLH ............................... 100 mg/m³
Basis for original (SCP) IDLH
The chosen IDLH is based on the statement by ILO [1971] that the 4-hour LC₅₀ was 122 to 230 mg/m³ for small animals.

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Schechter 1958</td>
<td>276 mg/m³</td>
<td>-</td>
<td>4 hr</td>
<td>552 mg/m³ (2.0)</td>
<td>55 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Schechter 1958</td>
<td>72 mg/m³</td>
<td>-</td>
<td>4 hr</td>
<td>144 mg/m³ (2.0)</td>
<td>14 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Svirbely 1954</td>
<td>144 mg/m³</td>
<td>-</td>
<td>4 hr</td>
<td>288 mg/m³ (2.0)</td>
<td>29 mg/m³</td>
</tr>
</tbody>
</table>

Human data
None relevant for use in determining the revised IDLH.

Revised IDLH: 15 mg/m³
Basis for revised IDLH: The revised IDLH for decaborane is 15 mg/m³ based on acute inhalation toxicity data in animals [Schechter 1958].

REFERENCES:

Demeton

CAS number ................................................. 8055-48-3
NIOSH REL ..............................................
Current OSHA PEL ..................................................
1989 OSHA PEL ..................................................
1993-1994 ACGIH TLV ...........................................
Description of Substance .........................................
Amber, oily liquid with a sulfur-like odor.

Original (SCP) IDLH ..........................................
Revised (SCP) IDLH ............................................
Short-term exposure guidelines ..................................
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>$L_C_{50}$ (mg/m$^3$)</th>
<th>$L_C_{10}$ (mg/m$^3$)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value (mg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>15</td>
<td>4 hr</td>
<td>30 mg/m$^3$ (2.0)</td>
<td>3.0 mg/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Izmerov et al. 1982</td>
<td>15</td>
<td>4 hr</td>
<td>30 mg/m$^3$ (2.0)</td>
<td>3.0 mg/m$^3$</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>$L_D_{20}$ (mg/kg)</th>
<th>$L_D_{50}$ (mg/kg)</th>
<th>Adjusted LD (mg/kg)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Gurevich et al. 1962</td>
<td>oral</td>
<td>5.5</td>
<td>5.5</td>
<td>1.5 mg/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Rosival et al. 1958</td>
<td>oral</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5 mg/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Schafer 1972</td>
<td>oral</td>
<td>5.5</td>
<td>5.5</td>
<td>1.2 mg/m$^3$</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ........................................

In a subchronic inhalation study, no signs of illness resulted from the first day of exposure to 3 mg/m$^3$ for 2 hours. Tremors were noted on the second day, lacrimation and more severe tremors on the third day, and 10 of the 17 rats died during the fourth day [Deichmann and Rakoczy 1955]. It has been reported that the acute oral and dermal toxicity of demeton in mammals is approximately the same as that of parathion; the American Conference of Governmental Industrial Hygienists TLV for demeton is based on an analogy to parathion [ACGIH 1991].

Human data ..................................................

None relevant for use in determining the revised IDLH.

Revised IDLH: 10 mg/m$^3$

Basis for revised IDLH: The revised IDLH for demeton is 10 mg/m$^3$ based on an analogy with parathion [ACGIH 1991] which has a revised IDLH of 10 mg/m$^3$.

REFERENCES:

Diacetone alcohol

CAS number .................................................. 123-42-2
NIOSH REL .......................................................... 50 ppm (240 mg/m³) TWA
Current OSHA PEL .................................................. 50 ppm (240 mg/m³) TWA
1989 OSHA PEL .................................................. Same as current PEL
1993-1994 ACGIH TLV ............................................. 50 ppm (238 mg/m³) TWA
Description of Substance ........................................ Colorless liquid with a faint, minty odor.
LEL ........................................................................... 1.8% (10% LEL, 1,800 ppm)
Original (SCP) IDLH .................................................. 2,100 ppm
Basis for original (SCP) IDLH ................................... The only acute inhalation toxicity data available on which to base an IDLH for diacetone alcohol is the statement by Patty [1963] that animals exposed for 1 to 3 hours to 2,100 ppm exhibited restlessness, irritation of the membranes, excitement, and later somnolence [Gross as cited by Lehmann and Flury 1943]. The chosen IDLH is obviously conservative.

Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₁₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth and Carpenter 1949</td>
<td>oral</td>
<td>4,000</td>
<td>-</td>
<td>5,797 ppm</td>
<td>580 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Walton et al. 1928</td>
<td>oral</td>
<td>4,683</td>
<td>-</td>
<td>6,743 ppm</td>
<td>674 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Wenzel and Koff 1956</td>
<td>oral</td>
<td>3,950</td>
<td>-</td>
<td>5,725 ppm</td>
<td>571 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................................. Animals exposed for 1 to 3 hours to 2,100 ppm exhibited restlessness, irritation of the membranes, excitement, and later somnolence [Lehmann and Flury 1943].

Human data ............................................................... It has been reported that eye irritation appeared in volunteers exposed for 15 minutes at 100 ppm [Silverman et al. 1946].

Revised IDLH: 1,800 ppm (LEL)

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals [Lehmann and Flury 1943], a value of about 2,000 ppm would have been appropriate. However, the revised IDLH for diacetone alcohol is 1,800 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.8%).

REFERENCES:

Diazomethane

CAS number ......................................................... 334-88-3
NIOSH REL .........................................................
Current OSHA PEL ................................................ 0.2 ppm (0.4 mg/m³) TWA
1989 OSHA PEL .................................................... Same as current PEL
1993-1994 ACGIH TLV ........................................... 0.2 ppm (0.34 mg/m³) TWA
Description of Substance .............................................. Yellow gas with a musty odor.
LEL ................................................................. Unknown
Basis for original (SCP) IDLH ........................................ 2 ppm

The only available acute inhalation toxicity data concerning diazomethane is the statement by Patty [1963] that a 10-minute exposure to 175 ppm was lethal for cats [Flury and Zernik 1931]. This concentration is obviously too high for an IDLH. ACGIH [1971] reported that the toxicity of diazomethane seems comparable to that of phosgene. Therefore, the chosen IDLH is based on an analogy with phosgene, which has an IDLH of 2 ppm.

Short-term exposure guidelines ....................................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Marhold 1986</td>
<td>175</td>
<td>-----</td>
<td>10 min</td>
<td>221 ppm (0.69)</td>
<td>12 ppm</td>
</tr>
</tbody>
</table>

Other animal data .............................................. It has been suggested that the toxicity of diazomethane is comparable to that of phosgene, possibly because diazomethane is a strong methylating agent [Potts et al. 1949].

Human data ....................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 2 ppm [Unchanged]
Basis for revised IDLH: Based on an analogy to phosgene [Potts et al. 1949] which has an IDLH of 2 ppm, the original IDLH for diazomethane of 2 ppm is not being revised at this time.

REFERENCES:

Diborane

CAS number ................................. 19287-45-7
NIOSH REL .................................. 0.1 ppm (0.1 mg/m³) TWA
Current OSHA PEL ........................... 0.1 ppm (0.1 mg/m³) TWA
1989 OSHA PEL ............................ Same as current PEL
1993-1994 ACGIH TLV ......................... 0.1 ppm (0.11 mg/m³) TWA

Description of Substance
Colorless gas with a repulsive, sweet odor.

LEL ......................................... 0.8% (10% LEL, 800 ppm)

Original (SCP) IDLH ........................... 40 ppm

Basis for original (SCP) IDLH ................. The chosen IDLH is based on the statement by ACGIH [1971] that Jacobson and Lawson [1962] found the rat 4-hour LC₅₀ to be 40 or 80 ppm, depending on the age or strain of rats used.

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat 1</td>
<td>Adams 1964</td>
<td>40</td>
<td>----</td>
<td>4 hr</td>
<td>80 ppm (2.0)</td>
<td>8.0 ppm</td>
</tr>
<tr>
<td>Rat 2</td>
<td>Jacobson and Lawson 1962</td>
<td>29</td>
<td>----</td>
<td>4 hr</td>
<td>58 ppm (2.0)</td>
<td>5.8 ppm</td>
</tr>
<tr>
<td>Rat 3</td>
<td>Jacobson and Lawson 1962</td>
<td>40-80</td>
<td>----</td>
<td>4 hr</td>
<td>80-160 ppm (2.0)</td>
<td>8.0 ppm</td>
</tr>
<tr>
<td>Rat 4</td>
<td>Krackow 1953</td>
<td>125-162</td>
<td>----</td>
<td>15 min</td>
<td>126-243 ppm (2.79)</td>
<td>13-14 ppm</td>
</tr>
<tr>
<td>Dog 1</td>
<td>Kunkel et al. 1956</td>
<td>----</td>
<td>125</td>
<td>2 hr</td>
<td>200 ppm (2.6)</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Hamster</td>
<td>Stumpe 1960</td>
<td>----</td>
<td>50</td>
<td>8 hr</td>
<td>125 ppm (2.5)</td>
<td>13 ppm</td>
</tr>
</tbody>
</table>

Human data .................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 15 ppm

Basis for revised IDLH: The revised IDLH for diborane is 15 ppm based on acute inhalation toxicity data in animals [Krackow 1953].

REFERENCES:

Dibutyl phosphate

CAS number............................................................... 107-66-4
NIOSH REL ............................................................ 1 ppm (5 mg/m³) TWA, 2 ppm (10 mg/m³) STEL
Current OSHA PEL .................................................... 1 ppm (5 mg/m³) TWA
1989 OSHA PEL ......................................................... 1 ppm (5 mg/m³) TWA, 2 ppm (10 mg/m³) STEL
1993-1994 ACGIH TLV .................................................. 1 ppm (8.8 mg/m³) TWA, 2 ppm (17 mg/m³) STEL

Description of Substance .............................................. Pale-amber, odorless liquid.

LEL ................................................................. Unknown
Original (SCP) IDLH .................................................. 125 ppm

Ba.I. for original (SCP) IDLH ............................................

Short-term exposure guidelines ......................................

ACUTE TOXICITY DATA

Animal or human data .................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 30 ppm

Revised IDLH: Due to the lack of relevant acute toxicity data, the revised IDLH for dibutyl phosphate is 30 ppm based on an analogy to tributyl phosphate which has a revised IDLH of 30 ppm.
Dibutyl phthalate

CAS number ........................................... 84-74-2
NIOSH REL ............................................. 5 mg/m³ TWA
Current OSHA PEL ..................................... 5 mg/m³ TWA
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV .................................. 5 mg/m³ TWA

Description of Substance: Colorless to faint-yellow, oily liquid with a slight, aromatic odor.

LEL(456°F) ............................................. 0.5% (10% LEL(456°F), 32,700 mg/m³)

Original (SCP) IDLH .................................... 9,300 mg/m³

Basis for original (SCP) IDLH: Because dibutylphthalate has a very low toxicity, the available toxicological data contains no evidence of an IDLH for it. Therefore, the chosen IDLH is based on an analogy with dimethylphthalate, which has an IDLH of 9,300 mg/m³.

Short-term exposure guidelines: None developed.

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LD (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Antonyuk and Aldyrev 1973</td>
<td>4,250 mg/m³</td>
<td></td>
<td></td>
<td>4,000 mg/m³</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Ismerov et al. 1982</td>
<td>25,000 mg/m³</td>
<td></td>
<td></td>
<td>5,600 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Antonyuk 1953</td>
<td>oral</td>
<td>5,289</td>
<td>56,000 mg/m³</td>
<td>3,702 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Sine 1993</td>
<td>oral</td>
<td>8,000</td>
<td>70,000 mg/m³</td>
<td>5,600 mg/m³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Timofeevskaisa et al. 1980</td>
<td>oral</td>
<td>10,000</td>
<td></td>
<td>7,000 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data: None relevant for use in determining the revised IDLH.

[Revised IDLH: 4,000 mg/m³]

Basis for revised IDLH: The revised IDLH for dibutyl phthalate is 4,000 mg/m³ based on acute inhalation toxicity data in animals (Izmerov et al. 1962). (Note: Due to its low volatility, this concentration could only be reached at elevated temperatures or if the liquid droplets become airborne as in a mist.)

REFERENCES:

3. Izmerov NF, Sanotsky IV, Sidorov KK [1962]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNK, p. 44.
**o-Dichlorobenzene**

CAS number ......................... 55-50-1
NIOH REL .................................. 50 ppm (300 mg/m³) CEILING
Current OSHA PEL ....................... 50 ppm (300 mg/m³) CEILING
1989 OSHA PEL Same as current PEL
1993-1994 ACGIH TLV ................... 25 ppm (150 mg/m³) TWA, 50 ppm (301 mg/m³) STEL

Description of Substance Colorless to pale-yellow liquid with a pleasant, aromatic odor.

LEL ......................................... 2.2% (10% LEL, 2,200 ppm)
Original (SCP) IDLH ..................... 1,000 ppm

Short-term exposure guidelines None developed

**ACUTE TOXICITY DATA**

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Browning 1953</td>
<td>-----</td>
<td>1,000</td>
<td>20 hr</td>
<td>1,450 ppm (3.45)</td>
<td>345 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Cameron et al. 1937</td>
<td>-----</td>
<td>800</td>
<td>24 hr</td>
<td>2,880 ppm (3.6)</td>
<td>288 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hollingsworth et al. 1958</td>
<td>-----</td>
<td>821</td>
<td>7 hr</td>
<td>1,970 ppm (2.4)</td>
<td>197 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Ben-Dyke et al. 1970</td>
<td>oral</td>
<td>500</td>
<td>-----</td>
<td>573 ppm</td>
<td>57 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Patty 1942</td>
<td>oral</td>
<td>2,000</td>
<td>-----</td>
<td>2,391 ppm</td>
<td>229 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Thomson 1976/77</td>
<td>oral</td>
<td>500</td>
<td>-----</td>
<td>573 ppm</td>
<td>57 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Yagkyoku 1981</td>
<td>oral</td>
<td>4,386</td>
<td>-----</td>
<td>5,025 ppm</td>
<td>503 ppm</td>
</tr>
</tbody>
</table>

Other animal data ..................... RD₉₀ (mouse), 182 ppm [DeCesauritz et al. 1981].

Human data ............................. Concentrations up to 100 ppm have been reported to have caused sporadic irritation of the eyes and respiratory tract [Elkins 1956].

**Revised IDLH: 200 ppm**

Basis for revised IDLH: The revised IDLH for o-dichlorobenzene is 200 ppm based on acute inhalation toxicity data in animals [Hollingsworth et al. 1958]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 100 ppm.

**REFERENCES:**


o-Dichlorobenzene (continued)

p-Dichlorobenzene

CAS number ........................................ 106-48-7
NIOSH REL ......................................... None established; NIOSH considers p-dichlorobenzene to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ................................. 75 ppm (450 mg/m³) TWA
1989 OSHA PEL ..................................... 75 ppm (450 mg/m³) TWA, 110 ppm (675 mg/m³) STEL
1993-1994 ACGIH TLV ............................ 10 ppm (50 mg/m³) TWA, A3

Description of Substance ........................... Colorless or white crystalline solid with a mothball-like odor.
LEL ............................................. 2.5% (10% LEL, 2,500 ppm)
Original (SCP) IDLH ............................... 1,000 ppm
Basis for original (SCP) IDLH ........................ No useful data on acute inhalation toxicity are available on which to base the IDLH for p-dichlorobenzene. The chosen IDLH, therefore, is based on an analogy with o-dichlorobenzene, which has an IDLH of 1,000 ppm.

Short-term exposure guidelines ........................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Ben-Dyke et al. 1970</td>
<td>oral</td>
<td>500</td>
<td>-----</td>
<td>573 ppm</td>
<td>57 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Deichmann and Gerarde 1969</td>
<td>oral</td>
<td>-----</td>
<td>657</td>
<td>982 ppm</td>
<td>98 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Domenjou 1946</td>
<td>oral</td>
<td>2,950</td>
<td>-----</td>
<td>3,380 ppm</td>
<td>338 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hollingsworth et al. 1956</td>
<td>oral</td>
<td>-----</td>
<td>4,000</td>
<td>4,583 ppm</td>
<td>458 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Hollingsworth et al. 1956</td>
<td>oral</td>
<td>-----</td>
<td>2,800</td>
<td>3,208 ppm</td>
<td>320 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Yakkyoku 1957</td>
<td>oral</td>
<td>2,512</td>
<td>-----</td>
<td>2,878 ppm</td>
<td>288 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td></td>
<td>oral</td>
<td>2,820</td>
<td>-----</td>
<td>3,242 ppm</td>
<td>324 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................. No adverse effects were noted in a workplace averaging 125 ppm (range 50 to 170 ppm), but painful irritation of the eyes and nose was found at 80 to 160 ppm, and breathing was difficult at concentrations greater than 160 ppm [Hollingsworth et al. 1956]. In another workplace, workers exposed to 17 to 500 ppm reported severe eye irritation [Dow 1978].

Other human data ................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 150 ppm
Basis for revised IDLH: The revised IDLH for p-dichlorobenzene is 150 ppm based on acute inhalation toxicity data in workers [Dow 1978; Hollingsworth et al. 1956]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for p-dichlorobenzene at any detectable concentration.]

REFERENCES:
Dichlorodifluoromethane

CAS number ........................................ 75-71-8
CAS

NIOSH REL ..........................................

Current OSHA PEL ................................

1989 OSHA PEL ....................................

1993-1994 ACGIH TLV ............................

Original (SCP) IDLH ................................

Easis for original (SCP) IDLH ......................

Existing short-term exposure guidelines ........

Description of Substance .........................

Colorless gas with an ether-like odor at extremely high concentrations.

LEL ....................................................

Nonflammable Gas

Original (SCP) IDLH ................................

Based on the statement by ILO [1971] that 50,000 ppm induces dizziness in humans, an IDLH of 50,000 ppm is chosen for this draft technical standard.


1-hour EEGL: 10,000 ppm
24-hour EEGL: 1,000 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>760,000</td>
<td>760,000</td>
<td>10 min</td>
<td>760,000 ppm (1.0)</td>
<td>76,000 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>800,000</td>
<td>800,000</td>
<td>10 min</td>
<td>800,000 ppm (1.0)</td>
<td>80,000 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>600,000</td>
<td>600,000</td>
<td>2 hr</td>
<td>960,000 ppm (1.6)</td>
<td>96,000 ppm</td>
</tr>
</tbody>
</table>

Other animal data ..................................

Serious cardiac arrhythmia was found in 5 of 12 dogs exposed to 50,000 ppm for 5 minutes and injected with epinephrine [Reinhardt et al. 1971]. In another study, respiratory-circulatory effects that included bronchoconstriction and tachycardia were found at 50,000 to 100,000 ppm [Aviado and Smith 1975]. Exposure up to 60,000 ppm was tolerated for 80 minutes by 1 volunteer [NRC 1984]: when exposed at 40,000 ppm for 14 minutes and then at 20,000 ppm for 66 minutes, another volunteer developed EEG changes and had slurred speech and decreased psychologic test scores [NRC 1984]. It has been stated that 50,000 ppm induces dizziness [ILO 1971]. Volunteers exposed for 2.5 hours to 10,000 ppm showed a 7% reduction in a standardized psychomotor test [Azar et al. 1972].

Human data ........................................

Volunteers exposed for 2.5 hours to 10,000 ppm showed a 7% reduction in a standardized psychomotor test [Azar et al. 1972].

Revised IDLH: 15,000 ppm

Basis for revised IDLH: The revised IDLH for dichlorodifluoromethane is 15,000 ppm based on acute inhalation toxicity data in humans [Azar et al. 1972; ILO 1971] and animals [Aviado and Smith 1975; Reinhardt et al. 1971].

REFERENCES:


151
Dichlorodifluoromethane (continued)


1,3-Dichloro-5,5-dimethylhydantoin

CAS number ........................................ 118-52-5
NIOSH REL ........................................ 0.2 mg/m³ TWA. 0.4 mg/m³ STEL
Current OSHA PEL .............................. 0.2 mg/m³ TWA
1989 OSHA PEL ................................. 0.2 mg/m³ TWA. 0.4 mg/m³ STEL
1993-1994 ACGIH TLV ......................... 0.2 mg/m³ TWA. 0.4 mg/m³ STEL

Description of Substance ................... White powder with a chlorine-like odor.
LEL .................................................. Unknown

Original (SCP) IDLH* .......................... Unknown [Note: "Effective" IDLH = 5 mg/m³ — see discussion below.]
Basis for original (SCP) IDLH ............. Very little data are available on which to base an IDLH for 1,3-dichloro-5,5-dimethylhydantoin. For this draft technical standard, therefore, the respirators have been selected on the basis of the assigned protection factor afforded by each device up to 25 × the OSHA PEL of 0.2 mg/m³ (i.e., 5 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 5 mg/m³.

Short-term exposure guideline ............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (mg/m³)</th>
<th>LC₃₃ (mg/m³)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Glyco 1981</td>
<td>20,000</td>
<td></td>
<td>1 hr</td>
<td>25,000 (1.25)</td>
<td>2,500</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₃₃ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kay 1961/1962</td>
<td>oral</td>
<td>542</td>
<td></td>
<td>3,794</td>
<td>379</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Korolev et al. 1982</td>
<td>oral</td>
<td>1,520</td>
<td></td>
<td>10,640</td>
<td>1,064</td>
</tr>
<tr>
<td>G. pig</td>
<td>Korolev et al. 1982</td>
<td>oral</td>
<td>1,350</td>
<td></td>
<td>9,450</td>
<td>945</td>
</tr>
</tbody>
</table>

Human data .................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 5 mg/m³
Basis for revised IDLH: Based on health considerations and acute oral toxicity data in animals [Kay 1961/62; Korolev et al. 1982], a value of about 500 mg/m³ would have been appropriate for 1,3-dichloro-5,5-dimethylhydantoin. However, the revised IDLH for 1,3-dichloro-5,5-dimethylhydantoin is 5 mg/m³ based on being 25 times the NIOSH REL and OSHA PEL of 0.2 mg/m³ (25 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for 1,3-dichloro-5,5-dimethylhydantoin).

REFERENCES:

1,1-Dichloroethane

- **CAS number**: 75-34-3
- **NIOSH REL**: 100 ppm (400 mg/m³) TWA
- **Current OSHA PEL**: 100 ppm (400 mg/m³) TWA
- **1989 OSHA PEL**: Same as current PEL
- **1993-1994 ACGIH TLV**: 100 ppm (400 mg/m³) TWA

**Description of Substance**: Colorless, oily liquid with a chloroform-like odor.

**LEL**: 5.4% (10% LEL, 5,400 ppm)

**Original (SCP) IDLH**: 4,000 ppm

**Basis for original (SCP) IDLH**: Patty [1963] reported that rats survived 8-hour exposures to 4,000 ppm, but died at 16,000 ppm [Smyth 1956]. However, 18,000 ppm has not been chosen as the IDLH because Kirk-Othmer [1964] indicated that 1,1-dichloroethane causes narcosis. For this draft technical standard, 4,000 ppm is chosen as the IDLH.

**Short-term exposure guidelines**: None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data**:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LCI,0 (ppm)</th>
<th>LCl,0 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>16,000</td>
<td>32,000 (2.0)</td>
<td>4 hr</td>
<td>3,200 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Mueller 1925</td>
<td>17,300</td>
<td>27,680 (1.6)</td>
<td>2 hr</td>
<td>2,768 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>16,000</td>
<td>40,000 (2.5)</td>
<td>8 hr</td>
<td>4,000 ppm</td>
<td></td>
</tr>
</tbody>
</table>

**Human data**: None relevant for use in determining the revised IDLH.

**Revised IDLH**: 3,000 ppm

**Basis for revised IDLH**: The revised IDLH for 1,1-dichloroethane is 3,000 ppm based on acute inhalation toxicity data in animals [Carpenter et al. 1949; Mueller 1925].

**REFERENCES**:

## 1,2-Dichloroethylene

**CAS number** ................................................. 540-59-0  
**NIOSH REL** ..............................................  
**Current OSHA PEL** ....................................... 200 ppm (760 mg/m³) TWA  
**1989 OSHA PEL** ........................................... Same as current PEL  
**1993-1994 ACGIH TLV** .................................. 200 ppm (760 mg/m³) TWA  
**Description of Substance** ................................. Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.  
**LEL** ......................................................... 5.6% (10% LEL, 5,600 ppm)  
**Original (SCP) IDLH** ..................................... 4,000 ppm  
**Basis for original (SCP) IDLH** .............................. Patty [1963] reported that rats exposed to the cis-isomer of dichloroethylene for 4 hours at 8,000 ppm were neither killed nor anesthetized, but at 16,000 ppm, anesthesia occurred in 8 minutes and death occurred in 4 hours [Smyth 1956]. Because Patty [1963] also reported that the trans-isomer was twice as toxic and anesthetic as the cis-isomer, an IDLH of 4,000 ppm is chosen.

### Short-term exposure guidelines

**None developed**

### ACUTE TOXICITY DATA

#### Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>trans-isomer</td>
<td>ATSDR 1990</td>
<td>21,723</td>
<td>----</td>
<td>6 hr</td>
<td>130,338 ppm (2.3)</td>
<td>13,034 ppm</td>
</tr>
<tr>
<td>cis-isomer</td>
<td>Smyth 1956</td>
<td>----</td>
<td>16,000</td>
<td>6 hr</td>
<td>32,000 ppm (2.0)</td>
<td>3,200 ppm</td>
</tr>
</tbody>
</table>

#### Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50 (mg/kg)</th>
<th>LD10 (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>USDA 1966</td>
<td>oral</td>
<td>770</td>
<td>----</td>
<td>1,337 ppm</td>
<td>134 ppm</td>
</tr>
<tr>
<td>trans-isomer</td>
<td>Freudt et al. 1977</td>
<td>oral</td>
<td>1,275</td>
<td>----</td>
<td>8,925 ppm</td>
<td>893 ppm</td>
</tr>
</tbody>
</table>

#### Human data

It has been reported that exposure to the trans-isomer at 2,200 ppm caused burning of the eyes, vertigo, and nausea [von Oettingen 1955]. An exposure to the trans-isomer at 819 ppm for 30 minutes has been reported to cause no untoward effects, while inhalation of either 1,887 to 2,184 ppm for 5 minutes or 1,191 ppm for 10 minutes has resulted in vertigo, pressure in the head, and somnolence [von Oettingen 1937].

**Revised IDLH: 1,000 ppm**

**Basis for revised IDLH: The revised IDLH for 1,2-dichloroethylene is 1,000 ppm based on acute inhalation toxicity data in humans [von Oettingen 1937, 1955].**

### REFERENCES:

1,2-Dichloroethylene (continued)


Dichloroethyl ether

CAS number .................................................. 111-44-4
NIOSH REL ................................................. 5 ppm (30 mg/m³) TWA, 10 ppm (60 mg/m³) STEL (skin); NIOSH considers dichloroethyl ether to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ........................................... 10 ppm (60 mg/m³) CEILING (skin)
OSHA PEL ................................................... 1989 5 ppm (30 mg/m³) TWA, 10 ppm (60 mg/m³) STEL (skin)
OSHA PEL ................................................... 1993-1914 ACGIH TLV 5 ppm (28 mg/m³) TWA, 10 ppm (56 mg/m³) STEL (skin)

Description of Substance .................................................. Colorless liquid with a chlorinated solvent-like odor.

LEL .............................................................. 2.7% (10% LEL, 2,700 ppm)

Original (SCP) IDLH ........................................... 250 ppm
Basis for original (SCP) IDLH ........................................... The chosen IDLH is based on the statements by Patty [1963] that 250 ppm caused death in rats from a 4-hour exposure [Carpenter et al. 1949] and that 500 to 1000 ppm might cause death in guinea pigs from an exposure of only 30 to 60 minutes duration [Schrenk et al. 1933].

Short-term exposure guidelines ............................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>250</td>
<td>500 ppm (2.0)</td>
<td>5 hr</td>
<td>50 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>77</td>
<td>154 ppm (2.0)</td>
<td>4 hr</td>
<td>15 ppm</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Izmerov et al. 1982</td>
<td>152</td>
<td>243 ppm (1.6)</td>
<td>2 hr</td>
<td>24 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Marhold 1986</td>
<td>500</td>
<td>625 ppm (1.21)</td>
<td>3 hr</td>
<td>61 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Schrenk et al. 1933</td>
<td>500</td>
<td>1,075 ppm (2.15)</td>
<td>5 hr</td>
<td>108 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ................................................. Volunteers found brief (undefined) exposures to 100 to 260 ppm to be tolerable, although irritating [Schrenk et al. 1933].

Revised IDLH: 100 ppm
Basis for revised IDLH: The revised IDLH for dichloroethyl ether is 100 ppm based on acute inhalation toxicity data in humans [Schrenk et al. 1933]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 100 ppm. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for dichloroethyl ether at concentrations above 5 ppm.]

REFERENCES:

2. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNIT, p. 45.
Dichloromonofluoromethane

CAS number ......................................... 75-43-4
NIOSH REI .................................. 10 ppm (40 mg/m³) TWA
Current OSHA PEL ............................ 1.000 ppm (4.200 mg/m³) TWA
1989 OSHA PEL ............................ 10 ppm (40 mg/m³) TWA
1993-1994 ACGIH TLV .......................... 10 ppm (42 mg/m³) TWA
Description of Substance ...................... Colorless gas with a slight, ether-like odor.
LEL ......................................... Nonflammable Gas
Original (SCP) IDLH ......................... 50,000 ppm
Basis for original (SCP) IDLH............... ACGIH [1971] reported that 52,000 ppm produced
incoordination, irregular breathing, and tremors in guinea pigs
[Underwriters' Laboratory 1935]. Scheel (member of the
Standards Completion Program Respirator Committee), in
evaluating the work of Aviado and Belej [1974], indicated cardiac
toxicity at 100,000 ppm. Based on the above data, an IDLH of
50,000 ppm has been chosen.

Guidance Levels (EEGLs):

<table>
<thead>
<tr>
<th>1-hour EEGL</th>
<th>24-hour EEGL</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 ppm</td>
<td>3 ppm</td>
</tr>
</tbody>
</table>

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₁₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Kozbakova 1976</td>
<td>&gt;800,000 mg/m³</td>
<td></td>
<td>2 hr</td>
<td>&gt;37,832 ppm (2.0)</td>
<td>&gt;37,183 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Tappan and Wenz 1964</td>
<td>49,900 ppm</td>
<td></td>
<td>4 hr</td>
<td>99,800 ppm (2.0)</td>
<td>9,300 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>von Weigand 1971</td>
<td>100,000 ppm</td>
<td>&lt;1 hr</td>
<td>&lt;12,500 ppm (1.25)</td>
<td>&lt;12,500 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>von Weigand 1971</td>
<td>100,000 ppm</td>
<td>&lt;1 hr</td>
<td>&lt;125,000 ppm (1.25)</td>
<td>&lt;125,000 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ................................ In 5-minute cardiac sensitization screening tests, 2 of
12 unanesthetized dogs exposed to 10,000 ppm of
dichloromonofluoromethane plus intravenous epinephrine
showed evidence of serious arrhythmia; no response was noted
at 5,000 ppm [Mullin 1975].

Human data ...................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 5,000 ppm
Basis for revised IDLH: The revised IDLH for dichloromonofluoromethane is 5,000 ppm based on acute inhalation
toxicity data in animals [Mullin 1975; Tappan and Wenz 1964; von Weigand 1971]. This may be a conservative value due
to the lack of relevant acute toxicity data for workers.

REFERENCES:

1. ACGIH [1971]. Dichloromonofluoromethane. In: Documentation of the threshold limit values for substances in
workroom air. 3rd ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, pp. 81-82.
arhythmia in the mouse. Toxicology 2:31-42.
November 1975. [From ACGIH [1991]. Dichlorofluoromethane. In: Documentation of the threshold limit values and
biological exposure indices. 6th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, pp. 434-435.]
Dichloromonofluoromethane (continued)


1,1-Dichloro-1-nitroethane

CAS number ........................................ 594-72-9
NIOSH REL ........................................ 2 ppm (10 mg/m³) TWA
Current OSHA PEL .................................. 10 ppm (80 mg/m³) CEILING
1983-1994 OSHA PEL ......................... 2 ppm (10 mg/m³) TWA
1993-1994 ACGIH TLV ......... 2 ppm (12 mg/m³) TWA

Description of Substance ............................. Colorless liquid with an unpleasant odor.
LEL .................................................... Unknown
Original (SCP) IDLH .................. 150 ppm
Basis for original (SCP) IDLH ........................................ The chosen IDLH is based on the study by Machle et al. [1945] in which autopsies on animals exposed to over 170 ppm for over 30 minutes revealed pulmonary edema and hemorhage, with damage to the heart, liver, and kidneys.

Short-term exposure guidelines ........................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1945</td>
<td>170</td>
<td>----</td>
<td>30 min</td>
<td>170 ppm (1.0)</td>
<td>17 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Machle et al. 1945</td>
<td>170</td>
<td>----</td>
<td>30 min</td>
<td>170 ppm (1.0)</td>
<td>17 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1945</td>
<td>97</td>
<td>----</td>
<td>6 hrs</td>
<td>23 ppm (2.3)</td>
<td>22 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Machle et al. 1945</td>
<td>97</td>
<td>----</td>
<td>6 hrs</td>
<td>233 ppm (2.3)</td>
<td>22 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1945</td>
<td>52</td>
<td>18.75 hrs</td>
<td>17 ppm (3.33)</td>
<td>17 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Machle et al. 1945</td>
<td>52</td>
<td>18.75 hrs</td>
<td>172 ppm (3.33)</td>
<td>17 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .................. Animals have tolerated 25 ppm for 204 hours [Machle et al. 1945].

Human data .................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 25 ppm

Basis for revised IDLH: The revised IDLH for 1,1-dichloro-1-nitroethane is 25 ppm based on acute inhalation toxicity data in animals [Machle et al. 1945]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCE:

Dichlorotetrafluoroethane

<table>
<thead>
<tr>
<th>CAS number</th>
<th>76-14-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>1,000 ppm (7,000 mg/m³) TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>1,000 ppm (7,000 mg/m³) TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>1,000 ppm (6,990 mg/m³) TWA</td>
</tr>
<tr>
<td>Description of Substance</td>
<td>Colorless gas with a faint, ether-like odor at high concentrations. Nonflammable Gas</td>
</tr>
<tr>
<td>LEL</td>
<td>50,000 ppm</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>Dichlorotetrafluoroethane is known to be a narcotic in high concentrations, but no human exposure data are available concerning its narcotic effects. Based on an analogy with dichlorodifluoromethane, a related compound that produces dizziness in humans at 50,000 ppm [ILO 1971], an IDLH of 50,000 ppm is assumed for this draft technical standard.</td>
</tr>
</tbody>
</table>

Existing short-term exposure guidelines


- 1-hr EEGL: 10,000 ppm
- 24-hr EEGL: 1,000 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₆₉ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Paulet 1976</td>
<td>720,000</td>
<td>---</td>
<td>30 min</td>
<td>720,000 ppm (1.0)</td>
<td>72,000 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Paulet 1976</td>
<td>700,000</td>
<td>---</td>
<td>30 min</td>
<td>700,000 ppm (1.0)</td>
<td>70,000 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Paulet 1976</td>
<td>750,000</td>
<td>---</td>
<td>30 min</td>
<td>750,000 ppm (1.0)</td>
<td>75,000 ppm</td>
</tr>
</tbody>
</table>

Other animal data

Evidence of serious arrhythmia was noted in 1 of 12 dogs exposed for 5 minutes to 25,000 ppm intravenous epinephrine [Reinhardt et al. 1971]. Cardiac sensitization has been induced with endogenous epinephrine at 50,000 to 800,000 ppm [Mullin et al. 1972; Reinhardt et al. 1971]. Significant reduction in ventilatory lung capacity, bradycardia, and increased variability in heart rate have been reported following exposures to 2,300 to 21,400 ppm for 15, 45, or 60 seconds [IPCS 1990].

Human data

Significant reduction in ventilatory lung capacity, bradycardia, and increased variability in heart rate have been reported following exposures to 2,300 to 21,400 ppm for 15, 45, or 60 seconds [IPCS 1990].

Revised IDLH: 15,000 ppm

Basis for revised IDLH: The revised IDLH for dichlorotetrafluoroethane is 15,000 ppm based on acute inhalation toxicity data in animals [Reinhardt et al. 1971] and an analogy to dichlorodifluoromethane, another closely related halogenated hydrocarbon, which has a revised IDLH of 15,000 ppm.

REFERENCES:

Dichlorvos

CAS number ........................................... 62-73-7
NIOSH REL ........................................... 
Current OSHA PEL .................................... 1 mg/m³ TWA [skin]
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ............................... 0.00 mg/m³ (0.1 ppm) TWA [skin]
Description of Substance .............................. Colorless to amber liquid with a mild, chemical odor.
LEL ...................................................... Unknown
Original (SCP) IDLH .................................... 200 mg/m³
Basis for original (SCP) IDLH .......................... No useful data on acute inhalation toxicity are available on which to base the IDLH for dichlorvos. If the IDLH were estimated from the female rat oral LD₅₀ of 55 mg/kg [Mattson et al. 1955 cited by Patty 1963], an IDLH of 400 mg/m³ would be chosen. On the basis of an analogy with paraquat, however, which has an OSHA PEL of 0.1 mg/m³ and an IDLH of 20 mg/m³, an IDLH of 200 mg/m³ has been chosen for dichlorvos which has an OSHA PEL of 1 mg/m³.

Short-term exposure guidelines ........................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LCₐ₀</th>
<th>LCₐₙ</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gig Sanit 1968</td>
<td>15</td>
<td>-----</td>
<td>4 hr</td>
<td>30 mg/m³ (2.0)</td>
<td>3.0 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Sanit 1968</td>
<td>13</td>
<td>-----</td>
<td>4 hr</td>
<td>16 mg/m³ (2.0)</td>
<td>2.6 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀</th>
<th>LD₉₀</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Hartley and Kidd 1984</td>
<td>oral</td>
<td>100</td>
<td>-----</td>
<td>700 mg/m³</td>
<td>70 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Ikuzawa et al. 1966</td>
<td>oral</td>
<td>61</td>
<td>-----</td>
<td>427 mg/m³</td>
<td>43 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Zashkareva et al. 1977</td>
<td>oral</td>
<td>10</td>
<td>-----</td>
<td>70 mg/m³</td>
<td>7.0 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Technical News 1972</td>
<td>oral</td>
<td>17</td>
<td>-----</td>
<td>119 mg/m³</td>
<td>12 mg/m³</td>
</tr>
</tbody>
</table>

Human data ................................................ Exposure to a concentration of 1 mg/m³ for 7.5 to 8.5 hours resulted in a plasma cholinesterase depression of 20 to 25% [Hunter 1964].

Revised IDLH: 100 mg/m³

Basis for revised IDLH: The revised IDLH for dichlorvos is 100 mg/m³ based on an analogy to paraquat. Since the toxicity of dichlorvos is about 10 times lower than paraquat (based on acute oral toxicity data in animals), the revised IDLH for dichlorvos is 10 times the revised IDLH for paraquat (10 mg/m³).

REFERENCES:

Dichlorvos (continued)


Dieldrin

CAS number .................................. 60-57-1
NIOSH REL .................................. 0.25 mg/m³ TWA [skin]; NIOSH considers dieldrin to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL .................................. 0.25 mg/m³ TWA [skin]; NIOSH considers dieldrin to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

1989 OSHA PEL .................................. Same as current PEL
1993-1994 ACGIH TLV .................................. 0.25 mg/m³ TWA [skin]

Description of Substance .................................. Colorless to light-tan crystals with a mild, chemical odor.

LEL .................................. Noncombustible Solid

Original (SCP) IDLH .................................. 450 mg/m³

Basis for original (SCP) IDLH .................................. No data on acute inhalation toxicity are available on which to base the IDLH for dieldrin. The chosen IDLH, therefore, has been estimated from the statement by Deichmann and Gerarde [1969] that an oral dose of 65 mg/kg is believed to be a reasonable estimate of the lethal dose in man. Thoennes and Hataley [1972] and Gleason et al. [1969] reported similar estimates of the lethal dose for man [Hodge et al. 1967; Katuschner 1960]. None developed.

Short-term exposure guidelines .................................. None developed.

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (mg/m³)</th>
<th>LC₉₅ (mg/m³)</th>
<th>0.5-hr Adjusted Value</th>
<th>Derived Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Gig Tr Prof Zabol 1964</td>
<td>80</td>
<td>-----</td>
<td>160 mg/m³ (2.0)</td>
<td>16 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>13</td>
<td>-----</td>
<td>26 mg/m³ (2.0)</td>
<td>2.6 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>45</td>
<td>-----</td>
<td>315 mg/kg</td>
<td>32 mg/kg</td>
</tr>
<tr>
<td>G. pig</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>49</td>
<td>-----</td>
<td>343 mg/kg</td>
<td>34 mg/kg</td>
</tr>
<tr>
<td>Mouse</td>
<td>Kenage and Morgan 1978</td>
<td>oral</td>
<td>38</td>
<td>-----</td>
<td>266 mg/kg</td>
<td>27 mg/kg</td>
</tr>
<tr>
<td>Dog</td>
<td>Spencer 1973</td>
<td>oral</td>
<td>66</td>
<td>-----</td>
<td>455 mg/kg</td>
<td>46 mg/kg</td>
</tr>
<tr>
<td>Rat</td>
<td>Treon and Cleveland 1955</td>
<td>oral</td>
<td>38</td>
<td>-----</td>
<td>266 mg/kg</td>
<td>27 mg/kg</td>
</tr>
</tbody>
</table>

Human data .................................. The lethal oral dose has been estimated to be about 5 grams [Deichmann and Gerarde 1969; Hodge et al. 1967]. [Note: An oral dose of 5 grams is equivalent to a worker being exposed to 3,300 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 50 mg/m³

Basis for revised IDLH: The revised IDLH for dieldrin is 50 mg/m³ based on acute oral toxicity data in humans [Deichmann and Gerarde 1969; Hodge et al. 1967]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for dieldrin at concentrations above 0.25 mg/m³.]

REFERENCES:

Dieldrin (continued)

6. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNK, p. 73.
Diethylamine

CAS number ................................................. 109-89-7
NIDSH REL .................................................. 10 ppm (30 mg/m³) TWA, 25 ppm (75 mg/m³) STEL
Current OSHA PEL .......................... 25 ppm (75 mg/m³) TWA
1989 OSHA PEL .......................... 10 ppm (30 mg/m³) TWA, 25 ppm (75 mg/m³) STEL
1993-1994 ACGIH TLV .................. 5 ppm (15 mg/m³) TWA, 15 ppm (45 mg/m³) STEL [skin]
Description of Substance .................. Colorless liquid with a fishy, ammonia-like odor.
LEL ......................................................... 1.8% (10% LEL, 1,800 ppm)
Original (SCP) IDLH .................. 2,000 ppm
Basis for original (SCP) IDLH ............ Patty [1963] made the statement that a 4-hour exposure to
none developed

Short-term exposure guidelines ..... 4,000 ppm killed 3 of 6 rats. However, because of the severe

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Mine et al. 1960</td>
<td>4,000</td>
<td>----</td>
<td>4 hr</td>
<td>6,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Mine et al. 1960</td>
<td>oral</td>
<td>560</td>
<td></td>
<td>1,243 ppm</td>
<td>124 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Patel et al. 1985</td>
<td>oral</td>
<td>500</td>
<td></td>
<td>1,151 ppm</td>
<td>115 ppm</td>
</tr>
</tbody>
</table>

Other animal data ............ Rₐₒₐ (mouse), 184 ppm [Nielsen and Yamagiwa 1989].

Human data .................. It has been stated that the simple alkyl amines are generally
more toxic than ammonia [ACGIH 1991]. The American
Conference of Governmental Industrial Hygienists TLV for
diethylamine (10 ppm TWA, 25 ppm STEL) was based on an
analogy to ammonia (25 ppm TWA, 35 ppm STEL) [ACGIH 1991].

Revised IDLH: 200 ppm

Basis for revised IDLH: The revised IDLH for diethylamine is 200 ppm based on acute inhalation toxicity data in animals
[Nielsen and Yamagiwa 1989] and an analogy to ammonia [ACGIH 1991].

REFERENCES:

2-Diethylaminoethanol

CAS number ........................................ 100-37-8
NIOSH REL ........................................ 10 ppm (50 mg/m³) TWA [skin]
Current OSHA PEL .................................. 10 ppm (50 mg/m³) TWA [skin]
1989 OSHA PEL .................................. Same as current PEL
1993-1994 ACGIH TLV ......................... 10 ppm (48 mg/m³) TWA [skin]

Description of Substance ........................... Colorless liquid with a nauseating, ammonia-like odor.

LEL .................................................. 500 ppm

Original (SCP) IDLH ................................ No useful data on acute inhalation toxicity are available on which to base the IDLH for diethylaminoethanol. The chosen IDLH is based on the following statements by Comish [1965]: "exposure of rats to 500 ppm, 6 hours daily for 5 days, resulted in severe weight loss and high mortality. Daily exposure at 200 ppm resulted in the death of 7 of 50 rats during the first month. A single human exposure for a few seconds to a level well below 200 ppm resulted in nausea and vomiting."

Basis for original (SCP) IDLH ..................... None developed

Short-term exposure guidelines ....................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₈₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Lomonova 1970</td>
<td>924</td>
<td>1,627</td>
<td>4 hr</td>
<td>1.848 ppm (2.0)</td>
<td>185 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Lomonova 1970</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₈₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth and Carpenter 1944</td>
<td>oral</td>
<td>1,300</td>
<td></td>
<td>1,868 ppm</td>
<td>187 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ A very short exposure (<30 seconds) to a concentration estimated to be less than 100 ppm has resulted in nausea and vomiting within 5 minutes; other persons in the same room also complained of the nauseating odor but did not become ill [Comish 1965].

Revised IDLH: 100 ppm

Base for revised IDLH: The revised IDLH for 2-diethylaminoethanol is 100 ppm based on acute inhalation toxicity data in humans [Comish 1965].

REFERENCES:

Difluorodibromomethane

CAS number ........................................ 75-61-6
NIOSH REL ........................................
Current OSHA PEL ................................ 100 ppm (860 mg/m³) TWA
1989 OSHA PEL .................................... Same as current PEL
1993-1994 ACGIH TLV ............................. 100 ppm (858 mg/m³) TWA

Description of Substance .......................... Colorless, heavy liquid or gas (above 76°F) with a characteristic odor.

LEL .................................................. Noncombustible Liquid/Nonflammable Gas
Original (SCP) IDLH ............................... 2,500 ppm
Basis for original (SCP) IDLH ..................... The chosen IDLH is based on the rat LC₅₀ of 2,300 ppm [Comstock et al. 1953 cited by NIOSH 1974] and on the statement by Patty [1963] that 4,000 ppm for 15 minutes caused significant pulmonary damage in rats [Chambers et al. 1950].

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Chambers et al. 1950</td>
<td>54,620</td>
<td>55,000</td>
<td>15 min</td>
<td>43.158 ppm (0.79)</td>
<td>4.316 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Comstock and Oberst 1952</td>
<td>----</td>
<td>----</td>
<td>15 min</td>
<td>43.450 ppm (0.79)</td>
<td>4.345 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................. It has been reported that 4,000 ppm for 15 minutes caused significant pulmonary damage in rats [Chambers et al. 1950]. Fatalities were noted in rats after exposures of to 2,300 ppm for 6 hours/day, 5 days/week for 7 weeks [Comstock et al. 1953].

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 ppm

Basis for revised IDLH: The revised IDLH for difluorodibromomethane is 2,000 ppm based on inhalation toxicity data in animals [Chambers et al. 1950; Comstock et al. 1953].

REFERENCES:

Diglycidyl ether

CAS number ................................................. 2238-07-5
NIOSH REL .................................................. 0.1 ppm (0.5 mg/m³) TWA; NIOSH considers diglycidyl ether to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ........................................... 0.5 ppm (2.8 mg/m³) CEILING
1989 OSHA PEL .............................................. 0.1 ppm (0.5 mg/m³) TWA
1993-1994 ACGIH TLV ..................................... 0.1 ppm (0.53 mg/m³) TWA

Description of Substance .................................. Colorless liquid with a strong, irritating odor.

LEL .......................................................... Unknown

Original (SCP) IDLH .......................................... 25 ppm
Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the male mouse 4-hour LC₅₀ of 30 ppm [Hine et al. 1956].

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Hine et al. 1956</td>
<td>30</td>
<td>40</td>
<td>4 hr</td>
<td>60 ppm (2.0)</td>
<td>6.0 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Hine et al. 1961</td>
<td>86</td>
<td>192</td>
<td>4 hr</td>
<td>192 ppm (2.0)</td>
<td>19 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Hine et al. 1961</td>
<td>30</td>
<td>75</td>
<td>8 hr</td>
<td>75 ppm (2.5)</td>
<td>7.5 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1961</td>
<td>100</td>
<td>400</td>
<td>4 hr</td>
<td>400 ppm (2.0)</td>
<td>40 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1961</td>
<td>60</td>
<td>170</td>
<td>8 hr</td>
<td>170 ppm (2.5)</td>
<td>17 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Marhold 1986</td>
<td>200</td>
<td>400</td>
<td>4 hr</td>
<td>400 ppm (2.0)</td>
<td>40 ppm</td>
</tr>
</tbody>
</table>

Human data ................................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 10 ppm

Basis for revised IDLH: The revised IDLH for diglycidyl ether is 10 ppm based on acute inhalation toxicity data in animals [Hine et al. 1956; Hine et al. 1961]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for diglycidyl ether at concentrations above 0.1 ppm.]

REFERENCES:

Diisobutyl ketone

CAS number ........................................... 108-83-8
NIOSH REL ........................................... 25 ppm (150 mg/m³) TWA
Current OSHA PEL .................................... 50 ppm (200 mg/m³) TWA
1989 OSHA PEL ......................................... 25 ppm (150 mg/m³) TWA
1993-1994 ACGIH TLV .................................. 25 ppm (145 mg/m³) TWA
Description of Substance .......................... Colorless liquid with a mild, sweet odor.
LEL(@200°F) ........................................... 0.8% (10% LEL(@200°F), 800 ppm)
Original (SCP) IDLH .................................. 2,000 ppm

The chosen IDLH is based on the UCC [1971] report that "breathing saturated vapors in air killed 1 of 6 animals in 8 hours; breathing 2,000 ppm for 8 hours killed 5 of 6 animals. Breathing 1,000 ppm for 8 hours produced illness but no deaths." This is the only useful data available on which to base the IDLH for this substance.

Short-term exposure guidelines ..................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1949</td>
<td>2,000</td>
<td>2,000</td>
<td>4 hr</td>
<td>4,000 ppm (2.0)</td>
<td>600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1949</td>
<td>2,000</td>
<td>2,000</td>
<td>8 hr</td>
<td>5,000 ppm (2.5)</td>
<td>500 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>oral</td>
<td>5,750</td>
<td>6,799 ppm</td>
<td>680 ppm</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Shell 1961</td>
<td>oral</td>
<td>2,416</td>
<td>3,674 ppm</td>
<td>167 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1949</td>
<td>oral</td>
<td>5,880</td>
<td>6,860 ppm</td>
<td>686 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ............................................ It has been reported that a 3-hour exposure at 50 or 100 ppm caused slight irritation to the eyes, nose, and throat [Smyth et al. 1949].

Revised IDLH: 500 ppm

References: The revised IDLH for diisobutyl ketone is 500 ppm based on acute inhalation toxicity data in animals [Smyth et al. 1949].

REFERENCES:

Diisopropylamine

**CAS number** ........................................ 108-18-9
**NIOSH REL** .......................................... 5 ppm (20 mg/m³) TWA [skin]
**Current OSHA PEL** .................................... 5 ppm (20 mg/m³) TWA [skin]
**1988 OSHA PEL** ........................................ Same as current PEL
**1993-1994 ACGIH TLV** ............................... 5 ppm (21 mg/m³) TWA [skin]

**Description of Substance**
Colorless liquid with an ammonia- or fish-like odor.

**LEL** ..................................................... 1.1% (10% LEL, 1,100 ppm)

**Original (SCP) IDLH** ..................................... 1,000 ppm

**Basis for original (SCP) IDLH**
The chosen IDLH is based on the UCC [1971] report that a 4-hour exposure to 1,000 ppm killed 2 of 6 rats. Patty [1963] reported the same information [Smyth et al. 1954].

**Short-term exposure guidelines**
None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₅ (ppm)</th>
<th>LC₁₆ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>1,140</td>
<td>----</td>
<td>2 hr</td>
<td>1,824 ppm (3.6)</td>
<td>182 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>1,000</td>
<td>----</td>
<td>2 hr</td>
<td>1,596 ppm (3.1)</td>
<td>160 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>----</td>
<td>LC₉₅ 1,000</td>
<td>----</td>
<td>2 hr</td>
<td>200 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1949</td>
<td>----</td>
<td>2,207</td>
<td>2.5 hr</td>
<td>3,752 ppm (1.7)</td>
<td>375 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Treon et al. 1949</td>
<td>----</td>
<td>2,207</td>
<td>80 min</td>
<td>3,090 ppm (3.4)</td>
<td>309 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Treon et al. 1949</td>
<td>----</td>
<td>2,207</td>
<td>72 min</td>
<td>2,869 ppm (3.1)</td>
<td>287 ppm</td>
</tr>
</tbody>
</table>

**Human data**
Complaints of nausea, headache, and temporary dimness in vision were reported in workers 2 to 3 hours following several 5- to 10-minute exposures to about 176 ppm; concentrations otherwise during the workshift averaged about 24 to 48 ppm [Treon et al. 1949]

**Revised IDLH:** 200 ppm

**Basis for revised IDLH:** The revised IDLH for diisopropylamine is 200 ppm based on acute inhalation toxicity data in workers [Treon et al. 1949] and animals [Izmerov et al. 1982; Smyth et al. 1954].

**REFERENCES:**
1. Izmerov NF, Sanotsky IV, Storov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 54.
Dimethyl acetamide

CAS number ......................................... 127-19-5
NIOSH REL .......................................... 10 ppm (35 mg/m³) TWA [skin]
Current OSHA PEL ................................ 10 ppm (35 mg/m³) TWA [skin]
1989 OSHA PEL ...................................... Same as current PEL
1993-1994 ACGIH TLV .............................. 16 ppm (36 mg/m³) TWA [skin]

Description of Substance: Colorless liquid with a weak, ammonia- or fish-like odor.

LEL (@ 212°F) ........................................ 1.8% (10% LEL (@ 212°F), 1,800 ppm)

Original (SCP) IDLH ................................ 400 ppm

Basis for original (SCP) IDLH: The chosen IDLH is based on the statement by Deichmann and Gerarde [1969] that acute inhalation at 406 and 575 ppm causes some deaths and degeneration of the liver in several species of laboratory animals. Although no time period is specified for that exposure, the chosen IDLH is probably reasonable, and perhaps even conservative, because Patty [1963] reported that liver injury was noted only in some rats and dogs exposed to repeated inhalation at 100 to 200 ppm [Horn].

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kennedy and Sherman 1986</td>
<td>2,675</td>
<td>-</td>
<td>1 hr</td>
<td>2,970 ppm (1.2)</td>
<td>297 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD (mg/kg)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Bartsch et al. 1976</td>
<td>oral</td>
<td>4,620</td>
<td>-</td>
<td>8,934 ppm</td>
<td>893 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Monsanto 1990</td>
<td>oral</td>
<td>4,800</td>
<td>-</td>
<td>9,282 ppm</td>
<td>928 ppm</td>
</tr>
</tbody>
</table>

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 300 ppm

Basis for revised IDLH: The revised IDLH for dimethyl acetamide is 300 ppm based on acute inhalation toxicity data in animals [Kennedy and Sherman 1986].

REFERENCES:


172
Dimethylamine

CAS number ................................. 124-40-3
NIOSH REL ..................................
Current OSHA PEL ............................ 10 ppm (18 mg/m³) TWA
1989 OSHA PEL ............................ Same as current PEL
1993-1994 ACGIH TLV ....................... 5 ppm (9.2 mg/m³) TWA, 15 ppm (27.6 mg/m³) STEL
Description of Substance ................... Colorless gas with an ammonia- or fish-like odor.
LEL ........................................... 2.8% (10% LEL, 2,800 ppm)

1989 OSHA PEL ..............................
1993-1994 ACGIH TLV .........................

Original (SCP) IDLH ...................... 2,000 ppm
Basis for original (SCP) IDLH ............. No data on acute inhalation toxicity are available for dimethylamine. Therefore, the chosen IDLH is based on an analogy with diethylamine which has an IDLH of 2,000 ppm.

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₆₉ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Koch et al. 1980</td>
<td>4,700</td>
<td>-----</td>
<td>4 hr</td>
<td>9,400 ppm (2.0)</td>
<td>940 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Steinhagen et al. 1982</td>
<td>4,540</td>
<td>-----</td>
<td>6 hr</td>
<td>10,442 ppm (2.3)</td>
<td>1,044 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Steinhagen et al. 1982</td>
<td>7,650</td>
<td>-----</td>
<td>2 hr</td>
<td>12,240 ppm (1.6)</td>
<td>1,224 ppm</td>
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</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₉ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Dzhanshivili 1967</td>
<td>oral</td>
<td>698</td>
<td>-----</td>
<td>2,613 ppm</td>
<td>261 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Dzhanshivili 1967</td>
<td>oral</td>
<td>336</td>
<td>-----</td>
<td>1,183 ppm</td>
<td>118 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Dzhanshivili 1967</td>
<td>oral</td>
<td>240</td>
<td>-----</td>
<td>898 ppm</td>
<td>90 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Dzhanshivili 1967</td>
<td>oral</td>
<td>240</td>
<td>-----</td>
<td>898 ppm</td>
<td>90 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................ RD₅₀ (mouse), 511 ppm [Steinhagen et al. 1982];
RD₅₀ (rat), 573 ppm [Steinhagen et al. 1982].

Human data ............................... None relevant for use in determining the revised IDLH.

Revised IDLH: 500 ppm
Basis for revised IDLH: The revised IDLH for dimethylamine is 500 ppm based on acute inhalation toxicity data in animals [Steinhagen et al. 1982].

REFERENCES:

N,N-Dimethylaniline

CAS number ........................................ 121-69-7
NIOSH REL ............................................
Current OSHA PEL ............................... 5 ppm (25 mg/m³) TWA
1989 OSHA PEL ........................................ 5 ppm (25 mg/m³) TWA
1993-1994 ACGIH TLV ............................... 5 ppm (25 mg/m³) TWA
Description of Substance ............................ Pale yellow, oily liquid with an amine-like odor.
LEL .................................................. Unknown
Original (SCP) IDLH ................................. 100 ppm
Basis for original (SCP) IDLH ...................... No quantitative data on acute inhalation toxicity are available for dimethylaniline. Because the TLV for dimethylaniline is based on an analogy with aniline [ACGIH 1971], the chosen IDLH is also based on an analogy with aniline, which has an IDLH of 100 ppm.

Short-term exposure guidelines .................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Slusar et al. 1972</td>
<td>—</td>
<td>50</td>
<td>4 hr</td>
<td>100 ppm (2.0)</td>
<td>10 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>oral</td>
<td>1,410</td>
<td>—</td>
<td>1,956 ppm</td>
<td>196 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ N,N-Dimethylaniline has been reported to be quantitatively less toxic than aniline but produces a very similar effect — notably, methemoglobinemia [Clayton and Clayton 1981]. It has been reported that 50 mg/kg is the lethal oral dose [Hall 1969]. [Note: An oral dose of 50 mg/kg is equivalent to a 70-kg worker being exposed to 2,333 mg/m³ (483 ppm) for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 100 ppm [Unchanged]
Basis for revised IDLH: Based on an analogy with aniline [Clayton and Clayton 1981] which has an IDLH of 100 ppm and to acute oral toxicity data in humans [Hall 1969], the original IDLH for N,N-dimethylaniline (100 ppm) is not being revised for at this time.

REFERENCES:

Dimethyl-1,2-dibromo-2,2-dichlorethyl phosphate (Naled)

CAS number ........................................... 300-76-5
NIOSH REL ............................................
Current OSHA PEL ................................... 3 mg/m³ TWA
1989 OSHA PEL ...................................... 3 mg/m³ TWA
1993-1994 ACGIH TLV .............................. 3 mg/m³ TWA [skin]

Description of Substance ............................. Colorless to white solid or straw-colored liquid (above 80°F) with a slightly pungent odor.

LEL ..................................................... Noncombustible Solid
Original (SCP) IDLH ................................. 1,800 mg/m³
Basis for original (SCP) IDLH ...................... Because no useful data on acute inhalation toxicity are available, the chosen IDLH has been estimated from the male rat oral LD₅₀ of 250 mg/kg [Gaines 1969 cited by ACGIH 1971]. ACGIH [1971] also reported that the acute toxicity data, inhalation data, and experience to date indicate that this is not a highly dangerous material. None developed

Short-term exposure guidelines .....................

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Berteau and Deen 1978</td>
<td>inhalation</td>
<td>156</td>
<td>------</td>
<td>1,092 mg/m³</td>
<td>109 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Berteau and Deen 1978</td>
<td>oral</td>
<td>222</td>
<td>------</td>
<td>1,554 mg/m³</td>
<td>155 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Berteau and Deen 1978</td>
<td>oral</td>
<td>160</td>
<td>------</td>
<td>1,120 mg/m³</td>
<td>112 mg/m³</td>
</tr>
<tr>
<td>Mammal</td>
<td>Debska et al. 1975</td>
<td>oral</td>
<td>430</td>
<td>------</td>
<td>3,010 mg/m³</td>
<td>301 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gaines 1969</td>
<td>oral</td>
<td>250</td>
<td>------</td>
<td>1,750 mg/m³</td>
<td>175 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Haley et al. 1975</td>
<td>oral</td>
<td>330</td>
<td>------</td>
<td>2,310 mg/m³</td>
<td>231 mg/m³</td>
</tr>
</tbody>
</table>

*Note: An inhalation exposure that was presented as "mg/kg."

Human data ............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 200 mg/m³
Basis for revised IDLH: The revised IDLH for dimethyl-1,2-dibromo-2,2-dichloroethylene phosphate is 200 mg/m³ based on acute toxicity data in animals [Berteau and Deen 1978, Debska et al. 1975; Gaines 1969; Haley et al. 1975].

REFERENCES:

Dimethylformamide

CAS number ........................................ 68-12-2
NIOSH REL ........................................
Current OSHA PEL ............................... 10 ppm (30 mg/m³) TWA [skin]
1989 OSHA PEL .................................... Same as current PEL
1983-1994 ACGIH TLV ............................. 10 ppm (30 mg/m³) TWA [skin]
Description of Substance .......................... Colorless to pale-yellow liquid with a faint, amine-like odor.
LEL(@212°C) ........................................ 2.2% (10% LEL(@212°C), 2.2 ppm)
Original (SCP) IDLH ............................... 3,500 ppm
Basis for original (SCP) IDLH ................. The chosen IDLH is based on the statements by Clayton et al. [1963] that rats survived a 4-hour exposure to air saturated with dimethylformamide vapor [Smyth and Carpenter 1948] and inhalation of saturated vapors for 6 hours was lethal [Haskell Laboratory]. A.D. Little reports that the saturated concentration at 20°C is 3.550 ppm. Because exposures to rats for 4 hours were at saturated concentrations, 3,500 ppm is chosen as the IDLH.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>( \text{LC}_{50} ) (ppm)</th>
<th>( \text{LC}_{10} ) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Haskell</td>
<td>5,000</td>
<td>3,092</td>
<td>6 hr</td>
<td>12,500 ppm (2.1)</td>
<td>1,125 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Stassenkova 1961</td>
<td>5,000</td>
<td>3,092</td>
<td>2 hr</td>
<td>4,947 ppm (2.1)</td>
<td>494 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>( \text{LD}_{50} ) (mg/kg)</th>
<th>( \text{LD}_{10} ) (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Druckrey et al. 1967</td>
<td>oral</td>
<td>2,400</td>
<td>-----</td>
<td>6,447 ppm</td>
<td>645 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Lobanova 1958</td>
<td>oral</td>
<td>3,700</td>
<td>-----</td>
<td>8,530 ppm</td>
<td>852 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Massmann 1956</td>
<td>oral</td>
<td>3,500</td>
<td>-----</td>
<td>8,059 ppm</td>
<td>806 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 500 ppm
Basis for revised IDLH: The revised IDLH for dimethylformamide is 500 ppm based on acute inhalation toxicity data in animals [Stassenkova 1961].

REFERENCES:
1. A.D. Little [7]. A.D. Little, Inc. Information supplied to NIOSH during Standards Completion Project.
1,1-Dimethylhydrazine

CAS number ........................................... 57-14-7
NIOSH REL ...........................................
Current OSHA PEL ...................................
1989 OSHA PEL ........................................
1993·1994 ACGIH TLV .................................
Description of Substance ..........................
LEL .......................................................... 50 ppm
Original (SCP) IDLH ....................................
Existing short-term exposure guidelines .......

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Jacobson et al. 1955</td>
<td>252</td>
<td>----</td>
<td>4 hr</td>
<td>504 ppm (2.0)</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Jacobson et al. 1955</td>
<td>172</td>
<td>----</td>
<td>4 hr</td>
<td>344 ppm (2.0)</td>
<td>34 ppm</td>
</tr>
<tr>
<td>Hamster</td>
<td>Jacobson et al. 1955</td>
<td>392</td>
<td>----</td>
<td>4 hr</td>
<td>784 ppm (2.0)</td>
<td>78 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Jacobson et al. 1955</td>
<td>232</td>
<td>----</td>
<td>4 hr</td>
<td>22 ppm (2.0)</td>
<td>22 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Jacobson et al. 1955</td>
<td>133</td>
<td>----</td>
<td>4 hr</td>
<td>104 ppm (2.0)</td>
<td>10 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Weeks et al. 1963</td>
<td>52</td>
<td>----</td>
<td>15 min</td>
<td>2,828 ppm (0.79)</td>
<td>283 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Weeks et al. 1963</td>
<td>3,580</td>
<td>----</td>
<td>1 hr</td>
<td>1,763 ppm (1.25)</td>
<td>176 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Weeks et al. 1963</td>
<td>1,410</td>
<td>----</td>
<td>1 hr</td>
<td>1,226 ppm (1.25)</td>
<td>123 ppm</td>
</tr>
</tbody>
</table>

Other animal data .....................................
None adverse effects were noted in dogs exposed at 50, 200, and 600 ppm for 60, 15, and 5 minutes, respectively; only mild toxic responses were noted at 100, 400, and 1,200 ppm for 60, 15, and 5 minutes, respectively [Weeks et al. 1963].

Human data ............................................
None relevant for use in determining the revised IDLH.
1,1-Dimethylhydrazine (continued)

Revised IDLH: 15 ppm

Basis for revised IDLH: The revised IDLH for 1,1-dimethylhydrazine is 15 ppm based on acute toxicity data in animals [Jacobson et al. 1955]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for 1,1-dimethylhydrazine at concentrations above 0.06 ppm.]

REFERENCES:

Dimethylphthalate

CAS number ........................................... 131-11-3
NIOSH REL .............................................
Current OSHA PEL .................................... 5 mg/m³ TWA
1989 OSHA PEL ..................................... Same as current PEL
1993-1994 ACGIH TLV ............................. 5 mg/m³ TWA
Description of Substance .......................... Colorless, oily liquid with a slight, aromatic odor.
LEL (@358°F) ........................................ 0.9% (10% LEL (@358°F), 11,300 mg/m³)
Original (SCP) IDLH ............................ 9,300 mg/m³
Based on original (SCP) IDLH .......... The chosen IDLH is based on the statement by Spector [1956] that 9,300 mg/m³ was a lethal concentration for the cat [Eller 1937].

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀</th>
<th>LC₆₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Eller 1937</td>
<td>9,610 mg/m³</td>
<td>6 hr</td>
<td>22,149 mg/m³ (2.3)</td>
<td>2,215 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Lehman 1955</td>
<td>oral</td>
<td>6,900</td>
<td></td>
<td>48,300 mg/m³</td>
<td>4,830 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Lehman 1955</td>
<td>oral</td>
<td>1,000</td>
<td></td>
<td>7,000 mg/m³</td>
<td>700 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Lehman 1955</td>
<td>oral</td>
<td>5,400</td>
<td></td>
<td>16,800 mg/m³</td>
<td>1,680 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Timofeevskai et al. 1963</td>
<td>oral</td>
<td>4,800</td>
<td></td>
<td>47,600 mg/m³</td>
<td>4,760 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Timofeevskai et al. 1963</td>
<td>oral</td>
<td>6,800</td>
<td></td>
<td>47,600 mg/m³</td>
<td>4,760 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Woodard and Hagan 1948</td>
<td>oral</td>
<td>4,400</td>
<td></td>
<td>30,800 mg/m³</td>
<td>3,080 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Woodard and Hagan 1948</td>
<td>oral</td>
<td>2,400</td>
<td></td>
<td>16,800 mg/m³</td>
<td>1,680 mg/m³</td>
</tr>
</tbody>
</table>

Human data .......................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 mg/m³

Based for revised IDLH: The revised IDLH for dimethylphthalate is 2,000 mg/m³ based on acute inhalation toxicity data in animals [Eller 1937]. [Note: Due to its low volatility, this concentration could only be reached at elevated temperatures or if the liquid droplets become airborne as in a mist.]

REFERENCES:

Dimethyl sulfate

CAS number ........................................ 77-78-1
NIOSH REL ........................................
Current OSHA PEL ............................
1989 OSHA PEL ..............................
1993-1994 ACGIH TLV .........................

description of Substance......................

LEL .............................................

Original (SCP) IDLH ............................

basis for original (SCP) IDLH ..............

Short-term exposure guidelines .............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Batsura et al. 1980</td>
<td>8</td>
<td>----</td>
<td>4 hr</td>
<td>17 ppm (2.0)</td>
<td>1.7 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Deichmann and Gerarde 1969</td>
<td>----</td>
<td>97</td>
<td>10 min</td>
<td>67 ppm (0.69)</td>
<td>6.7 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Ghiringhelli et al. 1957</td>
<td>75</td>
<td>----</td>
<td>20 min</td>
<td>65 ppm (10.87)</td>
<td>6.5 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Zabol 1979</td>
<td>53</td>
<td>----</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>G. pig</td>
<td>Marhold 1986</td>
<td>32</td>
<td>----</td>
<td>1 hr</td>
<td>40 ppm (1.25)</td>
<td>4.0 ppm</td>
</tr>
</tbody>
</table>

Other human data ................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 7 ppm

| Basis for revised IDLH: | The revised IDLH for dimethyl sulfate is 7 ppm based on acute inhalation toxicity data in humans (Deichmann and Gerarde 1969). [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for dimethyl sulfate at concentrations above 0.1 ppm.] |

REFERENCES:

Dinitrobenzene (o-, m-, p-isomers)

CAS number ........................................... 526-29-0 (o-isomer), 99-55-0 (m-isomer), 100-25-4 (p-isomer)
NIOSH REL ........................................
Current OSHA PEL ................................... 1 mg/m³ TWA [skin]
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ............................... 1 mg/m³ (0.15 ppm) TWA [skin]
Description of Substance .......................... Pale-white or yellow solid.
LEL ...................................................... Unknown
Original (SCP) IDLH .................................... 200 mg/m³
Basis for original (SCP) IDLH ......................... No data on acute inhalation toxicity are available on which to base an IDLH for dinitrobenzene. The chosen IDLH, therefore, has been estimated from the statement by Deichmann and Gerarde [1969] that the probable lethal oral dose for an adult is 2 grams.

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-isomer</td>
<td>Cat</td>
<td>oral</td>
<td>-----</td>
<td>29</td>
<td>203 mg/m³</td>
<td>20 mg/m³</td>
</tr>
<tr>
<td></td>
<td>m-isomer</td>
<td>oral</td>
<td>83</td>
<td>-----</td>
<td>581 mg/m³</td>
<td>58 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Rabbit</td>
<td>oral</td>
<td>400</td>
<td>-----</td>
<td>2,800 mg/m³</td>
<td>280 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................... The probable lethal oral dose has been reported to be 2 grams [Deichmann and Gerarde 1969]. [Note: An oral dose of 2 grams is equivalent to a worker being exposed to about 1,300 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 50 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for dinitrobenzene. Therefore, the revised IDLH for dinitrobenzene is 50 mg/m³ based on acute oral toxicity data in humans [Deichmann and Gerarde 1969].

REFERENCES:

Dinitro-o-cresol

CAS number ........................................... 534-52-1
NIOSH REL ............................................
Current OSHA PEL ..................................... 0.2 mg/m³ TWA [skin]
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV .................................. 0.2 mg/m³ TWA [skin]

Description of Substance ...................................
Yellow, odorless solid.

LEL ..........................................................
Original (SCP) IDLH ....................................... 5 mg/m³

Easls for original (SCP) IDLH .........................

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₈₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Burkatskaya 1965</td>
<td>LC₅₀: 40 mg/m³</td>
<td>------</td>
<td>4 hr</td>
<td>80 mg/m³ (2.6)</td>
<td>8.0 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₈₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Colliot 1972</td>
<td>oral</td>
<td>7</td>
<td>------</td>
<td>49 mg/m³</td>
<td>4.9 mg/m³</td>
</tr>
<tr>
<td>Cat</td>
<td>Deceauret al. 1981</td>
<td>oral</td>
<td>50</td>
<td>------</td>
<td>250 mg/m³</td>
<td>35 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Mechhem and Vemot 1972</td>
<td>oral</td>
<td>22</td>
<td>------</td>
<td>147 mg/m³</td>
<td>15 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Popov and Vrochinsky 1976</td>
<td>oral</td>
<td>24.6</td>
<td>------</td>
<td>172 mg/m³</td>
<td>17 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Popov and Vrochinsky 1976</td>
<td>oral</td>
<td>24.6</td>
<td>------</td>
<td>172 mg/m³</td>
<td>17 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Spencer et al. 1948</td>
<td>oral</td>
<td>31</td>
<td>------</td>
<td>217 mg/m³</td>
<td>22 mg/m³</td>
</tr>
</tbody>
</table>

Human data ................................................ An exposure of 4.7 mg/m³ per day resulted in fever, a basal metabolic rate of 400%, rapid pulse and respiration, profuse sweating, shortness of breath, and cough (Fairhall 1957). A single oral dose of 75 mg produced no toxic effects in five volunteers (Harvey et al. 1951). [Note: An oral dose of 75 mg is equivalent to a worker being exposed to 50 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 5 mg/m³ [Unchanged]

Basis for revised IDLH: Based on acute toxicity data in humans [Fairhall 1957; Harvey et al. 1951] and animals [Colliot 1972], the original IDLH for dinitro-o-cresol (5 mg/m³) is not being revised at this time.

REFERENCES:

Dinitro-o-cresol (continued)

Dinitrotoluene (mixed isomers)

CAS number ...................................................... 25321-14-6
NIOSH REL ............................................................
Current OSHA PEL ....................................................
1989 OSHA PEL ...........................................................
1993-1994 ACGIH TLV ...........................................
Description of Substance ............................................... Orange-yellow crystalline solid with a characteristic odor.
LEL .................................................................
Original (SCP) IDLH .................................................. 200 mg/m³
Basis for original (SCP) IDLH .................................... Because no data on acute inhalation toxicity are available concerning the physiological response to dinitrotoluene, the chosen IDLH has been estimated from the oral cat minimal lethal dose of 27 mg/kg [White and Hay 1901 and Kuhls 1905 cited by Spector 1956].

Short-term exposure guidelines ........................................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50</th>
<th>LD95</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Isomer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Rickert et al. 1984</td>
<td>oral</td>
<td>216</td>
<td>-----</td>
<td>1,512 mg/m³</td>
<td>151 mg/m³</td>
</tr>
<tr>
<td>2,4-Isomer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Rickert et al. 1984</td>
<td>oral</td>
<td>1,954</td>
<td>-----</td>
<td>13,678 mg/m³</td>
<td>2,368 mg/m³</td>
</tr>
<tr>
<td>Cat</td>
<td>Rickert et al. 1984</td>
<td>oral</td>
<td>-----</td>
<td>27</td>
<td>189 mg/m³</td>
<td>19 mg/m³</td>
</tr>
</tbody>
</table>

Human data .................................................................. It has been reported that the toxic effects of dinitrotoluene are similar in character to those of other aromatic nitro compounds, such as dinitrobenzene [ACGIH 1991].

Revised IDLH: 50 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for dinitrotoluene. Therefore, the revised IDLH for dinitrotoluene is 50 mg/m³ based on an analogy with dinitrobenzene [ACGIH 1991]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for dinitrotoluene at concentrations above 1.5 mg/m³.]

REFERENCES:

Di-sec octyl phthalate

CAS number ........................................... 117-81-7
NIOSH REL ............................................. 5 mg/m³ TWA, 10 mg/m³ STEL; NIOSH considers di-sec octyl phthalate to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ..................................... 5 mg/m³ TWA
1989 OSHA PEL ...................................... 5 mg/m³ TWA, 10 mg/m³ STEL
1993-1994 ACGIH TLV ................................. 5 mg/m³ TWA, 10 mg/m³ STEL

Description of Substance .......................... Colorless, oily liquid with a slight odor.

LEL(474°F) .............................................. 0.3% (10% LEL(474°F), 8,600 mg/m³)

Original (SCP) IDLH* .................................. Unknown "Note: "Effective" IDLH = 3,000 mg/m³ — see discussion below.

Basis for original (SCP) IDLH .................... Patty [1963] made the statement that inhalation of the vapor-mist mixture produced by bubbling air through a column of plasticizer maintained at 170°C could be tolerated for 2 hours without producing fatalities. In a 4-hour period, however, all rats had succumbed. On the basis of these experiments, the hazard to exposed workers should be very low under ordinary circumstances. Because di-sec octyl phthalate has such a low toxicity, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 1,000 x the OSHA PEL of 5 mg/m³ (i.e., 5,000 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 5,000 mg/m³.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Autian 1973</td>
<td>oral</td>
<td>34,000</td>
<td></td>
<td>233,000</td>
<td>23,800 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Autian 1973</td>
<td>oral</td>
<td>26,000</td>
<td></td>
<td>182,000</td>
<td>18,200 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Shibko and Blumenthal 1973</td>
<td>oral</td>
<td>30,000</td>
<td></td>
<td>210,000</td>
<td>21,000 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Yagi et al. 1976</td>
<td>oral</td>
<td>30,000</td>
<td></td>
<td>210,000</td>
<td>21,000 mg/m³</td>
</tr>
</tbody>
</table>

Human data ............................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 5,000 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for di-sec octyl phthalate. Since the acute oral toxicity data in animals [Autian 1973; Shibko and Blumenthal 1973; Yagi et al. 1976] indicates that di-sec octyl phthalate has low acute toxicity, the revised IDLH for di-sec octyl phthalate is 5,000 mg/m³ based on being 1,000 times the OSHA PEL of 5 mg/m³ (1,000 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for di-sec octyl phthalate). [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for di-sec octyl phthalate at concentrations above 5 mg/m³].

REFERENCES:

Dioxane

CAS number .......................... 123-91-1
NIOSH REL .......................... 1 ppm (3.6 mg/m³) 30-minute CEILING; NIOSH considers dioxane to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1990).

Current OSHA PEL .......................... 100 ppm (360 mg/m³) TWA [skin]
1989 OSHA PEL .......................... 25 ppm (90 mg/m³) TWA [skin]
1993-1994 ACGIH TLV .......................... 25 ppm (90 mg/m³) TWA [skin]

Description of Substance

Lethal concentration
Baala

LEL ......................................... 2,000 ppm

Colorless liquid or solid (below 53°F) with a mild, ether-like odor.

None

2.0% (10% LEL, 2,000 ppm)

None

2,000 ppm

The chosen IDLH is based on the acute inhalation toxicity data cited by AIHA [1960] in which a lethal concentration of 1,000 to 3,000 ppm for 3 hours is reported for guinea pigs, and on the lethal concentration of 2,085 ppm (6 hours) for mice [Klimmer 1937] reported by Spector [1966]. ACGIH [1971] reported that guinea pigs could tolerate 2,000 ppm for several hours without serious symptoms [Yant et al. 1930]. Therefore, exposure of workers to 2,000 ppm for 30 minutes probably would not impede escape or cause any irreversible health effects.

None relevant for use in determining the revised IDLH.

REFERENCES:

Diphenyl

CAS number ................................................. 92-52-4
NIOSH REL .................................................. 
Current OSHA PEL ..............................................
1989 OSHA PEL ..................................................
1993-1994 ACGIH TLV ............................................

Description of Substance

LEL(@232°F) ......................................................
0.6% (10% LEL(@232°F), 5,000 mg/m³)
Original (SCP) IDLH .............................................
300 mg/m³

The chosen IDLH is based on the following statements by Hakkinen et al. [1973]: "one fatal case of liver necrosis with some areas of cirrhosis occurred in a worker who had been regularly exposed to concentrations of vapor of approximately 100 mg/m³. Other workers with repeated exposure to concentrations greater than 5 mg/m³ had gastrointestinal symptoms as well as polyneuritic complaints, with abnormalities of both the electroencephalogram and electromyogram. Some showed hepatic damage detected by liver function tests and biopsy."

Short-term exposure guidelines .................................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Deichmann et al. 1947</td>
<td>oral</td>
<td>2,400</td>
<td>16,800 mg/m³</td>
<td>1,680 mg/m³</td>
<td>1.680 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann et al. 1947</td>
<td>oral</td>
<td>1,280</td>
<td>22,960 mg/m³</td>
<td>2,296 mg/m³</td>
<td>2.296 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Isshiki et al. 1983</td>
<td>oral</td>
<td>1,900</td>
<td>13,300 mg/m³</td>
<td>1,330 mg/m³</td>
<td>1.330 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Hananto 1986</td>
<td>oral</td>
<td>3,400</td>
<td>16,800 mg/m³</td>
<td>1,680 mg/m³</td>
<td>1.680 mg/m³</td>
</tr>
</tbody>
</table>

Human data ....................................................

It has been reported that one fatal case of liver necrosis with some areas of cirrhosis occurred in a worker who had been regularly exposed to concentrations of 100 mg/m³ of vapor. Other workers with repeated exposure to concentrations greater than 5 mg/m³ had gastrointestinal symptoms as well as polyneuritic complaints, with abnormalities of both the electroencephalogram and electromyogram. Some showed hepatic damage detected by liver function tests and biopsy.

Revised IDLH: 100 mg/m³

Basis for revised IDLH: The revised IDLH for diphenyl is 100 mg/m³ based on acute and chronic inhalation toxicity data in workers [Hakkinen et al. 1973].

REFERENCES:

Dipropylene glycol methyl ether

CAS number ........................................ 34590-94-4
NIOSH REL ........................................ 100 ppm (600 mg/m³) TWA, 150 ppm (900 mg/m³) STEL [skin]
Current OSHA PEL ................................. 100 ppm (600 mg/m³) TWA [skin]
1989 OSHA PEL ...................................... 100 ppm (600 mg/m³) TWA, 150 ppm (900 mg/m³) STEL [skin]
1993-1994 ACGIH TLV ......................... 100 ppm (600 mg/m³) TWA, 150 ppm (900 mg/m³) STEL [skin]

Description of Substance

Colorless liquid with a mild, ether-like odor.

Original (SCP) IDLH* ................................ 1.1% (10% LEL[@392°F], 1,100 ppm)

No acute toxicity data are available on which to base an IDLH for dipropylene glycol methyl ether. According to Patty [1963] this substance is low in toxicity by inhalation. Therefore, for this draft technical standard, respirators have been selected on the basis of the assigned protection factor afforded by each device up to a concentration of 50 x the OSHA PEL of 100 ppm (i.e., 5,000 ppm); only the "most protective" respirators are permitted for use in concentrations exceeding 5,000 ppm. Concentrations above 5,000 ppm are unlikely to be encountered in the workplace because of the high boiling point and low vapor pressure of this substance.

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀(mg/kg)</th>
<th>LD₉₅(mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Rowe et al. 1954</td>
<td>oral</td>
<td>5,135</td>
<td>5,855 ppm</td>
<td>584 ppm</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>Shideman and Procita 1951</td>
<td>oral</td>
<td>7,500</td>
<td>8,525 ppm</td>
<td>852 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>oral</td>
<td>5,389</td>
<td>6,080 ppm</td>
<td>608 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Concentrations between 300 and 400 ppm have been reported to be very disagreeable [Rowe et al. 1954]. Central nervous system impairment (undefined) occurred at 1,000 ppm in one of two subjects [Stewart et al. 1970].

Revised IDLH: 600 ppm

Basis for revised IDLH: The revised IDLH for dipropylene glycol methyl ether is 600 ppm based on acute toxicity data in humans [Rowe et al. 1954; Stewart et al. 1970] and animals [Rowe et al. 1954; Smyth et al. 1962]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations between 400 and 1,000 ppm.

REFERENCES:

**Endrin**

CAS number ........................................ 72-20-8
NIOSH REL ........................................
Current OSHA PEL ................................
1989 OSHA PEL ...................................
1993-1994 ACGIH TLV ..........................
Description of Substance .......................... Colorless to tan, crystalline solid with a mild, chemical odor.
LEL ..................................................
Original (SCP) IDLH* ............................. 2,000 mg/m³ [Note: "Effective" IDLH = 200 mg/m³ — see discussion below.]

Short-term exposure guidelines ................. None developed

**ACUTE TOXICITY DATA**

*Lethal concentration data:*

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ₖₐₜ</th>
<th>LC₉₅ₖₐₜ</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>ACGIH 1971</td>
<td>LC₂₀₅ₖₐₜ: 2,000 mg/m³</td>
<td>4 hr</td>
<td>2,500 mg/m³ (2.25)</td>
<td>250 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

*Lethal dose data:*

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>L₉₅₀ₖₐₜ (mg/kg)</th>
<th>L₉₅₆ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monkey</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>3</td>
<td>21 mg/kg</td>
<td>2.1 mg/kg</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>16</td>
<td>112 mg/kg</td>
<td>11 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Hamster</td>
<td>Ottolenghi et al. 1974</td>
<td>oral</td>
<td>10</td>
<td>70 mg/kg</td>
<td>7.0 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Sanderson and Noakes 1970</td>
<td>oral</td>
<td>3</td>
<td>21 mg/kg</td>
<td>2.1 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Treon et al. 1955</td>
<td>oral</td>
<td>5</td>
<td>35 mg/kg</td>
<td>3.5 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1955</td>
<td>oral</td>
<td>7</td>
<td>49 mg/kg</td>
<td>4.9 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Webb et al. 1973</td>
<td>oral</td>
<td>1.4</td>
<td>10 mg/kg</td>
<td>1.0 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

*Human data:* An oral dose of 171 mg/kg has been reported to be lethal [Runhaar et al. 1985]. It has also been reported that the approximate oral dose producing convulsions is about 0.2 mg/kg [Hayes 1982]. [Note: Oral doses of 171 mg/kg or 0.2 mg/kg are equivalent to a 70-kg worker being exposed to about 8,000 mg/m³ or 9 mg/m³, respectively, for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

**Revised IDLH:** 2 mg/m³

*Basis for revised IDLH:* The revised IDLH for endrin is 2 mg/m³ based on acute oral toxicity data in humans [Hayes 1982] and in animals [AAPCO 1966; Sanderson and Noakes 1970; Treon et al. 1955; Webb et al. 1973]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.
REFERENCES:


Epichlorohydrin

CAS number ................................. 106-89-8
NIOSH REL .................................. None established; NIOSH considers epichlorohydrin to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ............................ 5 ppm (19 mg/m³) TWA (skin)
1989 OSHA PEL .............................. 2 ppm (8 mg/m³) TWA (skin)
1993·1914 ACGIH TLV ......................... Colorless liquid with a slightly irritating, chloroform-like odor.

LEL ......................................... 3.8% (10% LEL, 3,800 ppm)

Original (SCP) IDLH ........................... 250 ppm

Basis for original (SCP) IDLH ............... The chosen IDLH is based on the rat 4-hour LC₅₀ of 250 ppm [Carpenter et al. 1949 cited by NIOSH 1976a).


<table>
<thead>
<tr>
<th>ERPG</th>
<th>Value (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERPG-1</td>
<td>2 ppm</td>
</tr>
<tr>
<td>ERPG-2</td>
<td>20 ppm</td>
</tr>
<tr>
<td>ERPG-3</td>
<td>100 ppm</td>
</tr>
</tbody>
</table>

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>...</td>
<td>250</td>
<td>4 hr</td>
<td>500 ppm (2.0)</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Dow</td>
<td>2.617</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Rat</td>
<td>Dow</td>
<td>2.165</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Mouse</td>
<td>Freuder and Leake 1941</td>
<td>...</td>
<td>8,300</td>
<td>10 min</td>
<td>8,100 ppm (1.0)</td>
<td>830 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>250</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth and Carpenter 1948</td>
<td>...</td>
<td>8 hr</td>
<td>600 ppm (2.4)</td>
<td>60 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Smyth and Possani 1986</td>
<td>...</td>
<td>7,414</td>
<td>10 min</td>
<td>7,414 ppm (1.0)</td>
<td>741 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Weil et al. 1963</td>
<td>360</td>
<td>...</td>
<td>6 hr</td>
<td>828 ppm (2.3)</td>
<td>93 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Weil et al. 1963</td>
<td>250</td>
<td>...</td>
<td>8 hr</td>
<td>600 ppm (2.4)</td>
<td>60 ppm</td>
</tr>
<tr>
<td>Other animal data</td>
<td>RD₅₀ (mouse), 687 ppm [Alarie 1981].</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Workers engaged in the production of epichlorohydrin from dichlorohydrin glycerin, with isolated exposures to epichlorohydrin ranging from 4.9 to 54.9 ppm, showed no apparent adverse effects [Pettke et al. 1966]. Concentrations of 20 ppm produced transient burning of the eyes and nasal mucosa, 40 ppm produced eye and throat irritation that persisted for 48 hours, and concentrations in excess of 100 ppm were considered intolerable with a potential for lung edema and kidney lesions [NIOSH 1976b].

Revised IDLH: 75 ppm

Basis for revised IDLH: The revised IDLH for epichlorohydrin is 75 ppm based on acute inhalation toxicity data in humans [NIOSH 1976b; Pettke et al. 1966] and animals [Carpenter et al. 1949; NPIRI 1974; Smyth and Carpenter 1948; Weil et al. 1963]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for epichlorohydrin at any detectable concentration.]

REFERENCES:

Epichlorohydrin (continued)


EPN

CAS number ........................................ 2104-54-5
NIOSH REL .............................................
Current OSHA PEL ................................. 0.5 mg/m³ TWA [skin]
1989 OSHA PEL ...................................... Same as current PEL
1993-1994 ACGIH TLV .............................. 0.5 mg/m³ TWA [skin]
Description of Substance ......................... Yellow solid with an aromatic odor.
LEL ....................................................... 50 mg/m³
Original (SCP) IDLH ............................... No data on acute inhalation toxicity are available on which to base the IDLH for EPN. The chosen IDLH, therefore, has been estimated from the female rat oral LD₅₀ of 8 mg/kg [Gaines 1969 cited by NIOSH 1976].

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LDₙ₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>20</td>
<td>----</td>
<td>140 mg/m³</td>
<td>14 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gaines 1969</td>
<td>oral</td>
<td>8</td>
<td>----</td>
<td>56 mg/m³</td>
<td>5.6 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gaines 1969</td>
<td>oral</td>
<td>36</td>
<td>----</td>
<td>252 mg/m³</td>
<td>25 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Hodge et al. 1954</td>
<td>oral</td>
<td>7</td>
<td>----</td>
<td>49 mg/m³</td>
<td>4.9 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Nishizawa et al. 1962</td>
<td>oral</td>
<td>12.2</td>
<td>----</td>
<td>85 mg/m³</td>
<td>8.5 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................ Ingestion of 3 mg EPN per day for 32 days did not depress plasma or red blood cell (RBC) cholinesterase; 6 mg EPN per day for 88 days did not cause a significant depression of RBC or plasma cholinesterase [Rider et al. 1959]. It has been reported that the threshold of incipient toxicity appears to be 9 mg [Moeller and Rider 1962].

Revised IDLH: 5 mg/m³
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for EPN. Therefore, the revised IDLH for EPN is 5 mg/m³ based on acute oral toxicity data in humans [Rider et al. 1959] and animals [Gaines 1969; Hodge et al. 1954]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:
Ethanolamine

CAS number ................................................. 141-43-5
NIOSH REL ................................................................. 3 ppm (8 mg/m³) TWA, 6 ppm (15 mg/m³) STEL
Current OSHA PEL .................................................. 3 ppm (6 mg/m³) TWA
1993-1994 ACGIH TLV ........................................ 3 ppm (7.5 mg/m³) TWA, 6 ppm (15 mg/m³) STEL

Description of Substance ..........................................
Colorless, viscous liquid or solid (below 51°F) with an unpleasant, ammonia-like odor.

LEL(@25°F) ........................................... 3.0% (10% LEL(@25°F), 3,000 ppm)
Original (SCP) IDLH ........................................... 1,000 ppm
Basis for original (SCP) IDLH ..................................

The chosen IDLH is based on the statement by AIHA [1968] that the saturated concentration (less than 1,316 ppm) at room temperature should not be immediately hazardous to life. However, AIHA [1968] also reported that sprays and mists evolving from these compounds at elevated temperatures may be dangerous.

Existing short-term exposure guidelines ..................................

1-hour EEGL: 50 ppm
24-hour EEGL: 3 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Treon et al. 1957</td>
<td>LC₁₀: 233</td>
<td>-----</td>
<td>1 hr</td>
<td>291 ppm (1.25)</td>
<td>29 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₁₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Hartung and Cornish 1968</td>
<td>oral</td>
<td>3,320</td>
<td>-----</td>
<td>9,150 ppm</td>
<td>915 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Sidorov et al. 1968</td>
<td>oral</td>
<td>620</td>
<td>-----</td>
<td>1,709 ppm</td>
<td>717 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Sidorov et al. 1968</td>
<td>oral</td>
<td>2,050</td>
<td>-----</td>
<td>5,650 ppm</td>
<td>565 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Sidorov et al. 1968</td>
<td>oral</td>
<td>1,475</td>
<td>-----</td>
<td>4,065 ppm</td>
<td>407 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Sidorov et al. 1968</td>
<td>oral</td>
<td>1,000</td>
<td>-----</td>
<td>2,776 ppm</td>
<td>278 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Sidorov and Timofievskaya 1979</td>
<td>oral</td>
<td>1,000</td>
<td>-----</td>
<td>2,756 ppm</td>
<td>276 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Sidorov et al. 1968</td>
<td>oral</td>
<td>700</td>
<td>-----</td>
<td>2,776 ppm</td>
<td>278 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Vernez et al. 1977</td>
<td>oral</td>
<td>1,720-1,970</td>
<td>-----</td>
<td>4,740-5,439 ppm</td>
<td>474-543 ppm</td>
</tr>
</tbody>
</table>

Other animal data ...........................................
Cats exposed for 2 hours to vapors of ethanolamine at concentrations reaching 970 ppm displayed vomiting tendencies; mice had no adverse effects from the same exposures [Sidorov et al. 1968]. A single 8-hour exposure to "concentrated vapors" did not kill any of six rats [UCC 1970]. Guinea pigs survived a 15-minute exposure to ethanolamine at 193 ppm [Treon et al. 1957].

Human data ..............................................
None relevant for use in determining the revised IDLH.

Revised IDLH: 30 ppm
Basis for revised IDLH: The revised IDLH for ethanolamine is 30 ppm based on acute inhalation toxicity data in animals [Treon et al. 1957].
REFERENCES:

# 2-Ethoxyethanol

**CAS number** ........................................... 110-80-5
**NIOSH REL** .............................................
**Current OSHA PEL** .................................... 0.5 ppm (1.8 mg/m³) TWA [skin]
**1989 OSHA PEL** ....................................... Same as current PEL
**1993-1994 ACGIH TLV** .............................. 5 ppm (18 mg/m³) TWA [skin]

**Description of Substance**
Colorless liquid with a sweet, pleasant, ether-like odor.

**LEL[200°F]** ........................................... 1.7% (10% LEL[200°F], 1,700 ppm)

**Original (SCP) IDLH** ............................... 6,000 ppm
**Basis for original (SCP) IDLH** ................. The chosen IDLH is based on the statement by AIHA [1963] that investigators concluded from animal experiments that substantially saturated atmospheres (6,000 ppm) at ordinary room temperatures will not produce serious injury in 1 hour [Waite et al. 1930].

**Short-term exposure guidelines** ............... None developed

## ACUTE TOXICITY DATA

### Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>2,000</td>
<td>3,000</td>
<td>7 hr</td>
<td>4,800 ppm (2.4)</td>
<td>480 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Waite et al. 1930</td>
<td>3,000</td>
<td>7 hr</td>
<td>10,950 ppm (3.65)</td>
<td>1,095 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Werner et al. 1943</td>
<td>1,820</td>
<td>7 hr</td>
<td>4,368 ppm (2.4)</td>
<td>437 ppm</td>
<td></td>
</tr>
</tbody>
</table>

### Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Eastman 1982</td>
<td>oral</td>
<td>2.451</td>
<td>-----</td>
<td>4,575 ppm</td>
<td>458 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Gig Tr Prof Zabol 1963</td>
<td>oral</td>
<td>2.125</td>
<td>-----</td>
<td>3,567 ppm</td>
<td>397 ppm</td>
</tr>
</tbody>
</table>

### Other animal data

Some investigators have stated that at ordinary room temperatures substantially saturated atmospheres (i.e., about 6,000 ppm) will not produce serious injury in 1 hour [Waite et al. 1930].

### Human data

Volunteers with some work experience reported that odor levels of 125 ppm were noticeable and that the odor level that would be intolerable was greater than 255 ppm [Clayton and Clayton 1982].

## Revised IDLH: 500 ppm

**Basis for revised IDLH:** The revised IDLH for 2-ethoxyethanol is 500 ppm based on acute inhalation toxicity data in animals [NPIRI 1974; Werner et al. 1943]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 255 ppm.

## REFERENCES:

2-Ethoxyethanol (continued)

2-Ethoxyethyl acetate

CAS number ........................................ 111-15-9
NIOSH REL ........................................
Current OSHA PEL .................................
1989 OSHA PEL ..................................
1993-1994 ACGIH TLV ..........................
LEL ..................................................
Original (SCP) IDLH ................................
Basis for original (SCP) IDLH ..................
Patty [1963] reported that guinea pigs survived a 1-hour exposure to an atmosphere essentially saturated with vapor (estimated to be less than 4,000 ppm) [Lehmann and Flury 1943]. Because the data concerning the concentration is not very specific, the IDLH is based on the concentration of 2-ethoxyethylacetate in saturated air at 20°C (i.e., 2,600 ppm).

Short-term exposure guidelines .............

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LCO₅₀ (ppm)</th>
<th>LCO₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1959</td>
<td>2,204</td>
<td>-----</td>
<td>8 hr</td>
<td>5,510 ppm (2.5)</td>
<td>521 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1941</td>
<td>LC₅₀: 1,550</td>
<td>-----</td>
<td>8 hr</td>
<td>3,770 ppm (2.5)</td>
<td>375 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Truhaut et al. 1979</td>
<td>&gt;2,000</td>
<td>-----</td>
<td>4 hr</td>
<td>&gt;4,000 ppm (2.0)</td>
<td>&gt;400 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Eastman 1982</td>
<td>oral</td>
<td>1,950</td>
<td>-----</td>
<td>1,950</td>
<td>249 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Isin et al. 1988</td>
<td>oral</td>
<td>2,700</td>
<td>-----</td>
<td>2,700</td>
<td>340 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth et al. 1941</td>
<td>oral</td>
<td>1,910</td>
<td>-----</td>
<td>1,910</td>
<td>243 ppm</td>
</tr>
</tbody>
</table>

Human data ....................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 500 ppm
Basis for revised IDLH: The revised IDLH for 2-ethoxyethyl acetate is 500 ppm based on acute inhalation toxicity data in animals [Pozzani et al. 1959; Smyth et al. 1941; Truhaut et al. 1979]. This may be a conservative value due to the lack of relevant inhalation acute toxicity data for workers.

REFERENCES:

Ethyl acetate

CAS number .................................................. 141-78-5
NIOSH REL .................................................. 400 ppm (1,400 mg/m³) TWA
Current OSHA PEL .................................. 400 ppm (1,400 mg/m³) TWA
1989 OSHA PEL ........................................... Same as current PEL.
1993-1994 ACGIH TLV ................................. 400 ppm (1,440 mg/m³) TWA

Description of Substance .......................... Colorless liquid with an ether-like, fruity odor.

LEL .......................................................... 2.0% (10% LEL, 2,000 ppm)

Original (SCP) IOLH ........................................ 10,000 ppm
Basis for original (SCP) IOLH .................... Spector [1956] cited a mouse 3-hour LC₅₀ of 12,330 ppm

Short-term exposure guidelines .................. None developed

Short-term exposure guidelines ..................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Rlina 1933</td>
<td>---</td>
<td>21</td>
<td>2 hr</td>
<td>26 ppm (1.25)</td>
<td>2.6 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Clayton and Clayton 1981</td>
<td>16,000</td>
<td>---</td>
<td>6 hr</td>
<td>36,100 ppm (2.3)</td>
<td>3,680 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Ismerov et al. 1982</td>
<td>12,295</td>
<td>---</td>
<td>2 hr</td>
<td>19,672 ppm (1.6)</td>
<td>3,967 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Patty 1963</td>
<td>1,600</td>
<td>---</td>
<td>8 hr</td>
<td>4,000 ppm (2.5)</td>
<td>400 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Spealman et al. 1945</td>
<td>---</td>
<td>12,130</td>
<td>3 hr</td>
<td>22,194 ppm (2.6)</td>
<td>2,319 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>UCC 1968</td>
<td>LC₅₀: 16,000</td>
<td>---</td>
<td>4 hr</td>
<td>32,000 ppm (2.0)</td>
<td>3,200 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................ RD₅₀ (mouse), 814 ppm [Alarie 1961].

Human data .................................................. Workers regularly exposed to concentrations from 375 to

1,500 ppm for several months showed no unusual signs or symptoms [Patty 1963]. Concentrations in the range of 8,000 to 20,000 ppm have been considered dangerous for short exposures [Henderson and Haggard 1943]. However, the revised IDLH for ethyl acetate is 2,000 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 2.0%).

Revised IDLH: 2,000 ppm [LEL]
Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in workers [Henderson and Haggard 1943; Patty 1963], a value between 2,000 and 8,000 ppm would have been appropriate for ethyl acetate. However, the revised IDLH for ethyl acetate is 2,000 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 2.0%).

REFERENCES:

Ethyl acetate (continued)

Ethyl acrylate

**CAS number** .............................................. 140-88-5
**NIOSH REL** .............................................. None established; NIOSH considers ethyl acrylate to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].
**Current OSHA PEL** ........................................ 25 ppm (100 mg/m³) TWA [skin]
**1989 OSHA PEL** ........................................... 5 ppm (20 mg/m³) TWA, 25 ppm (100 mg/m³) STEL [skin]
**1993-1994 ACGIH TLV** ................................. 5 ppm (20 mg/m³) TWA, 15 ppm (61 mg/m³) STEL, A2

**Description of Substance** ................................. Colorless liquid with an acrid odor.

**LEL** .......................................................... 1.4% (10% LEL, 1,400 ppm)

**Original (SCP) IDLH** ........................................ 2,000 ppm

**Basis for Original (SCP) IDLH** ........................... The chosen IDLH is based on the statements by Pozzani et al. 1949 cited by Patty [1963], and UCC [1971] that 5 of 6 rats died following a 4-hour exposure to 2,000 ppm, and that 1,000 ppm for 4 hours killed 0 of 6 rats.

**Short-term exposure guidelines** .......................... None developed

**Acute Toxicity Data**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Oberly and Tansy 1985</td>
<td>2,180</td>
<td>-----</td>
<td>4 hr</td>
<td>4,360 ppm (2.0)</td>
<td>438 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Pozzani et al. 1949</td>
<td>-----</td>
<td>1,240</td>
<td>7 hr</td>
<td>2,850 ppm (2.4)</td>
<td>289 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Pozzani et al. 1949</td>
<td>-----</td>
<td>1,240</td>
<td>7 hr</td>
<td>2,850 ppm (2.4)</td>
<td>289 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1949</td>
<td>LC₉₅: 2,000</td>
<td>-----</td>
<td>4 hr</td>
<td>4,000 ppm (2.0)</td>
<td>400 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Sidorov and Timofievskaya 1979</td>
<td>3.894</td>
<td>-----</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

**Other animal data** ........................................ RD₃ₐ (mouse), 315 ppm [DeCecauritz et al. 1981]. Thirty-day exposures of rats to 300 or 540 ppm resulted in mortality; while rats survived 30-day exposures to 70 ppm [Treon et al. 1949].

**Human data** ................................................ Prolonged inhalation exposures at 50 to 75 ppm produced drowsiness, headache, and nausea [Nemec and Bauer 1978].

**Revised IDLH: 300 ppm**

**Basis for revised IDLH:** The revised IDLH for ethyl acrylate is 300 ppm based on toxicity data in humans [Nemec and Bauer 1978] and animals [DeCecauritz et al. 1981; Oberly and Tansy 1985; Pozzani et al. 1949; Treon et al. 1949]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for ethyl acrylate at any detectable concentration.]

**References:**

Ethyl alcohol

CAS number .............................................. 64-17-5
NIOSH REL ........................................................ 1000 ppm (1,900 mg/m³) TWA
Current OSHA PEL ............................................. 1000 ppm (1,900 mg/m³) TWA
1989 OSHA PEL .................................................. Same as current PEL
1993-1994 ACGIH TLV ...................................... 1000 ppm (1,880 mg/m³) TWA
Description of Substance ...................................... Clear, colorless liquid with a weak, ethereal, vinous odor.
LEL .......................................................... 3.3% (10% LEL: 3,300 ppm)
Original (SCP) IDLH ............................................. 15,000 ppm
Basis for original (SCP) IDLH .................................. None developed

Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>20,000</td>
<td>----</td>
<td>10 hr</td>
<td>34,200 ppm (2.71)</td>
<td>5,420 ppm</td>
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<tr>
<td>Mouse</td>
<td>Tiunov et al. 1982</td>
<td>20,363</td>
<td>----</td>
<td>4 hr</td>
<td>40,727 ppm (2.0)</td>
<td>4,073 ppm</td>
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</table>

Lethal dose data:

<table>
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<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₃₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Savchenkov 1967</td>
<td>oral</td>
<td>5.450</td>
<td>7.050</td>
<td>12,611 ppm</td>
<td>1,261 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Wiberg et al. 1970</td>
<td>oral</td>
<td>7.050</td>
<td>7.050</td>
<td>25,807 ppm</td>
<td>2,581 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................................. RD₅₀ (mouse), 27,314 ppm [Alarie 1981].

Human data .......................................................... It was reported in a clinical study that concentrations greater than 20,900 ppm were intolerably irritating and 15,000 ppm caused continuous lachrymation and coughing while concentrations between 5,200 and 10,400 ppm allowed work to be carried on, but with a certain amount of discomfort [Lester and Greenberg 1951]. In this same study, it was determined that 62% of the ethyl alcohol inhaled was absorbed [Lester and Greenberg 1951].

Revised IDLH: 3,300 ppm (LEL)
Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Lester and Greenberg 1951], a value of about 10,000 ppm would have been appropriate. However, the revised IDLH for ethyl alcohol is 3,300 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 3.3%).

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REFERENCES:

Ethylamine

CAS number ................................. 75-04-7
NIOSH REL .................................. -
Current OSHA PEL .......................... 10 ppm (18 mg/m³) TWA
1989 OSHA PEL ............................. Same as current PEL
1993-1994 ACGIH TLV ..................... 5 ppm (9.2 mg/m³) TWA, 15 ppm (27.8 mg/m³) STEL

Description of Substance

Colorless gas or water-white liquid (below 62°F) with an ammonia-like odor.

LEL ......................................... 3.5% (10% LEL, 3,500 ppm)
Original (SCP) IDLH ........................ 4,000 ppm
Basis for original (SCP) IDLH .......... The chosen IDLH is based on the UCC [1958] report that a
Short-term exposure guidelines ......... 4-hour exposure to 4,000 ppm killed 1 of 6 rats.

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Mine et al. 1960</td>
<td>3,000</td>
<td>6,000</td>
<td>4 hr</td>
<td>6,000 ppm (2.0)</td>
<td>600 ppm</td>
</tr>
<tr>
<td>Mammal</td>
<td>Kulagina 1975</td>
<td>1,200</td>
<td>3,000</td>
<td>4 hr</td>
<td>3,000 ppm (2.0)</td>
<td>600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>UCC 1958</td>
<td>4,000</td>
<td>8,000</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>600 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>UCC 1958</td>
<td>oral</td>
<td>400</td>
<td>1,497 ppm</td>
<td>400 ppm</td>
<td>600 ppm</td>
</tr>
</tbody>
</table>

Human data ................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 600 ppm
Basis for revised IDLH: The revised IDLH for ethylamine is 600 ppm based on acute inhalation toxicity data in animals

[Hine et al. 1960; UCC 1958].

REFERENCES:

2. Kulagina NK [1975]. Dependence of biological activity of aliphatic hydrocarbons on their chemical structure and
Ethyl benzene

CAS number .................................. 100-41-4
NIOSH REL .................................. 
Current OSHA PEL ............................ 100 ppm (435 mg/m³) TWA
1989 OSHA PEL ................................. 100 ppm (435 mg/m³) TWA
1993-1994 ACGIH TLV ....................... 100 ppm (434 mg/m³) TWA, 125 ppm (543 mg/m³) STEL

Description of Substance
Colorless liquid with an aromatic odor.

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>4,000</td>
<td>4,000</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................ RO₄₀ (mouse): 1,430 ppm [DeCeaurriz et al. 1981; Nielsen and Alarie 1982].

Human data ...................................... Dizziness was caused in one volunteer after a 5-minute exposure to 2,000 ppm [Yant et al. 1930].

Revised IDLH: 800 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Yant et al. 1930] and animals [DeCeaurriz et al. 1981; Smyth et al. 1962], a value between 800 and 2,000 ppm would have been appropriate. However, the revised IDLH for ethyl benzene is 800 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 0.8%).

REFERENCES:

Ethyl bromide

CAS number ................................................. 74-96-4
NIOSH REL .........................................................
The 1989 OSHA PEL may not be protective to workers.
Current OSHA PEL .............................................
1988 OSHA PEL .................................................. 200 ppm (600 mg/m³) TWA
1989 OSHA PEL ................................................. 200 ppm (800 mg/m³) TWA, 250 ppm (1100 mg/m³) STEL
1983-1994 ACGIH TLV .......................................... 5 ppm (22 mg/m³) TWA, 1.5

Description of Substance ..................................
Colorless to yellow liquid with an ether-like odor.

LEL .............................................................. 6.8% (10% LEL, 6.800 ppm)

Original (SCP) IDLH ............................................ 3,500 ppm

Basis for original (SCP) IDLH ................................
The chosen IDLH is based on the minimal lethal concentration
for mice of 3,500 ppm [Bachem 1927 as cited by von
Oettingen 1937] cited by ACGIH [1971].

Short-term exposure guidelines ................................
None developed

**ACUTE TOXICITY DATA**

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{10} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Bachem 1927</td>
<td></td>
<td>3,500</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Back et al. 1972</td>
<td>26,980</td>
<td></td>
<td>1 hr</td>
<td>33,725 ppm (1.25)</td>
<td>3,373 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Back et al. 1972</td>
<td>16,230</td>
<td></td>
<td>1 hr</td>
<td>20,288 ppm (1.25)</td>
<td>2,029 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NTP 1988</td>
<td>4,581</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>NTP 1988</td>
<td>2,723</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Sayers and Yant 1929</td>
<td>LC_{50}: 100,000</td>
<td></td>
<td>1.5 hr</td>
<td>145,500 ppm (1.45)</td>
<td>14,500 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Sayers and Yant 1929</td>
<td>LC_{50}: 140,000</td>
<td></td>
<td>10 min</td>
<td>96,600 ppm (0.69)</td>
<td>9,660 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Sayers and Yant 1929</td>
<td></td>
<td>24,000</td>
<td>30 min</td>
<td>24,000 ppm (1.0)</td>
<td>2,400 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Sayers and Yant 1929</td>
<td></td>
<td>7,000</td>
<td>&gt;4.5 hr</td>
<td>&gt;14,500 ppm (2.6)</td>
<td>&gt;1,456 ppm</td>
</tr>
</tbody>
</table>

Other animal data .............................................
Exposure at 1,700 ppm for 9 hours caused no anesthesia or
apparent adverse effects [Sayers and Yant 1929].

Human data ......................................................
Concentrations of 12,000 ppm caused immediate eye irritation in
volunteers and 5 minutes at 6,500 ppm resulted in eye irritation,
headache, and vertigo [Sayers and Yant 1929]. Workers
exposed intermittently to concentrations up to 1,500 ppm
complained of no systematic symptoms over a period of several
years [Watrous 1947].

**Revised IDLH: 2,000 ppm**

Basis for revised IDLH: The revised IDLH for ethyl bromide is 2,000 ppm based on acute inhalation toxicity data in
humans [Sayers and Yant 1929, Watrous 1947] and animals [Back et al. 1972; Sayers and Yant 1929]. This may be a
conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations between 1,500
and 6,500 ppm.

REFERENCES:

   Cincinnati, OH: American Conference of Governmental Industrial Hygienists, p. 105.
   Wright-Patterson Air Force Base, OH: 6570th Aerospace Medical Research Laboratory, Report No. TSA-20-72-3,
   NC: National Toxicology Program, NTP/NIH Publication No. 89-2818.
5. Sayers R, Yant WP [1929]. Physiological response attending exposure to vapors of methyl bromide, methyl chloride,
   19(3):349-446.

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Ethyl butyl ketone

CAS number ................................................. 106-35-4
NIOSH REL .................................................. 50 ppm (230 mg/m³) TWA
Current OSHA PEL .......................................... 50 ppm (230 mg/m³) TWA
1989 OSHA PEL .................................................. Same as current PEL
1993-1994 ACGIH TLV ........................................ 50 ppm (234 mg/m³) TWA
Description of Substance ................................ Colorless liquid with a powerful, fruity odor.
LEL ............................................................. Unknown
Original (SCP) IDLH .......................................... 3,000 ppm
Basis for original (SCP) IDLH ................................. The chosen IDLH is based on the statements by Patty [1963] and Deichmann and Gerarde [1969] that 0 rats died following a 4-hour exposure to 2,000 ppm, but 6 of 6 rats died following a 4-hour exposure to 4,000 ppm [Smyth et al. 1949].

Short-term exposure guidelines .............................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{10} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1949</td>
<td>LC_{50}: 4,000</td>
<td>---</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{10} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1949</td>
<td>oral</td>
<td>2.760</td>
<td>---</td>
<td>4,067 ppm</td>
<td>408 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................... It has been reported that rats survived a 4-hour exposure to 2,000 ppm [Smyth et al. 1949].

Human data ..................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 1,000 ppm

Basis for revised IDLH: The revised IDLH for ethyl butyl ketone is 1,000 ppm based on acute inhalation toxicity data in animals [Smyth et al. 1949].

REFERENCE:

Ethyl chloride

CAS number ........................................... 75-00-3
NIOSH REL ............................................
Handle with caution in the workplace.
Current OSHA PEL .................................... 1,000 ppm (2,600 mg/m³) TWA
1989 OSHA PEL ....................................... Same as current PEL
1993-1994 ACGIH TLV ............................... 1,000 ppm (2,640 mg/m³) TWA

Description of Substance
Colorless gas or liquid (below 54°F) with a pungent, ether-like odor.

LEL ...................................................... 3.8% (10% LEL, 3,800 ppm)
Original (SCP) IDLH .................................. 20,000 ppm
Basis for original (SCP) IDLH .......................... The chosen IDLH is based on human exposure data reported by Davidson [1926] in which 13,000 ppm caused no difficulty in walking or balancing after 21 minutes, but 19,000 ppm caused weak analgesia and slight dizziness after 12 minutes.

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>59,701</td>
<td>-----</td>
<td>2 hr</td>
<td>95,522 ppm (1.14)</td>
<td>9,550 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>54,478</td>
<td>-----</td>
<td>2 hr</td>
<td>87,164 ppm (1.14)</td>
<td>8,716 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Sayers and Yant 1929</td>
<td>40,000</td>
<td>45 min</td>
<td>45,600 ppm (1.14)</td>
<td>4,560 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................... It has been reported that 13,000 ppm for 21 minutes caused no difficulty in walking or balancing but 19,000 ppm caused weak analgesia and slight dizziness after 12 minutes [Davidson 1926].

Revised IDLH: 3,800 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Davidson 1926], a value of about 13,000 ppm would have been appropriate. However, the revised IDLH for ethyl chloride is 3,800 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 3.8%).

REFERENCES:

2. Izmerov NF, Sanciky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 68.
Ethylene chlorohydrin

CAS number ................................................................. 107-07-3
NIOSH REL .................................................................
Current OSHA PEL ......................................................
1989 OSHA PEL ...........................................................
1993-1994 ACGIH TLV ............................................... 1 ppm

Description of Substance
Colorless liquid with a faint, ether-like odor.

LEL .................................................................
Original (SCP) IDLH ..................................................
Basis for original (SCP) IDLH ........................................

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (ppm)</th>
<th>LC&lt;sub&gt;90&lt;/sub&gt; (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Ambrose 1950</td>
<td>7.5</td>
<td>---</td>
<td>1 hr</td>
<td>9 ppm (1.2)</td>
<td>0.9 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Browning 1965</td>
<td>32</td>
<td>---</td>
<td>4 hr</td>
<td>64 ppm (2.0)</td>
<td>6.4 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Kovysin 1971</td>
<td>260</td>
<td>---</td>
<td>7</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Rat</td>
<td>Patty 1963</td>
<td>33</td>
<td>---</td>
<td>4 hr</td>
<td>66 ppm (2.0)</td>
<td>6.6 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Semenova et al. 1971</td>
<td>87</td>
<td>---</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Mouse</td>
<td>Semenova et al. 1971</td>
<td>115</td>
<td>---</td>
<td>?</td>
<td>?</td>
<td>?</td>
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</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg)</th>
<th>LD&lt;sub&gt;90&lt;/sub&gt; (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Goldblatt and Chiesman 1944</td>
<td>oral</td>
<td>72</td>
<td>---</td>
<td>150 ppm</td>
<td>15 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Lawrence et al. 1971</td>
<td>oral</td>
<td>81</td>
<td>---</td>
<td>169 ppm</td>
<td>17 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Semenova et al. 1971</td>
<td>oral</td>
<td>71</td>
<td>---</td>
<td>148 ppm</td>
<td>15 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth et al. 1941</td>
<td>oral</td>
<td>110</td>
<td>---</td>
<td>230 ppm</td>
<td>23 ppm</td>
</tr>
</tbody>
</table>

Other animal data
Rats exposed for 15 minutes a day at concentrations of 900 to 1,000 ppm died within a few days [Goldblatt and Chiesman 1944]. Repeated 1-hour exposures (not defined) to 2 ppm can be fatal to rats [Ambrose 1950].

Human data
Death has resulted from a 2-hour exposure at an estimated concentration of 300 ppm [Dierker and Brown 1964].

Revised IDLH: 7 ppm
Basis for revised IDLH: The revised IDLH for ethylene chlorohydrin is 7 ppm based on acute inhalation toxicity data in animals [Browning 1965; Patty 1963].
REFERENCES:

Ethylenediamine

**CAS number** ........................................ 107-15-3
**NIOSH REL** ..............................................
**Current OSHA PEL** ....................................... 10 ppm (25 mg/m³) TWA
**1989 OSHA PEL** ........................................... Same as current PEL
**1983-1984 ACGIH TLV** .................................... 10 ppm (25 mg/m³) TWA
**Description of Substance** .............................. Colorless, viscous liquid with an ammonia-like odor.
**LEL (@12°F)** ................................................ 2.5% (10% LEL (@12°F), 2,600 ppm)
**Original (SCP) IDLH** ...................................... 2.000 ppm

The chosen IDLH is based on the statement by AIHA [1970] that an 8-hour exposure to 4,000 ppm killed 8 of 8 rats, but that an 8-hour exposure to 2,000 ppm killed 0 of 8 rats [Smyth et al. 1951]. Further support for the chosen IDLH is gained from the statement by UCC [1971] that humans will not stay in concentrations of 2,000 ppm.

**Short-term exposure guidelines** ........................ None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₃₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>4,000</td>
<td>10,000</td>
<td>8 hr</td>
<td>10,000 ppm (2.5)</td>
<td>1,000 ppm</td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>500</td>
<td>1,400</td>
<td>140 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth et al. 1941</td>
<td>oral</td>
<td>470</td>
<td>1,316</td>
<td>132 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>oral</td>
<td>1,160</td>
<td>3,248</td>
<td>325 ppm</td>
<td></td>
</tr>
</tbody>
</table>

**Other animal data** ..................................... It has been reported that rats have survived an 8-hour exposure to 2,000 ppm [Smyth et al. 1951].

**Human data** ........................................... It has been reported that workers will not stay in concentrations of 2,000 ppm [UCC 1971].

**Revised IDLH:** 1,000 ppm

**Basis for revised IDLH:** The revised IDLH for ethylenediamine is 1,000 ppm based on acute inhalation toxicity data in animals [Smyth et al. 1951]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations between 1,000 and 2,000 ppm.

**REFERENCES:**

2. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 86.
Ethylene dibromide

CAS number ........................................ 106-93-4
NIOSH REL ........................................ 0.045 ppm TWA, 0.13 ppm 15-minute CEILING; NIOSH considers ethylene dibromide to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL .................................. 20 ppm TWA, 30 ppm CEILING.
1988 OSHA PEL ..................................... Same as current PEL.
1993-1994 ACGIH TLV ............................. A2 [skin]

Description of Substance ..................................
LEL .................................................. Colorless liquid or solid (below 50°F) with a sweet odor.

Noncombustible Liquid ..............................
Original (SCP) IDLH ................................ 400 ppm
Basis for original (SCP) IDLH ........................ The chosen IDLH is based on the maximum survival exposure for rats of 400 ppm for 36 minutes [Rowe et al. 1952] cited by Patty [1983].

Short-term exposure guidelines .......................... None developed.

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>$L_{10}$ (ppm)</th>
<th>$L_{50}$ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF*)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Bakhish 1973</td>
<td>1,831</td>
<td>----</td>
<td>30 min</td>
<td>1,631 ppm (1.0)</td>
<td>181 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>McCollister et al. 1956</td>
<td>400</td>
<td>8 hr</td>
<td>2,420 ppm (10.1)</td>
<td>202 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Rowe et al. 1952</td>
<td>----</td>
<td>400</td>
<td>3 hr</td>
<td>1,780 ppm (4.48)</td>
<td>178 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Rowe et al. 1952</td>
<td>----</td>
<td>691</td>
<td>1 hr</td>
<td>1,330 ppm (1.78)</td>
<td>123 ppm</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 1.2 [ten Berge et al. 1986].

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>$L_{10}$ (mg/kg)</th>
<th>$L_{50}$ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kenaga and Morgan 1978</td>
<td>oral</td>
<td>108</td>
<td>----</td>
<td>97 ppm</td>
<td>9.7 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Rowe et al. 1952</td>
<td>oral</td>
<td>55</td>
<td>----</td>
<td>45 ppm</td>
<td>4.9 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Rowe et al. 1952</td>
<td>oral</td>
<td>120</td>
<td>----</td>
<td>95 ppm</td>
<td>9.9 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Rowe et al. 1952</td>
<td>oral</td>
<td>146</td>
<td>----</td>
<td>131 ppm</td>
<td>13 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Rowe et al. 1952</td>
<td>oral</td>
<td>420</td>
<td>----</td>
<td>376 ppm</td>
<td>38 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Rowe et al. 1952</td>
<td>oral</td>
<td>117</td>
<td>----</td>
<td>105 ppm</td>
<td>11 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................................................

It has been stated that ethylene dibromide is more toxic than carbon tetrachloride in inhalation exposures less than 7 hours [McCollister et al. 1956]. It has been reported that rats have survived a 36-minute exposure to 400 ppm [Rowe et al. 1952]. It has been stated that a concentration of 50 ppm (for an unstated time period) could be dangerous to exposed humans [Kochmann 1928]. Exposures above 100 ppm for an hour or less or by longer exposures at lower concentrations (e.g., 75 ppm) have resulted in gastrointestinal discomfort, vomiting, and respiratory involvement [Ott et al. 1980].

Human data .................................................................

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for ethylene dibromide is 100 ppm based on acute inhalation toxicity data in humans [Ott et al. 1980] and animals [Rowe et al. 1952]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for ethylene dibromide at concentrations above 0.045 ppm.]
REFERENCES:

Ethylene dichloride

CAS number ......................................... 107-06-2
NIOSH REL ..............................................
Current OSHA PEL ........................................
1989 OSHA PEL ...........................................
1993-1994 ACGIH TLV .....................................

Description of Substance ..............................
Colorless liquid with a pleasant, chloroform-like odor.

LEL ......................................................
Original (SCP) IDLH ......................................
50 ppm TWA. 100 ppm CEILING. 200 ppm 5-minute MAXIMUM PEAK in any 3 hours

Short-term exposure guidelines .................
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>( LC_{50} ) (ppm)</th>
<th>( LC_{10} ) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Arch Exp Pathol Pharmacol 1929</td>
<td>-----</td>
<td>1,217</td>
<td>2 hr</td>
<td>1,947 ppm (1.6)</td>
<td>195 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Carpenter et al. 1949</td>
<td>-----</td>
<td>1,000</td>
<td>4 hr</td>
<td>2,000 ppm (2.0)</td>
<td>200 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Heppel et al. 1945</td>
<td>-----</td>
<td>3,000</td>
<td>7 hr</td>
<td>7,200 ppm (2.4)</td>
<td>720 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>Marhold 1986</td>
<td>3,000</td>
<td>1,500</td>
<td>7 hr</td>
<td>3,600 ppm (2.4)</td>
<td>360 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Spencer et al. 1951</td>
<td>1,000</td>
<td>-----</td>
<td>7 hr</td>
<td>7,200 ppm (2.4)</td>
<td>720 ppm</td>
</tr>
</tbody>
</table>

Other animal data ..................................
It has been reported that female rats survived a 1.5-hour exposure to 1,000 ppm [Spencer et al. 1951].

Human data ...........................................
In one study, 1 of 6 workers reported symptoms such as nausea, vomiting, and dizziness from exposures between 10 and 37 ppm [Brzozowski et al. 1954].

Revised IDLH: 50 ppm

Revised IDLH for ethylene dichloride is 50 ppm based on acute inhalation toxicity data in workers [Brzozowski et al. 1964]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for ethylene dichloride at concentrations above 1 ppm.]

REFERENCES:

Ethylene dichloride (continued)


Ethylene glycol dinitrate

CAS number .................................................. 628-96-6
NIOSH REL ..................................................... 0.1 mg/m³ STEL [skin]
Current OSHA PEL ........................................... 0.2 ppm (1 mg/m³) CEILING [skin]
1988 OSHA PEL ................................................ 0.1 mg/m³ STEL [skin]
1993-1994 ACGIH TLV ........................................ 0.05 ppm (0.31 mg/m³) TWA [skin]
Description of Substance ..................................... Colorless to yellow, oily, odorless liquid.
LEL ...................................................................... Unknown
Original (SCP) IDLH* ........................................... 500 mg/m³ [Note: "Effective" IDLH = 200 mg/m³ — see discussion below]
Basis for original (SCP) IDLH .................................. No data on acute inhalation toxicity are available on which to base the IDLH for ethylene glycol dinitrate (EGDN) and/or nitroglycerin. The chosen IDLH, therefore, is based on chronic toxicity data concerning the physiological response of animals to EGDN. According to Patty [1963], rats and guinea pigs survived 6 months of exposures to 500 mg/m³ (80 ppm) EGDN with the only effect being slight drowsiness and some Heinz body formation [Stein 1956]. Although Patty [1963] stated that EGDN is more toxic for cats and rabbits, the chosen IDLH is still probably conservative because cats given 2-hour daily exposures to 21 ppm EGDN for 1,000 days exhibited only marked blood changes [von Oettingen 1946]. However, because of the assigned protection factor afforded by each device, 2,000 x the OSHA PEL of 0.1 mg/m³ (i.e., 200 mg/m³) is the concentration above which only the "most protective" respirators are permitted.

Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Animal data ....................................................... Rats and guinea pigs have survived 6 months of exposure to 500 mg/m³ with the only effect being slight drowsiness and some Heinz body formation [NIOSH 1978]. Cats given 2-hour daily exposures for 1,000 days to 133 mg/m³ exhibited only marked blood changes [von Oettingen 1946].

Human data ....................................................... Headaches have developed in workers exposed to 0.4 to 0.87 mg/m³ for 25 minutes; all workers had decreases in blood pressure [Trainor and Jones 1966]. Ethylene glycol dinitrate and nitroglycerine are vasodilators and initial exposures result in headache, dizziness, nausea, or decreases in blood pressure; however, workers became tolerant of the vasodilatory activity after 2 to 4 days of exposure [NIOSH 1978].

Revised IDLH: 75 mg/m³
Basis for revised IDLH: The revised IDLH for ethylene glycol dinitrate is 75 mg/m³ based on an analogy to nitroglycerine [NIOSH 1978] which has a revised IDLH of 75 mg/m³.

REFERENCES:

Ethyleneimine

CAS number .............................................. 151-56-4
NIOSH REL ................................................ None established; NIOSH considers ethyleneimine to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ...................................... Cardiogen
1989 OSHA PEL .......................................... Same as current PEL
1993-1994 ACGIH TLV .................................. 0.5 ppm (0.88 mg/m³) TWA [skin]

Description of Substance .................................. Colorless liquid with an ammonia-like odor.
LEL .......................................................... 3.3% (10% LEL, 3,300 ppm)
Original (SCP) IDLH .................................... 100 ppm
Basis for original (SCP) IDLH ............................... According to Patty [1963], 1 of 6 guinea pigs and 1 of 6 rats died from a 2-hour exposure to 100 ppm; a 2-hour exposure to 50 ppm killed 0 of 6 guinea pigs and 0 of 6 rats [Carpenter et al. 1948].

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>( LC_{50} ) (ppm)</th>
<th>( LC_{90} ) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF(^*))</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Carpenter et al. 1948</td>
<td>———</td>
<td>25</td>
<td>8 hr</td>
<td>310 ppm (32-43)</td>
<td>31 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Carpenter et al. 1948</td>
<td>( LC_{50} ): 100</td>
<td>———</td>
<td>2 hr</td>
<td>353 ppm (3.53)</td>
<td>35 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1948</td>
<td>———</td>
<td>100</td>
<td>2 hr</td>
<td>353 ppm (3.53)</td>
<td>35 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1948</td>
<td>250</td>
<td>———</td>
<td>1 hr</td>
<td>470 ppm (3.88)</td>
<td>47 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Carpenter et al. 1948</td>
<td>250</td>
<td>———</td>
<td>1 hr</td>
<td>470 ppm (3.88)</td>
<td>47 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1948</td>
<td>62</td>
<td>———</td>
<td>4 hr</td>
<td>219 ppm (7.27)</td>
<td>22 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Izmerov et al. 1982</td>
<td>———</td>
<td>56</td>
<td>2 hr</td>
<td>197 ppm (3.53)</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>222</td>
<td>———</td>
<td>2 hr</td>
<td>786 ppm (3.53)</td>
<td>79 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>56</td>
<td>———</td>
<td>2 hr</td>
<td>197 ppm (3.53)</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Izmerov et al. 1982</td>
<td>———</td>
<td>———</td>
<td>10 min</td>
<td>82 ppm (0.366)</td>
<td>82 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>56</td>
<td>———</td>
<td>———</td>
<td>———</td>
<td>———</td>
</tr>
<tr>
<td>Mouse</td>
<td>Silver and McGrath 1944</td>
<td>2,236</td>
<td>———</td>
<td>———</td>
<td>———</td>
<td>———</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 1.1 [ten Berge et al. 1966].

Other animal data ........................................ It has been reported that rats and guinea pigs survived 2-hour exposures to 50 ppm [Carpenter et al. 1949]. Exposure to concentrations greater than 100 ppm has caused respiratory tract irritation and inflammation, but symptoms may be delayed several hours [Gosselin et al. 1976]. Also, it has been presumed that severe exposures might result in an overwhelming pulmonary edema since ethyleneimine is a powerful lacrimator and emetic [Gosselin et al. 1976].

Revised IDLH: 100 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Gosselin et al. 1976], the original IDLH for ethyleneimine (100 ppm) is not being revised at this time. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for ethyleneimine at any detectable concentration. OSHA currently requires in 29 CFR 1910.1012 that workers engaged in handling ethyleneimine be provided with and required to wear and use a supplied-air respirator that has a full facemask and is operated in a pressure-demand or other positive-pressure mode.]

REFERENCES:

Ethyleneimine (continued)


Ethylene oxide

CAS number ........................................ 75-21-8
NIOSH REL ....................................... <0.1 ppm (<0.18 mg/m³) TWA, 5 ppm (9 mg/m³) CEILING, 
10-minutes/day, NIOSH considers ethylene oxide to be a 
potential occupational carcinogen as defined by the OSHA 
carcinogen policy [29 CFR 1910].

Current OSHA PEL .................................
1989 OSHA PEL .................................... 1 ppm TWA, 5 ppm 15-minute "EXCURSION"
1993-1994 ACGIH TLV ............................. 1 ppm (1.8 mg/m³) TWA, A2

Description of Substance ..........................
Colorless gas or liquid (below 51°F) 
with an ether-like odor.

LEL ................................................. 3.0% (10% LEL, 3,000 ppm)

Original (SCP) IDLH .............................. 800 ppm
Basis for original (SCP) IDLH ................... The chosen IDLH is based on the statement by AIHA [1958] that 
the estimated LC₅₀ for a 4-hour exposure is approximately 800 to 
1,500 ppm depending on the species [Jacobson et al. 1956]. In 
addition, Patty [1963] stated that for humans 500 ppm is 
probably safe for single exposures (no more than once per 
week) of 1-hour duration.

Existing short-term exposure guidelines ........
National Research Council (NRC 1986) Emergency Exposure 
Guidance Levels (EEGLs):
1-hour EEGL: 20 ppm 
24-hour EEGL: 1 ppm

ACUTE TOXICITY DATA
Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Back et al. 1972</td>
<td>826</td>
<td>-</td>
<td>4 hr</td>
<td>1,672 ppm (2.0)</td>
<td>167 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>4,000</td>
<td>-</td>
<td>4 hr</td>
<td>6,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann and Gerarde 1969</td>
<td>800</td>
<td>-</td>
<td>4 hr</td>
<td>1,600 ppm (2.0)</td>
<td>160 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Ismerov et al. 1982</td>
<td>819</td>
<td>-</td>
<td>4 hr</td>
<td>1,623 ppm (2.0)</td>
<td>164 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Jacobson et al. 1956</td>
<td>2,460</td>
<td>-</td>
<td>4 hr</td>
<td>2,820 ppm (3.0)</td>
<td>292 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Jacobson et al. 1956</td>
<td>835</td>
<td>-</td>
<td>4 hr</td>
<td>1,670 ppm (2.0)</td>
<td>167 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Jacobson et al. 1956</td>
<td>960</td>
<td>-</td>
<td>4 hr</td>
<td>1,920 ppm (2.0)</td>
<td>192 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ Other than temporary, slight irritation, no after-effects were 
reported in 4 men after intentional exposure to 2,500 ppm for a 
brief period; definite nasal irritation was reported after 
10 seconds of exposure to 12,500 ppm [Walker and Greeson 1932]. Exposures to concentrations above 2,000 ppm have 
resulted in headache, nausea, vomiting, dyspnea, hematological 
abnormalities, and respiratory irritation [NRC 1986]. Based on 
acute toxicity data in animals, it has been suggested that injury 
or death would be associated with exposure to 8,000 ppm for 
10 minutes, 4,000 ppm for 30 minutes, or 2,000 ppm for 
80 minutes; a 1-hour exposure to 500 ppm was considered as 
not likely to produce injury [Clayton and Clayton 1981].

Revised IDLH: 800 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Clayton and Clayton 1981; NRC 1986; 
Walker and Greeson 1932] the original IDLH for ethylene oxide (800 ppm) is not being revised at this time. (Note: NIOSH 
recommends as part of its carcinogen policy that the "most protective" respirators be worn for ethylene oxide at 
concentrations above 5 ppm. OSHA currently requires in 29 CFR 1910.1047 that workers be provided with and required 
to wear and use the "most protective" respirators in concentrations exceeding 2,000 ppm (2,000 x the PEL)).
REFERENCES:

Ethyl ether

CAS number ................................................. 60-20-7
NIOSH REL .................................................. The 1989 OSHA PEL may not be protective to workers.
Current OSHA PEL ........................................... 400 ppm (1,200 mg/m³) TWA
1989 OSHA PEL ............................................. 400 ppm (1,200 mg/m³) TWA, 500 ppm (1,500 mg/m³) STEL
1993-1994 ACGIH TLV ..................................... 400 ppm (1,210 mg/m³) TWA, 500 ppm (1,320 mg/m³) STEL
Description of Substance .................................. Colorless liquid with a pungent, sweetish odor.

NIOSH LEL ............................................... .

The chosen IDLH is based on the lower explosive limit (LEL) of 19,000 ppm [NFPA 1975]. The toxicological data do not indicate that exposure to this concentration for 30 minutes would impede escape or cause irreversible health effects. According to the Pennsylvania Department of Environmental Resources [1973], the inhalation of 3.5% by volume (35,000 ppm) causes loss of consciousness within 30 to 40 minutes, and concentrations above 7.5% (75,000 ppm) are dangerous to life.

None developed

Acute Toxicity Data

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₇₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Flury and Zernik 1935</td>
<td>104,000</td>
<td>76,000</td>
<td>7</td>
<td>116,800 ppm (1.6)</td>
<td>11,680 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Flury and Zernik 1935</td>
<td>73,000</td>
<td>65,000</td>
<td>2 hr</td>
<td>9,685 ppm (1.49)</td>
<td>969 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Schwetz and Becker 1970</td>
<td>6,500</td>
<td>6,500</td>
<td>1.65 hr</td>
<td>9,685 ppm (1.49)</td>
<td>969 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Schwetz and Becker 1970</td>
<td>6,500</td>
<td>6,500</td>
<td>1.65 hr</td>
<td>9,685 ppm (1.49)</td>
<td>969 ppm</td>
</tr>
</tbody>
</table>

Human data

The lowest anesthetic level is 1.21% by volume [Clayton and Clayton 1981; Cook 1945; Henderson and Haggard 1943], a value between 2,000 and 19,000 ppm would have been appropriate. However, the revised IDLH for ethyl ether is 1,900 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.9%).

Revised IDLH: 1,900 ppm [LEL]

References

Ethyl formate

CAS number ........................................ 109-94-4
NCGSH REL ........................................ 100 ppm (300 mg/m³) TWA
Current OSHA PEL .................................. 100 ppm (300 mg/m³) TWA
1989 CSHA PEL ...................................... Same as current PEL
1993-1994 ACGIH TLV .......................... 100 ppm (303 mg/m³) TWA
Description of Substance .......................... Colorless liquid with a fruity odor.
LEL .................................................. 2.8% (10% LEL, 2.800 ppm)
Original (SCP) IDLH .............................. 8,000 ppm

The chosen IDLH is based on the statements by Smyth [1956] cited in Patty [1963] and by UCC [1968] that 5 of 6 rats died following a 4-hour exposure to 8,000 ppm and no rats died from a 4-hour exposure to 4,000 ppm.

Short-term exposure guidelines .................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>L⁰₉₅ (ppm)</th>
<th>L₉₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Flury and Zernik 1931</td>
<td>LC₅₀: 10,000</td>
<td>8,000</td>
<td>1.5 hr</td>
<td>14,500 ppm (1.45)</td>
<td>1,450 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>LC₅₀: 8,000</td>
<td>8,000</td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>1,600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>LC₅₀: 8,000</td>
<td>8,000</td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>1,600 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Jenner et al. 1964</td>
<td>oral</td>
<td>1.850</td>
<td>4,205 ppm</td>
<td>421 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Jenner et al. 1964</td>
<td>oral</td>
<td>1.130</td>
<td>2,552 ppm</td>
<td>252 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>2.075</td>
<td>4,716 ppm</td>
<td>472 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ................................ It has been stated that rats have survived a 4-hour exposure to 4,000 ppm [UCC 1968].

Human data ....................................... It has been reported that 330 ppm produced slight eye irritation and rapidly increasing nasal irritation [Flury and Zernik 1931].

Revised IDLH: 1,500 ppm

Basis for revised IDLH: The revised IDLH for ethyl formate is 1,500 ppm based on acute inhalation toxicity data in animals [Flury and Zernik 1931; Smyth 1956; Smyth et al. 1954]. This may be a conservative value due to the lack of relevant acute toxicity data for workers at concentrations above 330 ppm.

REFERENCES:


222
**Ethyl mercaptan**

CAS number .................................................. 75-06-1
NIOSH REL .................................................. 0.5 ppm (1.3 mg/m³) 15-minute CEILING
Current OSHA PEL ........................................... 10 ppm (25 mg/m³) CEILING
1989 OSHA PEL .................................................. 0.5 ppm (1 mg/m³) TWA
1993-1994 ACGIH TLV ........................................ 0.5 ppm (1.3 mg/m³) TWA

Description of Substance ................................. Colorless liquid with a strong, skunk-like odor.

LEL .............................................................. 2.8% (10% LEL, 2,800 ppm)

Original (SCP) IDLH ......................................... 2,500 ppm

Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the mouse 4-hour LC₅₀ of 2,770 ppm [Fairchild and Stokinger 1958 cited by ACGIH 1971].

Short-term exposure guidelines ......................... None developed.

**ACUTE TOXICITY DATA**

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Fairchild and Stokinger 1958</td>
<td>4,420</td>
<td>-----</td>
<td>4 hr</td>
<td>8,840 ppm (2.0)</td>
<td>884 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Fairchild and Stokinger 1958</td>
<td>2,770</td>
<td>-----</td>
<td>4 hr</td>
<td>5,540 ppm (2.0)</td>
<td>554 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₁₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Fairchild and Stokinger 1958</td>
<td>oral</td>
<td>682</td>
<td>------</td>
<td>1,849 ppm</td>
<td>181 ppm</td>
</tr>
</tbody>
</table>

Human data .................................................... None relevant for use in determining the revised IDLH.

**Revised IDLH:** 500 ppm 
**Basis for revised IDLH:** The revised IDLH for ethyl mercaptan is 500 ppm based on acute inhalation toxicity data in animals [Fairchild and Stokinger 1958]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

**REFERENCES:**

N-Ethylmorpholine

CAS number ........................................ 100-74-3
NIOSH REL ...........................................
Current OSHA PEL .................................. 20 ppm (94 mg/m³) TWA [skin]
1988 OSHA PEL .................................... 5 ppm (23 mg/m³) TWA [skin]
1983-1994 ACGIH TLV ......................... 5 ppm (24 mg/m³) TWA [skin]

Description of Substance ......................... Colorless liquid with an ammonia-like odor.

LEL .......................................................... Unknown

Original (SCP) IDLH .................................. 2,000 ppm

The chosen IDLH is based on the statement that 1 of 6 rats died following a 4-hour exposure to 2,000 ppm [Smyth et al. 1954 cited by ACGIH 1971].

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>LC₅₀: 2,000</td>
<td>---</td>
<td>4 hr</td>
<td>4,000 ppm (2,0)</td>
<td>400 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>oral</td>
<td>1,780</td>
<td>2,601</td>
<td>260 ppm</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Timofievskaya 1979</td>
<td>oral</td>
<td>1,200</td>
<td>1,754</td>
<td>175 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ................................................... Exposures to 100 ppm for 2.5 minutes have resulted in olfactory fatigue and irritation of the eyes, nose, and throat; irritation was slight after 25 minutes at 50 ppm and absent at 25 ppm [Smyth 1964]. Corneal edema has been noted in workers exposed to concentrations greater than 40 ppm for several hours [Demehl 1966]. In another study, workers exposed to concentrations as high as 11 ppm but averaging about 3 to 4 ppm complained of drowsiness, optical halos, and foggy vision [Woewicki 1968].

Revised IDLH: 100 ppm

The revised IDLH for N-ethylmorpholine is 100 ppm based on acute inhalation toxicity data in humans [Demehl 1966; Smyth 1964]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 100 ppm.

REFERENCES:


224
Ethyl silicate

CAS number .............................................. 78-10-4
NIOSH REL ..............................................
Current OSHA PEL ............................................. 10 ppm (85 mg/m³) TWA
1989 OSHA PEL ............................................. 10 ppm (85 mg/m³) TWA
1993-1994 ACGIH TLV ............................................. 10 ppm (85 mg/m³) TWA
Description of Substance ...................................... Colorless liquid with a sharp, alcohol-like odor.
LEL .................................................................
Original (SCP) IDLH ............................................. 78·10⁻⁴ ppm (85 mglm⁻³) TWA
       10.000 ppm
Basis for original (SCP) IDLH .................................
The chosen IDLH is based on the following statements by AIHA [1968]: "Smyth and Seaton [1940] reported that 1,740 ppm in dry air caused the first guinea pig death in 15 minutes, while at 1,170 ppm the first death was in 2 hours. In the presence of 70% humidity, effects were less pronounced, presumably because part of the ethyl silicate was hydrolyzed."
Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₆₇ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>----</td>
<td>1,000</td>
<td>4 hr</td>
<td>2,000 ppm (2.0)</td>
<td>200 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth and Seaton 1940</td>
<td>----</td>
<td>700</td>
<td>6 hr</td>
<td>1,610 ppm (2.3)</td>
<td>161 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth and Seaton 1940</td>
<td>----</td>
<td>1,740</td>
<td>15 min</td>
<td>1,375 ppm (0.79)</td>
<td>130 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth and Seaton 1940</td>
<td>----</td>
<td>2,270</td>
<td>2 hr</td>
<td>1,972 ppm (1.6)</td>
<td>187 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₇ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>oral</td>
<td>6,270</td>
<td>----</td>
<td>5,068 ppm</td>
<td>507 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................................. It has been stated that 2,000 ppm is about the maximum exposure for 80 minutes without the production of serious disturbances in guinea pigs and rats; 500 ppm is the maximum exposure for several hours without causing serious effects [Smyth and Seaton 1940].

Human data .......................................................... Exposure to a concentration of 1,200 ppm caused lacrimation and 250 ppm caused irritation of the eyes and nose [Smyth and Seaton 1940]. It has been stated that 700 ppm is probably intolerable for more than 30 minutes [Smyth and Seaton 1940].

Revised IDLH: 700 ppm

Basis for revised IDLH: The revised IDLH for ethyl silicate is 700 ppm based on acute inhalation toxicity data in humans [Smyth and Seaton 1940].

REFERENCES:

Ferbam

CAS number ........................................... 14484-64-1
NIOSH REL ............................................... 
Current OSHA PEL ....................................... 10 mg/m³ TWA
1989 OSHA PEL ......................................... 15 mg/m³ TWA
1993-1994 ACGIH TLV .................................. 10 mg/m³ TWA
Description of Substance ................................ Dark brown to black, odorless solid.
LEL ............................................................. Unknown
Original (SCP) IDLH* ..................................... No Evidence ["Effective" IDLH = 7,500 mg/m³ – see discussion below.]

Basis for original (SCP) IDLH .......................... There is no evidence in the available toxicological data of an IDLH for ferbam. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances, it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 × the OSHA PEL (500 × 15 mg/m³ is 7,500 mg/m³).

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Hodge et al. 1952</td>
<td>oral</td>
<td>3,000</td>
<td>14,000</td>
<td>3,100</td>
<td>2,100 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Hodge et al. 1952</td>
<td>oral</td>
<td>2,000</td>
<td>14,000</td>
<td>2,100</td>
<td>1,400 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Korablev 1969</td>
<td>oral</td>
<td>1,130</td>
<td>7,910</td>
<td>791</td>
<td>791 mg/m³</td>
</tr>
<tr>
<td></td>
<td>Lee et al. 1978</td>
<td>oral</td>
<td>3,400</td>
<td>23,800</td>
<td>2,300</td>
<td>2,300 mg/m³</td>
</tr>
</tbody>
</table>

Human data ............................................. Large oral doses cause gastrointestinal disturbances [Proctor et al. 1988]. The dust is irritating to the eyes and respiratory tract; severe exposures are expected to cause depression of the central nervous system [Proctor et al. 1988].

Revised IDLH: 800 mg/m³
Basis for revised IDLH: The revised IDLH for ferbam is 800 mg/m³ based on acute oral toxicity data in animals (Korablev 1969).

REFERENCES:

Ferrovanadium dust

CAS number ........................................... 12804-58-9
NIOSH REL ........................................ 1 mg/m³ TWA, 3 mg/m³ STEL
Current OSHA PEL ................................. 1 mg/m³ TWA
1989 OSHA PEL .................................... 1 mg/m³ TWA, 3 mg/m³ STEL
1993-1994 ACGIH TLV ......................... 1 mg/m³ TWA, 3 mg/m³ STEL

Description of Substance .......................... Dark, odorless particulate dispersed in air.
Solid

Original (SCP) IDLH* ............................... No Evidence [*Note: "Effective" IDLH = 500 mg/m³ – see discussion below.]

Basis for original (SCP) IDLH .................. The available toxicological data contain no evidence of an IDLH for ferrovanadium dust. ACGIH [1971] reported that no acute intoxication occurred in animals exposed at concentrations as high as 10,000 mg/m³ [Roshchin 1952]. Therefore, for this draft technical standard, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 500 = the OSHA PEL of 1 mg/m³ (i.e., 500 mg/m³); only the "most protective" respirators are permitted for concentrations exceeding 500 mg/m³.

Short-term exposure guidelines ........................... None developed

ACUTE TOXICITY DATA

Animal data ........................................ No acute intoxication occurred in animals exposed to concentrations as high as 10,000 mg/m³; serious pathologic changes occurred only at concentrations ranging from 1,000 to 2,000 mg/m³ in 1-hour exposures on alternate days for 2 months [Roshchin 1952]. It was also reported that exposure of rats to 40 to 80 mg/m³ for 2 months caused bronchitis, interstitial fibrosis, and perivascular edema [Clayton and Clayton 1981].

Human data ...................................... Systemic effects have not been reported from industrial exposure [Proctor et al. 1988].

Revised IDLH: 500 mg/m³

Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of ferrovanadium dust would impair escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for ferrovanadium dust is 500 mg/m³ based on being 500 times the NIOSH REL of 1 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).

REFERENCES:

Fluorides (as F)

<table>
<thead>
<tr>
<th>CAS number</th>
<th>Vari- es</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>2.5 mg/m³ TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>2.5 mg/m³ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1983-1994 ACGIH TLV</td>
<td>2.5 mg/m³ TWA</td>
</tr>
<tr>
<td>Description of Substance</td>
<td>Vari- es</td>
</tr>
<tr>
<td>Original (SCP) IDLH</td>
<td>500 mg F/m³</td>
</tr>
</tbody>
</table>
| Basis for original (SCP) IDLH | No data on acute inhalation toxicity are available on which to base the IDLH for fluorides. The chosen IDLH, therefore, has been estimated from the human acute lethal dose of 5 grams of sodium fluoride [Largent 1961 cited by AIHA 1965]. AIHA [1965] stated that the atmospheric concentration (immediately hazardous to life) is unknown, but "particulate fluorides are not likely to cause acute health problems among workmen unless large quantities are swallowed, or unless the more toxic decomposition products are involved. Exact concentrations producing immediate illness are unknown, but most likely are very high."

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀₀</th>
<th>LC₆₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CP)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiF₄</td>
<td>Carpenter et al. 1969</td>
<td>69,220 mg/m³</td>
<td>4 hr</td>
<td>101,071 mg F/m³</td>
<td>10,107 mg F/m³</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaF₂</td>
<td>Budavari 1959</td>
<td>oral</td>
<td>&gt;5,000</td>
<td>&gt;17,051 mg F/m³</td>
<td>&gt;17,051 mg F/m³</td>
<td>1,705 mg F/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Veit Aked Med Wk 1977</td>
<td>oral</td>
<td>4,250</td>
<td>14,488 mg F/m³</td>
<td>14,488 mg F/m³</td>
<td>1,449 mg F/m³</td>
</tr>
<tr>
<td>AIR₃·3Na</td>
<td>Largent 1948</td>
<td>oral</td>
<td>9,000</td>
<td>34,208 mg F/m³</td>
<td>34,208 mg F/m³</td>
<td>3,421 mg F/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Gig Tr Prof Zabol 1988</td>
<td>oral</td>
<td>70</td>
<td>297 mg F/m³</td>
<td>297 mg F/m³</td>
<td>30 mg F/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Sine 1993</td>
<td>oral</td>
<td>125</td>
<td>530 mg F/m³</td>
<td>530 mg F/m³</td>
<td>53 mg F/m³</td>
</tr>
<tr>
<td>F₅₁·Mg·6H₂O</td>
<td>Frear 1969</td>
<td>oral</td>
<td>200</td>
<td>581 mg F/m³</td>
<td>581 mg F/m³</td>
<td>58 mg F/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Frear 1969</td>
<td>oral</td>
<td>200</td>
<td>581 mg F/m³</td>
<td>581 mg F/m³</td>
<td>58 mg F/m³</td>
</tr>
</tbody>
</table>
Fluorides (as F) (continued)

Human data .................................................

Skin rashes and complaints of the gastric, intestinal, circulatory, respiratory, and nervous systems have been reported in workers exposed chronically to concentrations ranging from 11 to 24 mg F/m$^3$ [Roholm 1937]. Chronic exposures at concentrations greater than 24 mg F/m$^3$ have been considered to be "elevated" and a concentration of 10 mg F/m$^3$ was considered "excessive" [Collings et al. 1952]. It has also been stated that the atmospheric concentration immediately hazardous to life is unknown, and particulate fluorides are not likely to cause acute health problems among workers unless large quantities are ingested; concentrations producing immediate illness are unknown, but most likely are very high [AIHA 1965]. It has been stated that 5 grams of sodium fluoride is the probable lethal oral dose [Largent 1961]. (Note: An oral dose of 5 grams is equivalent to a worker being exposed to about 1,500 mg F/m$^3$ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.)

Revised IDLH: 250 mg F/m$^3$

Basis for revised IDLH: The revised IDLH for fluorides is 250 mg F/m$^3$ based on toxicity data in humans [AIHA 1965; Largent 1961; Roholm 1937]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 250 mg F/m$^3$.

REFERENCES:

7. Largent EJ [1948]. Fluorosis, the health aspects of fluorine compounds. Columbus, OH: Ohio State University Press.
Fluorine

CAS number ......................................................... 7782-41-4
NIOSH REL .........................................................
Current OSHA PEL ................................................
1989 OSHA PEL ...................................................
1993-1994 ACGIH TLV ...........................................
Description of Substance ...........................................
LEL .................................................................
Original (SCP) IDLH ..............................................
Basis for original (SCP) IDLH ....................................
Existing short-term exposure guidelines .........................

**ACUTE TOXICITY DATA**

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>$L_{50}$ (ppm)</th>
<th>$L_{50}$ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Keplinger and Suissa 1968</td>
<td>185</td>
<td></td>
<td>1 hr</td>
<td>233 ppm (1.25)</td>
<td>23 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Keplinger and Suissa 1968</td>
<td>150</td>
<td></td>
<td>1 hr</td>
<td>188 ppm (1.25)</td>
<td>19 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Keplinger and Suissa 1968</td>
<td>270</td>
<td></td>
<td>20 min</td>
<td>270 ppm (1.0)</td>
<td>27 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Keplinger and Suissa 1968</td>
<td>170</td>
<td></td>
<td>1 hr</td>
<td>213 ppm (1.25)</td>
<td>21 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................................

It has been reported that 2 men were able to tolerate 25 ppm very briefly but both developed sore throats and chest pains lasting 6 hours; 50 ppm could not be tolerated [Rickey 1959]. Volunteers tolerated 10 ppm for 15 minutes with a minimum of irritation [Ricca 1970]. Intermittent exposures to 10 ppm were repeated every 3 to 5 minutes for 15 minutes over 2 to 3 hours with only slight irritation of the eyes and skin noted [Ricca 1970]. Much irritation of the eyes have been noted at 100 ppm, but with no aftereffects after only 30 seconds [Grant 1974]. It has been observed that exposures up to 30 ppm for 3 to 30 minutes had no ill effects [Lyon 1962].

Revised IDLH: 25 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Grant 1974; Lyon 1982; Ricca 1970; Rickey 1959], the original IDLH for fluorine (25 ppm) is not being revised at this time.

REFERENCES:

Fluorotrichloromethane

CAS number .............................................. 75-69-4
NIOSH REL .................................................. 1,000 ppm (5,600 mg/m³) CEILING
Current OSHA PEL ...................................... 1,000 ppm (5,600 mg/m³) TWA
1988 OSHA PEL ............................................ 1,000 ppm (5,600 mg/m³) CEILING
1993-1994 ACGIH TLV .................................. 1,000 ppm (5,600 mg/m³) CEILING

Description of Substance
Colorless to water-white, nearly odorless liquid or gas (above 75°F).
Noncombustible Liquid/Nonflammable Gas

Original (SCP) IDLH ........................................... 10,000 ppm

Basis for original (SCP) IDLH
Scheel (member of the Standards Completion Program Respirator Committee), in evaluating the work of Reinhardt et al. [1971], indicated cardiac toxicity occurred at 12,000 ppm. The chosen IDLH is based on that data.

Existing short-term exposure guidelines

- 1-hour EEGL: 1,500 ppm
- 24-hour EEGL: 500 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Barras 1974</td>
<td>26,200</td>
<td>52,400</td>
<td>4 hr</td>
<td>5,240 ppm</td>
<td>5,240 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Lester and Greenberg 1975</td>
<td>100,000</td>
<td>96,000</td>
<td>20 min</td>
<td>9,600 ppm</td>
<td>9,600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Scholz 1972</td>
<td>100,000</td>
<td>160,000</td>
<td>2 hr</td>
<td>16,000 ppm</td>
<td>16,000 ppm</td>
</tr>
</tbody>
</table>

Other animal data
Evidence of serious arrhythmia was noted in 1 of 12 conscious dogs exposed for 5 minutes to 5,000 ppm plus intravenous epinephrine [Reinhardt et al. 1971]. However, in another study, endogenous epinephrine was not sufficient to precipitate arrhythmia in dogs exposed to 5,000 to 10,000 ppm [Reinhardt et al. 1971].

Human data
None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 ppm
Basis for revised IDLH: The revised IDLH for fluorotrichloromethane is 2,000 ppm based on acute toxicity data in animals [Reinhardt et al. 1971] and to be consistent with a closely-related chlorofluorocarbon, 1,1,2-trichloro-1,2,2-trifluoromethane which has a revised IDLH of 2,000 ppm.

REFERENCES:
Formaldehyde

| CAS number | 60-00-0 |
| NIOSH REL | | |
| Current OSHA PEL | 0.016 ppm TWA, 0.1 ppm 15-minute CEILING; NIOSH considers formaldehyde to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990]. |
| 1989 OSHA PEL | 0.75 ppm TWA, 2 ppm STEL |
| 1993-1994 ACGIH TLV | 0.3 ppm (0.37 mg/m³) CEILING, A2 |
| Description of Substance | Nearly colorless gas with a pungent, suffocating odor. |
| LEL | 7.0% (10% LEL, 7,000 ppm) |
| Original (SCP) IDLH | 30 ppm |
| Basis for original (SCP) IDLH | Patty [1963] reported that "exposure to 10 to 20 ppm produces almost immediate eye irritation and a sharp burning sensation of the nose and throat which may be associated with sneezing, difficulty in taking a deep breath, and coughing; recovery is prompt from these transient effects [Kodak 1936-1960]." Because Patty [1963] also reported that "it has been estimated that exposure for 5 to 10 minutes to 50 to 100 ppm might cause serious injury to the lower respiratory passages in man [Kodak 1936-1960]." 30 ppm seems reasonable as the IDLH. |

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>333</td>
<td>-----</td>
<td>2 hr</td>
<td>53 ppm (1.6)</td>
<td>53 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Izmerov et al. 1982</td>
<td>-----</td>
<td>133</td>
<td>2 hr</td>
<td>53 ppm (1.6)</td>
<td>53 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Skog 1950</td>
<td>815</td>
<td>-----</td>
<td>30 min</td>
<td>815 ppm (1.0)</td>
<td>61 ppm</td>
</tr>
</tbody>
</table>

Other animal data (mouse), 3.13 ppm [Amar 1981].

Human data


It has been reported that exposure to 10 to 20 ppm produces almost immediate eye irritation and a sharp burning sensation of the nose and throat which may be associated with sneezing, difficulty in taking a deep breath, and coughing; recovery is prompt from these transient effects [Kodak 1936-1960]. It has been estimated that exposure for 5 to 10 minutes to 50 to 100 ppm might cause serious injury to the lower respiratory passages [Kodak 1936-1960]. The following exposure-effect data has also been reported: most subjects experience irritation of the eyes, nose, and throat at 1 to 3 ppm; many subjects cannot tolerate prolonged exposures to 4 to 5 ppm; and difficulty in breathing was experienced at 10 to 20 ppm [IARC 1982]. In a summary of health effects data, upper airway irritation and increased nasal airway resistance were reported at 0.1 to 25 ppm and lower airway and chronic pulmonary obstruction at 5 to 30 ppm [NRC 1981].
Formaldehyde (continued)

Revised IDLH: 20 ppm

Basis for revised IDLH: The revised IDLH for formaldehyde is 20 ppm based on acute inhalation toxicity data in humans (IARC 1982; Kodak 1936-1960; NRC 1981). [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for formaldehyde at concentrations above 0.016 ppm. OSHA currently requires in 29 CFR 1910.1048 that workers be provided with and required to wear and use the "most protective" respirators in concentrations exceeding 75 ppm (i.e., 100 x the OSHA PEL of 0.75 ppm).]

REFERENCES:

Formic acid

CAS number .............................................. 64-18-6
NIOSH REL .................................................. 5 ppm (9 mg/m³) TWA
Current OSHA PEL ........................................ 5 ppm (9 mg/m³) TWA
1988 OSHA PEL ........................................... Same as current PEL
1983-1994 ACGIH TLV .................................. 5 ppm (9.4 mg/m³) TWA, 10 ppm (19 mg/m³) STEL
Description of Substance ................................. Colorless liquid with a pungent, penetrating odor.
LEL(90% solution) ........................................... 18% (10% LEL (90% solution), 18,000 ppm)
Original (SCP) IDLH ....................................... 30 ppm
Basis for original (SCP) IDLH ......................... Because no data on acute inhalation toxicity are available on
which to base an IDLH for formic acid, the chosen IDLH is based
on an analogy with formaldehyde, which has an IDLH of 30 ppm.

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gig Tr Prof Zabol 1963</td>
<td>7,353</td>
<td>-----</td>
<td>15 min</td>
<td>6,204 ppm (0.79)</td>
<td>620 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Zabol 1963</td>
<td>3,246</td>
<td>-----</td>
<td>15 min</td>
<td>2,964 ppm (0.79)</td>
<td>297 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50 (mg/kg)</th>
<th>LD10 (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gig Tr Prof Zabol 1963</td>
<td>oral</td>
<td>1,100</td>
<td>-----</td>
<td>4,651 ppm</td>
<td>403 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Zabol 1963</td>
<td>oral</td>
<td>700</td>
<td>-----</td>
<td>2,565 ppm</td>
<td>256 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>von Getzingen 1959</td>
<td>oral</td>
<td>4,000</td>
<td>-----</td>
<td>14,659 ppm</td>
<td>1,466 ppm</td>
</tr>
</tbody>
</table>

Human data .............................................. Workers exposed to about 15 ppm have complained of nausea
[Fahy and Elkins 1954].

Revised IDLH: 30 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in animals [Gig Tr Prof Zabol 1963], a value of about 250 ppm would have been appropriate for formic acid. However, the original IDLH for formic acid (30 ppm) is not being revised at this time.

REFERENCES:

3. von Getzingen WF [1959]. The aliphatic acids and their esters—toxicity and potential dangers. AMA Arch Ind Health 20:517-531.
Furfural

CAS number ........................................ 90-01-1
NIOSH REL ........................................
Current OSHA PEL ................................
1989 OSHA PEL ...................................
1993-1994 ACGIH TLV .........................
Description of Substance ......................
LEL .....................................................
Original (SCP) IDLH ..............................
Basis for original (SCP) IDLH ..................

Short-term exposure guidelines ...............

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Deichmann and Gerarde 1969</td>
<td>370</td>
<td>-----</td>
<td>6 hr</td>
<td>851 ppm (2.3)</td>
<td>85 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Deichmann and Gerarde 1969</td>
<td>-----</td>
<td>370</td>
<td>6 hr</td>
<td>851 ppm (2.3)</td>
<td>85 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Quaker Oats</td>
<td>260</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Rat</td>
<td>Terrill et al. 1989</td>
<td>275</td>
<td>-----</td>
<td>6 hr</td>
<td>402 ppm (2.3)</td>
<td>40 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Terrill et al. 1989</td>
<td>1,037</td>
<td>-----</td>
<td>1 hr</td>
<td>1,296 ppm (1.25)</td>
<td>130 ppm</td>
</tr>
</tbody>
</table>

Other animal data ......................................

Human data .............................................

Widespread eye and respiratory tract irritation has been noted in workers exposed to concentrations ranging from 5 to 16 ppm [Apol and Lucas 1975]. Headaches, itching of the throat, and red and weeping eyes have occurred at concentrations ranging from 1.9 to 14 ppm [Korenman and Resnik 1930].

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for furfural is 100 ppm based on acute inhalation toxicity data in humans [Apol and Lucas 1975; Korenman and Resnik 1930] and animals [Deichmann and Gerarde 1969; Terrill et al. 1989]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 16 ppm.

REFERENCES:


.. 235
Furfuryl alcohol

CAS number .................................................. 98-00-0
NIOSH REL ........................................................ 13 ppm (40 mg/m³) TWA, 15 ppm (60 mg/m³) STEL [skin]
Current OSHA PEL ................................................. 50 ppm (200 mg/m³) TWA
1989 OSHA PEL .................................................. 10 ppm (40 mg/m³) TWA, 15 ppm (60 mg/m³) STEL [skin]
1993-1994 ACGIH TLV ........................................... 10 ppm (40 mg/m³) TWA, 15 ppm (60 mg/m³) STEL [skin]

Description of Substance

Colorless to amber liquid with a faint, burning odor.

ACUTE TOXICITY

Original (SCP) IDLH .............................................

Current OSHA 1993-1994 ................................. 75 ppm (200 mg/m³)

Description of concentration data:

LEL .............................................................. 1.8% (10% LEL, 1,800 ppm)

Other animal data .............................................. Exposure of rats to 100 ppm for 6 hours per day, 5 days per week for 16 weeks resulted in decreased weight gain and biochemical changes in the brain (i.e., increased cerebral glial acid-proteinase and phosphohydrolase activity) [Savolainen and Pfaffli 1983].

Human data ..................................................... No discomfort was reported from concentrations up to 10.8 ppm for 15 minutes, but severe lacrimation occurred at 15.8 ppm [Apol 1973]. It has also been reported that there is no hazard from exposures up to 16 ppm [Burton and Rivera 1972].

Revised IDLH: 75 ppm

Basis for revised IDLH: The revised IDLH is 75 ppm based on acute inhalation toxicity data in animals [Terrill et al. 1989].

REFERENCES:

Glycidol

CAS number ........................................ 556-52-5
NIOSH REL ...........................................
Current OSHA PEL ............................... 25 ppm (75 mg/m³) TWA
1989 OSHA PEL ................................. 25 ppm (75 mg/m³) TWA
1993-1994 ACGIH TLV ......................... 25 ppm (75 mg/m³) TWA
Description of Substance ....................... Colorless liquid.
LEL .................................................. Unknown
Original (SCP) IDLH ............................. 500 ppm
Basis for original (SCP) IDLH .................. The chosen IDLH is based on the mouse 4-hour LC₅₀ of 450 ppm and the rat 8-hour LC₅₀ of 580 ppm [Hine et al. 1956 cited by ACGIH 1971, and Patty 1963].

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Hine et al. 1956</td>
<td>450</td>
<td></td>
<td>4 hr</td>
<td>900 ppm (2.0)</td>
<td>30 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1956</td>
<td>580</td>
<td></td>
<td>8 hr</td>
<td>1,450 ppm (2.5)</td>
<td>145 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................ It has been reported that rats exposed repeatedly to 400 ppm for 7 hours per day, 5 days a week for 10 weeks showed no evidence of cumulative toxicity, only very slight irritation of the eyes, and slight lacrimation and respiratory distress following the first few exposures [Hine et al. 1956].

Human data ....................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 150 ppm

Basis for revised IDLH: The revised IDLH for glycidol is 150 ppm based on acute inhalation toxicity data in animals [Hine et al. 1956].

REFERENCES:

Graphite (natural)

CAS number ........................................... 7782-42-5
NIOSH REL ...........................................
Current OSHA PEL ................................. 2.5 mg/m³ (respirable dust) TWA
1989 OSHA PEL ................................. 2.5 mg/m³ (respirable dust) TWA
1993-1994 ACGIH TLV ............................ 2 mg/m³ (respirable dust) TWA
Description of Substance ......................... Steel gray to black, greasy feeling, odorless solid.
LEL ............................................... Solid
Original (SCP) IDLH* .............................. No Evidence [*Note: “Effective” IDLH = 7,500 mppcf — see discussion below.]
Basis for original (SCP) IDLH ..................... The available toxicological data contain no evidence that an acute exposure to a high concentration of graphite would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the “most protective” respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL (500 x 15 mppcf is 7,500 mppcf).
Short-term exposure guidelines .................... None developed

ACUTE TOXICITY DATA

Animal or human data .............................. None relevant for use in determining the revised IDLH.

Revised IDLH: 1,250 mg/m³
Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of graphite would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for graphite (natural) is 1,250 mg/m³ based on being 500 times the NIOSH REL of 2.5 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the “most protective” respirators should be used for particulates).
Hafnium compounds (as Hf)

CAS number ................................................. 7440-58-6 (Metal)
NIOH REL ...................................................... 0.5 mg/m³ TWA
Current OSHA PEL .......................................... 0.5 mg/m³ TWA
1988 OSHA PEL .............................................. Same as current PEL
1993-1994 ACGIH TLV ..................................... 0.5 mg/m³ TWA
Description of Substance ................................. Varies
Original (SCP) IDLH* ....................................... Unknown [*Note: "Effective" IDLH = 250 mg Hf/m³ — see discussion below.]

Basis for original (SCP) IDLH .............................. MCA [1966] stated that hafnium metal has a low order of toxicity.

ILO [1972] reported that hafnium compounds appear to have an acute toxicity slightly greater than those of corresponding zirconium salts (ZrCl₂, ZrOCl₂) [Haley et al. 1962]. However, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 500 x the OSHA PEL of 0.5 mg/m³ (i.e., 250 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 250 mg/m³.

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HfCl₂</td>
<td>Rat</td>
<td>oral</td>
<td>2.362</td>
<td>-----</td>
<td>13.791 mg Hf/m³</td>
<td>2.379 mg Hf/m³</td>
</tr>
<tr>
<td>HfCl₄</td>
<td>Mouse</td>
<td>oral</td>
<td>76</td>
<td>-----</td>
<td>359 mg Hf/m³</td>
<td>36 mg Hf/m³</td>
</tr>
</tbody>
</table>

Human data .................................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 50 mg Hf/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for hafnium compounds. Therefore, the revised IDLH for hafnium compounds is 50 mg Hf/m³ based on acute oral toxicity data in animals [Haley et al. 1962]. This may be a conservative value due to the lack of acute inhalation toxicity data for workers.

REFERENCES:

Heptachlor

CAS number ........................................ 76-44-8
NIOSH REL ............................................ 0.5 mg/m³ TWA [skin]; NIOSH considers heptachlor to be a
potential occupational carcinogen as defined by the OSHA
carcinogen policy [29 CFR 1990].

Current OSHA PEL ..................................... 0.5 mg/m³ TWA [skin]
1988 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV .................................... 0.5 mg/m³ TWA [skin]

Description of Substance ................................ White to light-tan crystals with a camphor-like odor.
Noncombustible Solid

Original (SCP) IDLH .................................... 700 mg/m³
Basis for original (SCP) IDLH .......................... No data on acute inhalation toxicity are available on which to
base the IDLH for heptachlor. The chosen IDLH,
therefore, has been estimated from the male rat oral
LD₅₀ of 100 mg/kg [Gaines 1960 cited by ACGIH 1971].

Short-term exposure guidelines ..........................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Izmerov et al. 1982</td>
<td>150 mg/m³</td>
<td>200 mg/m³</td>
<td>4 hr</td>
<td>300 mg/m³ (2.0)</td>
<td>30 mg/m³</td>
</tr>
<tr>
<td>Mammal</td>
<td>Osetrov 1958</td>
<td></td>
<td></td>
<td>4 hr</td>
<td>400 mg/m³ (2.0)</td>
<td>40 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guinea pig</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>116</td>
<td>812</td>
<td>81 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Edison 1960</td>
<td>oral</td>
<td>40</td>
<td>280</td>
<td>28 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Gaines 1960</td>
<td>oral</td>
<td>100</td>
<td>700</td>
<td>70 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Kenaga and Morgan 1978</td>
<td>oral</td>
<td>68</td>
<td>476</td>
<td>48 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Osetrov 1958</td>
<td>oral</td>
<td>50</td>
<td>350</td>
<td>35 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Hamster</td>
<td>Truhaut et al. 1974</td>
<td>oral</td>
<td>100</td>
<td>700</td>
<td>70 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 35 mg/m³

Basis for revised IDLH: The revised IDLH for heptachlor is 35 mg/m³ based on acute inhalation toxicity data in animals
[Izmerov et al. 1982; Osetrov 1958]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective"
respirators be worn for heptachlor at concentrations above 0.5 mg/m³.]

REFERENCES:
Officials, Inc. p. 576.
5. Izmerov NF, Sandukov IY, Sidorov KK [1962]. Toxicometric parameters of industrial toxic chemicals under single
exposure. Moscow, Russia: Centre of International Projects, NITP, p. 71.
Special Publication 78-1:12.
7. Osetrov VE [1958]. Experimental data on toxicology of the insecticide heptachlor. Gig Tr Prof Zaboi 2(5):15 (in
Russian).
organochlorés. 1. Etude comparative des effets de toxicité aiguë chez le hamster et chez le rat. J Eur Toxicol
7(3):159-168 (in French).
n-Heptane

CAS number ........................................ 142-82-5
NIOSH REL ........................................ 85 ppm (350 mg/m³) TWA, 440 ppm (1,800 mg/m³) 15-minute CEILING
Current OSHA PEL ................................ 500 ppm (2,000 mg/m³) TWA
1989 OSHA PEL ........................... 400 ppm (1,600 mg/m³) TWA, 500 ppm (2,000 mg/m³) STEL
1993-1994 ACGIH TLV .................... 400 ppm (1,600 mg/m³) TWA, 500 ppm (2,050 mg/m³) STEL
Description of Substance .................. Colorless liquid with a gasoline-like odor.
LEL .................................................. 1.05% (10% LEL, 1,000 ppm)
Original (SCP) IDLH ...................... 5,000 ppm
Basis for original (SCP) IDLH .......... The chosen IDLH is based on the statement by Patty [1963] that a 15-minute exposure to 5,000 ppm produced a state of intoxication characterized by uncontrolled hilarity in some individuals and in others a stupor lasting for 30 minutes after the exposure [Patty and Yant 1929]. According to Patty [1963], a 4-minute exposure to this same concentration produces vertigo and incoordination [Patty and Yant 1929]. These symptoms described by Patty [1963] could perhaps impede escape.

Short-term exposure guidelines ............ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Flury and Zernik 1931</td>
<td>16,000</td>
<td>16,000</td>
<td>?</td>
<td>28,778 ppm (1.6)</td>
<td>2,878 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Marhold 1986</td>
<td>17,986</td>
<td>17,986</td>
<td>2 hr</td>
<td>28,778 ppm (1.6)</td>
<td>2,878 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Swann et al. 1974</td>
<td>15,000</td>
<td>15,000</td>
<td>10 min</td>
<td>25,000 ppm (1.0)</td>
<td>2,500 ppm</td>
</tr>
</tbody>
</table>

Other human data ................................ Inhalation of 1,000 ppm for 6 minutes was associated with slight dizziness [Patty and Yant 1929]. Exposure to 5,000 ppm for 4 minutes produced complaints of nausea, a loss of appetite, vertigo, and incoordination [Patty and Yant 1929]. A 15-minute exposure to 5,000 ppm produced a state of intoxication characterized by uncontrolled hilarity in some individuals and in others a stupor lasting for 30 minutes after the exposure [Patty and Yant 1929].

Revised IDLH: 750 ppm

Basis for revised IDLH: The revised IDLH for n-heptane is 750 ppm based on acute inhalation toxicity data in humans [Patty and Yant 1929].

REFERENCES:

Hexachloroethane

CAS number ................................................................. 67-72-1
NIOSH REL .................................................................

Current OSHA PEL ..........................................................
1989 OSHA PEL ...........................................................
1983-1984 ACGIH TLV ....................................................

Description of Substance ................................................
LEL ............................................................................

Original (SCP) IDLH .........................................................
300 ppm

Based on the toxicological data relating to potential liver injury
[Gotlieb et al. 1968; Elkins 1959], 300 ppm, the saturated vapor
pressure at 20°C [Kirk-Othmer 1964] has been chosen as the
IDLH.

Noncombustible Solid

300 ppm

300 ppm


Short-term exposure guidelines ...........................................

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Weeks et al. 1979</td>
<td>oral</td>
<td>4.460</td>
<td>---</td>
<td>3.273 ppm</td>
<td>317 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Weeks et al. 1979</td>
<td>oral</td>
<td>4.970</td>
<td>---</td>
<td>3.268 ppm</td>
<td>354 ppm</td>
</tr>
</tbody>
</table>

Human data ..................................................................

None relevant for use in determining the revised IDLH.

Revised IDLH: 300 ppm [Unchanged]

Based on acute oral toxicity data in animals [Weeks et al. 1979], the original IDLH for hexachloroethane
(300 ppm) is not being revised at this time. [Note: NIOSH recommends as part of its carcinogen policy that the "most
protective" respirators be worn for hexachloroethane at concentrations above 1 ppm.]

REFERENCES:

   Wiley & Sons, Inc., pp. 142-143.
Hexachloronaphthalene

CAS number .................................. 1335-87-1
NIOSH REL .................................................. 0.2 mg/m³ TWA [skin]
Current OSHA PEL .......................... 0.2 mg/m³ TWA [skin]
1989 OSHA PEL .......................... Same as current PEL
1993-1994 ACGIH TLV .................. 0.2 mg/m³ TWA [skin]

Description of Substance .................. White to light-yellow solid with an aromatic odor.
Noncombustible Solid

LEL ........................................... 2 mglm³

Original (SCP) IDLH ....................... Although AIHA [1966] stated that "IDLHs for the chloronaphthalenes are probably unattainable," an IDLH of 2 mg/m³ for hexachloronaphthalene has been chosen for this draft technical standard. The chosen IDLH is based on the industrial exposure cited by ACGIH [1971] in which fatal cases of hepatic injury occurred in a plant where air concentrations of mixed pentachloronaphthalenes and hexachloronaphthalenes ranged from 1 to 2 mg/m³ [Elkins 1959].

Short-term exposure guidelines .............. None developed

ACUTE TOXICITY DATA

Animal data .................................. Repeated exposure of rats to 8.9 mg/m³ of a mixture of hexachloronaphthalene and pentachloronaphthalene for up to 4.5 months produced jaundice and was fatal; minor liver injury still occurred at 1.16 mg/m³ [Drinker et al. 1937]. Hexachloronaphthalene has been shown to be more toxic than pentachloronaphthalene in ingestion studies with calves [Bell 1958]. Total doses of hexachloronaphthalene ranging from 5 to 23 mg/kg were given orally in mineral oil over 10 days and lacrimation, salivation, nasal discharge, depression, and anorexia occurred by the 5th day [Bell 1958].

Human data .................................. It has been reported that fatal cases of hepatic injury have occurred from chronic exposures in a plant where air concentrations of mixed pentachloronaphthalenes and hexachloronaphthalenes ranged from 1 to 2 mg/m³ [Elkins 1959].

Revised IDLH: 2 mg/m³ [Unchanged] Basis for revised IDLH: Based on chronic inhalation toxicity data in humans [Elkins 1959] and animals [Bell 1958, Drinker 1937], the original IDLH for hexachloronaphthalene (2 mg/m³) is not being revised at this time.

REFERENCES:

n-Hexane

CAS number .............................................. 110-54-3
NIOSH REL ..........................................
Current OSHA PEL .................................................. 50 ppm (180 mg/m³) TWA
1989 OSHA PEL ........................................ 50 ppm (180 mg/m³) TWA
1993-1994 ACGIH TLV ........................................ 50 ppm (176 mg/m³) TWA
Description of Substance ................................. Colorless liquid with a gasoline-like odor.
LEL ....................................................... 1.1% (10% LEL, 1,100 ppm)
Original (SCP) IDLH ........................................ 5,000 ppm
Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the statement by Patty [1963] that a 10-minute exposure to 5,000 ppm caused dizziness and a sensation of giddiness [Patty and Yant 1929]. Because these symptoms could impede escape, 5,000 ppm is judged to be the IDLH.
None developed

Short-term exposure guidelines ........................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kimura et al. 1971</td>
<td>oral</td>
<td>28.710</td>
<td>56.137</td>
<td>5,614 ppm</td>
<td>--------------</td>
</tr>
</tbody>
</table>

Human data ............................................ It has been reported that a 10-minute exposure to 5,000 ppm caused dizziness and a sensation of giddiness [Patty and Yant 1929].

Revised IDLH: 1,100 ppm (LEL)
Basis for revised IDLH: Based on health considerations and acute toxicity data in humans [Patty and Yant 1929], a value of about 2,500 ppm would have been appropriate. However, the revised IDLH for n-hexane is 1,100 ppm based strictly on safety considerations (i.e., being 10% of the lower exposure limit of 1.1%).

REFERENCES:

2-Hexanone

CAS number ........................................... 591-78-6

NIOSH REL .............................................

Current OSHA PEL .....................................

1989 OSHA PEL ........................................

1993-1994 ACGIH TLV ..................................

Description of Substance ......................

LEL .......................................................

Original (SCP) IOLH .................................

Basis for original (SCP) IOLH .................

The chosen IOLH is based on the statements by AIHA [1968] that guinea pigs exposed to 6,000 ppm showed signs of beginning narcosis at 30 minutes and deep anesthesia at the end of 1 hour; death did not occur for 6.5 hours at this concentration [Specht et al. 1940]. Also, AIHA [1968] reported that 8,000 ppm killed all rats during a 4-hour exposure [Smyth et al. 1954]. [Note: For “convenience”, an IOLH of 5,000 ppm (50 x the OSHA PEL) was originally chosen rather than 6,000 ppm.]

Short-term exposure guidelines .................

None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>8,000</td>
<td>16,000</td>
<td>4 hr</td>
<td>1,600 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Schrenk et al. 1936</td>
<td>20,000</td>
<td>26,600 ppm</td>
<td>70 min</td>
<td>1,600 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>8,000 (LC₅₀)</td>
<td>16,000 ppm</td>
<td>4 hr</td>
<td>1,600 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Schrenk et al. 1936</td>
<td>oral</td>
<td>2,590</td>
<td>4,358 ppm</td>
<td>436 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>oral</td>
<td>2,490</td>
<td>1,538 ppm</td>
<td>154 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Tanii et al. 1936</td>
<td>oral</td>
<td>2,439</td>
<td>3,089 ppm</td>
<td>409 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ............................

Narcosis occurs in guinea pigs after 30 minutes of exposure to 20,000 ppm [Schrenk et al. 1936].

Human data ......................................

Volunteers exposed to 1,000 ppm reported a strong odor and transient, moderate eye and nasal irritation [Divincenzo et al. 1978].

Revised IDLH: 1,600 ppm

Basis for revised IDLH: The revised IDLH for 2-hexanone is 1,600 ppm based on acute inhalation toxicity data in humans [Divincenzo et al. 1978] and animals [NPIRI 1974; Smyth et al. 1954]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 1,000 ppm.

REFERENCES:

2-Hexanone (continued)

Hexone

CAS number .......................................................... 108-10-1
NIOSH REL .........................................................
Current OSHA PEL .............................................
1989 OSHA PEL ................................................
1993-1994 ACGIH TLV ...........................................
Description of Substance: Colorless liquid with a pleasant odor.
LEL(@200°F) ......................................................
Original (SCP) IDLH ..............................................
Basis for original (SCP) IDLH ...................................

The chosen IDLH is based on the statement by Patty [1963] from Smyth [1956] that rats survived a 4-hour exposure to 2,000 ppm; death occurred as a result of a 4-hour exposure to 4,000 ppm. Also, AIHA [1966] reported that exposure of rats to 4,000 ppm for 4 hours killed 6 of 6 and exposure at 2,000 ppm for 4 hours killed 5 of 6 [Smyth et al. 1951].

Short-term exposure guidelines .................................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (ppm)</th>
<th>LC&lt;sub&gt;10&lt;/sub&gt; (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>LC&lt;sub&gt;50&lt;/sub&gt;: 4,700</td>
<td>1,000</td>
<td>4 hr</td>
<td>6,000 ppm (2.0)</td>
<td>500 ppm</td>
</tr>
</tbody>
</table>

Other animal data ............................................. It has been reported that rats survived exposures to 2,000 ppm for 4 hours [Smyth et al. 1951].

Human data .................................................... It has been reported that 200 ppm has an objectionable odor and is irritating to the eyes [Silverman et al. 1946]. Among a group of workers exposed to concentrations of 500 ppm for 20 to 30 minutes and about 80 ppm for the rest of the shift, most experienced irritation of the eyes, nose, and throat, weakness, loss of appetite, headache, nausea, vomiting, and a sore throat [Linari et al. 1964].

Revised IDLH: 500 ppm

Basis for revised IDLH: The revised IDLH for hexone is 500 ppm based on acute inhalation toxicity data in humans [Linari et al. 1964; Silverman et al. 1946]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 500 ppm.

REFERENCES:

sec-Hexyl acetate

CAS number ............................................. 108-84-9
NIOSH REL ............................................. 50 ppm (300 mg/m³) TWA
Current OSHA PEL ................................. 50 ppm (300 mg/m³) TWA
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV .............................. 50 ppm (285 mg/m³) TWA
Description of Substance .......................... Colorless liquid with a mild, pleasant, fruity odor.
Original (SCP) IDLH ................................. 4,000 ppm
Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the statement by ACGIH [1971] that 2 of 6 rats died from a 4-hour exposure to 4,000 ppm [Smyth et al. 1954].

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>( LC_{50} ) (ppm)</th>
<th>( LC_{Lo} ) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>4,000</td>
<td>2,000</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>UCC 1966</td>
<td>4,000</td>
<td>2,000</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>400 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>( LD_{50} ) (mg/kg)</th>
<th>( LD_{Lo} ) (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>UCC 1966</td>
<td>oral</td>
<td>6,160</td>
<td>7,187</td>
<td>719 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ................................................. Volunteers noted an unpleasant odor and irritation of the eyes and upper respiratory tract at 100 ppm [Silverman et al. 1946].

Revised IDLH: 500 ppm
Basis for revised IDLH: The revised IDLH for sec-hexyl acetate is 500 ppm based on acute inhalation toxicity data in humans [Silverman et al. 1946] and animals [Smyth et al. 1954; UCC 1966].

REFERENCES:

Hydrazine

CAS number .................................................. 302-01-2
NIOSH REL .................................................
Current OSHA PEL ........................................... 1 ppm (1.3 mg/m³) TWA [skin]
1989 OSHA PEL .............................................. 0.1 ppm (0.1 mg/m³) TWA [skin]
1993-1994 ACGIH TLV ..................................... 0.1 ppm (0.13 mg/m³) TWA [skin], A2
Description of Substance .................................. Colorless, fuming, oily liquid with an ammonia-like odor.
LEL .............................................................. 2.9% (10% LEL, 2.900 ppm)
Original (SCP) IDLH ......................................... 80 ppm
Basis for original (SCP) IDLH ............................... The chosen IDLH is based on the statement by Patty [1963] that a 4-hour exposure to 80 to 300 ppm killed 14 of 30 rats [Comstock et al. 1954].

<table>
<thead>
<tr>
<th>SPEGL Type</th>
<th>Concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-hour SPEGL</td>
<td>0.12 ppm</td>
</tr>
<tr>
<td>2-hour SPEGL</td>
<td>0.16 ppm</td>
</tr>
<tr>
<td>4-hour SPEGL</td>
<td>0.03 ppm</td>
</tr>
<tr>
<td>8-hour SPEGL</td>
<td>0.015 ppm</td>
</tr>
<tr>
<td>16-hour SPEGL</td>
<td>0.008 ppm</td>
</tr>
<tr>
<td>24-hour SPEGL</td>
<td>0.005 ppm</td>
</tr>
</tbody>
</table>

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{50} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Comstock et al. 1954</td>
<td>190</td>
<td>190</td>
<td>4 hr</td>
<td>380 (2.0) 30 ppm</td>
<td>38 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Comstock et al. 1954</td>
<td>260</td>
<td>260</td>
<td>4 hr</td>
<td>520 (2.0) 30 ppm</td>
<td>52 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Comstock et al. 1954</td>
<td>270</td>
<td>270</td>
<td>4 hr</td>
<td>540 (2.0) 30 ppm</td>
<td>54 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Comstock et al. 1954</td>
<td>300</td>
<td>300</td>
<td>4 hr</td>
<td>600 (2.0) 30 ppm</td>
<td>60 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Jacobson et al. 1955</td>
<td>570</td>
<td>570</td>
<td>1 hr</td>
<td>788 (1.25) 52 ppm</td>
<td>79 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Jacobson et al. 1955</td>
<td>570</td>
<td>570</td>
<td>4 hr</td>
<td>1,140 (2.0) 52 ppm</td>
<td>114 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Jacobson et al. 1955</td>
<td>570</td>
<td>570</td>
<td>4 hr</td>
<td>504 (2.0) 52 ppm</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Jacobson et al. 1955</td>
<td>252</td>
<td>252</td>
<td>1 hr</td>
<td>380 (2.0) 52 ppm</td>
<td>38 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{50} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Swiechicki 1973</td>
<td>oral</td>
<td>60</td>
<td>60</td>
<td>316 ppm</td>
<td>32 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Swiechicki 1973</td>
<td>oral</td>
<td>59</td>
<td>59</td>
<td>311 ppm</td>
<td>31 ppm</td>
</tr>
</tbody>
</table>

Human data ............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 50 ppm
Basis for revised IDLH: The revised IDLH for hydrazine is 50 ppm based on acute inhalation toxicity data in animals [Comstock et al. 1954; Jacobson et al. 1955]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for hydrazine at concentrations above 0.03 ppm.]

REFERENCES:

Hydrazine (continued)


Hydrogen bromide

CAS number ........................................... 10035-10-6
NIOSH REL ........................................... 3 ppm (10 mg/m³) CEILING
Current OSHA PEL .................................... 3 ppm (10 mg/m³) TWA
1989 OSHA PEL ....................................... 3 ppm (10 mg/m³) CEILING
1993-1994 ACGIH TLV ................................. 3 ppm (9.8 mg/m³) CEILING

Description of Substance
Colorless gas with a sharp, irritating odor.

LEL .......................................................
Original (SCP) IDLH .................................... 50 ppm
Basis for original (SCP) IDLH......................... Nonflammable gas

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Back et al. 1972</td>
<td>2,858</td>
<td>-----</td>
<td>1 hr</td>
<td>1,573 ppm (1.25)</td>
<td>357 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Back et al. 1972</td>
<td>814</td>
<td>-----</td>
<td>1 hr</td>
<td>1,018 ppm (1.25)</td>
<td>102 ppm</td>
</tr>
</tbody>
</table>

Other animal data

Hydrogen bromide (with a rat 1-hour LC₁₀ of 2,858 ppm [Back et al. 1972]) is about as acutely toxic as hydrogen chloride (with a rat 1-hour LC₅₀ of 3,124 ppm [MacEwen and Vemot 1974]). Volunteers noted nose and throat irritation at 2 to 6 ppm after several minutes [Clayton and Clayton 1981]. It has been reported that 1,300 to 2,000 ppm are lethal in exposures lasting a few minutes [NRC 1981].

Revised IDLH: 30 ppm

Basis for revised IDLH: Based on an analogy to hydrogen chloride [Back et al. 1972; MacEwen and Vemot 1974] which has a revised IDLH of 50 ppm (which is 10 times the NIOSH REL), the revised IDLH for hydrogen bromide is 30 ppm (which is also 10 times the NIOSH REL). This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations of hydrogen bromide between 6 and 1,300 ppm.

REFERENCES:

Hydrogen chloride

CAS number ......................................... 7647-01-0
NIOSH REL .................................. 
Current OSHA PEL ............................ 
1989 OSHA PEL .................................. Same as current PEL
1993-1994 ACGIH TLV ......................... 
5 ppm (7.5 mg/m³) CEILING
Description of Substance Colorless to slightly yellow gas with a pungent, irritating odor.
LEL .......................................... 
100 ppm
Original (SCP) IDLH .......................... 
Existing short-term exposure guidelines .......... The chosen IDLH is based on the statements by Patty [1963] that according to Matt [1889] as cited in Flury and Zemik [1931], work is impossible when one inhales air containing hydrogen chloride in concentrations of 75 to 150 mg/m³ (50 to 100 ppm); work is difficult but possible when the air contains concentrations of 15 to 75 mg/m³ (10 to 50 ppm); and work is undisturbed at the concentration of 15 mg/m³ (10 ppm).
National Research Council [NRC 1987] Emergency Exposure Guidance Levels (EEGLs) and Short-term Public Emergency Guidance Levels (SPEGLs):

<table>
<thead>
<tr>
<th>Duration</th>
<th>EEGL</th>
<th>SPEGL</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-minute</td>
<td>100 ppm</td>
<td>1 ppm</td>
</tr>
<tr>
<td>1-hour</td>
<td>20 ppm</td>
<td>1 ppm</td>
</tr>
<tr>
<td>24-hour</td>
<td>20 ppm</td>
<td>1 ppm</td>
</tr>
</tbody>
</table>

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₃₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF*)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Leux 1968</td>
<td>-</td>
<td>1,300</td>
<td>30 min</td>
<td>1,300 ppm (1.0)</td>
<td>330 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Macnery and Vernet 1974</td>
<td>3.124</td>
<td>-</td>
<td>1 hr</td>
<td>6,248 ppm (2.0)</td>
<td>625 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1942</td>
<td>-</td>
<td>4,416</td>
<td>30 min</td>
<td>4,416 ppm (1.0)</td>
<td>442 ppm</td>
</tr>
<tr>
<td>O. pig</td>
<td>Machle et al. 1942</td>
<td>-</td>
<td>4,416</td>
<td>30 min</td>
<td>4,416 ppm (1.0)</td>
<td>442 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab Bioi Per 1933</td>
<td>-</td>
<td>2,000</td>
<td>5 min</td>
<td>500 ppm (0.17)</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Wohlssleigel et al. 1976</td>
<td>1,108</td>
<td>-</td>
<td>1 hr</td>
<td>2,216 ppm (2.0)</td>
<td>222 ppm</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 1.0 [ten Berge et al. 1986].

Other animal data .................................. RD₅₀ (mouse), 309 ppm [Alanis 1981].
Other human data ..................................

It has been reported that 50 to 100 ppm for 1 hour is barely tolerable and that 35 ppm causes irritation of the throat [Henderson and Haggard 1943]. It has also been reported that work is impossible at 50 to 100 ppm but is difficult but possible at 10 to 50 ppm [Flury and Zemik 1931].

Revised IDLH: 50 ppm
Basis for revised IDLH: The revised IDLH for hydrogen chloride is 50 ppm based on acute inhalation toxicity data in humans [Flury and Zemik 1931; Henderson and Haggard 1943; Tab Bioi Per 1933].
Hydrogen chloride (continued)

REFERENCES:

10. Tab Bioi Per [1933]; 3:231 (in German).
**Hydrogen cyanide**

| CAS number | 74-90-8 |
| NIOSH REL | 4.7 ppm (5 mg/m³) STEL (skin) |
| Current OSHA PEL | 10 ppm (11 mg/m³) TWA (skin) |
| 1989 OSHA PEL | 4.7 ppm (5 mg/m³) STEL (skin) |
| 1993-1994 ACGIH TLV | 10 ppm (11 mg/m³) CEILING (skin) |

**Description of Substance**

Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor.

| LEL | 5.6% (10% LEL, 5,600 ppm) |
| Original (SCP) IDLH | 50 ppm |

**Short-term exposure guidelines**

None developed.

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>AAPCO 1966</td>
<td>200</td>
<td>103</td>
<td>5 min</td>
<td>10 ppm (0.52)</td>
<td>10 ppm</td>
</tr>
<tr>
<td>Mammal</td>
<td>Arena 1970</td>
<td>36</td>
<td>40</td>
<td>2 hr</td>
<td>6.0 ppm (1.67)</td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>Dudley et al. 1942</td>
<td>107</td>
<td>71</td>
<td>10 min</td>
<td>7.1 ppm (0.67)</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Dudley et al. 1942</td>
<td>503</td>
<td>259</td>
<td>5 min</td>
<td>26 ppm (0.52)</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Dudley et al. 1942</td>
<td>323</td>
<td>166</td>
<td>5 min</td>
<td>17 ppm (0.52)</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Gates et al. 1946</td>
<td>759</td>
<td>216</td>
<td>1 min</td>
<td>22 ppm (0.28)</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Gates et al. 1946</td>
<td>759</td>
<td>216</td>
<td>1 min</td>
<td>22 ppm (0.28)</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Hartzell et al. 1985</td>
<td>275</td>
<td>233</td>
<td>15 min</td>
<td>21 ppm (0.77)</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Hartzell et al. 1985</td>
<td>370</td>
<td>170</td>
<td>30 min</td>
<td>17 ppm (1.0)</td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>Izmerov et al. 1982</td>
<td>357</td>
<td>234</td>
<td>2 min</td>
<td>13 ppm (0.37)</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Levin et al. 1987</td>
<td>160</td>
<td>160</td>
<td>10 min</td>
<td>16 ppm (1.0)</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Vernot et al. 1977</td>
<td>323</td>
<td>166</td>
<td>5 min</td>
<td>17 ppm (0.82)</td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>WHO 1970</td>
<td>179</td>
<td>231</td>
<td>1 hr</td>
<td>23 ppm (0.69)</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 2.7 [ten Berge et al. 1986].

**Other animal data**

The median effective concentrations to produce incapacitation (EC₅₀) in rats have been determined to be 139 ppm and 115 ppm in 15 and 30 minutes, respectively [Hartzell et al. 1985].

**Other human data**

It has been reported that 45 to 54 ppm can be tolerated for 0.5 to 1 hour without immediate or delayed effects; 110 to 135 ppm, however, may be fatal after 0.5 to 1 hour or later, or dangerous to life [Flury and Zemik 1931; Dudley et al. 1942].

**Revised IDLH:** 50 ppm [Unchanged]

**References:**

Hydrogen cyanide (continued)


7. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 75.


Hydrogen fluoride (as F)

CAS number .............................................. 7664-39-3
NIOSH REL .............................................. 3 ppm TWA
Current OSHA PEL .................................... 3 ppm TWA
1989 OSHA PEL ......................................... 3 ppm TWA, 8 ppm STEL
1993-1994 ACGIH TLV ................................ 3 ppm (2.6 mg/m³) CEILING

Description of Substance
Colorless gas or fuming liquid (below 67°F) with a strong, irritating odor.
Nonflammable Gas/Noncombustible Liquid

LEL .......................................................... 30 ppm
Original (SCP) IDLH .................................... 30 ppm
Basis for original (SCP) IDLH

The chosen IDLH is based on the statement by Patty [1963] that 24 mg/m³ (30 ppm) was tolerated by animals for a total of 41 hours without a fatality [Machle et al. 1934]. A concentration of 50 ppm is obviously too high to be selected as the IDLH, because Deichmann and Gerarde [1969] stated that 50 ppm may be fatal when inhaled for 30 to 60 minutes.

National Research Council (NRC) Emergency Exposure Limits (EELs) recommended to military and space agencies [Smyth 1966]

- 10-minute EEL: 20 ppm
- 30-minute EEL: 10 ppm
- 60-minute EEL: 8 ppm

Existing short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Darmer et al. 1972</td>
<td>2.776</td>
<td>-----</td>
<td>1 hr</td>
<td>1,799 ppm (3.61)</td>
<td>180 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>MacEwen and Vernot 1970</td>
<td>2.974</td>
<td>-----</td>
<td>2 hr</td>
<td>2,201 ppm (3.41)</td>
<td>250 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1950</td>
<td>3.133</td>
<td>313</td>
<td>7 hr</td>
<td>1,171 ppm (3.74)</td>
<td>117 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Wohlsagel et al. 1976</td>
<td>4,327</td>
<td>-----</td>
<td>15 min</td>
<td>3,072 ppm (0.71)</td>
<td>307 ppm</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 2.0 [ten Berge et al. 1986].

Other animal data

Guinea pigs and rabbits survived exposures to 30 ppm for 41 hours, but exposures to 300 ppm for 2 hours or more were fatal [Machle et al. 1934].

Human data

It has been stated that 50 ppm may be fatal when inhaled for 30 to 60 minutes [Deichmann and Gerarde 1969]. Volunteers tolerated concentrations as high as 4.7 ppm for 6 hours per day for 10 to 50 days without severe adverse effects [Largent 1961].

Revised IDLH: 30 ppm [Unchanged]

Based on existing IDLH: Based on acute inhalation toxicity data in humans [Deichmann and Gerarde 1969; Largent 1961] and animals [Machle et al. 1934], the original IDLH for hydrogen fluoride (30 ppm) is not being revised at this time.

REFERENCES:

Hydrogen fluoride (as F) (continued)

Hydrogen peroxide

CAS number ........................................... 7722-84-1
NIOSH REL ...........................................
Current OSHA PEL ...................................
1989 OSHA PEL ....................................
1993-1994 ACGIH TLV .............................
Description of Substance ..........................
Colorless liquid with a slightly sharp odor.
LEL ..................................................
Noncombustible Liquid
Original (SCP) IDLH ................................
75 ppm
Basis for original (SCP) IDLH ..............
The chosen IDLH is based on the statement by AIHA [1957] that the short exposure tolerance is unknown for man, but is probably 75 ppm. AIHA [1957] also reported that a single 4-hour exposure to 75 ppm was tolerated by mice but higher concentrations produced delayed deaths [Svirbely]. According to AIHA [1957], concentrations in excess of 1,000 ppm would probably be lethal after a few minutes [Svirbely].

Short-term exposure guidelines .............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{10} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gig Tr Prof Zabol 1977</td>
<td>1,149</td>
<td>----</td>
<td>4 hr</td>
<td>2,836 ppm (2.0)</td>
<td>284 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Stokinger and Scheel 1962</td>
<td>----</td>
<td>227</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{10} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Lyazsky et al. 1963</td>
<td>oral</td>
<td>2,000</td>
<td>----</td>
<td>9,929 ppm</td>
<td>993 ppm</td>
</tr>
</tbody>
</table>

Other animal data ..............................................................

It has been reported that mice tolerated a single 4-hour exposure to 75 ppm [Svirbely].

Human data .................................................................

It has been stated that although the short-term exposure tolerance is unknown, it is probably about 75 ppm [AIHA 1957]. Death has resulted in a man who drank 100 ml [Raukhverger and Solodko 1974].

Revised IDLH: 75 ppm (Unchanged)

Basis for revised IDLH: Based on acute inhalation data in humans [AIHA 1957] and animals [Svirbely], the original IDLH for hydrogen peroxide (75 ppm) is not being revised at this time.

REFERENCES:

Hydrogen selenide (as Se)

CAS number ........................................... 7783-07-5
NIOSH REL ........................................... 0.05 ppm (0.2 mg/m³) TWA
Current OSHA PEL .................................... 0.05 ppm (0.2 mg/m³) TWA
1989 OSHA PEL ....................................... Same as current PEL
1993-1994 ACGIH TLV ................................ 0.05 ppm (0.16 mg/m³) TWA
Description of Substance .............................. Colorless gas with an odor resembling decayed horse radish.
LEL ...................................................... Unknown
Original (SCP) IDLH ................................... 2 ppm
Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the report by Dudley and Miller [1941] that “12.5% of the guinea pigs which had been exposed for 2 hours at 1.8 ppm (0.006 mg/l) died within 30 days of the exposure. A 4-hour exposure to 1.8 ppm was lethal to 18.8% of the guinea pigs exposed, and a 4-hour exposure to 2.1 ppm was lethal to 25% of the animals exposed.”
Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>O. pig</td>
<td>Dudley and Miller 1941</td>
<td>0.3</td>
<td>4 hr</td>
<td>0.75 ppm (2.5)</td>
<td>0.08 ppm</td>
<td></td>
</tr>
<tr>
<td>O. pig</td>
<td>Dudley and Miller 1941</td>
<td>LC₉₅ 1.8</td>
<td>4 hr</td>
<td>2.6 ppm (2.0)</td>
<td>0.18 ppm</td>
<td></td>
</tr>
<tr>
<td>O. pig</td>
<td>Dudley and Miller 1941</td>
<td>LC₉₅ 2.1</td>
<td>4 hr</td>
<td>4.2 ppm (2.0)</td>
<td>0.42 ppm</td>
<td></td>
</tr>
<tr>
<td>O. pig</td>
<td>Dudley and Miller 1941</td>
<td>LC₉₅ 2.9</td>
<td>2 hr</td>
<td>2.9 ppm (1.6)</td>
<td>0.29 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Wilber 1980</td>
<td>5.9</td>
<td>1 hr</td>
<td>7.4 ppm (1.25)</td>
<td>0.74 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ............................................. Although very toxic, no fatalities have been reported, possibly because hydrogen selenide is easily oxidized to red selenium on the surface of mucous membranes of the nose and throat [Friberg et al. 1979]. Concentrations of 1.5 ppm have been found to be intolerable due to eye and nasal irritation [Dudley and Miller 1941].

Revised IDLH: 1 ppm
Basis for revised IDLH: The revised IDLH for hydrogen selenide is 1 ppm based on acute inhalation data in humans [Dudley and Miller 1941; Friberg et al. 1979].

REFERENCES:

Hydrogen sulfide

CAS number ........................................... 7783-06-4
NIOSH REL ..............................................
Current OSHA PEL .............................. 10 ppm (15 mg/m³) 10-minute CEILING
1989 OSHA PEL ............................. 20 ppm CEILING, 50 ppm 10-minute MAXIMUM PEAK
1993-1994 ACGIH TLV .................... 10 ppm (14 mg/m³) TWA, 15 ppm (21 mg/m³) STEL

Description of Substance ...................... Colorless gas with a strong odor of rotten eggs.

LEL ...................................................... 4.0% (10% LEL, 4,000 ppm)

Basis for original (SCP) IDLH .................. 300 ppm

Existing short-term exposure guidelines ....

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Back et al. 1972</td>
<td>713</td>
<td>400</td>
<td>1 hr</td>
<td>977 ppm (1.37)</td>
<td>96 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Lefaux 1968</td>
<td>600</td>
<td>200</td>
<td>30 min</td>
<td>200 ppm (1.0)</td>
<td>60 ppm</td>
</tr>
<tr>
<td>House</td>
<td>MacEwen and Vernot 1972</td>
<td>614</td>
<td>1 hr</td>
<td>869 ppm (1.37)</td>
<td>87 ppm</td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1932</td>
<td>1,141 ppm (2.57)</td>
<td>35 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Tansey et al. 1981</td>
<td>444</td>
<td>4 hr</td>
<td>1,141 ppm (2.57)</td>
<td>114 ppm</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 2.2 (ten Berge et al. 1966).

Other human data ........................................

It has been reported that 170 to 300 ppm is the maximum concentration that can be endured for 1 hour without serious consequences [Henderson and Haggard 1943] and that olfactory fatigue occurs at 100 ppm [Poda 1966]. It has also been reported that 50 to 100 ppm causes mild conjunctivitis and respiratory irritation after 1 hour; 500 to 700 ppm may be dangerous in 0.5 to 1 hour; 700 to 1,000 ppm results in rapid unconsciousness, cessation of respiration, and death; and 1,000 to 2,000 ppm results in unconsciousness, cessation of respiration, and death in a few minutes [Yant 1930].

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for hydrogen sulfide is 100 ppm based on acute inhalation toxicity data in humans [Henderson and Haggard 1943; Poda 1966; Yant 1930] and animals [Back et al. 1972; MacEwen and Vernot 1972; Tansey et al. 1981].
Hydrogen sulfide (continued)

REFERENCES:

Hydroquinone

CAS number ........................................ 123-31-9
NIOSH REL ............................................. 2 mg/m^3 15-minute CEILING
Current OSHA PEL ........................................ 2 mg/m^3 TWA
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ..................................... 2 mg/m^3 TWA
Description of Substance ................................. Light-tan, light-gray, or colorless crystals.
LEL ...................................................... Unknown
Original (SCP) IDLH* ...................................... Unknown (Note: "Effective" IDLH = 200 mg/m^3 — see discussion below)

Basis for original (SCP) IDLH ......................... No acute inhalation toxicity data are available on which to base an IDLH for hydroquinone. For this draft technical standard, therefore, the respirators have been selected on the basis of the assigned protection factor afforded by each device up to 100 x the OSHA PEL of 2 mg/m^3 (i.e., 200 mg/m^3); only the "most highly reliable" respirators are permitted for use in concentrations exceeding 200 mg/m^3. This concentration is not likely to be attained in industry.

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{90} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Kazpuchina 1979</td>
<td>oral</td>
<td>490</td>
<td>-----</td>
<td>3,163 mg/m^3</td>
<td>343 mg/m^3</td>
</tr>
<tr>
<td>Mouse</td>
<td>Korolev et al. 1973</td>
<td>oral</td>
<td>245</td>
<td>-----</td>
<td>1,715 mg/m^3</td>
<td>172 mg/m^3</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Takahashi 1975</td>
<td>oral</td>
<td>200</td>
<td>-----</td>
<td>1,400 mg/m^3</td>
<td>140 mg/m^3</td>
</tr>
<tr>
<td>Rat</td>
<td>Woodward et al. 1949</td>
<td>oral</td>
<td>320</td>
<td>-----</td>
<td>2,240 mg/m^3</td>
<td>224 mg/m^3</td>
</tr>
<tr>
<td>G. pig</td>
<td>Woodward et al. 1949</td>
<td>oral</td>
<td>550</td>
<td>-----</td>
<td>3,850 mg/m^3</td>
<td>385 mg/m^3</td>
</tr>
<tr>
<td>Dog</td>
<td>Woodward et al. 1949</td>
<td>oral</td>
<td>200</td>
<td>-----</td>
<td>1,400 mg/m^3</td>
<td>140 mg/m^3</td>
</tr>
<tr>
<td>Cat</td>
<td>Woodward et al. 1949</td>
<td>oral</td>
<td>70</td>
<td>-----</td>
<td>490 mg/m^3</td>
<td>49 mg/m^3</td>
</tr>
</tbody>
</table>

Human data .............................................. It has been reported that 5 to 12 grams is the lethal oral dose [Zeidman and Deutel 1945]. [Note: An oral dose of 5 to 12 grams is equivalent to a worker being exposed to 3,333 to 8,000 mg/m^3 for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 50 mg/m^3

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for hydroquinone. Therefore, the revised IDLH for hydroquinone is 50 mg/m^3 based on acute oral toxicity data in humans [Zeidman and Deutel 1945] and animals [Woodward et al. 1949].

REFERENCES:

Iodine

CAS number .................................. 7553-56-2
NIOSH REL .................................. 
Current OSHA PEL ............................ 0.1 ppm (1 mg/m³) CEILING
1989 OSHA PEL .............................. Same as current PEL
1993·1994 ACGIH TLV ..................... 0.1 ppm (1 mg/m³) CEILING
Description of substance .................... Violet solid with a sharp, characteristic odor.
LEL ............................................
Original (SCP) IDLH ........................... 10 ppm
Basis for original (SCP) IDLH ................. The chosen IDLH is based on an analogy with bromine which has an IDLH of 10 ppm.
Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₃₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>-----</td>
<td>76</td>
<td>1 hr</td>
<td>95 ppm (1.25)</td>
<td>9.5 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Routes</th>
<th>LD₃₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Angelis 1979</td>
<td>oral</td>
<td>16,000</td>
<td>-----</td>
<td>9,269 ppm</td>
<td>929 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Angelis 1979</td>
<td>oral</td>
<td>22,000</td>
<td>-----</td>
<td>14,159 ppm</td>
<td>1,460 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Angelis 1979</td>
<td>oral</td>
<td>6,000</td>
<td>-----</td>
<td>6,033 ppm</td>
<td>664 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Flury and Zernik 1931</td>
<td>oral</td>
<td>800</td>
<td>800</td>
<td>531 ppm</td>
<td>53 ppm</td>
</tr>
</tbody>
</table>

Human data .................................. It has been reported that work was difficult but possible at 0.15 to 0.2 ppm and that work was impossible at 0.3 ppm [Flury and Zernik 1931]. Exposures to 1 ppm have been reported to be highly irritating [Casarett 1975]. Eye irritation was experienced at 1.63 ppm after 2 minutes [ACGIH 1980]. It has been stated that iodine-containing materials appear to be more toxic than analogous bromine or chlorine-containing materials [ILO 1971]. The lethal oral dose has been reported to be 2 to 3 grams [Moore 1938]. [Note: An oral dose of 2 to 3 grams is equivalent to a worker being exposed to 126 to 190 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 2 ppm

Basis for revised IDLH: The revised IDLH for iodine is 2 ppm based on acute inhalation toxicity data in humans [ACGIH 1960]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 2 ppm. However, since it has been reported that iodine-containing materials are more toxic than bromine-containing materials, a revised IDLH of 2 ppm for iodine is appropriate since the revised IDLH for bromine is 3 ppm.

REFERENCES:

Iodine (continued)

7. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNIT, p. 76.
Iron oxide dust and fume (as Fe)

CAS number .................................................. 1309-37-1
NIOSH REL .................................................. 5 mg/m³ TWA
Current OSHA PEL ........................................ 10 mg/m³ TWA
1989 OSHA PEL ............................................... Same as current PEL
1993-1994 ACGIH TLV ....................................... 5 mg/m³ TWA (fume)
Description of substance ....................... Reddish-brown solid.
LEL ................................................................. Noncombustible Solids
Original (SCP) IDLH* ........................................ No Evidence ["Note: "Effective" IDLH = 5,000 mg Fe/m³ — see discussion below.]
Basis for original (SCP) IDLH .................. The available toxicological data contain no evidence that an acute exposure to iron oxide fume would impede escape or produce any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the “most protective” respirators are permitted for use in concentrations exceeding 500 × the OSHA PEL (500 × 10 mg Fe/m³ = 5,000 mg Fe/m³).

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Animal or human data .......................... None relevant for use in determining the revised IDLH.

Revised IDLH: 2,500 mg Fe/m³
Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of iron oxide dust and fume would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for iron oxide dust and fume is 2,500 mg Fe/m³ based on being 500 times the NIOSH REL of 5 mg Fe/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the “most protective” respirators should be used for particulates).
Isoamyl acetate

CAS number ................................................. 123-52-2
NIOSH REL .....................................................
Current OSHA PEL .................................................................
1989 OSHA PEL .................................................................
1993-1994 ACGIH TLV .........................................................

Description of substance ..............................................
Colorless liquid with a banana-like odor.

LEL (212°F) ....................................................
3.0% (10% LEL (212°F), 1,000 ppm)

TWA .................................
100 ppm (525 mg/m³)

Basis for original (SCP) IDLH ..............................
The chosen IDLH is based on the statement by ACGIH [1971] that slight narcotic effects were noted in cats exposed for 6 hours at 2,800 ppm [Flury and Wirth 1933]. This is the only useful data available on which to base the IDLH.

Short-term exposure guidelines ..............................
None developed

ACUTE TOXICITY DATA
Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC10 (ppm)</th>
<th>LC50 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Flury and Wirth 1933</td>
<td>6,470</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50 (mg/kg)</th>
<th>LD10 (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>7.422</td>
<td>16,600</td>
<td>9,603 ppm</td>
<td>960 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Yakkyoku 1981</td>
<td>oral</td>
<td>7.422</td>
<td>16,600</td>
<td>21,000 ppm</td>
<td>2,148 ppm</td>
</tr>
</tbody>
</table>

Other animal data ..........................................
Slight narcotic effects were noted in cats exposed to 2,800 ppm for 6 hours [Flury and Wirth 1933].

Human data ..................................................
Isoamyl acetate is considered more irritating than butyl acetate. Exposure to 1,000 ppm for 30 minutes resulted in irritation, dyspnea, fatigue, and increased pulse [Amor 1950]. It is considered dangerous to life after 5 hours of exposure to 10,000 ppm [Browning 1965].

Revised IDLH: 1,000 ppm
Basis for revised IDLH: The revised IDLH for isoamyl acetate is 1,000 ppm based on acute toxicity data in humans [Amor 1950] and animals [Munch 1972]. This value is also equal to 10% of the lower explosive limit of 1% (which was determined at 212°F).

REFERENCES:
Isoamyl alcohol (primary & secondary)

<table>
<thead>
<tr>
<th>Description of substance</th>
<th>LE L (primary)</th>
<th>LE L (secondary)</th>
<th>Original (SCP) IDLH</th>
<th>Easis for original (SCP) IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorless liquids with a disagreeable odor.</td>
<td>1.2% (10% LEL, 1,200 ppm)</td>
<td>Unknown</td>
<td>10,000 ppm (LEL)</td>
<td>The chosen IDLH is based on the lower explosive limit (LEL) of 12,000 ppm and the statement in Patty (1963) attributed to Smyth (1956) that rats survived 8,000 ppm. None developed</td>
</tr>
</tbody>
</table>

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>3,438</td>
<td>-----</td>
<td>6,557 ppm</td>
<td>656 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Purchase 1969</td>
<td>oral</td>
<td>2,300</td>
<td>-----</td>
<td>2,490 ppm</td>
<td>240 ppm</td>
</tr>
</tbody>
</table>

Other animal data

Human data

RDI₉₀ (mouse), 4,452 ppm [Alarie 1981]. An oral dose of 24.3 grams has been lethal for adults [Gosselin et al. 1984]. [Note: An oral dose of 24.3 grams is equivalent to a worker being exposed to 4,000 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 500 ppm.

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for isoamyl alcohol. Therefore, the revised IDLH for isoamyl alcohol (primary & secondary) is 500 ppm based on acute oral toxicity data in humans [Gosselin et al. 1984] and animals [Munch 1972]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

Isobutyl acetate

CAS number ...................................................... 110-19-0
NIOSH REL ..................................................... 150 ppm (700 mg/m³) TWA
Current OSHA PEL .............................................. 150 ppm (700 mg/m³) TWA
1989 OSHA PEL ................................................. Same as current PEL
1993-1994 ACGIH TLV ...................................... 150 ppm (713 mg/m³) TWA

Original (SCP) IDLH ......................................... 7,500 ppm

Basis for original (SCP) IDLH .................................. The chosen IDLH is based on the following statements: a 4-hour exposure to 8,000 ppm killed 4 of 8 rats [UCC 1979; Smyth et al. 1962 as cited by ACGIH 1971] and no deaths resulted from a 4-hour exposure of 8 rats to 4,000 ppm [UCC 1979; Smyth 1984 as cited by ACGIH 1971]. [Note: For "convenience" an IDLH of 7,500 ppm (50 x the OSHA PEL of 150 ppm) was chosen rather than 8,000 ppm.]

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Clay and Clayton 1981</td>
<td>LC₅₀: 21,000</td>
<td>LC₉₅: 8,000</td>
<td>2.5 hr</td>
<td>35,700 ppm (1.7)</td>
<td>1.570 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td></td>
<td></td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>1.600 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>4,673</td>
<td></td>
<td>6,772 ppm</td>
<td>677 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>oral</td>
<td>12,400</td>
<td></td>
<td>19,420 ppm</td>
<td>1,962 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................... It was reported that no rats dies following a 4-hour exposure to 4,000 ppm [UCC 1971].

Human data .................................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 1,300 ppm (LEL)

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals [Smyth et al. 1962], a value of about 1,500 ppm would have been appropriate for isobutyl acetate. However, the revised IDLH for isobutyl acetate is 1,300 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.3%).

REFERENCES:

Isobutyl alcohol

**CAS number** ........................................... 78-83-1

**NIOSH REL** ........................................... 50 ppm (150 mg/m³) TWA

**Current OSHA PEL** ..................................... 100 ppm (300 mg/m³) TWA

**1993-1994 ACGIH TLV** .................................. 50 ppm (152 mg/m³) TWA

**Description of substance** ............................... Colorless, oily liquid with a sweet, musty odor.

**LEL[@123°F]** ........................................... 1.7% (10% LEL[@123°F], 1,700 ppm)

**Original (SCP) IDLH** ...................................... 8,000 ppm

**Basis for original (SCP) IDLH** .......................... The chosen IDLH is based on the statement by Patty [1963] that 2 of 6 rats died when exposed for 4 hours to 8,000 ppm [Smyth et al. 1954].

**Short-term exposure guidelines** ........................ None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>LC₅₀: 8,000</td>
<td>----</td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>1,600 ppm</td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>L₃₀ (mg/kg)</th>
<th>L₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch and Schwartze 1925 oral</td>
<td>----</td>
<td>3,750</td>
<td>8,522 ppm</td>
<td>852 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>oral</td>
<td>2,460</td>
<td>5,591 ppm</td>
<td>559 ppm</td>
<td></td>
</tr>
</tbody>
</table>

**Other animal data** ..................................... RD₃₅ (mouse), 1,818 ppm [DeCesauritz et al. 1981].

**Human data** ........................................... None relevant for use in determining the revised IDLH.

**Revised IDLH:** 1,600 ppm

**Basis for revised IDLH:** The revised IDLH for isobutyl alcohol is 1,600 ppm based on acute inhalation toxicity data in animals [Smyth et al. 1954]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

**REFERENCES:**

Isophorone

CAS number ........................................ 78-50-1
NIOSH REL ........................................... 4 ppm (23 mg/m³) TWA
Current OSHA PEL .................................. 25 ppm (140 mg/m³) TWA
1989 OSHA PEL ..................................... 4 ppm (23 mg/m³) TWA
1993-1994 ACGIH TLV ............................... 5 ppm (28 mg/m³) CEILING

Description of substance ............................... Colorless to white liquid with a peppermint-like odor.

LEL .............................................. 0.8% (10% LEL, 800 ppm)

Basis for original (SCP) IDLH ................. 800 ppm

The chosen IDLH is based on the UCC [1971] report that exposure of animals for 1 hour to 880 ppm caused serious organ damage; only 1 of 6 animals died from an 8-hour exposure to air saturated with isophorone (approximately 525 ppm at 77°F).

Short-term exposure guidelines ..................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Specie</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>ATSDR 1989</td>
<td>3,300</td>
<td>885</td>
<td>6 hr</td>
<td>2,036 ppm (2.3)</td>
<td>204 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth and Seaton 1940</td>
<td>4,600</td>
<td>1,840</td>
<td>4 hr</td>
<td>3,680 ppm (2.0)</td>
<td>368 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1970</td>
<td>2,330</td>
<td>2,690</td>
<td>----</td>
<td>2,842 ppm (2.0)</td>
<td>284 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1970</td>
<td>2,330</td>
<td>2,690</td>
<td>----</td>
<td>3,280 ppm (2.5)</td>
<td>328 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Specie</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₀₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1970</td>
<td>oral</td>
<td>2,330</td>
<td>2,690</td>
<td>2,842 ppm</td>
<td>284 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Smyth et al. 1970</td>
<td>oral</td>
<td>2,330</td>
<td>2,690</td>
<td>3,280 ppm</td>
<td>328 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................. RD₅₀ (mouse), 27.8 ppm [DeCeaurriz et al. 1981]. It has been reported that exposure of animals for 1 hour to 880 ppm caused serious organ damage [UCC 1971].

Human data ........................................ A few of the 11 or 12 volunteers exposed for a few minutes to 200 or 400 ppm complained of nausea, headache, dizziness, faintness, inebriation, and a feeling of suffocation [Smyth and Seaton 1940].

Revised IDLH: 200 ppm

Basis for revised IDLH: The revised IDLH for isophorone is 200 ppm based on acute inhalation toxicity data in humans [Smyth and Seaton 1940] and animals [ATSDR 1989].

REFERENCES:

Isopropyl acetate

CAS number ................................................. 108-21-4
NIOSH REL ..................................................
Current OSHA PEL ........................................
1989 OSHA PEL ............................................
1989-1994 ACGIH TLV ...................................
Description of substance ..............................
LEL(@100°F)..............................................
Original (SCP) IDLH ......................................
Basis for original (SCP) IDLH ...........................
Short-term exposure guidelines ......................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{10} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1959</td>
<td>11,918</td>
<td>-----</td>
<td>8 hr</td>
<td>29,795 ppm (2.5)</td>
<td>2,980 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>LC_{50}: 32,000</td>
<td>LC_{10}: 16,000</td>
<td>4 hr</td>
<td>64,000 ppm (2.0)</td>
<td>6,400 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................
It has been stated that isopropyl acetate is comparable in toxicity to ethyl acetate and n-propyl acetate [ACGIH 1991].

Human data ..............................................
None relevant for use in determining the revised IDLH.

Revised IDLH: 1,800 ppm

The chosen IDLH is based on the UCC [1970] report that a 4-hour exposure to 16,000 ppm killed 1 of 6 rats.

REFERENCES:
Isopropyl alcohol

CAS number ................................................. 67-63-0
NIOSH REL .................................................................
Current OSHA PEL .............................................. 400 ppm (980 mg/m³) TWA
1989 OSHA PEL .................................................................
1993-1994 ACGIH TLV ........................................ 400 ppm (983 mg/m³) TWA

Description of substance ........................................ Colorless liquid with the odor of rubbing alcohol.

LEL ................................................................. 2.0% (10% LEL, 2,000 ppm)

Original (SCP) IDLH ........................................... 12,000 ppm

Existent short-term exposure guidelines ................................


1-hour EEGL: 400 ppm
24-hour EEGL: 200 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LCL (ppm)</th>
<th>LC (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>-</td>
<td>16,000</td>
<td>4 hr</td>
<td>32,000 ppm (2.0)</td>
<td>3,200 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>NCI 1974</td>
<td>-</td>
<td>12,000</td>
<td>3 hr</td>
<td>23,040 ppm (1.8)</td>
<td>2,304 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>12,000</td>
<td>-</td>
<td>8 hr</td>
<td>24,000 ppm (2.0)</td>
<td>2,400 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Antonova and Salmina 1978</td>
<td>oral</td>
<td>5,045</td>
<td>-</td>
<td>14,126 ppm</td>
<td>1,413 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Antonova and Salmina 1978</td>
<td>oral</td>
<td>3,600</td>
<td>-</td>
<td>10,080 ppm</td>
<td>1,008 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>WHO 1970</td>
<td>oral</td>
<td>4,410</td>
<td>-</td>
<td>17,948 ppm</td>
<td>1,795 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................ RD₅₀ (mouse), 17,693 ppm [Aralie 1981]. It has been reported that rats survived when exposed to 12,000 ppm for 4 hours [Smyth 1956].

Human data ................................................ Ten volunteers exposed for 3 to 5 minutes to 200, 400, or 600 ppm reported mild to moderate irritation of the eyes, nose, and throat at the two higher concentrations [Nelson et al. 1943]. The probable lethal oral dose has been reported to be 190 grams [Gosselin et al. 1984]. [Note: An oral dose of 190 grams is equivalent to a worker being exposed to about 50,700 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 2,000 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute toxicity data in humans [Smyth 1956; Nelson et al. 1943] and animals [NCI 1974; Smyth 1956], a value of about 2,400 ppm would have been appropriate for isopropyl alcohol. However, the revised IDLH for isopropyl alcohol is 2,000 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 2%).
REFERENCES:


Isopropylamine

CAS number ............................................ 75-31-0
NIOSH REL ..............................................
Current OSHA PEL ...................................... 5 ppm (12 mg/m³) TWA
1989 OSHA PEL ........................................ 5 ppm (12 mg/m³) TWA, 10 ppm (24 mg/m³) STEL
1983-1984 ACGIH TLV ................................. 5 ppm (12 mg/m³) TWA, 10 ppm (24 mg/m³) STEL
Description of substance ............................. Colorless liquid with an ammonia-like odor.
LEL .......................................................... Unknown
Original (SCP) IDLH ................................. 4,000 ppm
Basis for original (SCP) IDLH ..................... The chosen IDLH is based on the statement by ACGIH [1971] that 0 of 6 rats died from a 4-hour exposure to 4,000 ppm and 6 of 6 rats died after a 4-hour exposure to 8,000 ppm [Smyth et al. 1951]. No other quantitative data are available on which to base the IDLH.

Short-term exposure guidelines .................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>NCI 1974</td>
<td>4,000</td>
<td>8,000</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Shell 1961</td>
<td>7,000</td>
<td>7,630</td>
<td>40 min</td>
<td>7,630 ppm (1.09)</td>
<td>763 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>8,000</td>
<td>16,000</td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>1,600 ppm</td>
</tr>
</tbody>
</table>

Other animal data ..................................... It has been reported that rats have survived an exposure to 4,000 ppm for 4 hours [Smyth et al. 1951].

Human data ............................................. Volunteers have complained of nose and throat irritation after brief exposures to concentrations ranging from 10 to 20 ppm [Amoore and Hautala 1983].

Revised IDLH: 750 ppm
Basis for revised IDLH: The revised IDLH for isopropylamine is 750 ppm based on acute inhalation toxicity data in animals [NCI 1974; Shell 1961]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 20 ppm.

REFERENCES:

Isopropyl ether

CAS number ......................................... 108-20-3
NIDSH REL ........................................... 500 ppm (2,130 mg/m³) TWA
Current OSHA PEL ................................. 500 ppm (2,130 mg/m³) TWA
1989 OSHA PEL ..................................... Same as current PEL
1993-1994 ACGIH TLV ............................. 250 ppm (1,040 mg/m³) TWA, 310 ppm (1,300 mg/m³) STEL

Description of substance ............................... Colorless liquid with a sharp, sweet, ether-like odor.
LEL .................................................. 1.4% (10% LEL, 1,400 ppm)

Original (SCP) IDLH .................................. 10,000 ppm
Basis for original (SCP) IDLH ............................ The chosen IDLH is based on the UCC [1968] report that breathing the vapors in a state approaching saturation in room air killed all rats in a 10-minute exposure. [Note: Based on a vapor pressure of 119 mmHg [Patty 1963], the saturated concentration of isopropyl ether in air at 20°C is about 157,000 ppm.] Breathing 8,000 ppm was not fatal after a 4-hour exposure, but 16,000 ppm killed 6 of 8 animals exposed for the same period of time [UCC 1968].

Short-term exposure guidelines .......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Pavlova et al. 1963</td>
<td>108–20–3</td>
<td>300</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Pavlova et al. 1963</td>
<td>300</td>
<td>108–20–3</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Rat</td>
<td>UCC 1968</td>
<td>LC₅₀: 157,000</td>
<td>LC₉₀: 16,000</td>
<td>10 min</td>
<td>105,190 ppm (0.67)</td>
<td>10,519 ppm</td>
</tr>
<tr>
<td>Mammal</td>
<td>UCC 1968</td>
<td></td>
<td></td>
<td>4 hr</td>
<td>32,000 ppm (2.0)</td>
<td>3,200 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1939</td>
<td>oral</td>
<td>5,000–6,500</td>
<td>8,235–10,706</td>
<td>13,951 ppm</td>
<td>3,200 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>UCC 1968</td>
<td>oral</td>
<td>8,470</td>
<td>8,235–10,706</td>
<td>13,951 ppm</td>
<td>3,200 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>UCC 1968</td>
<td>oral</td>
<td>8,470</td>
<td>8,235–10,706</td>
<td>13,951 ppm</td>
<td>3,200 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................................. It has been reported that animals survived a 4-hour exposure to 8,000 ppm [UCC 1968].

Human data ............................................................. Volunteers exposed to 800 ppm for 5 minutes reported irritation of the eyes and nose [Silverman et al. 1946].

Revised IDLH: 1,400 ppm [LEL]
Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals [UCC 1968], a value of about 3,200 ppm would have been appropriate for isopropyl ether. However, the revised IDLH for isopropyl ether is 1,400 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.4%).

REFERENCES:
Isopropyl glycidyl ether

CAS number ................................................. 4016-14-2
NIOSH REL .................................................. 50 ppm (240 mg/m³) 15-minute CEILING
Current OSHA PEL ........................................... 50 ppm (240 mg/m³) TWA
1989 OSHA PEL ............................................. 50 ppm (240 mg/m³) TWA, 75 ppm (360 mg/m³) STEL
1993-1994 ACGIH TLV ..................................... 50 ppm (238 mg/m³) TWA, 75 ppm (350 mg/m³) STEL
Description of substance .................................. Colorless liquid.
LEL .......................................................... Unknown
Original (SCP) IDLH ......................................... 1,000 ppm
Basis for original (SCP) IDLH .............................. The chosen IDLH is based on the mouse 4-hour LC₅₀ of 1,500 ppm and the rat 8-hour LC₅₀ of 1,100 ppm [Hine et al. 1956 cited by Patty 1963].

Short-term exposure guidelines ............................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Hine et al. 1956</td>
<td>1,500</td>
<td>400</td>
<td>4 hr</td>
<td>1,000 ppm (2.0)</td>
<td>300 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Hine et al. 1956</td>
<td>1,100</td>
<td>2,750</td>
<td>8 hr</td>
<td>2,750 ppm (2.9)</td>
<td>275 ppm</td>
</tr>
</tbody>
</table>

Human data ..................................................... Workers exposed to 400 ppm have suffered irritation of the eyes and respiratory tract [Hine et al. 1956].

Revised IDLH: 400 ppm
Basis for revised IDLH: The revised IDLH for isopropyl glycidyl ether is 400 ppm based on acute inhalation toxicity data in workers [Hine et al. 1956]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 400 ppm.

REFERENCES:

Ketene

CAS number ................................................. 463-51-4
NIOSH REL ......................................................
Current OSHA PEL .............................................. 0.5 ppm (0.9 mg/m³) TWA, 1.5 ppm (3 mg/m³) STEL
1989 OSHA PEL .................................................. 0.5 ppm (0.9 mg/m³) TWA
1993-1994 ACGIH TLV ........................................ 0.5 ppm (0.86 mg/m³) TWA, 1.5 ppm (2.6 mg/m³) STEL
Description of substance .................................... Colorless gas with a penetrating odor.
LEL ........................................................................ Unknown
Original (SCP) IDLH* ........................................... Unknown [Note: "Effective" IDLH = 25 ppm — see discussion below.]
Basis for original (SCP) IDLH ................................. No data on acute inhalation toxicity are available on which to base an IDLH for ketene. For this draft technical standard, therefore, the respirators have been selected on the basis of the assigned protection factor afforded by each device up to 50 x the OSHA PEL of 0.5 ppm (i.e., 25 ppm); only the "most protective" respirators are permitted for use in concentrations exceeding 25 ppm.

Short-term exposure guidelines .............................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Mendenhall and Stokinger 1959</td>
<td>17</td>
<td>-</td>
<td>10 min</td>
<td>12 ppm (0.49)</td>
<td>1.2 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Treon et al. 1949</td>
<td>-</td>
<td>23</td>
<td>20 min</td>
<td>23 ppm (1.0)</td>
<td>2.1 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1949</td>
<td>-</td>
<td>53</td>
<td>2 hr</td>
<td>85 ppm (1.6)</td>
<td>8.5 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Treon et al. 1949</td>
<td>-</td>
<td>53</td>
<td>2 hr</td>
<td>85 ppm (1.6)</td>
<td>8.5 ppm</td>
</tr>
<tr>
<td>Pig</td>
<td>Treon et al. 1949</td>
<td>-</td>
<td>750</td>
<td>10 min</td>
<td>518 ppm (0.69)</td>
<td>52 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>Treon et al. 1949</td>
<td>-</td>
<td>200</td>
<td>10 min</td>
<td>138 ppm (0.69)</td>
<td>14 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Treon et al. 1949</td>
<td>-</td>
<td>50</td>
<td>10 min</td>
<td>138 ppm (0.69)</td>
<td>14 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1949</td>
<td>-</td>
<td>1,000</td>
<td>10 min</td>
<td>690 ppm (0.69)</td>
<td>69 ppm</td>
</tr>
</tbody>
</table>

Human data ..................................................... It has been stated that 5 ppm is the lowest concentration productive of a clinically relevant physiologic response [Stokinger 1960].

Revised IDLH: 5 ppm

Basis for revised IDLH: The revised IDLH for ketene is 5 ppm based on acute inhalation toxicity data in humans [Stokinger 1960] and animals [Treon et al. 1949]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 5 ppm.

REFERENCES:


278
# Lead compounds (as Pb)

**CAS number**
7439-92-1 (Metal)

**NIOSH REL**
0.100 mg/m³ TWA

**Current OSHA PEL**
0.050 mg/m³ TWA

**1989 OSHA PEL**
Same as current PEL

**1993-1994 ACGIH TLV**
0.15 mg/m³ TWA

**Description of substance**
Varies

**Original (SCP) IDLH**
700 mg Pb/m³ ["Effective" IDLH = 400 mg Pb/m³ — see discussion below.]

**Basis for original (SCP) IDLH**
No data on acute toxicity are available concerning the physiological effects caused by the inhalation of lead and its inorganic compounds. AIHA [1958], however, reported that the severity of the health hazard for a brief exposure is only moderate [Fairhall 1957; APHA 1943]. If the IDLH were estimated from the rat intraperitoneal LD₅₀ of 100 mg/kg for lead cyanide [NRC 1953] that was cited by NIOSH [1976], a value of 700 mg/m³ would be chosen as the IDLH. Using these data for lead cyanide rather than other data cited by NIOSH yields the most conservative estimate of the IDLH. Because of the assigned protection factor afforded by each device, however, 2,000 × the OSHA PEL of 0.2 mg Pb/m³ (i.e., 400 mg Pb/m³) is the concentration above which only the "most protective" respirators are permitted.

**Short-term exposure guidelines**
None developed

## ACUTE TOXICITY DATA

### Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₁₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PbO Dog</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>1,400</td>
<td>9,114 mg Pb/m³</td>
<td>911 mg Pb/m³</td>
<td></td>
</tr>
<tr>
<td>PbC₃H₆O₄</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>300</td>
<td>2,344 mg Pb/m³</td>
<td>154 mg Pb/m³</td>
<td></td>
</tr>
<tr>
<td>PbCl₂</td>
<td>Budavair 1983</td>
<td>oral</td>
<td>1,500</td>
<td>7,770 mg Pb/m³</td>
<td>770 mg Pb/m³</td>
<td></td>
</tr>
<tr>
<td>Pb(NO₃)₂</td>
<td>Tartler 1941</td>
<td>oral</td>
<td>500</td>
<td>2,205 mg Pb/m³</td>
<td>221 mg Pb/m³</td>
<td></td>
</tr>
<tr>
<td>Pb(CN)₂</td>
<td>NRC 1953</td>
<td>i.p.</td>
<td>100</td>
<td>560 mg Pb/m³</td>
<td>56 mg Pb/m³</td>
<td></td>
</tr>
</tbody>
</table>

**Human data**
It has been reported that 714 mg/kg of lead acetate (i.e., about 450 mg/kg of lead) is the lethal oral dose [Takahashi 1975]. [Note: An oral dose of 450 mg Pb/kg is equivalent to a 70-kg worker being exposed to 21,000 mg Pb/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

**Revised IDLH: 100 mg Pb/m³**

**Basis for revised IDLH:** No inhalation toxicity data are available on which to base an IDLH for lead compounds. The revised IDLH for lead compounds is 100 mg Pb/m³ based on acute oral toxicity data in humans [Takahashi 1975] and animals [Flury and Zernik 1935]. [Note: OSHA currently requires in 29 CFR 1910.1025 that workers be provided with and required to wear and use the "most protective" respirators in concentrations exceeding 100 mg Pb/m³ (i.e., 2,000 × the current OSHA PEL of 0.05 mg Pb/m³).]
Lead compounds (as Pb) (continued)

REFERENCES:

Lindane

CAS number ................................. .
CAS 58-89-9

NIOSH REL ..................................

Current OSHA PEL ............................ .
0.5 mg/m³ TWA [skin]

1989 OSHA PEL .............................. .
Same as current PEL

0.5 mg/m³ TWA [skin]

Description of substance ..................... .
White to yellow, crystalline powder with a slight, musty odor.

LEL .......................................... .
Noncombustible Solid

Original (SCP) IDLH ........................... .
1,000 mg/m³

Basis for original (SCP) IDLH ................. .
No useful data on acute inhalation toxicity are available on which to base the IDLH for lindane. The chosen IDLH, therefore, has been based on the child oral LD₅₀ of 180 mg/kg [CDC 1956 cited by NIOSH 1976] and the statement by Negherbon (1959) that the dangerous acute dose for man has been reported as 7 to 15 grams [CDC 1956].

Short-term exposure guidelines .......... .
None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Desi et al. 1978</td>
<td>oral</td>
<td>60</td>
<td>420 mg/m³</td>
<td>42 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Kenaga and Morgan 1978</td>
<td>oral</td>
<td>76</td>
<td>532 mg/m³</td>
<td>53 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Sun 1972</td>
<td>oral</td>
<td>44</td>
<td>308 mg/m³</td>
<td>31 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Hamster</td>
<td>Truhaut et al. 1974</td>
<td>oral</td>
<td>150</td>
<td>2,820 mg/m³</td>
<td>252 mg/m³</td>
<td></td>
</tr>
<tr>
<td>O. pig</td>
<td>Woodard and Hagan 1947</td>
<td>oral</td>
<td>127</td>
<td>889 mg/m³</td>
<td>89 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ............................... .
An oral dose of 150 mg/kg has been associated with grand mal seizures [Starr and Clifford 1972]. [Note: An oral dose of 150 mg/kg is equivalent to a 70-kg worker being exposed to 7,000 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.] It has also been stated that 7 to 15 grams is the dangerous acute dose [CDC 1956]. [Note: An oral dose of 7 to 15 grams is equivalent to a worker being exposed to 4,667 to 10,000 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 50 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for lindane. Therefore, the revised IDLH for lindane is 50 mg/m³ based on acute oral toxicity data in humans [Starr and Clifford 1972] and animals [Desi et al. 1978; Kenaga and Morgan 1978; Sun 1972; Woodard and Hagan 1947]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

Lindane (continued)


Lithium hydride

CAS number ........................................ 7580-67-8
NIOSH REL ........................................
Current OSHA PEL ....................................
1989 OSHA PEL ......................................
1993-1994 ACGIH TLV ................................

Description of substance

ODORLESS, OFF-WHITE TO GRAY, TRANSLUCENT, CRYSTALINE MASS OR WHITE POWDER.

Noncombustible Solid

Original (SCP) IDLH* ................................
Effective IDLH ....................

LEL .................................................

Odorless, off-white to gray, translucent, crystalline mass or white powder.

Short-term exposure guidelines

None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50}</th>
<th>LC_{10}</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Spiegl et al. 1956</td>
<td>22 mg/m³</td>
<td>-----</td>
<td>4 hr</td>
<td>4.4 mg/m³ (2.0)</td>
<td>4.4 mg/m³</td>
</tr>
</tbody>
</table>

Human data ................................................

It has been recommended that 0.5 mg/m³ is the maximum tolerable concentration for brief period of exposure [AIHA 1964].

Revised IDLH: 0.5 mg/m³

Basis for revised IDLH: The revised IDLH for lithium hydride is 0.5 mg/m³ based on acute inhalation toxicity data in humans [AIHA 1964].

REFERENCES:

### L.P.G.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
<td>68475-85-7</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>1,000 ppm (1,800 mg/m³) TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>1,000 ppm (1,800 mg/m³) TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>1,000 ppm (1,800 mg/m³) TWA</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Colorless, noncorrosive, odorless gas when pure.</td>
</tr>
<tr>
<td>LEL(propane)</td>
<td>2.1% (10% LEL, 2,100 ppm)</td>
</tr>
<tr>
<td>LEL(butane)</td>
<td>1.9% (10% LEL, 1,900 ppm)</td>
</tr>
<tr>
<td>Original (SCP) IDLH</td>
<td>19,000 ppm [LEL]</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>Because propane is a simple asphyxiant, L.P.G. is also considered to be a simple asphyxiant. L.P.G., therefore, does not present an IDLH hazard at concentrations below its lower explosive limit (LEL). The chosen IDLH, based on the &quot;estimated&quot; LEL for L.P.G. (19,000 ppm), is the concentration above which only the &quot;most protective&quot; respirators are permitted.</td>
</tr>
<tr>
<td>Short-term exposure guidelines</td>
<td>None developed</td>
</tr>
</tbody>
</table>

#### ACUTE TOXICITY DATA

| Animal data | None relevant for use in determining the revised IDLH. |
| Human data | At extremely high concentrations, L.P.G. may cause asphyxia by oxygen displacement [Proctor et al. 1988]. Propane concentrations of 100,000 ppm may cause dizziness within a few minutes [Proctor et al. 1988]. |

**Revised IDLH:** 2,000 ppm [LEL]
**Basis for revised IDLH:** Because L.P.G. may cause asphyxia [Proctor et al. 1988] at concentrations well above the lower explosive limit (LEL), the revised IDLH for L.P.G. is 2,000 ppm based strictly on safety considerations (i.e., being about 10% of the LELs of 1.9% for butane and 2.1% for propane).  

**REFERENCE:**

### Magnesium oxide fume

**CAS number** ......................................... 1309-48-4
**NIOSH REL** ........................................... The 1989 OSHA PEL may not be protective to workers.
**Current OSHA PEL** .................................... 15 mg/m³ (total dust) TWA
**1989 OSHA PEL** ....................................... 10 mg/m³ (total dust) TWA
**1993-1994 ACGIH TLV** ............................... 10 mg/m³ (total dust) TWA

**Description of substance**  
Finely divided white particulate dispersed in air.

**LEL** ...................................................... Noncombustible Solid

**Original (SCP) IDLH**  
No Evidence [Note: "Effective" IDLH = 7,500 mg/m³ — see discussion below.]

**Basis for original (SCP) IDLH**  
The available toxicological data contain no evidence of an IDLH for magnesium oxide fume, because the symptoms of metal fume fever would not impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL (500 x 15 mg/m³ is 7,500 mg/m³).

**Short-term exposure guidelines**  
None developed

### ACUTE TOXICITY DATA

**Animal data** ........................................... None relevant for use in determining the revised IDLH.

**Human data** .......................................... Volunteers exposed to freshly generated fume at concentrations ranging from 410 to 580 mg/m³ experienced only slight (unspecific) reactions [Drinker et al. 1927].

<table>
<thead>
<tr>
<th>Revised IDLH: 750 mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis for revised IDLH: The revised IDLH for magnesium oxide fume is 750 mg/m³ based on acute inhalation toxicity data in humans [Drinker et al. 1927].</td>
</tr>
</tbody>
</table>

**REFERENCE:**

Malathion

CAS number ........................................ 121-75-5
NIOSH REL ....................................... 10 mg/m³ TWA [skin]
Current OSHA PEL ................................ 15 mg/m³ TWA [skin]
1988 OSHA PEL ................................... 10 mg/m³ TWA [skin]
1993-1994 ACGIH TLV ............................. 10 mg/m³ TWA [skin]

Description of substance.......................... Deep-brown to yellow liquid with a garlic-like odor.

LEL .................................................. Unknown

Original (SCP) IDLH .................................. 5,000 mg/m³

Basis for original (SCP) IDLH ..................... No useful data on acute inhalation toxicity are available on which to base the IDLH for malathion. The chosen IDLH, therefore, has been estimated from the statement by Stolman [1969] that the acute oral LD₅₀ values for mice and rats range from 480 to 5,800 mg/kg.

Short-term exposure guidelines .................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (mg/m³)</th>
<th>LC₉₅ (mg/m³)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Izmerov et al. 1982</td>
<td></td>
<td>10</td>
<td>4 hr</td>
<td>20 mg/m³ (2.0)</td>
<td>2.0 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Sapecgin and Mikhailov 1986</td>
<td>84.6</td>
<td></td>
<td>4 hr</td>
<td>169 mg/m³ (2.0)</td>
<td>17 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>290</td>
<td></td>
<td>2,030 mg/m³</td>
<td>203 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>190</td>
<td></td>
<td>1,330 mg/m³</td>
<td>133 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>von Dozent et al. 1955</td>
<td>oral</td>
<td>570</td>
<td></td>
<td>3,990 mg/m³</td>
<td>399 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................ Workers exposed to initial concentrations up to 85 mg/m³ for 1 hour (that may have declined rapidly) over 42 consecutive days suffered no adverse effects [Golz 1959]. Workers exposed to concentrations that peaked at 56 mg/m³ and averaged 3.3 mg/m³ for 5 hours had normal cholinesterase levels [Culver et al. 1956]. A lethal oral dose of 246 to 471 mg/kg has been reported [Farago 1967; Jusie and Milic 1978]. [Note: An oral dose of 246 to 471 mg/kg is equivalent to a 70-kg worker being exposed to about 11,500 to 22,100 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 250 mg/m³

Basis for revised IDLH: The revised IDLH for malathion is 250 mg/m³ based on acute toxicity data in humans [Farago 1967; Golz 1959; Jusie and Milic 1978].

REFERENCES:

Malathion (continued)

4. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 56.
Maleic anhydride

CAS number .................................................. 108-31-6
NIO SH REL .................................................. 1 mg/m³ (0.25 ppm) TWA
Current OSHA PEL .......................................... 1 mg/m³ (0.25 ppm) TWA
1989 OSHA PEL .............................................. Same as current PEL
1993-1994 ACGIH TLV ...................................... 1 mg/m³ (0.25 ppm) TWA

Description of substance ................................. Colorless needles, white lumps, or pellets with an irritating, choking odor.

LEL ......................................................... 1.4% (10% LEL, 1.400 ppm)
Original (SCP) IDLH* .................................. Unknown [*Note: "Effective" IDLH = 2,000 mg/m³ – see discussion below]
Basis for original (SCP) IDLH ......................... No data on acute inhalation toxicity data are available on which to base an IDLH for maleic anhydride. MCA [1974] reported that it possesses little acute systemic toxic properties. For this draft technical standard, therefore, the respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 1 mg/m³ (i.e., 2,000 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 2,000 mg/m³.

Short-term exposure guidelines .......................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>(LD_{50}) (mg/kg)</th>
<th>(LD_{10}) (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Berzin 1969</td>
<td>oral</td>
<td>465</td>
<td>-----</td>
<td>3.255 mg/m³</td>
<td>326 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Berzin 1969</td>
<td>oral</td>
<td>850</td>
<td>5.950 mg/m³</td>
<td>595 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>875</td>
<td>6.125 mg/m³</td>
<td>613 mg/m³</td>
<td></td>
</tr>
<tr>
<td>O. pig</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>380</td>
<td>2.730 mg/m³</td>
<td>273 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>NCI 1974</td>
<td>oral</td>
<td>400</td>
<td>2.800 mg/m³</td>
<td>280 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data .............................................. In volunteers, 8 to 8 mg/m³ caused nasal irritation within 1 minute and ocular irritation after 15 to 20 minutes (Gervais 1967). In another study, concentrations of 10 mg/m³ and higher were found to be extremely irritating [IHFA 1969].

Revised IDLH: 10 mg/m³
Basis for revised IDLH: The revised IDLH for maleic anhydride is 10 mg/m³ based on acute inhalation toxicity data in volunteers [IHFA 1969].

REFERENCES:
Manganese compounds (as Mn)

CAS number ........................................... 7439-96-5 (Metal)

NIOSH REL .................................................

Current OSHA PEL ........................................ 1 mg/m³ TWA, 3 mg/m³ STEL

1989 OSHA PEL ............................................ Same as current PEL

1983-1984 ACGIH TLV .................................... 5 mg/m³ TWA

Description of substance ....................................

Original (SCP) IDLH* ...................................... No Evidence [*Note: "Effective" IDLH = 10,000 mg Mn/m³ – see discussion below.]

Basis for original (SCP) IDLH .............................. The available toxicological data do not indicate that exposure to a high concentration of manganese could impede escape within 30 minutes. For this draft technical standard, therefore, respirators have been assigned on the basis of the assigned protection factor afforded by each device up to 2,000 II the OSHA PEL (2,000 II 5 mg Mn/m³ is 10,000 mg Mn/m³; only the "most protective" respirators are permitted for use in concentrations exceeding 10,000 mg Mn/m³).

Short-term exposure guidelines .............................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mn</td>
<td>Marhold 1972</td>
<td>oral</td>
<td>9,000</td>
<td>61,000 mg Mn/m³</td>
<td>6,300 mg Mn/m³</td>
<td></td>
</tr>
<tr>
<td>MnCl₂</td>
<td>Marhold 1977</td>
<td>oral</td>
<td>2,940</td>
<td>6,586 mg Mn/m³</td>
<td>659 mg Mn/m³</td>
<td></td>
</tr>
<tr>
<td>MnCl₂</td>
<td>Gupta et al. 1981</td>
<td>oral</td>
<td>1,715</td>
<td>5,282 mg Mn/m³</td>
<td>528 mg Mn/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ............................................. Chronic exposures to workers averaging 47 mg/m³ caused manganese poisoning, while no cases occurred at exposures less than 30 mg/m³ [Flinn et al. 1940]. Chronic exposure to concentrations averaging 210 mg/m³ have been associated with pneumonia [Lloyd-Davies 1946]. Workers chronically exposed to concentrations of manganese dust averaging 20 mg/m³ showed signs of manganism [Smyth et al. 1973].

Revised IDLH: 500 mg Mn/m³

Basis for revised IDLH: The revised IDLH for manganese is 500 mg Mn/m³ based on acute inhalation toxicity data in animals [Gupta et al. 1981]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:
Mercury compounds [except (organo) alkyls] (as Hg)

CAS number ......................................................... 7439-97-5 (Metal)
NIOSH REL ..............................................................
Current OSHA PEL ..................................................
1989 OSHA PEL .....................................................
1993-1994 ACGIH TLV ..............................................

Description of substance ...........................................

Original (SCP) IDLH ................................................
Basis for original (SCP) IDLH ......................................
The chosen IDLH is based on the statement by Patty [1963] and AIHA [1966] that "severe damage has been produced in the kidneys, liver, brain, heart, lungs, and colon of rabbits exposed for a single 4-hour period to mercury vapor at an average concentration of 28.8 mg/m³; mild damage to most of these organs occurred from 1 hour of exposure [Ashe et al. 1953]."

Existing short-term exposure guidelines ....................... 28 mg Hg/m³

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hg</td>
<td>Rabbit</td>
<td>28</td>
<td></td>
<td>30 hr</td>
<td>110 mg Hg/m³ (2.91)</td>
<td>33 mg Hg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HgCl₂</td>
<td>Rat</td>
<td>oral</td>
<td>210</td>
<td></td>
<td>1,250 mg Hg/m³</td>
<td>125 mg Hg/m³</td>
</tr>
<tr>
<td>HgCl₂H₂</td>
<td>Rat, Mouse</td>
<td>oral</td>
<td>86</td>
<td>68</td>
<td>482 mg Hg/m³</td>
<td>48 mg Hg/m³</td>
</tr>
</tbody>
</table>

Other animal data .............................................. Severe damage has been produced in the kidneys, lungs, and colon of rabbits exposed for a single 4-hour period to mercury vapor at an average of 28.8 mg/m³; mild damage to most of the organs occurred after 1 hour of exposure [Ashe et al. 1953].

Human data ...................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 10 mg Hg/m³
Basis for revised IDLH: The revised IDLH for mercury compounds [except mercury (organo) alkyls] is 10 mg Hg/m³ based on acute inhalation toxicity data in animals [Ashe et al. 1953].
Mercury compounds [except (organo) alkyls] (as Hg) (continued)

REFERENCES:

Mercury (organo) alkyl compounds (as Hg)

| CAS number | ................................. | Varies |
| NIOSH REL  | ................................. | 0.01 mg/m³ TWA, 0.03 mg/m³ STEL [skin] |
| Current OSHA PEL | ................................. | 0.01 mg/m³ TWA, 0.04 mg/m³ CEILING |
| 1989 OSHA PEL | ................................. | 0.01 mg/m³ TWA, 0.03 mg/m³ STEL [skin] |
| 1993-1994 ACGIH TLV | ................................. | 0.01 mg/m³ TWA, 0.03 mg/m³ STEL [skin] |
| Description of substance | ................................. | 10 mg Hg/m³ |
| Original (SCP) IDLH | ................................. | The chosen IDLH is based on the statement by ACGIH [1971] that mice died within 3 to 5 hours at 10 to 30 mg/m³ organic mercury [Trakhtenberg 1950]. The chosen IDLH seems reasonable because NIOSH [1976] cited a mouse intraperitoneal LD₅₀ for dipropylmercury of 2 mg/kg [NRC 1952]. If the IDLH were estimated from this information, a value of 14 mg/m³ would be obtained. |
| Basis for original (SCP) IDLH | ................................. | None developed |

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HgC₆H₅</td>
<td>Rat</td>
<td>Russkykh and Frolova 1973</td>
<td>258 mg/m³</td>
<td>-----</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Mouse</td>
<td>Russkykh and Frolova 1973</td>
<td>91 mg/m³</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Hg (organo) alkyl</td>
<td>Mouse</td>
<td>Trakhtenberg 1950</td>
<td>10-30 mg/m³</td>
<td>3 hr</td>
<td>18-54 mg Hg/m³ (1.8)</td>
<td>1.8-5.4 mg Hg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Trakhtenberg 1950</td>
<td>10-30 mg/m³</td>
<td>5 hr</td>
<td>22-25 mg Hg/m³ (2.2)</td>
<td>2.2-2.6 mg Hg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HgC₆H₅</td>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>51</td>
<td>278 mg Hg/m³</td>
<td>28 mg Hg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>44</td>
<td>240 mg Hg/m³</td>
<td>24 mg Hg/m³</td>
<td></td>
</tr>
<tr>
<td>HgC₅H₉N₂</td>
<td>Rat</td>
<td>Grin et al. 1973</td>
<td>oral</td>
<td>60.9</td>
<td>180 mg Hg/m³</td>
<td>18 mg Hg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Grin et al. 1973</td>
<td>oral</td>
<td>21.9</td>
<td>105 mg Hg/m³</td>
<td>11 mg Hg/m³</td>
<td></td>
</tr>
<tr>
<td>HgC₅H₉N₂</td>
<td>Rat</td>
<td>Frear 1969</td>
<td>oral</td>
<td>200</td>
<td>742 mg Hg/m³</td>
<td>74 mg Hg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>NRC 1952</td>
<td>i.p.</td>
<td>-----</td>
<td>1.9</td>
<td>9.3 mg Hg/m³</td>
<td>0.9 mg Hg/m³</td>
</tr>
</tbody>
</table>

Human data

Deaths have resulted from 3 months exposure to diethyl mercury at an estimated concentration of 1 mg/m³ [Hill 1943]. The lethal dose of methyl mercury is estimated to be 200 mg, with paresthesia of the hands, feet, and mouth occurring at a total body burden of 40 mg [Bakir et al. 1973]. [Note: An oral dose of 200 mg of methyl mercury is equivalent to a worker being exposed to about 125 mg Hg/m³ for 30 minutes, assuming a breathing rate of 5 liters per minute and 100% absorption.]
Mercury (organos) alkyl compounds (as Hg) (continued)

**Revised IDLH:** 2 mg Hg/m³

**Basis for revised IDLH:** The revised IDLH for mercury (organos) alkyl compounds is 2 mg Hg/m³ based on acute toxicity data in humans (Bakir et al. 1973; Hill 1943) and animals (Trakhtenberg 1950).

**REFERENCES:**

Mesityl oxide

CAS number ........................................ 141-79-7
NIOSH REL ........................................ 10 ppm (40 mg/m³) TWA
Current OSHA PEL .................................. 25 ppm (100 mg/m³) TWA
1989 OSHA PEL ..................................... 15 ppm (80 mg/m³) TWA, 25 ppm (100 mg/m³) STEL
1993-1994 ACGIH TLV ............................ 15 ppm (80 mg/m³) TWA, 25 ppm (100 mg/m³) STEL

Description of substance .......................... Oily, colorless to light-yellow liquid with a peppermint- or honey-like odor.

LEL ................................................ 1.4% (10% LEL, 1,400 ppm)

Original (SCP) IDLH .................................. 5,000 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statement by Patty [1963] that 5,000 ppm might be dangerous to life in 30 to 60 minutes [Smyth et al. 1942].

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (mg/m³)</th>
<th>LC100 (mg/m³)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>1,000 mg/m³</td>
<td>-----</td>
<td>4 hr</td>
<td>2,000 ppm (2.0)</td>
<td>200 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>9,000 mg/m³</td>
<td>-----</td>
<td>4 hr</td>
<td>18,000 ppm (2.0)</td>
<td>1,800 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>10,000 mg/m³</td>
<td>-----</td>
<td>2 hr</td>
<td>15,000 ppm (1.6)</td>
<td>1,600 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Specht et al. 1940</td>
<td>2,000 mg/m³</td>
<td>-----</td>
<td>7 hr</td>
<td>4,800 ppm (2.4)</td>
<td>480 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50 (mg/kg)</th>
<th>LD100 (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Hann and Jansen 1974</td>
<td>oral</td>
<td>1,120</td>
<td>-----</td>
<td>1,922 ppm</td>
<td>192 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Hann and Jansen 1974</td>
<td>oral</td>
<td>1,600</td>
<td>-----</td>
<td>1,716 ppm</td>
<td>172 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>710</td>
<td>-----</td>
<td>1,218 ppm</td>
<td>122 ppm</td>
</tr>
</tbody>
</table>

Human data .......................................... The probable response to 100 ppm was predicted to be eye and mucous membrane irritation, difficulty breathing, headache, and vertigo [Shell 1957]. It has been stated that 5,000 ppm might be dangerous to life in 30 to 60 minutes [Smyth et al. 1942].

Revised IDLH: 1,400 ppm [LEL]
Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Smyth et al. 1942], a value of about 4,000 ppm would have been appropriate for mesityl oxide. However, the revised IDLH for mesityl oxide is 1,400 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.4%).

REFERENCES:

**Methoxychlor**

CAS number ........................................... 72-43-5

NIOSH REL ............................................. None established; NIOSH considers methoxychlor to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ........................................ 15 mg/m³ TWA

1989 OSHA PEL ........................................ 10 mg/m³ TWA

1993-1994 ACGIH TLV ................................... 10 mg/m³ TWA

Description of substance ......................... Colorless to light-yellow crystals with a slight, fruity odor.

LEL ........................................................... Unknown

Original (SCP) IDLH** ................................... No Evidence [*Note: "Effective" IDLH = 7,500 mg/m³ - see discussion below.]

ACGIH [1971] stated that methoxychlor has a very low toxicity. The available toxicological data indicate that an acute exposure to a high concentration of methoxychlor would not result in death or any irreversible health effects. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances, it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 times the OSHA PEL (500 x 15 mg/m³ is 7,500 mg/m³).

Short-term exposure guidelines ................. None developed

**ACUTE TOXICITY DATA**

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>$LD_{50}$ (mg/kg)</th>
<th>$LD_{100}$ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>CDC 1956</td>
<td>oral</td>
<td>5,000</td>
<td>--</td>
<td>35,000 mg/m³</td>
<td>3,500 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Coates et al. 1977</td>
<td>oral</td>
<td>1,000</td>
<td>--</td>
<td>7,000 mg/m³</td>
<td>700 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Kenaga and Morgan 1978</td>
<td>oral</td>
<td>&gt;6,000</td>
<td>--</td>
<td>&gt;42,000 mg/m³</td>
<td>&gt;4,200 mg/m³</td>
</tr>
</tbody>
</table>

Human data ............................................. It has been reported that 6,430 mg/kg is the estimated fatal oral dose [AAPCO 1966]. [Note: An oral dose of 6,430 mg/kg is equivalent to a worker being exposed to about 300,000 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 5,000 mg/m³

**Basis for revised IDLH:** The available toxicological data contain no evidence that an acute exposure to a high concentration of methoxychlor would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for methoxychlor is 5,000 mg/m³ based on being 500 times the OSHA PEL of 10 mg/m³. (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates). [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for methoxychlor at any detectable concentration.]
REFERENCES:

Methyl acetate

**CAS number** .......................................................... 79-20-9

**NIOSH REL** ..........................................................

**Current OSHA PEL** ................................................... 200 ppm (610 mg/m³) TWA

**1989 OSHA PEL** ..................................................... 200 ppm (610 mg/m³) TWA

**1993-1994 ACGIH TLV** ............................................. 200 ppm (605 mg/m³) TWA

**Description of substance** ........................................... Colorless liquid with a fragrant, fruity odor.

**LEL** ........................................................................... 3.1% (10% LEL, 3.100 ppm)

**Original (SCP) IDLH** .................................................. The chosen IDLH is based on an analogy with butyl acetate and ethyl acetate which have IDLHs of 10,000 ppm.

**Easie for original (SCP) IDLH** ........................................ None developed

**Short-term exposure guidelines** ....................................

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Flury and Wirth 1933</td>
<td>----</td>
<td>11,039</td>
<td>4 hr</td>
<td>22,078 ppm (2.0)</td>
<td>2,208 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Flury and Wirth 1933</td>
<td>----</td>
<td>21,753</td>
<td>1 hr</td>
<td>27,191 ppm (1.25)</td>
<td>2,719 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>----</td>
<td>32,000</td>
<td>4 hr</td>
<td>64,000 ppm (2.0)</td>
<td>6,400 ppm</td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>3.700</td>
<td>-----</td>
<td>8,408 ppm</td>
<td>841 ppm</td>
</tr>
</tbody>
</table>

**Human data** .......................................................... It has been reported that concentrations of 10,000 ppm for a short time caused irritation which persisted after exposure stopped [Clayton and Clayton 1981].

**Revised IDLH:** 3,100 ppm [LEL]

**Basis for revised IDLH:** Based on health considerations and acute inhalation toxicity data in humans [Clayton and Clayton 1981], the original value of about 10,000 ppm would have been appropriate for methyl acetate. However, the revised IDLH for methyl acetate is 3,100 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 3.1%).

**REFERENCES:**


**Methyl acetylene**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
<td>74-99-7</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>1,000 ppm (1,650 mg/m³) TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>1,000 ppm (1,650 mg/m³) TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>1,000 ppm (1,640 mg/m³) TWA</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Colorless gas with a sweet odor.</td>
</tr>
<tr>
<td>LEL</td>
<td>1.7% (10% LEL, 1,700 ppm)</td>
</tr>
<tr>
<td>Original (SCP) IDLH</td>
<td>15,000 ppm [LEL]</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>The chosen IDLH is based on the lower explosive limit (LEL) of 17,000 ppm rounded down to 15,000 ppm.</td>
</tr>
<tr>
<td>Short-term exposure guidelines</td>
<td>None developed</td>
</tr>
</tbody>
</table>

**ACUTE TOXICITY DATA**

| Animal data                  | None relevant for use in determining the revised IDLH. |
| Human data                   | It has been stated that methyl acetylene appears to be a general anesthetic with comparatively low toxicity [ACGIH 1991]. |

| Revised IDLH: 1,700 ppm [LEL] | Since methyl acetylene appears to have relatively low toxicity [ACGIH 1991], the revised IDLH is 1,700 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.7%).

**REFERENCE:**

Methyl acetylene-propadiene mixture (MAPP)

CAS number .............................................. 59955-75-8
CASN REL .................................................. .
Current OSHA PEL ......................................... 1,000 ppm (1,800 mg/m³) TWA,
1,250 ppm (2,250 mg/m³) STEL
1989 OSHA PEL .............................................. 1,000 ppm (1,800 mg/m³) TWA,
1,250 ppm (2,250 mg/m³) STEL
1993-1994 ACGIH TLV ....................................... 1,000 ppm (1,640 mg/m³) TWA,
1,250 ppm (2,050 mg/m³) STEL
Description of substance ................................. Colorless gas with a strong, characteristic, foul odor.
LEL .............................................................. 3.4% (10% LEL, 3,400 ppm)
Original (SCP) IDLH ........................................ 15,000 ppm
Basis for original (SCP) IDLH ............................ Because the TLV for a methyl acetylene-propadiene mixture has been set by analogy to methyl acetylene [ACGIH 1971], the chosen IDLH is also set by analogy with methyl acetylene which has an IDLH of 15,000 ppm.
Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Animal or human data .................................... None relevant for use in determining the revised IDLH.
Other data .................................................. The American Conference of Governmental Industrial Hygienists TLV for a methyl acetylene-propadiene mixture (MAPP) is based on an analogy to methyl acetylene [ACGIH 1991].

Revised IDLH: 3,400 ppm [LEL]
Basis for revised IDLH: Since a methyl acetylene-propadiene mixture appears to have relatively low toxicity, and based on an analogy to methyl acetylene [ACGIH 1991], the revised IDLH is 3,400 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 3.4%).

REFERENCES:

Methyl acrylate

CAS number ......................................... 96-33-3
NIOSH REL .................................. 
Current OSHA PEL ............................ 10 ppm (35 mg/m³) TWA [skin]
1989 OSHA PEL ........................................... Same as current PEL
1993-1994 ACGIH TLV .......................... 10 ppm (35 mg/m³) TWA [skin]
Description of substance ....................... Colorless liquid with an acrid odor.
LEL ............................................... 2.8% (10% LEL, 2,800 ppm)
Original (SCP) IDLH .............................. 1,000 ppm

Basis for original (SCP) IDLH .................. The chosen IDLH is based on the rat 4-hour LC₅₀ of 1,000 ppm in which 3 of 6 rats died [Smyth and Carpenter 1948 cited by Patty 1963].

Short-term exposure guidelines .............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>House Mouse</td>
<td>Lomonova and Klimova 1979</td>
<td>3.575</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Rat</td>
<td>Oberly and Tansey 1985</td>
<td>1.150</td>
<td>-----</td>
<td>4 hr</td>
<td>2,750 ppm (2.0)</td>
<td>270 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth and Carpenter 1948</td>
<td>1.000</td>
<td>-----</td>
<td>4 hr</td>
<td>2,000 ppm (2.0)</td>
<td>200 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1949</td>
<td>2.522</td>
<td>-----</td>
<td>1 hr</td>
<td>1,153 ppm (1.25)</td>
<td>315 ppm</td>
</tr>
</tbody>
</table>

Other animal data ......................... Rats exposed 4 hours per day, 5 days per week at 110 ppm for a total of 32 exposures had eye discomfort at the start of the investigation, but no overt signs of respiratory distress or other manifestations of toxicity were recorded [Oberly and Tansey 1985].

Human data .................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 250 ppm

Basis for revised IDLH: The revised IDLH for methyl acrylate is 250 ppm based on acute inhalation data in animals [Oberly and Tansey 1985; Smyth and Carpenter 1948; Treon et al. 1949].

REFERENCES:

**Methylal**

CAS number .................................................. 109-87-5
NIOSH REL .........................................................
Current OSHA PEL ............................................. 1,000 ppm (3,100 mg/m³) TWA
1993-1994 ACGIH TLV ........................................ 1,000 ppm (3,110 mg/m³) TWA
Description of substance ........................................ Colorless liquid with a chloroform-like odor.
LEL ................................................................. 2.2% (10% LEL, 2,200 ppm)
Original (SCP) IDLH ............................................. 15,000 ppm [LEL]
Basis for original (SCP) IDLH .................................. Patty [1963] reported that Weaver et al. [1951] noted only minor irritation in 50 mice that received fifteen 7-hour exposures to 11,000 ppm and that 6 of 50 mice died after fifteen 7-hour exposures to 18,000 ppm. Because the data indicate that acutely toxic effects occur only above the lower explosive limit (LEL) of 16,000 ppm, the IDLH is based on the LEL rounded down to 15,000 ppm. This is the concentration above which only the “most protective” respirators are permitted.

Short-term exposure guidelines ........................................ None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>L_{50} (ppm)</th>
<th>L_{10} (ppm)</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Marhold 1986</td>
<td>18,000</td>
<td>---</td>
<td>43,292 ppm (2.4)</td>
<td>4,329 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>15,000</td>
<td>---</td>
<td>7</td>
<td>?</td>
</tr>
<tr>
<td>Mouse</td>
<td>Weaver et al. 1951</td>
<td>18,354</td>
<td>---</td>
<td>44,050 ppm (2.4)</td>
<td>4,405 ppm</td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>L_{50} (mg/kg)</th>
<th>L_{10} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Knoefel et al. 1932</td>
<td>oral</td>
<td>5,704</td>
<td>---</td>
<td>12,644 ppm</td>
<td>1,264 ppm</td>
</tr>
</tbody>
</table>

In one study, the “no effect” levels were determined to be 2,810 and 8,450 ppm in rats and guinea pigs, respectively [Price et al. 1978]. Fifteen 7-hour exposures to 11,000 ppm caused only minor irritation in 50 mice [Weaver et al. 1951].

**Human data** ...................................................... Methylal has been used as an anesthetic in surgery [ACGIH 1991].

**Revised IDLH:** 2,200 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [ACGIH 1991] and animals [Price et al. 1978; Weaver et al. 1951], a value of about 10,000 ppm would have been appropriate for methylal. However, the revised IDLH for methylal is 2,200 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 2.2%).

**REFERENCES:**

Methylal (continued)

6. Price NH, Allen SD, Daniels AU, Yates WG [1978]. Toxicity data for establishing "immediately dangerous to life or health" (IDLH) values. Salt Lake City, UT: University of Utah Research Institute, USTL Division, Report No. TR 1510-005, Contract No. CDC-210-76-0143.
Methyl alcohol

CAS number ........................................... 67-56-1
NIOSH REL ........................................... 200 ppm (260 mg/m³) TWA, 250 ppm (325 mg/m³) STEL [skin]
Current OSHA PEL .................................. 200 ppm (260 mg/m³) TWA
1998 OSHA PEL ...................................... 200 ppm (260 mg/m³) TWA, 250 ppm (325 mg/m³) STEL [skin]
1993-1994 ACGIH TLV .......................... 200 ppm (262 mg/m³) TWA, 250 ppm (328 mg/m³) STEL [skin]
Description of substance ......................... Colorless liquid with a characteristic pungent odor.
LEL .................................................. 6.0% (10% LEL, 6,000 ppm)
Original (SCP) IDLH ............................... 25,000 ppm
Basis for original (SCP) IDLH ................... The chosen IDLH is based on the statement by Patty (1963) that it probably would be dangerous for men to be exposed to the vapors of methyl alcohol in concentrations of the order of 30,000 to 50,000 ppm for as much as 30 to 60 minutes.
10-min EEGL: 800 ppm
30-min EEGL: 400 ppm
1-hour EEGL: 200 ppm
24-hour EEGL: 10 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Flury and Wirth 1933</td>
<td>800</td>
<td>1,000</td>
<td>6 hr</td>
<td>76,000 ppm (2.3)</td>
<td>7,609 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>800</td>
<td>1,000</td>
<td>2 hr</td>
<td>60,150 ppm (1.6)</td>
<td>6,015 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NDRI 1974</td>
<td>800</td>
<td>1,000</td>
<td>4 hr</td>
<td>128,000 ppm (2.0)</td>
<td>12,800 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Larionov and Broitman 1975</td>
<td>oral</td>
<td>5,628</td>
<td>28,621 ppm</td>
<td>2,962 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Smith and Taylor 1982</td>
<td>oral</td>
<td>7,300</td>
<td>18,421 ppm</td>
<td>3,842 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1941</td>
<td>oral</td>
<td>12,880</td>
<td>67,789 ppm</td>
<td>6,779 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>WHO 1970</td>
<td>oral</td>
<td>14,200</td>
<td>74,737 ppm</td>
<td>7,474 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .................................. RO₅₀ (mouse), 41,514 ppm [Aline 1981].

Human data ........................................ Two human studies showed no effects at vapor concentrations ranging from 160 to 1,000 ppm [McAllister 1964; MDOH 1937]. It has been stated that it probably would be dangerous to be exposed to concentrations of the order of 30,000 to 50,000 ppm for as much as 30 to 60 minutes [Patty 1963]. It has been reported that the lethal oral dose is between 143 and 6,422 mg/kg [Arena 1970; Deichmann and Gerarde1969; Handa 1983]. [Note: An oral dose of 143 to 6,422 mg/kg is equivalent to a 70-kg worker being exposed to about 7,000 to 225,000 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 6,000 ppm
Basis for revised IDLH: The revised IDLH for methyl alcohol is 6,000 ppm based on acute inhalation toxicity data in animals [Izmerov et al. 1982]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations between 1,000 and 30,000 ppm. However, this value is also 10% of the lower explosive limit of 5%.
Methyl alcohol (continued)

REFERENCES:

Methylamine

CAS number ........................................ 74-88-5
NIOSH REL ........................................
Current OSHA PEL ................................. 10 ppm (12 mg/m³) TWA
1989 OSHA PEL ...................................... 10 ppm (12 mg/m³) TWA
1993-1994 ACGIH TLV ............................. 5 ppm (6.4 mg/m³) TWA, 15 ppm (19 mg/m³) STEL
Description of substance ......................... Colorless gas with a fish- or ammonia-like odor.
LEL .................................................... 4.9% (10% LEL, 4,900 ppm)
Original (SCP) IDLH .................................. 100 ppm
Basis for original (SCP) IDLH ..................... The chosen IDLH is based on the severe respiratory tract irritation produced by methylamine. Deichmann and Gerarde [1969] stated that inhalation of methylamine vapors (greater than 100 ppm) causes irritation of the nose and throat, followed by violent sneezing, burning sensation of the throat, coughing, constriction of the larynx and difficulty in breathing, pulmonary congestion, and edema of the lungs.

Short-term exposure guidelines .................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1942</td>
<td>2,977 ppm</td>
<td>1,060 ppm</td>
<td>2 hr</td>
<td>2,977 ppm (2.6)</td>
<td>298 ppm</td>
</tr>
</tbody>
</table>

Human data ......................................... It has been reported that transient irritation of the eyes, nose, and throat has resulted from brief exposures to concentrations of 20 to 100 ppm; the odor was intolerable at 100 to 500 ppm [Clayton and Clayton 1981]. Inhalation of methylamine vapors (at concentrations greater than 100 ppm) has caused irritation of the nose and throat, followed by violent sneezing, burning sensation of the throat, coughing, constriction of the larynx and difficulty in breathing, pulmonary congestion, and edema of the lungs [Deichmann and Gerarde 1969].

Revised IDLH: 100 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Clayton and Clayton 1981; Deichmann and Gerarde 1969], the original IDLH for methylamine (100 ppm) is not being revised at this time.

REFERENCES:

3. Izmerov NF, Sanotskii IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNP, p. 81.
Methyl (n-amyl) ketone

CAS number ......................................... 110-43-0
NIOSH REL ............................................
Current OSHA PEL ................................. 100 ppm (465 mg/m³) TWA
1989 OSHA PEL ................................. Same as current PEL
1993-1994 ACGIH TLV .......................... 50 ppm (233 mg/m³) TWA
Description of substance .................................. Colorless to white liquid with a banana-like, fruity odor.
LEL(@151°F) .................................. 1.1% (10% LEL(@151°F), 1,100 ppm)

Short-term exposure guidelines ........................ None developed

ACUTE TOXICITY DATA
Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₆₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Clayton and Clayton 1981</td>
<td>4,000</td>
<td>2,000</td>
<td>4 hr</td>
<td>6,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Specht et al. 1940</td>
<td>2,000</td>
<td>14.0 hr</td>
<td>6,180 ppm (3.09)</td>
<td>618 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₆₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>oral</td>
<td>1,670</td>
<td>730</td>
<td>2,461 ppm</td>
<td>246 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Srepel and Akacic 1962</td>
<td>oral</td>
<td>1,076 ppm</td>
<td>108 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ........................................ Exposures to guinea pigs lasting 4-8 hours were irritating to the mucous membranes at 1,500 ppm, strongly narcotic at 2,000 ppm, and caused narcosis and death at 4,800 ppm [Specht et al. 1940].

Human data ................................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 800 ppm
Basis for revised IDLH: The revised IDLH for methyl (n-amyl) ketone is 800 ppm based on acute inhalation toxicity data in animals [Clayton and Clayton 1981].

REFERENCES:
Methyl bromide

CAS number ........................................ 74-83-9
NIOSH REL .......................................... None established. NIOSH considers methyl bromide to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL .................................... 20 ppm (80 mg/m³) CEILING [skin]
1989 OSHA PEL ...................................... 20 ppm (80 mg/m³) CEILING [skin]
1993-1994 ACGIH TLV ................................. 5 ppm (20 mg/m³) TWA [skin]

Description of substance .............................. Colorless gas with a chloroform-like odor at high concentrations.

LEL .................................................. 2,000 ppm
PEL .................................................. 10% (10% LEL, 10,000 ppm)

Original (SCP) IDLH .................................. The chosen IDLH is based on the statement by Patty [1963] that rats survived 2,600 ppm for 24 minutes [Irish et al. 1940]. None developed

Current (SCP) IDLH .................................. 5 ppm (1.6) 

TOXICITY DATA

Short-term exposure guidelines ....................... None established; NIOSH considers methyl bromide to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Alexeeff et al. 1985</td>
<td>1,200</td>
<td>-----</td>
<td>1 hr</td>
<td>3,500 ppm (1.25)</td>
<td>150 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Bakhishev 1973</td>
<td>7,316</td>
<td>-----</td>
<td>10 min</td>
<td>7,316 ppm (1.0)</td>
<td>732 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Bakhishev 1975</td>
<td>2,833</td>
<td>1,500</td>
<td>10 min</td>
<td>2,833 ppm (1.0)</td>
<td>282 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>390</td>
<td>1,200</td>
<td>8 hr</td>
<td>755 ppm (2.5)</td>
<td>76 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Sayers et al. 1929</td>
<td>-----</td>
<td>300</td>
<td>9 hr</td>
<td>780 ppm (2.6)</td>
<td>78 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................... It has been reported that rats have survived an exposure to 2,600 ppm for 24 minutes [Irish et al. 1940].

Human data .......................................... It has been stated that 220 ppm can be endured for several hours without serious effects [Clarke et al. 1945].

Revised IDLH: 250 ppm

Basis for revised IDLH: The revised IDLH for methyl bromide is 250 ppm based on acute inhalation toxicity data in humans [Clarke et al. 1945]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 220 ppm. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for methyl bromide at any detectable concentration.]

REFERENCES:

Methyl Cellosolve®

CAS number ................................................. 109-86-4
NIOSH REL .................................................. 0.1 ppm (0.3 mg/m³) TWA [skin]
Current OSHA PEL .......................................... 25 ppm (30 mg/m³) TWA [skin]
1989 OSHA PEL ................................................ Same as current PEL
1983-1984 ACGIH TLV ...................................... 5 ppm (18 mg/m³) TWA [skin]
Description of substance ..................................... Colorless liquid with a mild, ether-like odor.

LEL ...................................................................... 1.8% (10% LEL, 1.6 ppm)

Original (SCP) IDLH* .......................................... 2,000 ppm [Note: "Effective" IDLH = 1,250 ppm — see discussion below.]

Based on a UCC [1969] report that 0 of 6 rats died after a 2-hour exposure to 2,000 ppm, 4 of 6 rats died after a 4-hour exposure to 2,000 ppm, and 8 of 6 rats died after an 8-hour exposure to 2,000 ppm, an IDLH of 2,000 ppm was chosen. However, respirators have been assigned on the basis of the assigned protection factor afforded by each device up to a concentration of 50 times the OSHA PEL of 25 ppm (i.e., 1,250 ppm); only the "most protective" respirators are permitted for use in concentrations exceeding 1,250 ppm.

Short-term exposure guidelines ............................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>UCC 1969</td>
<td>2,000</td>
<td>2,000</td>
<td>4 hr</td>
<td>4,000 ppm (2.0)</td>
<td>600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>UCC 1969</td>
<td>2,000</td>
<td>2,000</td>
<td>8 hr</td>
<td>5,000 ppm (3.15)</td>
<td>500 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Werner et al. 1943</td>
<td>1,480</td>
<td>1,480</td>
<td>7 hr</td>
<td>3,552 ppm (2.4)</td>
<td>355 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Ballantyne 1987</td>
<td>oral</td>
<td>2,170</td>
<td>5,250</td>
<td>528 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Carpenter et al. 1986</td>
<td>oral</td>
<td>890</td>
<td>1,972</td>
<td>197 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Gig Tr Prof Sabol 1963</td>
<td>oral</td>
<td>1,480</td>
<td>3,278</td>
<td>328 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth et al. 1941</td>
<td>oral</td>
<td>950</td>
<td>2,104</td>
<td>210 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .............................................. It has been reported that rats survived a 2-hour exposure to 2,000 ppm [UCC 1969]. Chronic exposure to 50 to 100 ppm has been associated with headache, dizziness, laryngitis, weakness, hyperreflexia, disorientation, unequal pupil size, and visual and/or auditory disturbances [ACGIH 1991]. It has been reported that 3,380 mg/kg is the lethal oral dose [Young and Woolmer 1946]. [Note: An oral dose of 3,380 mg/kg is equivalent to a 70-kg worker being exposed to about 50,000 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Human data ...................................................... None developed

Revised IDLH: 200 ppm

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals [UCC 1969], a value of about 400 ppm would have been appropriate for methyl Cellosolve®. However, the revised IDLH for methyl Cellosolve® is 200 ppm based on being 500 times the current NIOSH REL of 0.1 ppm (2,000 is an assigned protection factor for respirators; only the "most reliable" respirators are recommended above 2,000 times the NIOSH REL).
REFERENCES:


Methyl Cellosolve® acetate

CAS number ........................................... 110-49-6
NIOSH REL ........................................... 0.1 ppm (0.5 mg/m³ TWA [skin])
Current OSHA PEL .................................... 25 ppm (120 mg/m³ TWA [skin])
1989 OSHA PEL ...................................... Same as current PEL
1993-1994 ACGIH TLV ................................. 5 ppm (24 mg/m³ TWA [skin])

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

LEL ................................................. 1.7% (10% LEL, 1,700 ppm)
Original (SCP) IDLH .................................. 4,000 ppm

Basis for original (SCP) IDLH: The chosen IDLH is based on an analogy with methyl methacrylate which has an IDLH of 4,000 ppm.

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₆ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Flury and Wirth 1933</td>
<td>1,222 ppm</td>
<td>7 hr</td>
<td>2,533 ppm (2.4)</td>
<td>293 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth and Carpenter 1948</td>
<td>7,000 ppm</td>
<td>4 hr</td>
<td>24,000 ppm (2.0)</td>
<td>1,400 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₆ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth and Carpenter 1948</td>
<td>oral</td>
<td>3.350 mg/kg</td>
<td>1.250 mg/kg</td>
<td>4,833 ppm</td>
<td>483 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth et al. 1941</td>
<td>oral</td>
<td>1.782 mg/kg</td>
<td>1.782 mg/kg</td>
<td>2,400 ppm</td>
<td>178 ppm</td>
</tr>
</tbody>
</table>

Human data: It has been stated that methyl Cellosolve® acetate is slightly less toxic than methyl Cellosolve® (Gosselin et al. 1984).

Revised IDLH: 200 ppm

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals (Flury and Wirth 1933; Smyth and Carpenter 1948), a value of about 1,000 ppm would have been appropriate for methyl Cellosolve® acetate. However, the revised IDLH for methyl Cellosolve® acetate is 200 ppm based on being 2,000 times the current NIOSH REL of 0.1 ppm (2,000 is an assigned protection factor for respirators; only the most reliable respirators are recommended above 2,000 times the NIOSH REL).

REFERENCES:

Methyl chloride

CAS number ................................................. 74-87-3

NIOSH REL ................................................. None established; NIOSH considers methyl chloride to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ........................................ 100 ppm TWA, 200 ppm CEILING, 300 ppm 5-minute MAXIMUM PEAK IN ANY 3 HOURS

1989 OSHA PEL ........................................ 50 ppm (105 mg/m³) TWA, 100 ppm (210 mg/m³) STEL

1983-1994 ACGIH TLV .................................... 50 ppm (103 mg/m³) TWA, 100 ppm (207 mg/m³) STEL [skin]

Description of substance ............................. Colorless gas with a faint, sweet odor which is not noticeable at dangerous concentrations.

LEL .......................................................... 8.1% (10% LEL, 9,100 ppm)

Original (SCP) IDLH ...................................... 10,000 ppm

Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statement by Patty [1963] that 20,000 to 40,000 ppm is dangerous to animals in 30 to 60 minutes [Flury and Zemik 1931] and the report by MacDonald [1964] that a worker repeatedly walked in and out of an area in which concentrations greater than 10,000 ppm were measured.

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Bakhishev 1975</td>
<td>72,000</td>
<td>-</td>
<td>30 min</td>
<td>72,000 ppm (1.0)</td>
<td>7,200 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Chellman et al. 1986</td>
<td>2,200</td>
<td>-</td>
<td>6 hr</td>
<td>5,060 ppm (2.3)</td>
<td>506 ppm</td>
</tr>
<tr>
<td>Mammal</td>
<td>Clayton and Clayton 1981</td>
<td>2,760</td>
<td>-</td>
<td>4 hr</td>
<td>5,520 ppm (2.0)</td>
<td>552 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Clayton 1967</td>
<td>-</td>
<td>20,000</td>
<td>2 hr</td>
<td>32,000 ppm (1.6)</td>
<td>3,200 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>2,524</td>
<td>-</td>
<td>4 hr</td>
<td>5,048 ppm (2.0)</td>
<td>505 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>von Gettingen 1949</td>
<td>-</td>
<td>1,641</td>
<td>6 hr</td>
<td>33,720 ppm (2.3)</td>
<td>3,372 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................ It has been reported that 20,000 to 40,000 ppm is dangerous in 30 to 60 minutes [Flury and Zemik 1931]. It has been reported that a worker repeatedly walked in and out of an area in which concentrations greater than 10,000 ppm were measured; symptoms included blurring of vision, dizziness, and a slight headache [MacDonald 1964]. A worker exposed to concentrations of 2,000 to 4,000 ppm for 13 days stated that during the first week he was very sleepy and became quite dizzy; during the second week headache, blurring of speech, dizziness, mental confusion, and a staggering gait occurred [MacDonald 1964]. Another worker exposed to concentrations of 1,000 to 2,000 ppm during the workshift experienced dizziness, blurring of vision, headache, nausea, and vomiting [MacDonald 1964]. It has been stated that exposures to 20,000 ppm for 2 hours may be fatal [Deichmann and Gerarde 1969].

Human data ..................................................

Revised IDLH: 2,000 ppm

Basis for revised IDLH: The revised IDLH for methyl chloride is 2,000 ppm based on acute inhalation toxicity data in humans [MacDonald 1964]. [Note: NIOSH recommends as a part of its carcinogen policy that the "most protective" respirators be worn for methyl chloride at any detectable concentration.]
REFERENCES:


7. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 86.


Methyl chloroform

<table>
<thead>
<tr>
<th>CAS number</th>
<th>NIOSH REL</th>
<th>Current OSHA PEL</th>
<th>1989 OSHA PEL</th>
<th>1993-1994 ACGIH TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>71-55-5</td>
<td>350 ppm (1,900 mg/m³)</td>
<td>350 ppm (1,900 mg/m³)</td>
<td>350 ppm (1,900 mg/m³) TWA, 450 ppm (2,450 mg/m³) STEL</td>
<td>350 ppm (1,910 mg/m³) TWA, 450 ppm (2,460 mg/m³) STEL</td>
</tr>
</tbody>
</table>

**Description of substance:** Colorless liquid with a mild, chloroform-like odor.

**Original (SCP) IDLH:** 1,000 ppm

The chosen IDLH is based on the statement by MCA [1965] that "humans exposed to 900 to 1,000 ppm experience prompt, though minimal impairment of coordination. Above 1,700 ppm, obvious disturbances of equilibrium in humans have been observed." Deichmann and Gerarde [1969] stated that "the earliest symptoms of a single vapor exposure are lightheadedness and lassitude. The earliest sign of intoxication is an impaired Romberg test. In humans an abnormal Romberg test is usually observed shortly after exposures to 900 to 1,700 ppm." Because data are not available to indicate at what concentrations above 1,000 ppm a person's equilibrium would be affected enough to impede escape, 1,000 ppm is used as the IDLH. AIHA (1961) reported that humans exposed to 800 to 1,000 ppm exhibit early anesthetic effects including incoordination [Stewart et al. 1961; Torkelson et al. 1958]. Browning [1965] reported that several human subjects exposed to 920 ppm for periods ranging from 5 to 45 minutes showed a slight loss of coordination and equilibrium [Stewart et al. 1961].

**Existing short-term exposure guidelines:**

- 5-minute EEL: 2,500 ppm
- 15-minute EEL: 2,000 ppm
- 30-minute EEL: 2,000 ppm
- 60-minute EEL: 1,000 ppm

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>AIHA 1964</td>
<td>3,911</td>
<td>--</td>
<td>2 hr</td>
<td>6,258 ppm (1.6)</td>
<td>626 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Sangyo Igaku 1971</td>
<td>18,000</td>
<td>--</td>
<td>4 hr</td>
<td>32,000 ppm (2.0)</td>
<td>3,600 ppm</td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Pal'gov et al. 1990</td>
<td>oral</td>
<td>9,600</td>
<td>--</td>
<td>12,108 ppm</td>
<td>1,211 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Pal'gov et al. 1990</td>
<td>oral</td>
<td>6,000</td>
<td>--</td>
<td>7,568 ppm</td>
<td>757 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Torkelson et al. 1958</td>
<td>oral</td>
<td>5,600</td>
<td>--</td>
<td>7,139 ppm</td>
<td>714 ppm</td>
</tr>
</tbody>
</table>
Methyl chloroform (continued)

Other animal data

No significant signs of intoxication were seen in rats inhaling 500 ppm, 6 hours per day for 4 days [Savolainen et al. 1977]; in mice inhaling up to 1,300 ppm for 1 hour [Kjellstrand et al. 1965]; in rats inhaling up to 3,000 ppm for 0.5 to 4 hours [Mullin and Krivanek 1982]; or in baboons inhaling up to 1,400 ppm for 4 hours [Geller et al. 1962].

Human data

The onset of central anesthesia has occurred in individuals exposed for up to 7 hours to concentrations approaching 500 ppm [Stewart et al. 1969]. It has been stated that exposure to 900 to 1,000 ppm causes prompt, though minimal impairment of coordination; obvious disturbances in equilibrium have been noted above 1,700 ppm [MCA 1965]. Those exposed to 800 to 1,000 ppm have exhibited early anesthetic effects including incoordination [Stewart et al. 1961]. Volunteers exposed to 920 ppm for 5 to 45 minutes showed a slight loss of coordination and equilibrium [Stewart et al. 1961].

<table>
<thead>
<tr>
<th>Revised IDLH: 700 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis for revised IDLH: The revised IDLH for methyl chloroform is 700 ppm based on acute inhalation toxicity data in humans [MCA 1965; Stewart et al. 1961, 1969].</td>
</tr>
</tbody>
</table>

REFERENCES:

Methylcyclohexane

CAS number: 108-87-2
NIOSH REL: 400 ppm (1.800 mg/m³) TWA
Current OSHA PEL: 500 ppm (2.000 mg/m³) TWA
1989 OSHA PEL: 400 ppm (1.800 mg/m³) TWA
1993-1994 ACGIH TLV: 410 ppm (1.810 mg/m³) TWA

Description of substance: Colorless liquid with a faint, benzene-like odor.

LEL: 1.2% (10% LEL, 1.200 ppm)
Original (SCP) IDLH: 10,000 ppm
Basis for original (SCP) IDLH: With no reported human toxicological data, the chosen IDLH is based on the statement by Browning [1965] that Treon et al. [1943] were able to produce light narcosis in mice at 10,054 ppm. Browning [1965] also reported that Lazarew [1929] found the narcotic dose for mice to be 7,500 to 10,000 ppm. ACGIH [1971] noted that this narcotic dose (7,500 to 10,000 ppm) was for a 2-hour exposure [Lazarew 1929; Treon et al. 1943].

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>10,172 ppm</td>
<td>16,275 ppm (2.6)</td>
<td>2 hr</td>
<td>1,268 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Lazarew 1929</td>
<td>10,000-12,500 ppm</td>
<td>16,000-20,000 ppm (2.6)</td>
<td>2 hr</td>
<td>1,600-2,000 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1943</td>
<td>15,227 ppm</td>
<td>19,034 ppm (2.28)</td>
<td>1 hr</td>
<td>1,903 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>2,250 ppm</td>
<td>3,860 ppm</td>
<td>386 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 1,200 ppm [LEL]
Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in animals [Izmerov et al. 1982; Lazarew 1929; Treon et al. 1943], a value of about 1,600 ppm would have been appropriate for methylcyclohexane. However, the revised IDLH for methylcyclohexane is 1,200 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.2%).

REFERENCES:

3. Izmerov NF, Sandalsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 82.
6. Treon JF, Crutchfield WE, Kitzmiller KV [1943]. The physiological response of animals to cyclohexane, methyl cyclohexane, and certain derivatives of these compounds. II. Inhalation. J Ind Hyg Toxicol 23(6):323-347.
Methylcyclohexanol

CAS number .......................................................... 25630-42-3
NIOSH REL .......................................................... 50 ppm (235 mg/m³) TWA
Current OSHA PEL ................................................. 100 ppm (470 mg/m³) TWA
1993-1994 ACGIH TLV ............................................. 50 ppm (234 mg/m³) TWA

Description of substance ........................................ Straw-colored liquid with a weak odor like coconut oil.
LEL ........................................................................... Unknown
Original (SCP) IDLH ................................................ 10,000 ppm
Basis for original (SCP) IDLH ...................................... No data on acute inhalation toxicity are available on which to base the IDLH for methylcyclohexanol. The chosen IDLH, therefore, has been estimated from the rabbit oral lethal dose of 1.75 to 2.0 glkg (Treon et al. 1943 cited by Browning 1965). Because this compound has such a low vapor pressure, a concentration this great can only be achieved if the substance is heated.

Short-term exposure guidelines .................................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Deichmann and LeBlanc 1943</td>
<td>oral</td>
<td>1,660</td>
<td>∞</td>
<td>2,446 ppm</td>
<td>245 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1943b</td>
<td>oral</td>
<td>1,750-2,000</td>
<td>3,579-2,947</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .................................................. Rabbits exposed for 8 hours/day, 5 days/week for 10 weeks at 503 ppm had increased salivation, conjunctival irritation, and slight lethargy, while 232 ppm caused no such signs of intoxication [Treon et al. 1943b].

Human data ............................................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 500 ppm

Basis for revised IDLH: The revised IDLH for methylcyclohexanol is 500 ppm based on subchronic inhalation data in animals [Treon et al. 1943b]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

4. Treon JF, Crutchfield WE Jr, Kitzmiller KV [1943b]. The physiological response of animals to cyclohexane, methyl cyclohexane, and certain derivatives of these compounds. II. Inhalation. J Ind Hyg Toxicol 25(8):323-347.
o-Methylcyclohexanone

CAS number ........................................ 583-60-8
NIOSH REL ..........................................
Current OSHA PEL .................................... 50 ppm (230 mg/m³) TWA, 75 ppm 345 mg/m³ STEL [skin]
1989 OSHA PEL ...................................... 100 ppm (460 mg/m³) TWA [skin]
1993-1994 ACGIH TLV ............................... 50 ppm (229 mg/m³) TWA, 75 ppm (344 mg/m³) STEL [skin]
Description of substance ................................ Colorless liquid with a weak, peppermint-like odor.
LEL ..................................................... Unknown
Original (SCP) IDLH .................................. 2,500 ppm
Basis for original (SCP) IDLH ........................ The chosen IDLH is based on the statement by Patty [1963] that rabbits and cats exhibited sleepiness, respiratory irregularities, and poor coordination after a 1-hour exposure to 2,500 ppm; a 30-minute exposure to 3,500 ppm caused prostration in mice, guinea pigs, and rats [Gross as cited by Lehmann and Flury 1943].

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1969</td>
<td>2,800</td>
<td>600</td>
<td>4 hr</td>
<td>5,600 ppm (2.0)</td>
<td>560 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1969</td>
<td>oral</td>
<td>2.146</td>
<td>1,000-1,250</td>
<td>3,215 ppm</td>
<td>322 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1943</td>
<td>oral</td>
<td>2.146</td>
<td>1,000-1,250</td>
<td>3,215 ppm</td>
<td>322 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................. Mice, guinea pigs, and rats exposed at 3,500 ppm for 30 minutes suffered irritation of the mucous membranes and exhibited signs of central nervous system depression [Clayton and Clayton 1981]. Rabbits and cats exhibited sleepiness, respiratory irregularities, and poor coordination after a 1-hour exposure to 2,500 ppm [Clayton and Clayton 1981].

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 600 ppm

Basis for revised IDLH: The revised IDLH for o-methylcyclohexanone is 600 ppm based on acute inhalation toxicity data in animals [Smyth et al. 1969]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:


317
Methylene bisphenyl isocyanate (MDI)

CAS number ........................................... 101-68-8
NIOSH REL .............................................
Current OSHA PEL ....................................
1989 OSHA PEL ......................................
1993-1994 ACGIH TLV ..................................
Description of substance ............................
LEL .....................................................
Original (SCP) IDLH ...................................
Basis for original (SCP) IDLH ....................... The chosen IDLH is based on an analogy with toluene diisocyanate, which has an IDLH of 10 ppm. (Note: A concentration of 10 ppm methylene bisphenyl isocyanate is equivalent to about 100 mg/m³.)

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (mg/m³)</th>
<th>LC₉₅ (mg/m³)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Bunge et al. 1977</td>
<td>369</td>
<td>-----</td>
<td>4 hr</td>
<td>738 mg/m³ (2.0)</td>
<td>76 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Bunge et al. 1977</td>
<td>380</td>
<td>-----</td>
<td>4 hr</td>
<td>760 mg/m³ (2.0)</td>
<td>76 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Woolrich 1982</td>
<td>270</td>
<td>-----</td>
<td>7</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>2.200</td>
<td>-----</td>
<td>15,600 mg/m³</td>
<td>1,540 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Woolrich 1982</td>
<td>oral</td>
<td>31,690</td>
<td>222,830 mg/m³</td>
<td>22,183 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data .............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 75 mg/m³
Basis for revised IDLH: The revised IDLH for methylene bisphenyl isocyanate is 75 mg/m³ based on acute inhalation toxicity data in animals [Bunge et al. 1977].

REFERENCES:

2. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKhNT, p. 83.
Methylene chloride

CAS number .................................................. 75-09-2
NIOSH REL .................................................. None established; NIOSH considers methylene chloride to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL .......................................... 500 ppm TWA, 1,000 ppm CEILING,
2,000 ppm 5-minute MAXIMUM PEAK IN ANY 2 HOURS
1989 OSHA PEL ............................................. Same as current PEL
1993-1994 ACGIH TLV ...................................... 50 ppm (174 mg/m³) TWA, A2
Description of substance ..................................... Colorless liquid with a chloroform-like odor.
LEL .............................................................. 13% (10% LEL, 13,000 ppm)
Original (SCP) IDLH ........................................ 5,000 ppm
Basis for original (SCP) IDLH ................................
Short-term exposure guidelines ..............................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀  (ppm)</th>
<th>LC₃₀  (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Clayton 1967</td>
<td>----</td>
<td>5,000</td>
<td>2 hr</td>
<td>8,000 ppm (1.6)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Fiz Akt Vesh 1975</td>
<td>24,929</td>
<td>----</td>
<td>10 min</td>
<td>24,000 ppm (2.0)</td>
<td>2,493 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Heppel et al. 1944</td>
<td>----</td>
<td>10,800</td>
<td>7 hr</td>
<td>24,000 ppm (2.4)</td>
<td>2,400 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Lehmann et al. 1936</td>
<td>----</td>
<td>12,295</td>
<td>4.5 hr</td>
<td>25,820 ppm (2.4)</td>
<td>2,582 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>von Oettingen 1949</td>
<td>14,400</td>
<td>----</td>
<td>7 hr</td>
<td>34,560 ppm (2.4)</td>
<td>3,456 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>von Oettingen 1949</td>
<td>----</td>
<td>14,108</td>
<td>7 hr</td>
<td>33,859 ppm (2.4)</td>
<td>3,386 ppm</td>
</tr>
</tbody>
</table>

Human data ......................................................... Volunteers exposed at 1,000 ppm for 2 hours had carboxyhemoglobin levels in excess of those permitted in industry from exposure to carbon monoxide alone [Stewart et al. 1972]. A 10-minute exposure at 2,330 ppm has produced vertigo [Lehmann et al. 1936]. However, it has also been reported that no feeling of dizziness during 1-hour exposures. Thienes and Haley stated that no dizziness, but slight nausea, is caused by exposure to 2,300 ppm for 1 hour and that methylene chloride is not lethal at 25,000 ppm. Considering the data cited above, an IDLH of 5,000 ppm is chosen.

Revised IDLH: 2,300 ppm

Human data ......................................................... Volunteers exposed at 1,000 ppm for 2 hours had carboxyhemoglobin levels in excess of those permitted in industry from exposure to carbon monoxide alone [Stewart et al. 1972]. A 10-minute exposure at 2,330 ppm has produced vertigo [Lehmann et al. 1936]. However, it has also been reported that no feeling of dizziness during 1-hour exposures. Thienes and Haley stated that no dizziness, but slight nausea, is caused by exposure to 2,300 ppm for 1 hour and that methylene chloride is not lethal at 25,000 ppm [Thienes and Haley].

Human data ......................................................... Volunteers exposed at 1,000 ppm for 2 hours had carboxyhemoglobin levels in excess of those permitted in industry from exposure to carbon monoxide alone [Stewart et al. 1972]. A 10-minute exposure at 2,330 ppm has produced vertigo [Lehmann et al. 1936]. However, it has also been reported that no feeling of dizziness during 1-hour exposures. Thienes and Haley stated that no dizziness, but slight nausea, is caused by exposure to 2,300 ppm for 1 hour and that methylene chloride is not lethal at 25,000 ppm [Thienes and Haley].

REFERENCES:

Methylene chloride (continued)


8. Thienes CH, Haley TJ [?].

Methyl formate

CAS number ........................................ 107-31-3

NIOSH REL ............................................

Current OSHA PEL ..................................

1989 OSHA PEL ....................................

1983-1984 ACGIH TLV ............................

Description of substance ..........................

Colorless liquid with a pleasant odor.

LEL ..................................................

Original (SCP) IDLH ..................................

Basis for original (SCP) IDLH .................

Short-term exposure guidelines ..............

None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (ppm)</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Schrenk et al. 1936</td>
<td>50,000</td>
<td>50,000</td>
<td>20 min</td>
<td>43,500 ppm (0.87)</td>
<td>4,350 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg)</th>
<th>LD&lt;sub&gt;150&lt;/sub&gt; (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>1,622</td>
<td>1,622</td>
<td>4,542 ppm</td>
<td>454 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................

It has been stated that 5,000 ppm was considered the maximum concentration that guinea pigs could tolerate for 60 minutes without serious disturbances [Schrenk et al. 1936].

Human data ........................................

No adverse effects were found in humans after exposure to 1,500 ppm for 1 minute [Schrenk et al. 1936].

Revised IDLH: 4,500 ppm

Basis for revised IDLH: The revised IDLH for methyl formate is 4,500 ppm based on acute inhalation toxicity data in animals [Schrenk et al. 1936]. Also, this value is 10% of the lower explosive limit of 4.5%. 

REFERENCES:

5-Methyl-3-heptanone

CAS number .............................................. 541-85-5
NIOSH REL .............................................
Current OSHA PEL ......................................
1989 OSHA PEL ........................................
1993-1994 ACGIH TLV .................................
Description of substance ......................... Colorless liquid with a pungent odor.
LEL ..................................................................
Original (SCP) IDLH .................................... 3,000 ppm
Basis for original (SCP) IDLH ....................... The chosen IDLH is based on the statement by Patty [1963] that 0 of 6 rats died, but 3 of 6 mice died when exposed for 4 hours to about 3,000 ppm [Shell 1958].

Short-term exposure guidelines .............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{10} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Shell 1958</td>
<td>3,000</td>
<td>-----</td>
<td>4 hr</td>
<td>6,000 ppm (2.0)</td>
<td>600 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Shell 1958</td>
<td>LC_{10} 6,000</td>
<td>LC_{10} 6,000</td>
<td>6 hr</td>
<td>15,000 ppm (2.5)</td>
<td>1,500 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Shell 1961</td>
<td>3,484</td>
<td>3,484</td>
<td>6 hr</td>
<td>9,710 ppm (2.5)</td>
<td>871 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Shell 1961</td>
<td>3,484</td>
<td>3,484</td>
<td>6 hr</td>
<td>9,710 ppm (2.5)</td>
<td>871 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................... It has been reported that rats survived a 4-hour exposure to 3,000 ppm [Shell 1958].

Human data ............................................ Humans exposed to 25 ppm experienced irritation of the eyes and respiratory tract and detected a strong odor, while 100 ppm caused irritation of the mucous membranes, headache, and nausea which was too severe to tolerate for more than a few minutes [Clayton and Clayton 1981].

Revised IDLH: 100 ppm
Basis for revised IDLH: The revised IDLH for 5-methyl-3-heptanone is 100 ppm based on acute inhalation toxicity data in humans [Clayton and Clayton 1981].

REFERENCES:

Methyl hydrazine

CAS number ........................................ 60-34-4
NIOSH REL ........................................ 0.04 ppm (0.08 mg/m³) 2-hour CEILING; NIOSH considers methyl hydrazine to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ........................................ 0.2 ppm (0.35 mg/m³) CEILING (skin)
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ........................................ 0.2 ppm (0.38 mg/m³) CEILING (skin), A2

Description of substance ........................................ Fuming, colorless liquid with an ammonia-like odor.

LEL ........................................ 2.5% (10% LEL, 2,500 ppm)

Basis for original (SCP) IDLH ........................................ 50 ppm


<table>
<thead>
<tr>
<th>SPEGL Type</th>
<th>Concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-hour SPEGL</td>
<td>0.24 ppm</td>
</tr>
<tr>
<td>2-hour SPEGL</td>
<td>0.12 ppm</td>
</tr>
<tr>
<td>4-hour SPEGL</td>
<td>0.06 ppm</td>
</tr>
<tr>
<td>8-hour SPEGL</td>
<td>0.03 ppm</td>
</tr>
<tr>
<td>16-hour SPEGL</td>
<td>0.015 ppm</td>
</tr>
<tr>
<td>24-hour SPEGL</td>
<td>0.01 ppm</td>
</tr>
</tbody>
</table>

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Fairchild 1967</td>
<td>24</td>
<td>-----</td>
<td>4 hr</td>
<td>68 ppm (2.0)</td>
<td>6.8 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Haun et al. 1969</td>
<td>74</td>
<td>-----</td>
<td>4 hr</td>
<td>140 ppm (2.0)</td>
<td>15 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>Haun et al. 1969</td>
<td>163</td>
<td>-----</td>
<td>1 hr</td>
<td>203 ppm (1.25)</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Haun et al. 1970</td>
<td>195</td>
<td>-----</td>
<td>30 min</td>
<td>195 ppm (1.0)</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>Haun et al. 1970</td>
<td>145</td>
<td>-----</td>
<td>30 min</td>
<td>145 ppm (1.0)</td>
<td>15 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Haun et al. 1970</td>
<td>272</td>
<td>-----</td>
<td>30 min</td>
<td>272 ppm (1.0)</td>
<td>27 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Haun et al. 1970</td>
<td>427</td>
<td>-----</td>
<td>30 min</td>
<td>427 ppm (1.0)</td>
<td>43 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Haun et al. 1970</td>
<td>56</td>
<td>-----</td>
<td>4 hr</td>
<td>112 ppm (2.0)</td>
<td>11 ppm</td>
</tr>
<tr>
<td>Hamster</td>
<td>Jacobson et al. 1955</td>
<td>143</td>
<td>-----</td>
<td>4 hr</td>
<td>286 ppm (2.0)</td>
<td>29 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 20 ppm

Basis for revised IDLH: The revised IDLH for methyl hydrazine is 20 ppm based on acute inhalation toxicity data in animals [Haun et al. 1969, 1970]. [Note: NIOSH recommends as part of its carcinogen policy that the “most protective” respirators be worn for methyl hydrazine at concentrations above 0.04 ppm.]

REFERENCES:

**Methyl iodide**

CAS number ........................................... 74-88-4
NIOSH REL ........................................... 2 ppm (10 mg/m³) TWA [skin]; NIOSH considers methyl iodide to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1990).

Current OSHA PEL .................................. 5 ppm (28 mg/m³) TWA [skin]
1989 OSHA PEL .................................. 2 ppm (10 mg/m³) TWA [skin]
1993-1994 ACGIH TLV .................................. 2 ppm (12 mg/m³) TWA [skin]. A2

Description of substance .......................... Colorless liquid with a pungent, ether-like odor.
LEL ............................................. Noncombustible Liquid
Original (SCP) IDLH .......................... The chosen IDLH is based on the mouse 57-minute LC₅₀ of 680 ppm (Buckell 1950 cited by Patty 1963). 

| ERPG-1 | 25 ppm (60-minute) |
| ERPG-2 | 50 ppm (60-minute) |
| ERPG-3 | 125 ppm (60-minute) |

**LEL**

**LEL**

**Original (SCP) IDLH**

**Noncombustible Liquid**

**Existing short-term exposure guidelines**

**Brandon**

**Buckell**

**Deichmann and Gerarde**

**Monsanto (1986)**

**von Oettingen**

**REFERENCES:**

Methyl isobutyl carbinol

CAS number ........................................ 108-11-2
NIOSH REL ........................................... 
Current OSHA PEL ................................... 
1989 OSHA PEL ................................... 
1993-1994 ACGIH TLV ............................ 
Description of substance ............................. 
LEL ................................................. 
Original (SCP) IDLH ................................. 
Basis for original (SCP) IDLH ....................... 

Short-term exposure guidelines ..................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>$LC_{50}$ (ppm)</th>
<th>$LC_{10}$ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Browning 1965</td>
<td>$LC_{50}$: 2,000</td>
<td>$LC_{10}$: 600</td>
<td>8 hr</td>
<td>5,000 ppm (2.5)</td>
<td>500 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>2,000</td>
<td>400 ppm</td>
<td>4 hr</td>
<td>4,000 ppm (2.0)</td>
<td>400 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>McOmie and Anderson 1949</td>
<td>4,600</td>
<td>1,242 ppm</td>
<td>10 hr</td>
<td>12,420 ppm (2.7)</td>
<td>1,242 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>$LD_{50}$ (mg/kg)</th>
<th>$LD_{10}$ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>McOmie and Anderson 1949</td>
<td>oral</td>
<td>1,000</td>
<td>1,647 ppm</td>
<td>165 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>oral</td>
<td>2.590</td>
<td>4,266 ppm</td>
<td>427 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ..........................................................

Human data .................................................................

It has been reported that rats survived a 2-hour exposure to the saturated vapor (about 4,000 ppm at 60°F) [Smyth et al. 1951]. Eye irritation has occurred after exposures to 50 ppm for 15 minutes [Silverman et al. 1946].

Revised IDLH: 400 ppm

Basis for revised IDLH: The revised IDLH for methyl isobutyl carbinol is 400 ppm based on acute inhalation toxicity data in animals [Browning 1965; Carpenter et al. 1949]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 50 ppm.

REFERENCES:

Methyl isocyanate

CAS number ............................................. 624-83-9
NIOSH REL .................................................. 0.02 ppm (0.05 mg/m³) TWA [skin]
Current OSHA PEL ........................................ 0.02 ppm (0.05 mg/m³) TWA [skin]
1989 OSHA PEL ........................................... Same as current PEL
1993-1994 ACGIH TLV ..................................... 0.02 ppm (0.047 mg/m³) TWA [skin]
Description of substance .............................. Colorless liquid with a sharp, pungent odor.
LEL ................................................................ 5.3% (10% LEL, 5.3 ppm)
Original (SCP) IDLH ......................................... 20 ppm
Basis for original (SCP) IDLH ............................. The chosen IDLH is based on the statement by ACGIH [1971] that the rat 2-hour LC₅₀ is 21 ppm [Kimmerle and Eben 1964].

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Dodd et al. 1986</td>
<td>6.1</td>
<td>---</td>
<td>6 hr</td>
<td>34 ppm (2.3)</td>
<td>2.4 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Dodd et al. 1986</td>
<td>12.2</td>
<td>---</td>
<td>6 hr</td>
<td>38 ppm (2.3)</td>
<td>3.6 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Dodd et al. 1986</td>
<td>5.4</td>
<td>---</td>
<td>6 hr</td>
<td>12 ppm (2.3)</td>
<td>2.2 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Kimmerle and Eben 1964</td>
<td>21</td>
<td>---</td>
<td>2 hr</td>
<td>24 ppm (1.6)</td>
<td>3.4 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Vemot et al. 1977</td>
<td>oral</td>
<td>120</td>
<td>---</td>
<td>354 ppm</td>
<td>35 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Vijayarachavan and Kaushik 1987</td>
<td>oral</td>
<td>51.5</td>
<td>---</td>
<td>152 ppm</td>
<td>15 ppm</td>
</tr>
</tbody>
</table>

Human data .................................................. Volunteers experienced eye irritation and lacrimation after 1 to 5 minutes at 2 ppm, with more marked irritation at 4 ppm; exposures were unbearable at 21 ppm [Kimmerle and Eben 1964]. In another study, volunteers noted eye irritation and lacrimation at 5 ppm in less than 50 seconds [Mellon 1963].

Revised IDLH: 3 ppm
Basis for revised IDLH: The revised IDLH for methyl isocyanate is 3 ppm based on acute inhalation toxicity data in humans [Kimmerle and Eben 1964; Mellon 1983].

REFERENCES:

Methyl mercaptan

CAS number ........................................ ... 74-93-1
NIOSH REL ........................................ ... 0.5 ppm (1 mg/m³) 15-minute CEILING
Current OSHA PEL ................................. 10 ppm (20 mg/m³) CEILING
1989 OSHA PEL .................................... 0.5 ppm (1 mg/m³) TWA
1993-1994 ACGIH TLV ............................... 0.5 ppm (0.98 mg/m³) TWA

Description of substance
Colorless gas with a disagreeable odor like garlic or rotten cabbage.

LEL .................................................. 3.9% (10% LEL, 3,900 ppm)
Original (SCP) IDLH ................................. 400 ppm
Basis for original (SCP) IDLH
Because no useful data on acute inhalation toxicity are available on which to base the IDLH for methyl mercaptan, the chosen IDLH is based on an analogy with hydrogen sulfide. ACGIH [1971] reported that some investigators show toxicities of the same magnitude for hydrogen sulfide and methyl mercaptan [Ljunggren and Norberg 1943]; others indicate that the toxicity of methyl mercaptan is somewhat less than that of hydrogen sulfide [DeRekowski 1893; Frankel 1921]. Patty [1963] reported that 400 to 700 ppm hydrogen sulfide is dangerous after exposure of 0.5 to 1 hour [Henderson and Haggard 1943]. AIHA [1971] reported that concentrations of 400 to 700 ppm hydrogen sulfide caused loss of consciousness and possible death in 0.5 to 1 hour [MCA 1950]. Based on the data cited above, an IDLH of 400 ppm is chosen.

Short-term exposure guidelines
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Seluzhtisky 1972</td>
<td>3.3</td>
<td>------</td>
<td>2 hr</td>
<td>4 ppm (1.25)</td>
<td>0.4 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Taney et al. 1981</td>
<td>675</td>
<td>------</td>
<td>4 hr</td>
<td>1,350 ppm (2.0)</td>
<td>135 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LC₀ (mg/kg)</th>
<th>LD₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Seluzhtisky 1972</td>
<td>?</td>
<td>60.67</td>
<td>212 ppm</td>
<td>21 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data
Students accidentally exposed to about 4 ppm for several hours experienced headaches and nausea [Clayton and Clayton 1981]. Some investigators have reported that the toxicity of methyl mercaptan is similar to hydrogen sulfide while others report the toxicity to be somewhat less than hydrogen sulfide [DeRekowski 1893; Frankel 1921].

Revised IDLH: 150 ppm
Basis for revised IDLH: The revised IDLH for methyl mercaptan is 150 ppm based on acute inhalation toxicity data in animals [Taney et al. 1981] and an analogy to hydrogen sulfide [DeRekowski 1893; Frankel 1921] which has a revised IDLH of 150 ppm.
Methyl mercaptan (continued)

REFERENCES:

Methyl methacrylate

CAS number ........................................ 80-62-6
NIOSH REL ........................................
Current OSHA PEL ................................. 100 ppm (410 mg/m³) TWA
1989 OSHA PEL ..................................... Same as current PEL
1993-1994 ACGIH TLV ............................ 100 ppm (410 mg/m³) TWA
Description of substance .......................... Colorless liquid with an acrid, fruity odor.
1.7% (10% LEL; 1,700 ppm) 4,000 ppm
Basis for original (SCP) IDLH .................
The chosen IDLH is based on the statement by ACGIH [1971] that 4,400 ppm was fatal to rats and rabbits in 8 hours [Deichmann 1941]. Also, Patty [1963] cited an approximate rat LC₅₀ of 3,750 ppm [Deichmann 1941; Spealman et al. 1945]. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Blagodatin et al. 1976</td>
<td>18,750</td>
<td>----</td>
<td>4 hr</td>
<td>37,500 ppm (2.0)</td>
<td>3,750 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Blagodatin et al. 1976</td>
<td>4,417</td>
<td>----</td>
<td>2 hr</td>
<td>7,115 ppm (1.6)</td>
<td>712 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann 1941</td>
<td>4,400</td>
<td>4,400</td>
<td>8 hr</td>
<td>11,000 ppm (2.5)</td>
<td>1,100 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Deichmann 1941</td>
<td>4,207</td>
<td>4,500</td>
<td>4.5 hr</td>
<td>8,751 ppm (2.0)</td>
<td>875 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Deichmann 1941</td>
<td>4,567</td>
<td>4,567</td>
<td>5 hr</td>
<td>9,819 ppm (2.15)</td>
<td>982 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann 1941</td>
<td>3,750</td>
<td>----</td>
<td>4 hr</td>
<td>3,750 ppm (2.0)</td>
<td>3,750 ppm</td>
</tr>
<tr>
<td>Normal</td>
<td>Gig Sanit 1986</td>
<td>4,808</td>
<td>----</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Human data ........................................... Workers have experienced irritation, but tolerated 200 ppm without complaint [Spealman et al. 1945]. It has also been reported that 2,300 ppm was intolerable [Coleman 1963].

Revised IDLH: 1,000 ppm
Basis for revised IDLH: The revised IDLH for methyl methacrylate is 1,000 ppm based on acute inhalation toxicity data in humans [Coleman 1963] and animals [Blagodatin et al. 1976; Deichmann 1941].

REFERENCES:

α-Methyl styrene

CAS number ........................................... 98-83-9
NIOH REL .................................................. 
Current OSHA PEL ......................................... 50 ppm (240 mg/m^3) TWA, 100 ppm (485 mg/m^3) STEL
1989 OSHA PEL ............................................ 1.00 ppm (480 mg/m^3) CEILING
1993·1994 ACGIH TLV .................................. 50 ppm (242 mg/m^3) TWA, 100 ppm (483 mg/m^3) STEL

Description of substance: Colorless liquid with a characteristic odor.

LEL ...................................................... 1.9% (10% LEL, 1,900 ppm)
Original (SCP) IDLH ........................................ 5,000 ppm

Because no data on acute inhalation toxicity are available on which to base the IDLH for α-methyl styrene, the chosen IDLH is based on an analogy with styrene which has an IDLH of 5,000 ppm.

None developed

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Wolf et al. 1956</td>
<td>oral</td>
<td>4,900</td>
<td>6,982 ppm</td>
<td>698 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data: A considerable number of rats and guinea pigs exposed to 3,000 ppm for 7 to 8 hours/day, 5 days/week for up to 6 months died [Gerarde 1960; Wolf et al. 1956]. Rats and guinea pigs had slight changes in liver and kidney weights and some reduction in body weight following exposure to 800 ppm for 7 hours/day, 5 days/week for 27 days [Wolf et al. 1956]. No adverse effects were noted in rats, rabbits, mice, monkeys, and guinea pigs exposed 7 hours/day, 5 days/week for 3 months to 200 ppm [Wolf et al. 1956].

Human data: Four volunteers reported a definite unpleasant odor and slight eye irritation after about 2 minutes of exposure to 200 ppm [Wolf et al. 1956]. Strong eye and nasal irritation has been noted at concentrations above 600 ppm [Gerarde 1960; Wolf et al. 1956].

Revised IDLH: 700 ppm

References:

### Mica

<table>
<thead>
<tr>
<th>CAS number</th>
<th>12001-26-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>3 mg/m³ (respirable dust) TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>20 mpcf TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>3 mg/m³ (respirable dust) TWA</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>3 mg/m³ (respirable dust) TWA</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Colorless, odorless flakes or sheets of hydrous silicates. Noncombustible Solid</td>
</tr>
<tr>
<td>LEL</td>
<td>Non Evidence [Note: &quot;Effective&quot; IDLH = 10,000 mpcf; see discussion below.]</td>
</tr>
<tr>
<td>Original (SCP) IDLH*</td>
<td>The available toxicological data show no evidence that an acute exposure to a high concentration of mica would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the &quot;most protective&quot; respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL (500 x 20 mpcf = 10,000 mpcf).</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>None developed</td>
</tr>
</tbody>
</table>

#### Short-term exposure guidelines

None developed

#### ACUTE TOXICITY DATA

**Animal or human data** None relevant for use in determining the revised IDLH.

**Revised IDLH**: 1,500 mg/m³

**Basis for revised IDLH**: The available toxicological data contain no evidence that an acute exposure to a high concentration of mica would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for mica is 1,500 mg/m³ based on being 500 times the NIOSH REL of 3 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).
Molybdenum (insoluble compounds, as Mo)

<table>
<thead>
<tr>
<th>CAS number</th>
<th>7439-98-7 (Metal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>The 1989 OSHA PEL may not be protective to workers.</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>15 mg/m³ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>10 mg/m³ TWA</td>
</tr>
<tr>
<td>1993·1994 ACGIH TLV</td>
<td>Varies</td>
</tr>
<tr>
<td>Description of substance</td>
<td>No Evidence [<em>Note: &quot;Effective&quot; IDLH = 7.500 mg Mo/m³ — see discussion below.</em>]</td>
</tr>
<tr>
<td>Original (SCP) IDLH*</td>
<td>Revised IDLH: 5,000 mg Mo/m³</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>The available toxicological data contain no evidence that an acute exposure to a high concentration of insoluble molybdenum compounds would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for insoluble molybdenum compounds is 5,000 mg Mo/m³ based on being 500 times 10 mg Mo/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the &quot;most protective&quot; respirators should be used for particulates).</td>
</tr>
</tbody>
</table>

Short-term exposure guidelines

ACUTE TOXICITY DATA

Animal data

No fatalities were reported among animals that ingested amounts of molybdenum disulfide in doses as great as 6,000 mg Mo/kg (Fairhall et al. 1945). No changes were observed in rats over a 4-week period following inhalation exposures to metallic molybdenum at 25,000 to 30,000 mg/m³ or to molybdenum dioxide at 10,000 to 12,000 mg/m³ for 1 hour [FDA 1975].

Human data

Mining and metallurgy workers chronically exposed to 60 to 600 mg Mo/m³ reported an increased incidence of nonspecific symptoms that included weakness, fatigue, headache, anorexia, and joint and muscle pain [Lener and Bibr 1984].

**REFERENCES:**

**Molybdenum (soluble compounds, as Mo)**

<table>
<thead>
<tr>
<th>CAS number</th>
<th>Varies</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>The 1989 OSHA PEL may not be protective to workers.</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>5 mg/m³ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>5 mg/m³ TWA</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Varies</td>
</tr>
<tr>
<td>Original (SCP) IDLH*</td>
<td>No Evidence [&quot;Note: &quot;Effective&quot; IDLH = 2,500 mg Mo/m³ — see discussion below.]</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>The available toxicological data contain no data that an acute exposure to the soluble compounds of molybdenum could impede escape or cause irreversible health effects in 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 500 x the OSHA PEL of 5 mg Mo/m³ (i.e., 2,500 mg Mo/m³); only the &quot;most protective&quot; respirators are permitted for use in concentrations exceeding 2,500 mg Mo/m³.</td>
</tr>
</tbody>
</table>

**Short-term exposure guidelines**

None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₅</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na₂MoO₄</td>
<td>Barltrop 1991</td>
<td>&gt;2,080 mg/m³</td>
<td>-----</td>
<td>4 hr</td>
<td>&gt;1,939 mg Mo/m³</td>
<td>&gt;194 mg Mo/m³</td>
</tr>
<tr>
<td>MoO₂</td>
<td>Barltrop 1991</td>
<td>&gt;5,840 mg/m³</td>
<td>-----</td>
<td>4 hr</td>
<td>&gt;7,784 mg Mo/m³</td>
<td>&gt;778 mg Mo/m³</td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na₂MoO₄</td>
<td>Barltrop 1991</td>
<td>oral</td>
<td>4,000</td>
<td>-----</td>
<td>13,048 mg Mo/m³</td>
<td>1,305 mg Mo/m³</td>
</tr>
<tr>
<td>MoO₂</td>
<td>Barltrop 1991</td>
<td>oral</td>
<td>2,689</td>
<td>-----</td>
<td>12,541 mg Mo/m³</td>
<td>1,254 mg Mo/m³</td>
</tr>
<tr>
<td>MoO₂, CaMoO₄, (NH₄)₂MoO₄</td>
<td>Fairhall et al. 1945</td>
<td>oral</td>
<td>120 mg Mo/kg</td>
<td>-----</td>
<td>840 mg Mo/m³</td>
<td>84 mg Mo/m³</td>
</tr>
<tr>
<td>MoO₂, CaMoO₄, (NH₄)₂MoO₄, G pig</td>
<td>Fairhall et al. 1945</td>
<td>oral</td>
<td>120 mg Mo/kg</td>
<td>-----</td>
<td>840 mg Mo/m³</td>
<td>84 mg Mo/m³</td>
</tr>
<tr>
<td>CaMoO₄</td>
<td>Browning 1961</td>
<td>oral</td>
<td>101</td>
<td>-----</td>
<td>319 mg Mo/m³</td>
<td>34 mg Mo/m³</td>
</tr>
<tr>
<td>(NH₄)₂MoO₄</td>
<td>Coulston &amp; Korte 1975</td>
<td>oral</td>
<td>1,870</td>
<td>-----</td>
<td>6,371 mg Mo/m³</td>
<td>637 mg Mo/m³</td>
</tr>
<tr>
<td>G pig</td>
<td>Coulston &amp; Korte 1975</td>
<td>oral</td>
<td>2,200</td>
<td>-----</td>
<td>7,566 mg Mo/m³</td>
<td>755 mg Mo/m³</td>
</tr>
<tr>
<td>Cat</td>
<td>Coulston &amp; Korte 1975</td>
<td>oral</td>
<td>1,600</td>
<td>-----</td>
<td>5,488 mg Mo/m³</td>
<td>549 mg Mo/m³</td>
</tr>
</tbody>
</table>
Molybdenum (soluble compounds, as Mo) (continued)

Other animal data ........................................ No changes were observed in rats over a 4-week period following inhalation exposures to molybdenum trioxide at 12,000 to 15,000 mg/m³ or to ammonium paramolybdate at 3,000 to 5,000 mg/m³ for 1 hour [Fairhall et al. 1945]; however, irritation of the upper respiratory passages occurred after exposure to the ammonium paramolybdate dust [FDA 1975].

Human data .................................................. Mining and metallurgy workers chronically exposed to 60 to 800 mg Mo/m³ reported an increased incidence of nonspecific symptoms that included weakness, fatigue, headache, anorexia, and joint and muscle pain [Lener and Bibir 1984].

Revised IDLH: 1,000 mg Mo/m³

Basis for revised IDLH: The revised IDLH for soluble molybdenum compounds is 1,000 mg Mo/m³ based on toxicity data in workers [Lener and Bibir 1984] and animals [Barltrop 1991].

REFERENCES:

Monomethyl aniline

CAS number ........................................ 100-61-5
NIOSH REL ........................................ 0.5 ppm (2 mg/m³) TWA [skin]
Current OSHA PEL ................................. 2 ppm (8 mg/m³) TWA [skin]
1989 OSHA PEL ..................................... 0.5 ppm (2.2 mg/m³) TWA [skin]
1993-1994 ACGIH TLV .............................. 0.5 ppm (2.2 mg/m³) TWA [skin]
Description of substance ......................... Yellow to light-brown liquid with a weak, ammonia-like odor.
LEL ................................................... Unknown
Original (SCP) IDLH ................................ 100 ppm
Basis for original (SCP) IDLH .................... The chosen IDLH is based on an analogy with aniline which has an IDLH of 100 ppm.
Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₃₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Treon et al. 1949</td>
<td>oral</td>
<td>280</td>
<td>439 ppm</td>
<td>44 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>von Oettingen 1941</td>
<td>oral</td>
<td>1,200</td>
<td>1,883 ppm</td>
<td>188 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .................................. It has been reported that a dog survived 50 seven-hour exposures to 86 ppm [Treon et al. 1949].

Human data ........................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 100 ppm [Unchanged]
Basis for revised IDLH: Based on animal subchronic inhalation toxicity data [Treon et al. 1949] and an analogy to aniline which has a revised IDLH of 100 ppm, the original IDLH for monomethyl aniline (100 ppm) is not being revised at this time.

REFERENCES:

Morpholine

CAS number ......................................... 110-91-8
NIOSH REL .................................. 20 ppm (70 mg/m³) TWA, 30 ppm (105 mg/m³) STEL [skin]
Current OSHA PEL ............................ 20 ppm (70 mg/m³) TWA [skin]
1989 OSHA PEL .............................. 20 ppm (70 mg/m³) TWA, 30 ppm (105 mg/m³) STEL [skin]
1993-1994 ACGIH TLV ......................... 20 ppm (71 mg/m³) TWA [skin]

Description of substance ....................... Colorless liquid with a weak, ammonia- or fish-like odor.
LEL ......................................... 1.4% (10% LEL, 1,400 ppm)

Short-term exposure guidelines ............... The chosen IDLH is based on the statement by ILO [1972] that 1 of 6 rats died following an 8-hour exposure to 8,497 ppm. The chosen IDLH is also supported by Patty [1963] who reported that 1 hour was the maximum survival time for rats exposed to the saturated vapor (9,200 ppm); exposure of 6 rats to 8,000 ppm (calculated) for 8 hours resulted in no deaths [Smyth et al. 1954].

None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>ILO 1972</td>
<td>8,497</td>
<td>1,456</td>
<td>8 hr</td>
<td>21.243 ppm (2.5)</td>
<td>2,124 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Toksikol Nov Prom Khim Vesh 1966</td>
<td>8,497</td>
<td>1,456</td>
<td>2 hr</td>
<td>584 ppm (1.4)</td>
<td>58 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Bazarova and Miguekina 1975</td>
<td>oral</td>
<td>1,220</td>
<td>2,359</td>
<td>1,015 ppm</td>
<td>102 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Patel et al. 1985</td>
<td>oral</td>
<td>525</td>
<td>1,015 ppm</td>
<td>102 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>oral</td>
<td>1,050</td>
<td>2,030 ppm</td>
<td>203 ppm</td>
<td></td>
</tr>
</tbody>
</table>

No deaths resulted from exposures of 6 rats to 8,000 ppm for 8 hours [Smyth et al. 1954].

Irritation of the nose has been reported after a 1-minute exposure to 12,000 ppm and coughing started after 1.5 minutes; it was suggested that this concentration would probably be intolerable for long periods [Shea 1939].

Morpholine

REFERENCES:

Morpholine (continued)

Naphtha (coal tar)

CAS number ........................................ 8030-30-8
NIOSH REL ...........................................
Current OSHA PEL ..................................
1989 OSHA PEL .................................... Same as current PEL
1993·1994 ACGIH TLV ............................. 400 ppm (1,590 mg/ml) TWA
Description of substance ......................... Reddish-brown, mobile liquid with an aromatic odor.
LEL ................................................... 1.0-1.3% (10% LEL, 1,000-1,300 ppm)
Original (SCP) IDLH ............................... 10,000 ppm [LEL]
Basis for original (SCP) IDLH ................... According to AIHA [1970], 7,500 ppm benzene is judged dangerous to human life for exposures of 30 minutes or more [Henderson and Haggard 1943]. Because benzene is the most hazardous constituent of coal tar naphtha which is present in any appreciable amount, an IDLH of 7,500 ppm could be assumed. However, because the amount of benzene contained in naphtha is usually small, the lower explosive limit (LEL) of 10,000 ppm been used as the IDLH for this draft technical standard. [Note: The draft technical standard noted that the range of the LELs for each of the constituents of coal tar naphtha were between 10,000 and 13,000 ppm.]

Short-term exposure guidelines .................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LCI (ppm)</th>
<th>LC50 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1975</td>
<td>15,000</td>
<td>-----</td>
<td>4 hr</td>
<td>30,000 ppm (2.0)</td>
<td>3,000 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Stubblefield et al. 1989</td>
<td>2,319</td>
<td>-----</td>
<td>6 hr</td>
<td>5,335 ppm (2.3)</td>
<td>534 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1933</td>
<td>30,000</td>
<td>30,000</td>
<td>5 min</td>
<td>16,500 ppm (0.55)</td>
<td>1,650 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Taylor 1939</td>
<td>2,600</td>
<td>-----</td>
<td>6 hr</td>
<td>3,660 ppm (2.3)</td>
<td>366 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50 (mg/kg)</th>
<th>LD100 (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Stubblefield et al. 1989</td>
<td>oral</td>
<td>&gt;5,000</td>
<td>-----</td>
<td>&gt;7,659 ppm</td>
<td>&gt;766 ppm</td>
</tr>
</tbody>
</table>

Other human data .................... Acute exposure to 430 ppm has been reported to cause only slight eye and throat irritation [Carpenter et al. 1975].

Revised IDLH: 1,000 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Carpenter et al. 1975; Tab Biol Per 1933], a value of about 1,700 ppm would have been appropriate for coal tar naphtha. However, the revised IDLH for coal tar naphtha is 1,000 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limits of the various constituents of coal tar naphtha which range from 1.0 to 1.3%).

REFERENCES:

5. Tab Biol Per [1933]: 3-231 (in German).
Naphthalene

CAS number .............................................. 91-20-3
NIOSH REL ..............................................
Current OSHA PEL ....................................... 10 ppm (50 mg/m³) TWA
1989 OSHA PEL .......................................... 10 ppm (50 mg/m³) TWA
1993-1994 ACGIH TLV ................................. 12 ppm (52 mg/m³) TWA, 15 ppm (70 mg/m³) STEL
Description of substance .............................. Colorless to brown solid with an odor of mothballs.
LEL .......................................................... 0.9% (10% LEL, 900 ppm)
Original (SCP) IOLH .................................... 500 ppm
Basis for original (SCP) IOLH ......................... No useful data on acute inhalation toxicity are available on which to base the IOLH for naphthalene. The chosen IOLH, therefore, has been estimated from the probable oral lethal dose of 5 to 15 grams for an adult [Gerarde 1960 cited by AIHA 1967]. None developed
Short-term exposure guidelines ....................... ACUTE TOXICITY DATA
Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>(LD_{50}) (mg/Kg)</th>
<th>(LD_{95}) (mg/Kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gosselin et al. 1984</td>
<td>oral</td>
<td>1.800</td>
<td>2.355</td>
<td>236 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>1.200</td>
<td>1.570</td>
<td>157 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Matorova 1982</td>
<td>oral</td>
<td>533</td>
<td>697</td>
<td>70 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ............................................. The probable oral lethal dose has been reported to be between 5 and 15 grams [Gerarde 1960]. [Note: An oral dose between 5 and 15 grams is equivalent to a worker being exposed to about 600 to 1,800 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IOLH: 250 ppm
Basis for revised IOLH: No inhalation toxicity data are available on which to base an IOLH for naphthalene. Therefore, the revised IOLH for naphthalene is 250 ppm based on acute oral toxicity data in humans [Gerarde 1960].

REFERENCES:

4. Izmerov NF, Sanotsky IV, Sidorov IK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GNT, p. 89.
Nickel carbonyl (as Ni)

**CAS number** ................................................. 13463-39-3
**NIOSH REL** ...................................................
**Current OSHA PEL** ..............................................
**1989 OSHA PEL** ................................................
**1993-1994 ACGIH TLV** ........................................
**Description of substance** ....................................
**LEL** ............................................................
**Original (SCP) IDLH** .........................................

**Short-term exposure guidelines** ..............................

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{95} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Armit 1909</td>
<td>360</td>
<td>510</td>
<td>30 min</td>
<td>9.4 ppm (1.44)</td>
<td>52 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Brief et al. 1971</td>
<td>30</td>
<td>30 ppm (1.0)</td>
<td>30 min</td>
<td>3.0 ppm</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Coulston and Korte 1975</td>
<td>266</td>
<td>266 ppm (1.0)</td>
<td>30 min</td>
<td>27 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Gekkan Yakuji 1980</td>
<td>42</td>
<td>42 ppm (1.0)</td>
<td>30 min</td>
<td>4.2 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Kincaid et al. 1956</td>
<td>35</td>
<td>35 ppm (1.0)</td>
<td>30 min</td>
<td>3.5 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Kincaid et al. 1956</td>
<td>7</td>
<td>7 ppm (1.0)</td>
<td>30 min</td>
<td>0.7 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Kincaid et al. 1953</td>
<td>94</td>
<td>94 ppm (1.0)</td>
<td>30 min</td>
<td>9.6 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Kincaid et al. 1953</td>
<td>10</td>
<td>10 ppm (1.0)</td>
<td>30 min</td>
<td>1.0 ppm</td>
<td></td>
</tr>
</tbody>
</table>

**Other human data** ..............................................

It has been stated that 3 ppm for 30 minutes is the probable short-term exposure limit [Kincaid et al. 1956].

**Revised IDLH:** 2 ppm

**Revised for revised IDLH:** Based on acute toxicity data in humans [Brief et al. 1971; Kincaid et al. 1956], an IDLH of 3 ppm would have been appropriate for nickel carbonyl. However, the revised IDLH for nickel carbonyl is 2 ppm based on being 2,000 times the current OSHA PEL of 0.001 ppm (2,000 is an assigned protection factor for respirators; only the "most reliable" respirators are recommended above 2,000 times the OSHA PEL). (Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for nickel carbonyl at concentrations above 0.001 ppm.)

**REFERENCES:**

Nickel carbonyl (as Ni) (continued)

Nickel metal and other compounds (as Ni)

CAS number ........................................... 7440-02-0 (Metal)
NIOSH REL ............................... 0.015 mg/m³ TWA; NIOSH considers nickel compounds to be potential occupational carcinogens as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ................................
1989 OSHA PEL ............................. Metal and insoluble compounds: 1 mg/m³ TWA
1993-1994 ACGIH TLV ..................... Metal and insoluble compounds: 1 mg/m³ TWA

Description of substance ..................... Varies

Original (SCP) IDLH* ................................
Basis for original (SCP) IDLH ........................
The available toxicological data do not indicate that exposure to a high concentration of nickel metal or soluble nickel compounds could impede escape within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 "the OSHA PEL (2,000 × 1 mg Ni/m³ is 2,000 mg Ni/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 2,000 mg Ni/m³.

Short-term exposure guidelines ............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-h LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NiBF₄</td>
<td>NDRC 1943</td>
<td>-----</td>
<td>530 mg/m³</td>
<td>10 min</td>
<td>92 mg Ni/m³ (0.69)</td>
<td>9.2 mg Ni/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NiBF₄</td>
<td>NRC 1953</td>
<td>oral</td>
<td>500</td>
<td>844 mg Ni/m³</td>
<td>88 mg Ni/m³</td>
<td></td>
</tr>
<tr>
<td>NiO</td>
<td>FDRL 1983</td>
<td>oral</td>
<td>5,000</td>
<td>27,504 mg Ni/m³</td>
<td>2,756 mg Ni/m³</td>
<td></td>
</tr>
<tr>
<td>Ni</td>
<td>FDRL 1983</td>
<td>oral</td>
<td>5,000</td>
<td>35,000 mg Ni/m³</td>
<td>3,500 mg Ni/m³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Gekken Yakuji 1980</td>
<td>oral</td>
<td>5</td>
<td>35 mg Ni/m³</td>
<td>3.5 mg Ni/m³</td>
<td></td>
</tr>
<tr>
<td>Ni(NO₃)₂(SO₄)₂</td>
<td>FDRL 1984</td>
<td>oral</td>
<td>400</td>
<td>573 mg Ni/m³</td>
<td>57 mg Ni/m³</td>
<td></td>
</tr>
<tr>
<td>NiCl₂</td>
<td>Naro et al. 1968</td>
<td>oral</td>
<td>350</td>
<td>814 mg Ni/m³</td>
<td>81 mg Ni/m³</td>
<td></td>
</tr>
<tr>
<td>Ni(OH)₂</td>
<td>Naro et al. 1968</td>
<td>oral</td>
<td>410</td>
<td>953 mg Ni/m³</td>
<td>95 mg Ni/m³</td>
<td></td>
</tr>
<tr>
<td>NiCl₂</td>
<td>Itskova et al. 1969</td>
<td>oral</td>
<td>105</td>
<td>333 mg Ni/m³</td>
<td>33 mg Ni/m³</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .................................. It has been reported that pulmonary inflammation, degeneration of the bronchiolar mucosa, and atrophy of the olfactory epithelium resulted in rats and mice exposed to nickel sulfate hexahydrate at concentrations ranging from 0.7 to 13.5 mg Ni/m³ for 6 hours/day for 12 days [Benson et al. 1988].

Human data ........................................ None relevant for use in determining the revised IDLH.
Nickel metal and other compounds (as Ni) (continued)

<table>
<thead>
<tr>
<th>Revised IDLH: 10 mg Ni/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis for revised IDLH: The revised IDLH for nickel compounds is 10 mg Ni/m³ based on acute inhalation toxicity data in animals [NDRC 1943]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers. [Note: NIOSH recommends as part of its carcinogen policy that the &quot;most protective&quot; respirators be worn for nickel compounds at concentrations above 0.015 mg Ni/m³.]</td>
</tr>
</tbody>
</table>

REFERENCES:

Nicotine

CAS number ................................................. 54-11-5
NIOSH REL ...................................................
Current OSHA PEL .......................................... 0.5 mg/m³ TWA [skin]
1989 OSHA PEL ............................................. Same as current PEL
1993·19M ACGIH TLV ..................................... 0.5 mg/m³ TWA [skin]
Description of substance ........................................................................ Pale-yellow to dark-brown liquid with a fish-like odor when warm.
LEL ........................................................................... 0.7% (10% LEL, 4,700 mg/m³)
Original (SCP) IDLH .............................................. 35 mg/m³
Basis for original (SCP) IDLH ......................................................... No data on acute inhalation toxicity are available on which to base the IDLH for nicotine. The chosen IDLH, therefore, has been estimated from the human oral lethal dose of 80 mg [Lehman 1938 cited by Patty 1963 and ACGIH 1971].

Short-term exposure guidelines ......................................................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Franke and Thomas 1932</td>
<td>oral</td>
<td>9.2</td>
<td>---</td>
<td>64 mg/m³</td>
<td>6.4 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Lazutka et al. 1969</td>
<td>oral</td>
<td>3.34</td>
<td>---</td>
<td>23 mg/m³</td>
<td>2.3 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Sine 1993</td>
<td>oral</td>
<td>50</td>
<td>---</td>
<td>350 mg/m³</td>
<td>35 mg/m³</td>
</tr>
</tbody>
</table>

Human data .............................................................................. The fatal human dose has been estimated to be about 50 to 60 mg [Lazutka et al. 1969]. [Note: An oral dose of 50 to 60 mg/kg is equivalent to a 70-kg worker being exposed to about 30 to 40 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 5 mg/m³
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for nicotine. Therefore, the revised IDLH for nicotine is 5 mg/m³ based on acute oral toxicity data in humans [Lazutka et al. 1969] and animals [Franke and Thomas 1932; Lazutka et al. 1969].

REFERENCES:

Nitric acid

CAS number .............................................. 7697-37-2
NIOSH REL ....................................................
Current OSHA PEL ................................. 2 ppm (5 mg/m³) TWA
1989 OSHA PEL ............................................. 2 ppm (5 mg/m³) TWA
1993-1994 ACGIH TLV .................. 2 ppm (5.2 mg/m³) TWA, 4 ppm (10 mg/m³) STEL

Description of substance .................. Colorless, yellow, or red, fuming liquid with an acid, suffocating odor.

LEL ............................................................

Original (SCP) IDLH ................................. 100 ppm
Basis for original (SCP) IDLH .......... The chosen IDLH is based on the statement by MCA [1961] that pulmonary edema may result from an exposure of 100 to 150 ppm for only 0.5 to 1 hour. It is not clear if MCA [1961] was referring to nitric acid specifically, or to nitrogen oxides. The chosen IDLH seems reasonable, however, because an IDLH of 100 ppm was also selected for hydrogen chloride.

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gray et al. 1954</td>
<td>138</td>
<td>--</td>
<td>30 min</td>
<td>138 ppm (1.0)</td>
<td>14 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................. Rats receiving a single exposure to 83 mg/m³ nitric acid (24 ppm) exhibited no apparent adverse effects [Diggie and Gage 1954].

Human data ........................................ A maximum allowable workplace concentration of 10 ppm has been proposed [Fairhall 1957]. It has been reported that 430 mg/kg is the lethal oral dose [Gekkan Yakuji 1980]. [Note: An oral dose of 430 mg/kg is equivalent to a worker being exposed to about 2,300 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 25 ppm

Basis for revised IDLH: The revised IDLH for nitric acid is 25 ppm based on acute toxicity data in humans [Gekkan 1980] and animals [Diggie and Gage 1954]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

Nitric oxide

CAS number ........................................... 10102-43-9
NIOSH REL ...........................................
Current OSHA PEL ................................. 25 ppm (30 mg/m³) TWA
1989 OSHA PEL ........................................ Same as current PEL
1993·1994 ACGIH TLV .......................... 25 ppm (31 mg/m³) TWA
Description of substance ....................... Colorless gas.
LEL ...................................................... Nonflammable gas
Original (SCP) IDLH ............................... 100 ppm

No useful data on acute inhalation toxicity are available on which to base the IDLH for nitric oxide. The chosen IDLH, therefore, is based on the statement by Sax [1975] that 100 to 150 ppm oxides of nitrogen are dangerous for short exposures of 30 to 60 minutes. The chosen IDLH seems reasonable because NIOSH [1976] cited a rabbit 15-minute LC₅₀ of 315 ppm for nitric oxide [Carson et al. 1962].

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Carson et al. 1962</td>
<td>315</td>
<td>-----</td>
<td>15 min</td>
<td>249 ppm (0.79)</td>
<td>25 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Flury and Zernik 1931</td>
<td>2,500</td>
<td>2,500</td>
<td>12 min</td>
<td>1,850 ppm (0.74)</td>
<td>185 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Ivanov and Szubaev 1979</td>
<td>854</td>
<td>-----</td>
<td>4 hr</td>
<td>1,709 ppm (2.0)</td>
<td>171 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Pfleiser 1935</td>
<td>320</td>
<td>-----</td>
<td>7</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Other animal data .................................. Guinea pigs have survived an exposure at 175 ppm for an unstated period [Bodansky 1951].

Human data ......................................... It has been stated that exposures to oxides of nitrogen between 100 and 150 ppm are dangerous for exposures of 30 to 60 minutes [Sax 1975].

Revised IDLH: 100 ppm [Unchanged]

Based for revised IDLH: Based on acute inhalation toxicity data in humans [Sax 1975], the original IDLH for nitric oxide (100 ppm) is not being revised at this time.

REFERENCES:

p-Nitroaniline

CAS number ................................................... 100-91-6
NIOSH REL .................................................. 
Current OSHA PEL ........................................... 3 mg/m³ TWA [skin]
1989 OSHA PEL ............................................... 6 mg/m³ (1 ppm) TWA [skin]
1993-1994 ACGIH TLV ....................................... 3 mg/m³ TWA [skin]
Description of substance .................................. Bright yellow, crystalline powder with a slight ammonia-like odor.
LEL ............................................................... Unknown
Original (SCP) IDLH ........................................... 300 mg/m³
Basis for original (SCP) IDLH ............................... The chosen IDLH (300 mg/m³ or 50 ppm) is based on an analogy with aniline and the statement by AIHA [1955] that 50 to 100 ppm aniline can probably be tolerated for 1 hour. Although the IDLH chosen for aniline was 100 ppm, the IDLH of 50 ppm (300 mg/m³) chosen for p-nitroaniline Is reasonable because Von Oettingen [1941] stated that p-nitroaniline is more toxic than aniline.

Short-term exposure guidelines ............................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Back et al. 1972</td>
<td>oral</td>
<td>3,249</td>
<td>---</td>
<td>22.743</td>
<td>2,374 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Matrka et al. 1978</td>
<td>oral</td>
<td>750</td>
<td>5,250</td>
<td>525 mg/m³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Moskalenko 1966</td>
<td>oral</td>
<td>450</td>
<td>3,150</td>
<td>315 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>810</td>
<td>5,670</td>
<td>567 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data .................................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 300 mg/m³ [Unchanged]

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for p-nitroaniline. Therefore, based on acute oral toxicity data in animals [Matrka et al. 1978; Moskalenko 1966; Vernot et al. 1977], the original IDLH for p-nitroaniline (300 mg/m³) is not being revised at this time.

REFERENCES:

Nitrobenzene

CAS number ........................................ 98-95-3
NIOSH REL ........................................
Current OSHA PEL ............................... 1 ppm (5 mg/m³) TWA [skin]
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ............................... 1 ppm (5 mg/m³) TWA [skin]
Description of substance ........................... Yellow, oily liquid with a pungent odor like paste shoe polish.
LEL (200°F) ........................................ 1.8% (10% LEL (200°F), 1,800 ppm)
Original (SCP) IDLH .................................. 200 ppm
Basis for original (SCP) IDLH ................. The chosen IDLH is based on the statement by ACGIH [1971] and AIHA [1959] that Henderson and Haggard [1943] reported that 200 ppm is the maximum concentration that can be inhaled for 1 hour without serious disturbance.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>---</td>
<td>750</td>
<td>1,025 ppm</td>
<td>103 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Kashkaida and Kolodub 1988</td>
<td>oral</td>
<td>780</td>
<td>---</td>
<td>1,064 ppm</td>
<td>107 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1969</td>
<td>oral</td>
<td>600</td>
<td>---</td>
<td>820 ppm</td>
<td>82 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Vasilenko and Zvezdal 1981</td>
<td>oral</td>
<td>590</td>
<td>---</td>
<td>807 ppm</td>
<td>81 ppm</td>
</tr>
</tbody>
</table>

Human data ............................................ It has been reported that 200 ppm is the maximum concentration that can be inhaled for 1 hour without serious disturbance [Henderson and Haggard 1943].

Revised IDLH: 200 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Henderson and Haggard 1943], the original IDLH for nitrobenzene (200 ppm) is not being revised at this time.

REFERENCES:

p-Nitrochlorobenzene

CAS number ................................................. 100-00-5
NIOSH REL .............................................................. None established; NIOSH considers p-nitrochlorobenzene to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1910) that may be absorbed through the skin.

Current OSHA PEL .................................................. 1 mg/m³ TWA [skin]
OSHA PEL 1989 ...................................................... Same as current PEL
1989-1994 ACGIH TLV .............................................. 0.64 mg/m³ (0.1 ppm) TWA [skin]

Description of substance ......................................... Yellow, crystalline solid with a sweet odor.

LEL ................................................................. Unknown

Original (SCP) IDLH .................................................. 1,000 mg/m³
Basis for original (SCP) IDLH ...................................... No data on acute inhalation toxicity are available on which to base an IDLH for p-nitrochlorobenzene. The chosen IDLH, therefore, is based on an analogy with nitrobenzene, which has an IDLH of 200 ppm. (Note: A concentration of 200 ppm nitrobenzene is equivalent to about 1,000 mg/m³ p-nitrochlorobenzene.)

Short-term exposure guidelines ...................................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Watrous and Schultz 1950</td>
<td>164 mg/m³</td>
<td>-----</td>
<td>7 hr</td>
<td>393 mg/m³ (2.4)</td>
<td>39 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Back et al. 1972</td>
<td>oral</td>
<td>812</td>
<td>-----</td>
<td>5,684 mg/m³</td>
<td>568 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Back et al. 1972</td>
<td>oral</td>
<td>1,414</td>
<td>-----</td>
<td>9,885 mg/m³</td>
<td>990 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>440</td>
<td>-----</td>
<td>3,080 mg/m³</td>
<td>308 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Szilza and Magos 1959</td>
<td>oral</td>
<td>420</td>
<td>-----</td>
<td>2,940 mg/m³</td>
<td>294 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data .............................................. Exposures of cats and guinea pigs to 87 mg/m³ for 8 hours/day for 6 weeks resulted in methemoglobinemia and slight anemia [Watrous and Schultz 1950].

Human data ...................................................... Workers exposed intermittently for 0.5 to 1 hour over many months to concentrations ranging from 7 to 400 mg/m³ (average of 90 mg/m³) had only vague complaints of tiredness, loss of appetite, headache, and afternoon fatigue [Watrous and Schultz 1950]. Because of the strong and disagreeable odor, these workers voluntarily wore respiratory protection when exposed to the higher concentrations [Watrous and Schultz 1950].

Revised IDLH: 100 mg/m³
Basis for revised IDLH: The revised IDLH for p-nitrochlorobenzene is 100 mg/m³ based on subchronic inhalation toxicity data in workers [Watrous and Schultz 1950] and animals [Watrous and Schultz 1950]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 100 mg/m³. (Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for p-nitrochlorobenzene at any detectable concentration.)
REFERENCES:


2. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 92.


Nitroethane

CAS number ........................................... 79-24-3
NIOSH REL ........................................... 100 ppm (310 mg/m³) TWA
Current OSHA PEL .................................. 100 ppm (310 mg/m³) TWA
1989 OSHA PEL ...................................... Same as current PEL
1983-1984 ACGIH TLV .......................... 100 ppm (307 mg/m³) TWA
Description of substance ......................... Colorless, oily liquid with a mild, fruity odor.
LEL ................................................. 3.4% (10% LEL, 3,400 ppm)
Original (SCP) IDLH .................................. 1,000 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statements by Patty [1963] that exposure to 5,000 ppm for 2 hours was lethal to 1 of 2 rabbits and to 0 of 2 guinea pigs; exposure to the same concentration for 3 hours was fatal to 2 of 2 rabbits and to 0 of 2 guinea pigs [Machle et al. 1940].

Short-term exposure guidelines ..................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>IMCC 1979</td>
<td>LC₅₀: 13,000</td>
<td>-</td>
<td>6 hr</td>
<td>29,900 ppm (2.3)</td>
<td>2,990 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>-</td>
<td>6,250</td>
<td>2 hr</td>
<td>10,000 ppm (1.6)</td>
<td>1,000 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1940</td>
<td>5,000</td>
<td>-</td>
<td>2 hr</td>
<td>8,000 ppm (1.6)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1940</td>
<td>LC₉₅: 5,000</td>
<td>-</td>
<td>3 hr</td>
<td>9,000 ppm (1.8)</td>
<td>900 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................

Guinea pigs survived both a 2-hour and a 3-hour exposure to 5,000 ppm [Machle et al. 1940]. Rats exposed to 2,200 ppm for 8 hours had no noticeable difficulty [IMCC 1979].

Human data ........................................

None relevant for use in determining the revised IDLH.

Revised IDLH: 1,000 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in animals [Izmerov et al. 1982; Machle et al. 1940], the original IDLH for nitroethane (1,000 ppm) is not being revised at this time.

REFERENCES:

2. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 83.
Nitrogen dioxide

CAS number ........................................... 10102-44-0
NIOSH REL .............................................. 1 ppm (1.8 mg/m³) STEL
Current OSHA PEL ....................................... 5 ppm (9 mg/m³) CEILING
1989 OSHA PEL ........................................... 1 ppm (1.8 mg/m³) STEL
1993-1994 ACGIH TLV .................................. 3 ppm (5.6 mg/m³) TWA, 5 ppm (9.4 mg/m³) STEL

Description of substance

Yellowish-brown liquid or reddish-brown gas (above 70°F) with a pungent, acrid odor.

LEL .......................................................... 50 ppm
Original (SCP) IDLH ........................................ 50 ppm

Basis for original (SCP) IDLH

The chosen IDLH is based on the statement by Patty [1963] that concentrations above 50 ppm are considered dangerous to man for short exposures. Also, NIOSH [1974] cited a rat 4-hour LC₅₀ of 68 ppm [Gray et al., 1954].

American Industrial Hygiene Association [AIHA 1964]
Emergency Exposure Limits (EELs):

5-minute EEL: 35 ppm
15-minute EEL: 25 ppm
30-minute EEL: 20 ppm
60-minute EEL: 10 ppm

National Research Council [NRC 1965] Short-term Public Emergency Guidance Levels (SPEGLs):

1-hour SPEGL: 1 ppm
2-hour SPEGL: 0.5 ppm
4-hour SPEGL: 0.25 ppm
8-hour SPEGL: 0.12 ppm
16-hour SPEGL: 0.06 ppm
24-hour SPEGL: 0.04 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>L₅₀ (ppm)</th>
<th>L₅₀,o (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (ppm)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Buckley and Balchum 1965</td>
<td>30</td>
<td>-</td>
<td>1 hr</td>
<td>37 ppm (1.22)</td>
<td>3.7 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Carson et al. 1962</td>
<td>315</td>
<td>-</td>
<td>15 min</td>
<td>258 ppm (0.82)</td>
<td>26 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Gray et al. 1954</td>
<td>68</td>
<td>-</td>
<td>4 hr</td>
<td>133 ppm (1.01)</td>
<td>12 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Gray et al. 1954</td>
<td>138</td>
<td>-</td>
<td>10 min</td>
<td>138 ppm (1.0)</td>
<td>14 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Hidalgo and Machado 1977</td>
<td>31,000</td>
<td>-</td>
<td>8 hr</td>
<td>143 ppm (2.21)</td>
<td>14 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Steadman et al. 1966</td>
<td>64</td>
<td>-</td>
<td>8 hr</td>
<td>141 ppm (2.21)</td>
<td>14 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>Steadman et al. 1966</td>
<td>-</td>
<td>64</td>
<td>-</td>
<td>141 ppm (2.21)</td>
<td>14 ppm</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 3.5 [ten Berge et al. 1966].

Human data

It has been reported that 10 to 20 ppm has been mildly irritating [Patty 1963]. Exposure to 150 ppm or more (no time period given) has been reported to cause death from pulmonary edema [NRC 1979]. It has been predicted that 50% lethality would occur following exposure to 174 ppm for 1 hour [Book 1982].

Revised IDLH: 20 ppm

Basis for revised IDLH: The revised IDLH for nitrogen dioxide is 20 ppm based on acute inhalation toxicity data in humans [Patty 1963]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 20 ppm.
REFERENCES:


Nitrogen dioxide (continued)
Nitrogen trifluoride

CAS number ............................................. 7783-54-2
NIOSH REL .............................................
1989 OSHA PEL .........................................
Current OSHA PEL ......................................
1983-1994 ACGIH TLV .................................
Description of substance ............................ Colorless gas with a moldy odor.
LEL ............................................................. 2,000 ppm
Original (SCP) IDLH ....................................
Basis for original (SCP) IDLH ....................... The chosen IDLH is based on the mouse 4-hour LC_{50} of 2,000 ppm cited by Deichmann and Gerarde [1969]. Deichmann and Gerarde [1969] also stated that nitrogen trifluoride is a pulmonary irritant comparable in toxicity to the oxides of nitrogen.

Short-term exposure guidelines ........................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{50} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Deichmann and Gerarde 1969</td>
<td>2,000</td>
<td>-----</td>
<td>6 hr</td>
<td>4,000 ppm (2.0)</td>
<td>400 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>MacEwen and Vemot 1969</td>
<td>9,600</td>
<td>-----</td>
<td>1 hr</td>
<td>12,000 ppm (1.25)</td>
<td>1,200 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>MacEwen and Vemot 1969</td>
<td>7,500</td>
<td>-----</td>
<td>1 hr</td>
<td>9,375 ppm (1.25)</td>
<td>938 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Vemot et al. 1973</td>
<td>6,700</td>
<td>-----</td>
<td>1 hr</td>
<td>8,375 ppm (1.25)</td>
<td>838 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Vemot et al. 1973</td>
<td>7,500</td>
<td>-----</td>
<td>1 hr</td>
<td>9,375 ppm (1.25)</td>
<td>938 ppm</td>
</tr>
</tbody>
</table>

Human data .............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 1,000 ppm
Basis for revised IDLH: The revised IDLH for nitrogen trifluoride is 1,000 ppm based on acute inhalation toxicity data in animals [MacEwen and Vemot 1969, Vemot et al. 1973].

REFERENCES:

Nitroglycerine

CAS number ........................................ 55-63-0
NIOSH REL ........................................ 0.1 mg/m³ STEL [skin]
Current OSHA PEL ................................. 2 mg/m³ (0.2 ppm) CEILING [skin]
1989 OSHA PEL ..................................... 0.1 mg/m³ STEL [skin]
1993-1994 ACGIH TLV .............................. 0.46 mg/m³ (0.05 ppm) TWA [skin]

Description of substance ........................... Colorless to pale-yellow, viscous liquid or solid (below 56°F).
LEL .................................................. Unknown
Original (SCP) IDLH* ................................ 500 mg/m³* [Note: "Effective" IDLH = 200 mg/m³ – see discussion below.]

Basis for original (SCP) IDLH ...................... No data on acute inhalation toxicity are available on which to base the IDLH for ethylene glycol dinitrate (EGDN) and/or nitroglycerin. The chosen IDLH, therefore, is based on chronic toxicity data concerning the physiological response of animals to EGDN. According to Patty [1963], rats and guinea pigs survived 6 months of exposure to 500 mg/m³ (80 ppm) EGDN with the only effect being slight drowsiness and some Heinz body formation [Stein 1956]. Although Patty [1963] stated that EGDN is more toxic for cats and rabbits, the chosen IDLH is still probably conservative because cats given 2-hour daily exposures to 21 ppm EGDN for 1,000 days exhibited only marked blood changes [von Oettingen 1946]. However, because of the assigned protection factor afforded by each device, 2,000 x the OSHA PEL of 0.1 mg/m³ (i.e., 200 mg/m³) is the concentration above which only the "most protective" respirators are permitted.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₁₅ (mg/kg)</th>
<th>LD₃₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Horioka et al. 1982</td>
<td>oral</td>
<td>1,687</td>
<td></td>
<td></td>
<td>1,225 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Pharmacol Ther 1985</td>
<td>oral</td>
<td>105</td>
<td></td>
<td></td>
<td>74 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Pharmacol Ther 1985</td>
<td>oral</td>
<td>115</td>
<td></td>
<td></td>
<td>81 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................ Headaches have developed in workers exposed to 0.4 to 0.87 mg/m³ for 25 minutes; all had decreases in blood pressure [Trainor and Jones 1966]. Ethylene glycol dinitrate and nitroglycerine are vasodilators and initial exposures result in headache, dizziness, nausea, or decreases in blood pressure; however, workers become tolerant of the vasodilatory activity after 2 to 4 days of exposure [NIOSH 1978]. It has been estimated that the lethal oral dose in humans is 200 mg although others have survived doses of 1,200 mg with no apparent ill effects [Rabinowitch 1944]. [Note: An oral dose of 200 mg is equivalent to a worker being exposed to about 150 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 75 mg/m³

Basis for revised IDLH: The revised IDLH for nitroglycerine is 75 mg/m³ based on acute oral toxicity data in humans [NIOSH 1978] and animals [Pharmacol 1985].
Nitroglycerine (continued)

REFERENCES:

Nitromethane

CAS number ................................. 75-52-5
NIOSH PEL .................................. The 1989 OSHA PEL may not be protective to workers.
Current OSHA PEL .......................... 100 ppm (250 mg/m³) TWA
1989 OSHA PEL ......................... Same as current PEL
1993-1994 ACGIH TLV ................. 100 ppm (250 mg/m³) TWA
Description of substance .................. Colorless, oily liquid with a disagreeable odor.
LEL ......................................... 7.3% (10% LEL, 7,300 ppm)
Original (SCP) IDLH ...................... 1,000 ppm ea.al. for original (SCP) IDLH
Basis for original (SCP) IDLH ............. The chosen IDLH is based on the statement by Browning [1965] that with concentrations above 1,000 ppm, if the product of this and the time of exposure was greater than 1 (e.g., 1,000 ppm for 3 hours) some of the animals, including 1 monkey, died. Also, AIHA [1961] reported severe eye irritation at 500 ppm [Machle et al. 1940]. [Note: The statement by Browning [1965] regarding the product of the concentration and the time of exposure is apparently in error; the value "greater than 1" should probably be "greater than 1,000".]

Short-term exposure guidelines .............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₃₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>7,087</td>
<td>2 hr</td>
<td></td>
<td>11,339 ppm (1.6)</td>
<td>1,134 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>Skinner 1947</td>
<td>1,600</td>
<td>7</td>
<td></td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Weatherby 1955</td>
<td>2,500</td>
<td>12 hr</td>
<td></td>
<td>7,250 ppm (2.2)</td>
<td>725 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Weatherby 1955</td>
<td>5,000</td>
<td>6 hr</td>
<td></td>
<td>11,500 ppm (2.3)</td>
<td>1,150 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₃₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1940</td>
<td>oral</td>
<td>750</td>
<td>2,067 ppm</td>
<td>207 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Subbotin 1967</td>
<td>oral</td>
<td>940</td>
<td>2,590 ppm</td>
<td>259 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Subbotin 1967</td>
<td>oral</td>
<td>950</td>
<td>2,618 ppm</td>
<td>262 ppm</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>Weatherby 1955</td>
<td>oral</td>
<td>125</td>
<td>34 ppm</td>
<td>34 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Human data ................. None relevant for use in determining the revised IDLH.

Revised IDLH: 750 ppm

Basis for revised IDLH: The revised IDLH for nitromethane is 750 ppm based on acute inhalation toxicity data in animals [Weatherby 1955].

REFERENCES:

1-Nitropropane

CAS number .............................................. 108-03-2
NIOSH REL ................................................... 
Current OSHA PEL ........................................ 25 ppm (90 mg/m³) TWA
1989 OSHA PEL ............................................ Same as current PEL
1993-1994 ACGIH TLV .................................. 25 ppm (91 mg/m³) TWA

Description .............................................. Colorless liquid with a somewhat disagreeable odor.

LEL ........................................................... 2.2% (10% LEL, 2,200 ppm)
Original (SCP) IDLH ...................................... 2,800 ppm
Basis for original (SCP) IDLH ......................... The chosen IDLH is based on an analogy with 2-nitropropane which has an IDLH of 2,300 ppm. The animal data for 1-nitropropane given in Patty [1963] (i.e., 5,000 ppm for 3 hours killed 2 of 2 rabbits and 2 of 2 guinea pigs; 10,000 ppm for 1 hour killed 2 of 2 rabbits and 2 of 2 guinea pigs [Machle et al. 1940]) have not been used to determine the IDLH for 1-nitropropane because cats, which were far more susceptible to 2-nitropropane than guinea pigs or rabbits, were not used to study the effects of 1-nitropropane. None developed

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Marhold 1986</td>
<td>5,000</td>
<td>3 hr</td>
<td>9,000 ppm (1.8)</td>
<td>900 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle et al. 1940</td>
<td>5,000</td>
<td>3 hr</td>
<td>9,000 ppm (1.8)</td>
<td>900 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Machle et al. 1940</td>
<td>5,000</td>
<td>3 hr</td>
<td>9,000 ppm (1.8)</td>
<td>900 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Machle et al. 1940</td>
<td>10,000</td>
<td>1 hr</td>
<td>12,500 ppm (1.25)</td>
<td>1,250 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>3,100</td>
<td>8 hr</td>
<td>7,750 ppm (2.5)</td>
<td>775 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Gig Sanit 1967</td>
<td>oral</td>
<td>800</td>
<td>1,514 ppm</td>
<td>151 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Machle 1940</td>
<td>oral</td>
<td>250</td>
<td>471 ppm</td>
<td>47 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>NPIRI 1974</td>
<td>oral</td>
<td>455</td>
<td>661 ppm</td>
<td>86 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ...................................... It has been reported that rabbits survived a 1-hour exposure to 10,000 ppm [Machle et al. 1940].

Human data ............................................. Volunteers found brief exposures to concentrations exceeding 100 ppm to cause eye irritation [Silverman et al. 1948].

Revised IDLH: 1,000 ppm

Basis for revised IDLH: The revised IDLH for 1-nitropropane is 1,000 ppm based on acute inhalation toxicity data in animals [Machle et al. 1940; Marhold 1988; NPIRI 1974]. This may be a conservative value due to the lack of relevant acute toxicity data in workers exposed to concentrations above 100 ppm.

REFERENCES:

1-Nitropropane (continued)

2-Nitropropane

CAS number ........................................ 79-46-9
NIOSH REL ........................................ None established; NIOSH considers 2-nitropropane to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1990).

Current OSHA PEL .................................. 25 ppm (90 mg/m³) TWA
1989 OSHA PEL .................................. 10 ppm (35 mg/m³) TWA
1993-1994 ACGIH TLV ........................... Colorless liquid with a pleasant, fruity odor.

Description of substance .......................... 25 ppm (90 mg/m³) TWA
LEL ................................................. 10 ppm (36 mg/m³) TWA, A2

Original (SCP) IDLH ................................ 2.300 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statement by Patty [1953] that the lowest lethal concentration for the cat for a 1-hour exposure was found to be 2,353 ppm; the response of different species to 2-nitropropane varies considerably, but the cat was the most sensitive species in this investigation [Treon and Dutra 1952].

Short-term exposure guidelines ................. Revised IDLH: 100 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time (hr)</th>
<th>Adjusted 0.5-hr LC (ppm)</th>
<th>Derived value (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>Izmerov et al. 1982</td>
<td>2,703</td>
<td>-</td>
<td>2</td>
<td>4,324 ppm (1.4)</td>
<td>422 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Lewis et al. 1979</td>
<td>400</td>
<td>-</td>
<td>6</td>
<td>920 ppm (2.1)</td>
<td>92 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Treon and Dutra 1952</td>
<td>714</td>
<td>1,535 ppm (2.15)</td>
<td>5</td>
<td>1,535 ppm (2.1)</td>
<td>154 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Treon and Dutra 1952</td>
<td>2,381</td>
<td>5,159 ppm (2.15)</td>
<td>5</td>
<td>5,159 ppm (2.15)</td>
<td>512 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Treon and Dutra 1952</td>
<td>4,622</td>
<td>9,937 ppm (2.15)</td>
<td>5</td>
<td>9,937 ppm (2.15)</td>
<td>994 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Treon and Dutra 1952</td>
<td>2,353</td>
<td>2,941 ppm (1.4)</td>
<td>1</td>
<td>2,941 ppm (1.2)</td>
<td>294 ppm</td>
</tr>
</tbody>
</table>

Human data ....................................... Nausea, vomiting, diarrhea, anorexia, and severe headache have been reported in workers exposed to daily concentrations of 20 to 45 ppm [Skinner 1947].

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for 2-nitropropane is 100 ppm based on acute inhalation toxicity data in animals [Lewis et al. 1979]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 45 ppm. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for 2-nitropropane at any detectable concentration.]

REFERENCES:

1. Izmerov NF, Sanotoky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, OKNT, p. 94.

360
Nitrotoluene (o-, m-, p-isomers)

CAS numbers .................................................. 88-72-2 (o-isomer), 99-08-1 (m-isomer), 99-99-0 (p-isomer)

NIOSH REL .................................................. 2 ppm (11 mg/m³) TWA [skin]

Current OSHA PEL ......................................... 2 ppm (11 mg/m³) TWA [skin]

1993-1994 ACGIH TLV ....................................... 2 ppm (11 mg/m³) TWA [skin]

Description of substance .................................. Yellow liquids (o-, m-isomers) or a crystalline solid (p-isomer) with weak, aromatic odors.

LEL(o-isomer) .................................................. 2.2% (10% LEL, 2,200 ppm)

Original (SCP) IDLH ......................................... 200 ppm

Basis for original (SCP) IDLH ................................ The chosen IDLH is based on an analogy with nitrobenzene which has an IDLH of 200 ppm.

Short-term exposure guidelines ............................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>o-isomer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Vasileiko et al. 1978</td>
<td>oral</td>
<td>891</td>
<td>-----</td>
<td>1,094 ppm</td>
<td>109 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Vasileiko et al. 1978</td>
<td>oral</td>
<td>970</td>
<td>-----</td>
<td>1,191 ppm</td>
<td>119 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Vasileiko et al. 1978</td>
<td>oral</td>
<td>1,750</td>
<td>-----</td>
<td>2,149 ppm</td>
<td>215 ppm</td>
</tr>
<tr>
<td>p-isomer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Beck et al. 1972</td>
<td>oral</td>
<td>1,231</td>
<td>-----</td>
<td>1,612 ppm</td>
<td>151 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Vasileiko et al. 1978</td>
<td>oral</td>
<td>1,960</td>
<td>-----</td>
<td>2,407 ppm</td>
<td>241 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Vasileiko et al. 1978</td>
<td>oral</td>
<td>2,750</td>
<td>-----</td>
<td>2,149 ppm</td>
<td>215 ppm</td>
</tr>
</tbody>
</table>

Human data .................................................. It has been stated that nitrotoluene is only slightly toxic, especially in comparison with nitrobenzene [Linch 1974].

Revised IDLH: 200 ppm [Unchanged]

Basis for revised IDLH: Based on acute oral toxicity data in animals [Back et al. 1972; Vasileiko et al. 1978] and an analogy to nitrobenzene [Linch 1974] which has an IDLH of 200 ppm, the original IDLH for nitrotoluene (200 ppm) is not being revised at this time.

REFERENCES:

Octachloronaphthalene

CAS number ................................................. 2234-13-1
NIOSH REL .................................................. 0.1 mg/m³ TWA, 0.3 mg/m³ STEL [skin]
Current OSHA PEL ........................................... 0.1 mg/m³ TWA [skin]
1989 OSHA PEL ............................................. 0.1 mg/m³ TWA, 0.3 mg/m³ STEL [skin]
1993-1994 ACGIH TLV ...................................... 0.1 mg/m³ TWA, 0.3 mg/m³ STEL [skin]
Description of substance ................................. Waxy, pale-yellow solid with a aromatic odor.
LEL .................................................................... Noncombustible Solid
Original (SCP) IDLH* ......................................... Unknown [*Note: Effective IDLH = 1 mg/m³ — see discussion below.]
Basis for original (SCP) IDLH .............................. AIHA [1966] reported that the atmospheric concentration immediately hazardous to life is probably unattainable for the chloronaphthalenes with the possible exception of monochloronaphthalene. For this draft technical standard, however, an analogy with other chloronaphthalenes was used, and the respirators were selected on the basis of the assigned protection factor afforded by each device up to 10 × the OSHA PEL of 0.1 mg/m³ (i.e., 1 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 1 mg/m³.

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Animal or human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: Unknown [Unchanged]

Basis for revised IDLH: Due to a lack of relevant acute toxicity data, the IDLH for octachloronaphthalene remains "Unknown." The "most protective" respirators will continue to be recommended for concentrations exceeding 1 mg/m³ based on being 10 times the NIOSH REL and OSHA PEL of 0.1 mg/m³ (10 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for octachloronaphthalene).

REFERENCE:

Octane

CAS number ........................................ 111-85-9
NIOSH REL .............................................. 75 ppm (350 mg/m³) TWA.
Current OSHA PEL ..................................... 325 ppm (1,600 mg/m³) 15-minute CEILING
1989 OSHA PEL ........................................... 500 ppm (2,350 mg/m³) TWA
1993-1994 ACGIH TLV ............................... 300 ppm (1,450 mg/m³) TWA, 375 ppm (1,800 mg/m³) STEL
300 ppm (1,400 mg/m³) TWA, 375 ppm (1,750 mg/m³) STEL

Description of substance ........................... Colorless liquid with a gasoline-like odor.

LEL .......................................................... 10% (10% LEL, 1,000 ppm)
Original (SCP) IDLH .................................. 5,000 ppm
Basis for original (SCP) IDLH ...................... Because no human exposure data are available for octane, the chosen IDLH is based on an analogy with heptane which has an IDLH of 5,000 ppm.

Short-term exposure guidelines ..................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Jeppason 1975</td>
<td>i.v.</td>
<td>428</td>
<td>621 ppm</td>
<td>63 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data .................................. Narcosis resulted in mice exposed for 0.5 to 1.5 hours to 6,600 to 13,700 ppm [Fuhner 1921]. Respiratory arrest occurred in 1 of 4 mice within 5 minutes at 18,000 ppm and in 4 of 4 mice within 3 minutes at 32,000 ppm [Swann et al. 1974]. The narcotic concentration has been estimated to be either 6,000 ppm [Flury and Zemik 1931] or 10,000 ppm [Patty and Yant 1929]. The fatal concentration has been estimated to be 13,500 ppm [Flury and Zemik 1931].

Human data .......................................... Revised IDLH: 1,000 ppm [LEL]
Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Flury and Zemik 1931; Patty and Yant 1929], a value of about 3,000 ppm would have been appropriate for octane. However, the revised IDLH for octane is 1,000 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1%).

REFERENCES:

Oil mist (mineral)

CAS number .................................. 8012-95-1
NIOSH REL .................................. 
Current OSHA PEL ............................ 5 mg/m³ TWA
1989 OSHA PEL .................................
1993-1994 ACGIH TLV ..................................
Description of substance ..................................
Colorless, oily liquid aerosol dispersed in air.
LEL ......................................... 
Unknown
Original (SCP) IDLH* .................................. No Evidence

Validated IDLH* .................................. 

Basis for original (SCP) IDLH ................. No Evidence ["Note: "Effective" IDLH = 2,500 mg/m³ — see discussion below."

The available toxicological data contain no evidence that an acute exposure to mineral oil mist would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL (500 x 5 mg/m³ is 2,500 mg/m³).

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₃₅ (mg/kg)</th>
<th>Adjusted LD (mg/kg)</th>
<th>Derived value (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Bothe et al. 1975</td>
<td>oral</td>
<td>22,000</td>
<td>---</td>
<td>114,000 mg/m³</td>
<td>15,400 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 2,500 mg/m³

Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of oil mist (mineral) would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for oil mist (mineral) is 2,500 mg/m³ based on being 500 times the NIOSH REL and OSHA PEL of 5 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).

REFERENCE:

Osniun tetroxide (as Os)

<table>
<thead>
<tr>
<th>CAS number</th>
<th>20816-12-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>0.002 mg/m³ (0.0002 ppm) TWA, 0.006 mg/m³ (0.0006 ppm) STEL</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>0.002 mg/m³ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>0.002 mg/m³ (0.0002 ppm) TWA, 0.006 mg/m³ (0.0006 ppm) STEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>0.0016 mg/m³ (0.0002 ppm) TWA, 0.0047 mg/m³ (0.0006 ppm) STEL</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Colorless, crystalline solid or pale-yellow mass with an unpleasant, acid, chlorine-like odor. Noncombustible solid</td>
</tr>
</tbody>
</table>

Short-term exposure guidelines

None developed

Acute toxicity data

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₆₇</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Brunot 1933</td>
<td>2.316 mg/l</td>
<td></td>
<td>30 min</td>
<td>987 mg Os/m³ (1.0)</td>
<td>99 mg Os/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Shell 1962</td>
<td>497 mg/l</td>
<td></td>
<td>4 hr</td>
<td>317 mg Os/m³ (2.0)</td>
<td>32 mg Os/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Shell 1962</td>
<td>423 mg/l</td>
<td></td>
<td>4 hr</td>
<td>317 mg Os/m³ (2.0)</td>
<td>32 mg Os/m³</td>
</tr>
</tbody>
</table>

Human data

It has been suggested that 1 mg/ m³ is tolerable for 30 minutes [Flury and Zemik 1931]. Workers exposed to 0.1 to 0.6 mg/m³ suffered from lacrimation and disturbances of vision and in some cases, headache, conjunctivitis, and cough. [McLaughlin et al. 1946].

Revised IDLH: 1 mg Os/m³ [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Flury and Zemik 1931; McLaughlin et al. 1946]. The original IDLH for osmium tetroxide (1 mg Os/m³) is not being revised at this time.

References:

Oxalic acid

CAS number ........................................ 144-62-7
NIOSH REL ........................................ 1 mg/m³ TWA, 2 mg/m³ STEL
Current OSHA PEL ................................ 1 mg/m³ TWA
1989 OSHA PEL ........................................ 1 mg/m³ TWA, 2 mg/m³ STEL
1993-1994 ACGIH TLV .......................... 1 mg/m³ TWA, 2 mg/m³ STEL

Description of substance .......................... Colorless, odorless powder or granular solid.

LEL .............................................. Unknown

Original (SCP) IDLH .............................. 500 mg/m³

Basis for original (SCP) IDLH .................. The chosen IDLH has been calculated from the total oral lethal dose for man of 5 grams [ACGIH 1971].

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>(LD_{50}) (mg/kg)</th>
<th>(LD_{50}) (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Flury and Zemik 1935</td>
<td>oral</td>
<td>1,000</td>
<td>7,000</td>
<td>700 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Shlabak and Shatinakaya 1985</td>
<td>oral</td>
<td>7,500</td>
<td>52,500</td>
<td>5,250 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ...................................... It has been reported that the lethal oral dose is 15 to 30 grams [Webster 1930]. [Note: An oral dose of 15 to 30 grams is equivalent to a 30-minute exposure to 10,000 to 20,000 mg/m³ assuming a 50 liter per minute breathing rate and 100% absorption.]

Revised IDLH: 500 mg/m³ [Unchanged]

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for oxalic acid. Therefore, based on acute oral toxicity data in humans [Webster 1930] and animals [Flury and Zemik 1935], the original IDLH for oxalic acid (500 mg/m³) is not being revised at this time.

REFERENCES:

Oxygen difluoride

CAS number ........................................ 7783-41-7
NIOSH REL ........................................ 0.05 ppm (0.1 mg/m³) CEILING
Current OSHA PEL ................................. 0.05 ppm (0.1 mg/m³) TWA
1989 OSHA PEL .................................. 0.05 ppm (0.1 mg/m³) CEILING
1993-1994 ACGIH TLV ............................ 0.05 ppm (0.11 mg/m³) CEILING

Description of substance ........................... Colorless gas with a peculiar, foul odor.
LEL ............................................... 0.5 ppm
Nonflammable Gas

Original (SCP) IDLH ............................... 0.5 ppm

The chosen IDLH is based on the statements by Deichmann and Gerarde [1969] that oxygen difluoride is a strong irritant to the entire respiratory tract and causes pulmonary edema and hemorrhage when inhaled for a few hours at 0.5 ppm. Development of pulmonary signs leading to death may be delayed several hours after the exposure [Deichmann and Gerarde 1969]. In addition, AIHA [1967] reported that the Committee on Toxicology of the National Research Council recommended an Emergency Exposure Limit (EEL) of 0.5 ppm for a 10-minute exposure. This EEL is supposed to be for exposures that are "rare in the lifetime of an individual and permit some degree of reversible injury short of incapacitation" [Smyth 1966].

Existing short-term exposure guidelines ..............
National Research Council (NRC) Emergency Exposure Limits (EELs) recommended to military and space agencies [Smyth 1966]:

10-minute EEL: 0.5 ppm
30-minute EEL: 0.2 ppm
60-minute EEL: 0.1 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-Hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Darmer et al. 1972</td>
<td>2.6</td>
<td>1.5</td>
<td>1 hr</td>
<td>3.3 ppm (1.25)</td>
<td>0.3 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Darmer et al. 1972</td>
<td>1.5</td>
<td>1.5</td>
<td>1 hr</td>
<td>3.0 ppm (1.25)</td>
<td>0.2 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Darmer et al. 1972</td>
<td>26</td>
<td>26</td>
<td>1 hr</td>
<td>20 ppm (1.25)</td>
<td>2.0 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>Darmer et al. 1972</td>
<td>16</td>
<td>...</td>
<td>1 hr</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Human data .........................................
Oxygen difluoride is a strong irritant to the entire respiratory tract and causes pulmonary edema and hemorrhage when inhaled for a few hours at 0.5 ppm [Deichmann and Gerarde 1969].

Revised IDLH: 0.5 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Deichmann and Gerarde 1969], the original IDLH for oxygen difluoride (0.5 ppm) is not being revised at this time.

REFERENCES:


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Ozone

CAS number ......................................... 10028-15-6
NIOSH REL .............................................
Current OSHA PEL .....................................
1989 CSHA PEL ........................................
1993-1994 ACGIH TLV ............................... 0.1 ppm (0.2 mg/m³) CEILING

Description of substance ............................ Colorless to blue gas with a very pungent odor.
Nonflammable Gas ....................................

ORLGN II (SCP) IDLH ................................ 10 ppm

The chosen IDLH is based on the statement by AIHA [1966] that pulmonary edema developed in welders who had a severe acute exposure to an estimated 9 ppm ozone plus other air pollutants [Kleinfeld et al. 1957]. Patty [1963] reported that 15 to 20 ppm is lethal to small animals within 2 hours [Witheridge and Yaglou 1937]. AIHA [1966] also reported that on the basis of animal data, exposure at 50 ppm for 60 minutes will probably be fatal to humans [King 1963].

Existing short-term exposure guidelines ............


1-hour EEGL: 1 ppm
24-hour EEGL: 0.1 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Clemann and Bancroft 1957</td>
<td>-</td>
<td>12.4</td>
<td>3 hr</td>
<td>23 ppm (1.8)</td>
<td>2.3 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Deichmann and Gerarde 1969</td>
<td>-</td>
<td>21.8</td>
<td>3 hr</td>
<td>39 ppm (1.8)</td>
<td>3.8 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Mittler et al. 1956</td>
<td>-</td>
<td>21</td>
<td>3 hr</td>
<td>38 ppm (1.8)</td>
<td>3.8 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Mittler et al. 1956</td>
<td>-</td>
<td>21</td>
<td>3 hr</td>
<td>38 ppm (1.8)</td>
<td>3.8 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Mittler et al. 1956</td>
<td>-</td>
<td>24.8</td>
<td>3 hr</td>
<td>45 ppm (1.8)</td>
<td>4.5 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Mittler et al. 1956</td>
<td>-</td>
<td>24.8</td>
<td>3 hr</td>
<td>45 ppm (1.8)</td>
<td>4.5 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Stoshinger 1957</td>
<td>-</td>
<td>4.8</td>
<td>4 hr</td>
<td>10 ppm (2.0)</td>
<td>1.0 ppm</td>
</tr>
</tbody>
</table>

Other animal data ...................................

It has been reported that 15 to 20 ppm is lethal to small animals within 2 hours [Witheridge and Yaglou 1937].

Human data ...........................................

Pulmonary edema developed in welders who had a severe acute exposure to an estimated 9 ppm ozone plus other air pollutants [Kleinfeld et al. 1957]. It has been reported that on the basis of animal data, exposure at 50 ppm for 60 minutes will probably be fatal to humans [King 1963].

1-hour EEGL: 1 ppm
24-hour EEGL: 0.1 ppm

Revised IDLH: 5 ppm

Basis for revised IDLH: The revised IDLH for ozone is 5 ppm based on acute inhalation toxicity data in humans [Deichmann and Gerarde 1969; Kleinfeld et al. 1957].

REFERENCES:

Ozone (continued)

Paraquat

<table>
<thead>
<tr>
<th>CAS number</th>
<th>1910-42-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
<td>................................. .</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>................................. .</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>0.1 mg/m³ (respirable dust) TWA [skin]</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>0.5 mg/m³ (respirable dust) TWA [skin]</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>0.1 mg/m³ (respirable dust) TWA, 0.5 mg/m³ (total dust) TWA</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>................................. .</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>0.1 mg/m³ (respirable dust) TWA</td>
</tr>
</tbody>
</table>

**Description of substance**

- **LEL** ......................................... .
- **Original (SCP) IDLH** .............
- **Basis for original (SCP) IDLH** ....

**Short-term exposure guidelines**

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respirable dust</td>
<td>G. pig Gage 1968</td>
<td>5.0</td>
<td>----</td>
<td>30 min</td>
<td>1.0 mg/m³ (1.0)</td>
<td>0.30 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Gage 1968</td>
<td>3.0</td>
<td>----</td>
<td>30 min</td>
<td>1.0 mg/m³ (1.0)</td>
<td>0.30 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gage 1968</td>
<td>1.5</td>
<td>----</td>
<td>6 hr</td>
<td>2.3 mg/m³ (2.3)</td>
<td>0.21 mg/m³</td>
</tr>
<tr>
<td>Nonrespirable dust</td>
<td>Palazzolo 1965</td>
<td>6.400</td>
<td>4 hr</td>
<td>12.800 mg/m³ (2.0)</td>
<td>1.280 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀</th>
<th>LD₉₅</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Bailey and White 1965</td>
<td>oral</td>
<td>57</td>
<td>----</td>
<td>399 mg/m³</td>
<td>40 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Barabas et al. 1981</td>
<td>oral</td>
<td>120</td>
<td>----</td>
<td>840 mg/m³</td>
<td>84 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Iyakuhin 1979</td>
<td>oral</td>
<td>25</td>
<td>----</td>
<td>175 mg/m³</td>
<td>25 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Murray and Gibson 1972</td>
<td>oral</td>
<td>22</td>
<td>----</td>
<td>154 mg/m³</td>
<td>25 mg/m³</td>
</tr>
</tbody>
</table>

**Human data**

- It has been stated that the high acute inhalation toxicity of paraquat is dependent wholly on the size of the particulate, with respirable sizes (i.e., <5 micrometer mass median diameter) found to be 5 to 6 times more toxic than nonrespirable dusts [McElligo 1965]. It has been reported that under paraquat spraying conditions particle sizes appear to be nonrespirable [Swan 1969].

**Revised IDLH: 1 mg/m³**

**Basis for revised IDLH:** The revised IDLH for paraquat is 1 mg/m³ based on the acute inhalation toxicity data for respirable particulate in animals [Gage 1968]. This is a conservative value if the occupational exposure is totally to nonrespirable size particles of paraquat since respirable aerosols are much more toxic [McElligo 1965; Swan 1969].

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Paraquat (continued)

REFERENCES:

4. Iyakuhin Kenkyu (Study of Medical Supplies) [1979]; 10:520-522 (in Japanese).
Parathion

CAS number .................................. 56-38-2
NIOSH REL .................................. 0.05 mg/m³ TWA [skin]
Current OSHA PEL ............................ 0.1 mg/m³ TWA [skin]
1969 OSHA PEL ............................. Same as current PEL
1993-1994 ACGIH TLV ....................... 0.1 mg/m³ TWA [skin]

Description of substance ............... Pale-yellow to dark-brown liquid with a garlic-like odor.

LEL .................................. 20 mg/m³

Original (SCP) IDLH .......................... No useful data on acute inhalation toxicity are available on which to base the IDLH for parathion. If the IDLH were estimated from the statement by AIHA [1971] that "the minimum lethal oral dose for humans has been estimated as ranging from less than 10 mg to 120 mg [Bidstrup 1950; Grob 1950; Hayes 1963]," then an IDLH of 5 mg/m³ would be chosen. This appears to be far too conservative, however, because ACGIH (1971) noted that workers regularly exposed to 2 to 15 mg/m³, with an average concentration of 8 mg/m³, exhibited only a 25% decrease in cholinesterase levels [Kay et al. 1952]. The chosen IDLH, therefore, has been estimated from the female rat oral LD₅₀ of 3 mg/kg cited by ACGIH [1971].

Short-term exposure guidelines .......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC [CF]</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Deichmann et al. 1952</td>
<td>50 mg/m³</td>
<td>80 mg/m³</td>
<td>2 hr</td>
<td>8.0 mg/m³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Deichmann et al. 1952</td>
<td>14 mg/m³</td>
<td>22 mg/m³</td>
<td>2 hr</td>
<td>2.2 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1981</td>
<td>15 mg/m³</td>
<td>168 mg/m³</td>
<td>4 hr</td>
<td>17 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>USAF 1977</td>
<td>84 mg/m³</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Etz et al. 1966</td>
<td>oral 5</td>
<td>35 mg/kg</td>
<td>3.5 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Kenaga and Morgan 1978</td>
<td>oral 10</td>
<td>70 mg/kg</td>
<td>7.0 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>Kenaga and Morgan 1978</td>
<td>oral 3</td>
<td>21 mg/kg</td>
<td>2.1 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Minlisea et al. 1961</td>
<td>oral 0.93</td>
<td>6.5 mg/kg</td>
<td>0.7 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horse</td>
<td>Perkow 1978</td>
<td>oral 5</td>
<td>35 mg/kg</td>
<td>3.5 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>von Dosek et al. 1958</td>
<td>oral 8</td>
<td>56 mg/kg</td>
<td>5.6 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Weiss and Orel 1967</td>
<td>oral 2</td>
<td>14 mg/kg</td>
<td>1.4 mg/kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Human data .................................. Workers regularly exposed to 2 to 15 mg/m³ (average of 8 mg/m³) exhibited only a 25% decrease in cholinesterase levels [CDC 1950]. The minimum lethal oral dose has been reported to range from 0.17 to 1.471 mg/kg [Arena 1970; CDC 1956; Hartley and Kidl 1986]. (Note: An oral dose ranging from 0.17 to 1.471 mg/kg is equivalent to a worker being exposed to about 8 to 69 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.)
Parathion (continued)

Revised IDLH: 10 mg/m³
Basis for revised IDLH: The revised IDLH for parathion is 10 mg/m³ based on chronic inhalation toxicity data in humans [CDC 1956]. This may be a conservative value due to the lack of relevant acute toxicity data in humans exposed to concentrations above 10 mg/m³.

REFERENCES:

11. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemical agents under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 52.
Pentaborane

CAS number ........................................... 19624-22-7
NIOSH REL ........................................... 0.005 ppm (0.01 mg/m³) TWA, 0.015 ppm (0.03 mg/m³) STEL
Current OSHA PEL ................................. 0.005 ppm (0.01 mg/m³) TWA
1989 OSHA PEL ............................... 0.005 ppm (0.01 mg/m³) TWA, 0.015 ppm (0.03 mg/m³) STEL
1993-1994 ACGIH TLV ......................... 0.005 ppm (0.013 mg/m³) TWA, 0.015 ppm (0.039 mg/m³) STEL

Description of substance ......................... Colorless liquid with a pungent odor like sour milk.

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Jacobson 1958</td>
<td>3</td>
<td>---</td>
<td>4 hr</td>
<td>6 ppm (2.0)</td>
<td>0.6 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Leviskas et al. 1958</td>
<td>6</td>
<td>----</td>
<td>4 hr</td>
<td>12 ppm (2.0)</td>
<td>2.2 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Leviskas et al. 1958</td>
<td>3.4</td>
<td>---</td>
<td>4 hr</td>
<td>6.4 ppm (2.0)</td>
<td>0.7 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Weeks et al. 1964</td>
<td>35</td>
<td>----</td>
<td>15 min</td>
<td>28 ppm (0.79)</td>
<td>2.6 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>Weeks et al. 1964</td>
<td>244</td>
<td>----</td>
<td>2 min</td>
<td>100 ppm (0.41)</td>
<td>1.0 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Weir et al. 1964</td>
<td>87</td>
<td>----</td>
<td>5 min</td>
<td>37 ppm (0.55)</td>
<td>3.7 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Weir et al. 1964</td>
<td>40</td>
<td>----</td>
<td>5 min</td>
<td>22 ppm (0.55)</td>
<td>2.2 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Weir et al. 1964</td>
<td>31</td>
<td>---</td>
<td>15 min</td>
<td>24 ppm (0.79)</td>
<td>2.6 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Weir et al. 1964</td>
<td>19</td>
<td>----</td>
<td>15 min</td>
<td>15 ppm (0.79)</td>
<td>1.5 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Weir et al. 1964</td>
<td>15</td>
<td>----</td>
<td>30 min</td>
<td>15 ppm (1.0)</td>
<td>1.5 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Weir et al. 1964</td>
<td>11</td>
<td>----</td>
<td>30 min</td>
<td>11 ppm (1.0)</td>
<td>1.2 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Weir et al. 1964</td>
<td>10</td>
<td>---</td>
<td>1 hr</td>
<td>13 ppm (1.25)</td>
<td>1.3 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Weir et al. 1964</td>
<td>6</td>
<td>----</td>
<td>1 hr</td>
<td>7.5 ppm (1.25)</td>
<td>0.8 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 1 ppm

References for revised IDLH: The revised IDLH for pentaborane is 1 ppm based on acute inhalation toxicity data in animals [Jacobson 1958; Leviskas et al. 1958; Weir et al. 1964].

REFERENCES:

### Pentachloronaphthalene

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
<td>1321-64-8</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>0.5 mg/m³ TWA [skin]</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>0.5 mg/m³ TWA [skin]</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>0.5 mg/m³ TWA [skin]</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Pale-yellow or white solid or powder with an aromatic odor.</td>
</tr>
<tr>
<td>LEL</td>
<td>Noncombustible Solid</td>
</tr>
<tr>
<td>Original (SCP) IDLH*</td>
<td>Unknown</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>AIHA [1970] reported that the atmospheric concentration immediately hazardous to life is probably unattainable for the chloronaphthalenes with the possible exception of monochloronaphthalene. For this draft technical standard, however, an analogy with other chloronaphthalenes was used and the respirators were selected on the basis of the assigned protection factor afforded by each device up to 10 x the OSHA PEL of 0.5 mg/m³ (i.e., 5 mg/m³); only the &quot;most protective&quot; respirators are permitted for use in concentrations exceeding 5 mg/m³.</td>
</tr>
</tbody>
</table>

#### Short-term exposure guidelines

None developed

#### ACUTE TOXICITY DATA

**Animal or human data**

None relevant for use in determining the revised IDLH.

---

**Revised IDLH: Unknown [Unchanged]**

**Basis for revised IDLH:** Due to a lack of relevant acute toxicity data, the IDLH for pentachloronaphthalene remains "Unknown." The "most protective" respirators will continue to be recommended for concentrations exceeding 5 mg/m³ based on being 10 times the NIOSH REL and OSHA PEL of 0.5 mg/m³ (10 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for pentachloronaphthalene).

#### Reference:


375
Pentachlorophenol

CAS number ........................................ 87-86-5
NIOSH REL ...........................................
Current OSHA PEL .................................. 0.5 mg/m³ TWA [skin]
1989 OSHA PEL ..................................... Same as current PEL
1993-1994 ACGIH TLV .................................. 0.5 mg/m³ TWA [skin]
Description of substance .......................... Colorless to white, crystalline solid with a benzene-like odor.
LEL ................................................ Noncombustible Solid
Original (SCP) IDLH ................................. 150 mg/m³
Basis for original (SCP) IDLH ...................... No useful data on acute inhalation toxicity are available on which to base the IDLH for pentachlorophenol. AIHA (1970) stated that the atmospheric concentration immediately hazardous to life is not known for humans, but painful irritation to the nose is observed at concentrations below those that would be immediately hazardous to life. The chosen IDLH, therefore, has been estimated from the smallest lethal intravenous dose in rabbits of 22 mg/kg [Kahoe et al. 1939 as cited by ACGIH 1971].

Short-term exposure guidelines .................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₅</th>
<th>LC₅₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>DeLienko 1969</td>
<td>355 mg/m³</td>
<td>-----</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Mouse</td>
<td>DeLienko 1969</td>
<td>225 mg/m³</td>
<td>-----</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₀ (mg/kg)</th>
<th>Adjusted LD (mg/kg)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Borzellec et al. 1985</td>
<td>oral</td>
<td>117</td>
<td>-----</td>
<td>419 mg/kg</td>
<td>82 mg/kg</td>
</tr>
<tr>
<td>Hamster</td>
<td>Cabral et al. 1979</td>
<td>oral</td>
<td>168</td>
<td>-----</td>
<td>1,176 mg/kg</td>
<td>218 mg/kg</td>
</tr>
<tr>
<td>Rat</td>
<td>Deichmann et al. 1942</td>
<td>oral</td>
<td>27</td>
<td>70</td>
<td>189 mg/kg</td>
<td>19 mg/kg</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Deichmann et al. 1942</td>
<td>oral</td>
<td>340</td>
<td>70</td>
<td>490 mg/kg</td>
<td>49 mg/kg</td>
</tr>
<tr>
<td>Rat</td>
<td>Fielder et al. 1982</td>
<td>oral</td>
<td>150</td>
<td>70</td>
<td>1,050 mg/kg</td>
<td>105 mg/kg</td>
</tr>
</tbody>
</table>

Human data ........................................ Datas are particularly irritating to the eyes and nose at concentrations greater than 1 mg/m³ but concentrations up to 2.4 mg/m³ have been tolerated by workers that have been conditioned [Clayton and Clayton 1981]. It has been reported that 401 mg/kg is the minimum lethal oral dose [Haley 1977].

[Note: An oral dose of 401 mg/kg is equivalent to a worker being exposed to about 1,900 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 2.5 mg/m³

Basis for revised IDLH: The revised IDLH for pentachlorophenol is 2.5 mg/m³ based on acute toxicity data in humans [Clayton and Clayton 1981]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 2.4 mg/m³.
Pentachlorophenol (continued)

REFERENCES:
n-Pentane

| CAS number | 105-66-0 |
| NIOSH REL | 1,000 ppm (2,350 mg/m³) TWA, 810 ppm (1,800 mg/m³) 15-minute CEILING |
| Current OSHA PEL | 120 ppm (350 mg/m³) TWA |
| 1989 OSHA PEL | 810 ppm (1,800 mg/m³) TWA, 750 ppm (2,250 mg/m³) STEL |
| 1993-1994 ACGIH TLV | 800 ppm (1,770 mg/m³) TWA, 750 ppm (2,210 mg/m³) STEL |
| Description of substance | Colorless liquid with a gasoline-like odor. |
| LEL | 1.5% (10% LEL, 1,500 ppm) |
| Original (SCP) IDLH | 10,000 ppm (LEL) |
| Basis for original (SCP) IDLH | Patty [1963] reported the following: n-pentane causes narcosis in 5 to 60 minutes at 90,000 to 120,000 ppm. Only a narrow margin exists between the concentrations that cause narcosis and death in mice. In human studies, a 10-minute exposure to 5,000 ppm did not cause mucous membrane irritation or other symptoms. The odor of n-pentane at this concentration is readily detectable [Fuhner 1921]. AIHA [1966] reported that the atmospheric concentration immediately hazardous to life is unknown for man, but that the lethal concentration for mice has been reported as 128,200 ppm for a 37-minute exposure [Spector 1956]. Because the data indicate that acute toxic effects occur above the lower explosive limit (LEL) of 15,000 ppm, the LEL has been chosen as the IDLH (i.e., the concentration above which only the “most protective” respirators are permitted). |
| Short-term exposure guidelines | None developed |

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>Flury and Zernik 1931</td>
<td>120,000 mg/m³</td>
<td>30 min</td>
<td>120,000 ppm (1.0)</td>
<td>12,000 ppm</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Spector 1956</td>
<td>126,000 ppm</td>
<td>37 min</td>
<td>126,000 ppm (1.07)</td>
<td>23,718 ppm</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Stoughton &amp; Lameon 1936</td>
<td>125,000 mg/m³</td>
<td>2 hr</td>
<td>125,000 ppm (1.6)</td>
<td>17,333 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data

It has been reported that narcosis occurs after 5 to 60 minutes of exposure to 90,000 to 120,000 ppm [Patty 1963]. A value of at least 5,000 ppm would have been appropriate for n-pentane. However, the revised IDLH for n-pentane is 1,500 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.5%).

Human data

Mucous membrane irritation or other symptoms were not noted after a 10-minute exposure of 5,000 ppm [Patty and Yant 1929].

REFERENCES:


378
2-Pentanone

CAS number .............................................. 107-87-9
NIOSH REL ..............................................
Current OSHA PEL ...................................... 150 ppm (530 mg/m³) TWA
1989 OSHA PEL ......................................... 200 ppm (700 mg/m³) TWA
1993-1994 ACGIH TLV ................................... 200 ppm (705 mg/m³) TWA, 250 ppm (881 mg/m³) STEL

Description of substance: Colorless to water-white liquid with a characteristic acetone-like odor.

LEL ...................................................... 1.5% (10% LEL, 1,500 ppm)
Original (SCP) IDLH ................................... 5,000 ppm
Base for original (SCP) IDLH ........................ The chosen IDLH is based on the statement by Patty [1963] that the maximum concentration that caused no serious disturbances in guinea pigs in 1 hour was 5,000 ppm [Yant et al. 1936]. None developed

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>LC₅₀: 2,000</td>
<td>-----</td>
<td>4 hr</td>
<td>4,000 ppm (2.0)</td>
<td>400 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>LC₉₅: 4,000</td>
<td>-----</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Yant et al. 1936</td>
<td>50,000</td>
<td>50 min</td>
<td>60,000 ppm (1.2)</td>
<td>6,000 ppm</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Yant et al. 1936</td>
<td>12,000</td>
<td>5 hr</td>
<td>27,950 ppm (2.15)</td>
<td>2,795 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Clayton and Clayton 1982</td>
<td>oral</td>
<td>1,600</td>
<td>1,600</td>
<td>1,128 ppm</td>
<td>313 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Clayton and Clayton 1982</td>
<td>oral</td>
<td>1,600</td>
<td>1,600</td>
<td>1,128 ppm</td>
<td>313 ppm</td>
</tr>
</tbody>
</table>

Human data .................................. Exposure to a concentration of 1,500 ppm was associated with complaints of ocular and upper respiratory irritation [Yant et al. 1936].

Revised IDLH: 1,500 ppm
Base for revised IDLH: The revised IDLH for 2-pentanone is 1,500 ppm based on acute inhalation toxicity data in humans [Yant et al. 1936]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 1,500 ppm. Also, this value is 10% of the lower explosive limit of 1.5%.

REFERENCES:


380
Perchloromethyl mercaptan

CAS number ........................................... 594-42-3
NIOSH REL ...........................................
Current OSHA PEL ....................................
1989 OSHA PEL ......................................
1993-1994 ACGIH TLV .............................
Description of substance ...........................
Pale-yellow, oily liquid with an unbearable, acrid odor.
LEL ....................................................
Noncombustible Liquid
Original (SCP) IDLH .................................
Basis for original (SCP) IDLH ......................
No useful data on acute inhalation toxicity are available on which to base the IDLH for perchloromethyl mercaptan. The original IDLH, therefore, has been based on an analogy with hydrogen sulfide. According to ACGIH, perchloromethyl mercaptan is about 20 times more toxic than hydrogen sulfide which has an IDLH of 300 ppm.

Short-term exposure guidelines ...................
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{50} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Althoff 1973</td>
<td>11</td>
<td>16</td>
<td>1 hr</td>
<td>1.4 ppm (1.25)</td>
<td>1.4 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Althoff 1973</td>
<td>16</td>
<td>9</td>
<td>3 hr</td>
<td>1.6 ppm (1.8)</td>
<td>1.6 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Flury and Zernik 1931</td>
<td>-----</td>
<td>388</td>
<td>10 min</td>
<td>26 ppm (0.69)</td>
<td>27 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>38</td>
<td>36 min</td>
<td>46</td>
<td>3.6 ppm (0.79)</td>
<td>3.6 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Marhold 1972</td>
<td>13</td>
<td>3 hr</td>
<td>6.1 ppm (1.6)</td>
<td>6.1 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Vernot et al. 1977</td>
<td>11</td>
<td>4 hr</td>
<td>1.4 ppm (1.25)</td>
<td>1.4 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{50} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Marhold 1972</td>
<td>oral</td>
<td>82.6</td>
<td>75 ppm</td>
<td>7.5 ppm</td>
<td>7.5 ppm</td>
</tr>
</tbody>
</table>

Other human data ..................................
It has been stated that perchloromethyl mercaptan is about one-sixth as toxic as phosgene [Prentiss 1937].

Revised IDLH: 10 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Flury and Zernik 1931], a value of about 26 ppm would have been appropriate for perchloromethyl mercaptan. However, the original IDLH for perchloromethyl mercaptan (10 ppm) is not being revised at this time based on an analogy to phosgene [Prentiss 1937] which has a revised IDLH of 2 ppm.

REFERENCES:
1. ACGIH [?].
Perchloryl fluoride

CAS number ........................................ 7618-94-6
NIOSH REL .............................................
Current OSHA PEL ......................................
1989 OSHA PEL ........................................
1993-1994 ACGIH TLV ..............................
Description of substance ............................
LEL .....................................................
Original (SCP) IDLH .................................. 385 ppm
Basis for original (SCP) IDLH ........................
The chosen IDLH is based on the rat 4-hour LC50 of 385 ppm
[Greene et al. 1960 cited by ACGIH 1971].
None developed

Short-term exposure guidelines .................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Dost et al. 1974</td>
<td>2,000</td>
<td>800</td>
<td>30 min</td>
<td>2,200 ppm (1.1)</td>
<td>222 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Greene et al. 1960</td>
<td>295</td>
<td>175</td>
<td>4 hr</td>
<td>770 ppm (2.0)</td>
<td>77 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Greene et al. 1960</td>
<td>630</td>
<td>320</td>
<td>4 hr</td>
<td>1,260 ppm (2.0)</td>
<td>126 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Jacobson 1958</td>
<td>450</td>
<td>225</td>
<td>4 hr</td>
<td>902 ppm (2.0)</td>
<td>90 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 100 ppm
Basis for revised IDLH: The revised IDLH for perchloryl fluoride is 100 ppm based on acute inhalation toxicity data in animals [Greene et al. 1960; Jacobson 1958].

REFERENCES:

Petroleum distillates (naphtha)

CAS number .................................................. 8002-05-9
NIOSH REL .................................................. 350 mg/m³ TWA, 1,800 mg/m³ 15-minute CEILING
Current OSHA PEL ........................................ 500 ppm (2,000 mg/m³) TWA
1989 OSHA PEL ........................................... 400 ppm (1,600 mg/m³) TWA
1993-1994 ACGIH TLV .................................... 400 ppm (1,590 mg/m³) TWA

Description of substance ................................ Colorless liquid with a gasoline- or kerosene-like odor.

LEL .......................................................... 1.1% (10% LEL, 1,100 ppm)

Basis for original (SCP) IDLH ................................ 10,000 ppm

The chosen IDLH is based on the statement by AIHA [1963] that the atmospheric concentrations immediately hazardous to life are from 10,000 to 20,000 ppm [Henderson and Haggard 1943]. In addition, the short exposure tolerance to petroleum naphtha is based on a statement by AIHA [1963] that 4,000 to 7,000 ppm may be tolerated for 1 hour [Henderson and Haggard 1943], but not without development of definite symptoms of narcosis [Drinker et al. 1943].

None developed

Short-term exposure guidelines

None relevant for use in determining the revised IDLH.

ACUTE TOXICITY DATA

Animal data .................................................. None relevant for use in determining the revised IDLH.
Human data .................................................. It has been reported that concentrations of 10,000 to 20,000 ppm are immediately dangerous to health [Henderson and Haggard 1943]. It has also been stated that concentrations of 4,000 to 7,000 ppm could be tolerated for 1 hour, but not without definite symptoms of narcosis [Drinker et al. 1943].

Revised IDLH: 1,100 ppm [LEL]

Based for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Drinker et al. 1943; Henderson and Haggard 1943], a value of about 4,000 ppm would have been appropriate for petroleum distillates (naphtha). However, the revised IDLH for petroleum distillates (naphtha) is 1,100 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 1.1%).

REFERENCES:

Phenol

CAS number ........................................... 108-95-2
NIOSH REL .................................................. 3 ppm (19 mg/m³) TWA, 15.6 ppm (68 mg/m³) 15-minute CEILING [skin]
Current OSHA PEL ............................................. 15.6 ppm (68 mg/m³) 15-minute CEILING [skin]
1983-1994 ACGIH TLV ............................................. 5 ppm (18 mg/m³) TWA [skin]
Description of substance .................................. Colorless to light-pink, crystalline solid with a sweet, acrid odor.
LEL .................................................................. 1.8% (10% LEL, 1,800 ppm)
Original (SCP) IDLH .............................................. 250 ppm
Basis for original (SCP) IDLH ................................. The chosen IDLH is based on an analogy with cresol which has an IDLH of 250 ppm.
ACUTE TOXICITY DATA
Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Gig Tr Prof Iabol 1955</td>
<td>19</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Rat</td>
<td>Nagovnyi 1976</td>
<td>81</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Mouse</td>
<td>Nagovnyi 1976</td>
<td>49</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₃₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Brown and Lamson 1935</td>
<td>oral</td>
<td>317</td>
<td>-----</td>
<td>568 ppm</td>
<td>57 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Delichmann and Winterup 1944</td>
<td>oral</td>
<td>620</td>
<td>-----</td>
<td>752 ppm</td>
<td>75 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>-----</td>
<td>500</td>
<td>895 ppm</td>
<td>90 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>-----</td>
<td>80</td>
<td>143 ppm</td>
<td>14 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Koro1ev et al. 1973</td>
<td>oral</td>
<td>270</td>
<td>-----</td>
<td>483 ppm</td>
<td>48 ppm</td>
</tr>
</tbody>
</table>

Other animal data .............................................. RD₅₀ (mouse), 166 ppm [DeCeauriz et al. 1981]. In rats, an exposure of 312 ppm for 1 hour only resulted in lacrimation and eye and nasal irritation; a slight loss of coordination was reported within 4 hours of exposure to 230 ppm [Flickinger 1976].

Human data ......................................................... It has been stated that the toxicity of phenol is closely related to that of cresol [ACGIH 1991]. It has been reported that 14 to 140 mg/kg is the lethal oral dose [Delichmann and Gerarde 1969; Lefaux 1978]. [Note: An oral dose of 14 to 140 mg/kg is equivalent to a 70-kg worker being exposed to 167 to 1,670 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 250 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in animals [Flickinger 1976] and an analogy to cresol [ACGIH 1991] which has a revised IDLH of 250 ppm, the original IDLH for phenol of 250 ppm is not being revised at this time.
REFERENCES:

# p-Phenylene diamine

**CAS number** ................................................. 106-50-3
**NIOSH REL** .................................................. 0.1 mg/m³ TWA [skin]
**Current OSHA PEL** ........................................... 0.1 mg/m³ TWA [skin]
**1993 OSHA PEL** ............................................... Same as current PEL
**1993-1994 ACGIH TLV** ....................................... 0.1 mg/m³ TWA

**Description of substance** ...................................... White to slightly red, crystalline solid.

**Original (SCP) IDLH** ......................................... Unknown [Note: "Effective" IDLH = 25 mg/m³, see discussion below.]

**Basis for original (SCP) IDLH** ................................. ACGIH [1971] reported that the TLV for this is intended to be sufficiently low to minimize the number of persons becoming sensitized, but the limit is not low enough to prevent exacerbation of asthma in those already sensitized to p-phenylene diamine. Because sensitization cannot be endangered by concentrations far below the current PEL, it cannot be used to set an IDLH. Therefore, in the absence of other toxicological data and noting that Patty et al. [1989] found systemic poisoning from industrial exposure to this compound [Reichel 1934], for this draft technical report, the respirators have been selected on the basis of the aspiration factor afforded by each device up to the stable concentration at 20°C (approximately 29.1 mg/m³) reported to 25 mg/m³, only the "most protective" respirators should be used for ambient concentrations exceeding 25 mg/m³.

**Short-term exposure guidelines** ............................ None developed

## ACUTE TOXICITY DATA

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Burnett et al. 1977</td>
<td>oral</td>
<td>80</td>
<td>------</td>
<td>550 mg/m³</td>
<td>55 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Hanzlik 1923</td>
<td>oral</td>
<td>------</td>
<td>250</td>
<td>1,750 mg/m³</td>
<td>175 mg/m³</td>
</tr>
<tr>
<td>Cat</td>
<td>Hanzlik 1923</td>
<td>oral</td>
<td>------</td>
<td>100</td>
<td>700 mg/m³</td>
<td>70 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Lloyd et al. 1977</td>
<td>oral</td>
<td>98</td>
<td>------</td>
<td>610 mg/m³</td>
<td>61 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Sheftel 1988</td>
<td>oral</td>
<td>145</td>
<td>------</td>
<td>1,015 mg/m³</td>
<td>101 mg/m³</td>
</tr>
</tbody>
</table>

**Human data** ................................................ None relevant for use in determining the revised IDLH.

**Revised IDLH:** 25 mg/m³

**Basis for revised IDLH:** No inhalation toxicity data are available on which to base an IDLH for p-phenylene diamine. Therefore, based on health considerations and acute oral toxicity data in animals [Burnett et al. 1977; Hanzlik 1923; Lloyd et al. 1977], a value of about 50 mg/m³ would have been appropriate. However, the revised IDLH for p-phenylene diamine is 25 mg/m³ based on the concentration recommended originally in the Standards Completion Program for deciding when the "most protective" respirators should be used. Because sensitized workers may be affected by concentrations far below occupational exposure limits, exacerbation of asthma cannot be used to set an IDLH.

**REFERENCES:**

p-Phenylene diamine (continued)


Phenyl ether (vapor)

CAS number ........................................ 101-84-8
NIOSH REL ........................................ 1 ppm (7 mg/m³) TWA
Current OSHA PEL ................................ 1 ppm (7 mg/m³) TWA
1989 OSHA PEL .................................... Same as current PEL
1993-1994 ACGIH TLV .............................. 1 ppm (7 mg/m³) TWA, 2 ppm (14 mg/m³) STEL
Description of substance ............................. Colorless, crystalline solid or liquid (above 82°F) with a geranium-like odor.
LEL ................................................... 0.7% (10% LEL, 700 ppm)
Original (SCP) IDLH* .................................. No Evidence [Note: "Effective" IDLH = 100 ppm — see discussion below.]
Basis for original (SCP) IDLH .......................... No evidence of an IDLH for phenyl ether exists in the available toxicological data. Patty [1963] reported that phenyl ether’s vapors do not present a toxicological problem, but may be a nuisance because of its disagreeableness. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 100 x the OSHA PEL of 1 ppm (i.e., 100 ppm); only the "most protective" respirators are permitted for use in concentrations exceeding 100 ppm. High concentrations of the vapor are unlikely to be encountered in the workplace because of its high boiling point and low vapor pressure.

Short-term exposure guidelines ............................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Opdyke 1974</td>
<td>oral</td>
<td>3.370</td>
<td>---</td>
<td>3.377 ppm</td>
<td>334 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Vogel et al. 1964</td>
<td>oral</td>
<td>4.000</td>
<td>---</td>
<td>3.960 ppm</td>
<td>396 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Vogel et al. 1964</td>
<td>oral</td>
<td>4.000</td>
<td>---</td>
<td>3.960 ppm</td>
<td>396 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................................... Rats exposed to 20 ppm for 7 hours per day for 20 days exhibited only eye and nasal irritation [Hefner et al. 1975]. It has been reported that industrial experience has shown no evidence that phenyl ether, either as a liquid, mist, or vapor, is a health hazard under ordinary conditions of production and use; no overt systemic toxicity was found at concentrations that were not intolerably disagreeable [Clayton and Clayton 1981].

Human data .................................................................

Revised IDLH: 100 ppm
Basis for revised IDLH: Based on acute oral toxicity data in animals [Opdyke 1974; Vogel et al. 1964], a value of about 350 ppm would have been appropriate for phenyl ether vapor. However, the revised IDLH for phenyl ether vapor is 100 ppm based on being 100 times the NIOSH REL or OSHA PEL (100 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for phenyl ether vapor).

REFERENCES:

Phenyl ether-biphenyl mixture (vapor)

CAS number ........................................ 6004-13-5
NIOSH REL ........................................... 1 ppm (7 mg/m³) TWA
Current OSHA PEL .................................... 1 ppm (7 mg/m³) TWA
1989 OSHA PEL ...................................... Same as current PEL
1993-1994 ACGIH TLV ................................ Not specifically listed
Description of substance .............................. Colorless to straw-colored liquid or solid (below 54°F) with a disagreeable, aromatic odor.
LEL ..................................................... Unknown
Original (SCP) IDLH* .................................. No Evidence [Note: "Effective" IDLH = 100 ppm — see discussion below.]
Basis for original (SCP) IDLH* ...................... Patty [1963] reported that concentrations of the vapor of a phenyl ether-biphenyl mixture that are sufficiently high to cause toxic effects from a single exposure of up to 7 hours duration are not attainable [Dow]. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 100 x the OSHA PEL of 1 ppm (i.e., 100 ppm); only the "most protective" respirators are permitted for use in concentrations exceeding 100 ppm. High concentrations of the vapor are not likely to be encountered in the workplace because of the high boiling point and low vapor pressure of this material.

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>Gig Tr Prof Zabol 1967</td>
<td>oral</td>
<td>3.210</td>
<td>-----</td>
<td>3.178 ppm</td>
<td>318 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>4.200</td>
<td>-----</td>
<td>4.158 ppm</td>
<td>416 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>3.000</td>
<td>-----</td>
<td>2.970 ppm</td>
<td>297 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Marhold 1986</td>
<td>oral</td>
<td>2.460</td>
<td>-----</td>
<td>2.436 ppm</td>
<td>243 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ Concentrations ranging from 7 to 10 ppm have caused burning of the eyes, irritation of the respiratory tract, and severe nausea [ILO 1971].

Revised IDLH: 10 ppm

Basis for revised IDLH: The revised IDLH for a phenyl ether-biphenyl vapor mixture is 10 ppm based on acute inhalation toxicity data in humans [ILO 1971]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 10 ppm.

REFERENCES:

2. Gig Tr Prof Zabol [1967]: 13(4):42-44 (in Russian)
Phenyl glycidyl ether

CAS number ........................................ 122-80-1
NIOSH REL ........................................ 1 ppm (6 mg/m³) 15-minute CEILING; NIOSH considers phenyl glycidyl ether to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].
Current OSHA PEL ............................. 10 ppm (60 mg/m³) TWA
1993-1994 ACGIH TLV ......................... 1 ppm (6.7 mg/m³) TWA
Description of substance ...................... Colorless liquid.
LEL ................................................. Unknown
Original (SCP) IDLH* .......................... Unknown [Note: "Effective" IDLH = 500 ppm — see discussion below.]
Basis for original (SCP) IDLH .................. ACGIH (1971) reported that 10 rats exposed to 100 ppm phenyl glycidyl ether 7 hours/day for 50 days exhibited no immediately obvious signs of toxicity, and no deaths occurred [Hine et al. 1956]. The IDLH is unknown, but for this draft technical standard, I've chosen the OSHA PEL of 10 ppm (i.e., 500 ppm) has been chosen as the concentration above which only the "most protective" respirators are permitted. Because of the high boiling point and low vapor pressure of phenyl glycidyl ether, high concentrations are not likely to be encountered in the industrial environment.
Short-term exposure guidelines .............. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Hine et al. 1956</td>
<td>&gt;100</td>
<td>-----</td>
<td>6 hr</td>
<td>250 ppm (2.5)</td>
<td>&lt;20 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Hine et al. 1956</td>
<td>&gt;100</td>
<td>-----</td>
<td>4 hr</td>
<td>200 ppm (2.0)</td>
<td>&lt;20 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>&gt;200</td>
<td>-----</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Hine et al. 1956</td>
<td>oral</td>
<td>3.350</td>
<td>4.319 ppm</td>
<td>432 ppm</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Hine et al. 1956</td>
<td>oral</td>
<td>1.600</td>
<td>1.571 ppm</td>
<td>157 ppm</td>
<td></td>
</tr>
<tr>
<td>Mammal</td>
<td>Smyth et al. 1954</td>
<td>oral</td>
<td>4.240</td>
<td>4.719 ppm</td>
<td>478 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ......................... In a chronic study, rats exposed to 100 ppm for 7 hours/day for 50 days exhibited no immediately obvious signs of toxicity, and no deaths occurred [Hine et al. 1956].

Human data ...................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for phenyl glycidyl ether is 100 ppm based on chronic inhalation toxicity data in animals [Hine et al. 1956]. This may be a conservative value due to the lack of relevant human inhalation toxicity data for workers. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for phenyl glycidyl ether at concentrations above 1 ppm.]

REFERENCES:

390
Phenylhydrazine

CAS number ........................................... 100-63-0
NIOSH REL ........................................... 0.14 ppm (0.6 mg/m³) 2-hr CEILING [skin]. NIOSH considers phenylhydrazine to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1990).

Current OSHA PEL ................................... 5 ppm (22 mg/m³) TWA [skin]
1989 OSHA PEL ....................................... 5 ppm (20 mg/m³) TWA, 10 ppm (45 mg/m³) STEL [skin]
1993-1994 ACGIH TLV ............................... 0.1 ppm (0.44 mg/m³) TWA [skin], A2

Description of substance ............................ Colorless to pale-yellow liquid or solid (below 67°F) with a faint, aromatic odor.

LEL ....................................................... Unknown
Original (SCP) IDLH* ................................ 295 ppm [*Note: "Effective" IDLH = 250 ppm – see discussion below.]
Basis for original (SCP) IDLH ....................... No data on acute or chronic inhalation toxicity are available on which to base the IDLH. Systemic effects described by Patty [1963] were caused by chronic exposures from oral dosing. NIOSH [1978] cited a rat oral LD₅₀ of 188 mg/kg [Ekshtat 1965] which provides a calculated estimate of 1,300 mg/m³ (295 ppm) for the IDLH. Because of the assigned protection factor afforded by each device, however, 50 x the OSHA PEL of 5 ppm (i.e., 250 ppm) is the concentration above which only the "most protective" respirators are permitted.

Short-term exposure guidelines ..................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Ekshtat 1965</td>
<td>oral</td>
<td>188</td>
<td>----</td>
<td>391 ppm</td>
<td>29 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Ekshtat 1965</td>
<td>oral</td>
<td>Unknown</td>
<td>174</td>
<td>371 ppm</td>
<td>27 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Ekshtat 1965</td>
<td>oral</td>
<td>80</td>
<td>----</td>
<td>125 ppm</td>
<td>13 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Ekshtat 1965</td>
<td>oral</td>
<td>80</td>
<td>----</td>
<td>125 ppm</td>
<td>13 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Ekshtat 1965</td>
<td>oral</td>
<td>200-250</td>
<td>----</td>
<td>312-390 ppm</td>
<td>33-39 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 15 ppm
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for phenylhydrazine. Therefore, the revised IDLH for phenylhydrazine is 15 ppm based on acute oral toxicity data in animals [Ekshtat 1965]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for phenylhydrazine at concentrations above 0.14 ppm.]

REFERENCES:

Phosdrin

CAS number ........................................ 7796-34-7
NIOSH REL .................................................................
Current OSHA PEL .................................................... 0.1 mg/m³ TWA (skin)
1989 OSHA PEL .................................................... 0.1 ppm (0.3 mg/m³) STEL (skin)
1993-1994 ACGIH TLV ....................................................
0.01 ppm (0.52 mg/m³) TWA,
0.03 ppm (0.27 mg/m³) STEL (skin)

Description of substance ........................................
Pale-yellow to orange liquid with a weak odor.

LEL .................................................................
Unknown

Original (SCP) IDLH .................................................... 4 ppm

Basis for original (SCP) IDLH .................................................
No useful data on acute inhalation toxicity are available on which to base the IDLH for Phosdrin. The chosen IDLH has been estimated from the male rat oral LD₅₀ of 6 to 7 mg/kg [Shell 1956 cited by ACGIH 1971]. [Note: A concentration of 4 ppm phosdrin is equivalent to about 40 mg/m³.]

Short-term exposure guidelines .................................
None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kodama et al. 1956</td>
<td>14</td>
<td>———</td>
<td>1 hr</td>
<td>10 ppm (2.35)</td>
<td>1.8 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kenaga 1979</td>
<td>oral</td>
<td>3</td>
<td>———</td>
<td>2.3 ppm</td>
<td>0.2 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Kodama et al. 1954</td>
<td>oral</td>
<td>4</td>
<td>———</td>
<td>3.0 ppm</td>
<td>0.3 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Shell 1956</td>
<td>oral</td>
<td>6-7</td>
<td>———</td>
<td>4.5-5.3 ppm</td>
<td>0.5 ppm</td>
</tr>
</tbody>
</table>

Human data .................................................................
A dose of 2.5 mg/day for 27 days caused a 25% decrease in red blood cell cholinesterase [Rider et al. 1975]. [Note: An oral dose of 2.5 mg/day for 27 days is equivalent to a worker being exposed to about 5 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 4 ppm [Unchanged]
Basis for revised IDLH: Based on acute toxicity data in humans [Rider et al. 1975], the original IDLH for phosdrin (4 ppm) is not being revised at this time.

REFERENCES:

Phosgene

CAS number ........................................ 75-44-5
NIOSH REL ..............................................
Current OSHA PEL .....................................
1989 OSHA PEL ........................................
1993-1994 ACGIH TLV .................................

Description of substance ..............................
LEL ......................................................
Original (SCP) IDLH .................................

Basis for original (SCP) IDLH .........................
The chosen IDLH is based on the statement by Jacobs [1967] that 1 part in 200,000 (5 ppm) is probably lethal for exposures of 30 minutes. Gross et al. [1965] indicated that concentrations as low as 0.5 ppm for 2 hours caused definite pathological changes in the lungs of rats sacrificed 86 hours post exposure; the investigators believed some abnormalities were present 3 months after rats had been exposed at 2 ppm for 80 minutes. An IDLH of 2 ppm is used for phosgene to prevent irreversible adverse health effects.

Existing short-term exposure guidelines ..............

1-hour EEGL: 0.2 ppm
24-hour EEGL: 0.02 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>(LC_{50}) (ppm)</th>
<th>(LC_{50}) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Diller 1978</td>
<td>500</td>
<td>-----</td>
<td>1 min</td>
<td>160 ppm (0.32)</td>
<td>16 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Diller 1978</td>
<td>-----</td>
<td>3</td>
<td>2.83 hr</td>
<td>5.3 ppm (0.76)</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Flury 1926</td>
<td>-----</td>
<td>30</td>
<td>17 min</td>
<td>25 ppm (0.82)</td>
<td>2.5 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Izmerov et al. 1982</td>
<td>-----</td>
<td>50</td>
<td>5 min</td>
<td>28 ppm (0.55)</td>
<td>2.8 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Izmerov et al. 1982</td>
<td>-----</td>
<td>80</td>
<td>30 min</td>
<td>88 ppm (1.0)</td>
<td>8.8 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>NORD 1946</td>
<td>340</td>
<td>-----</td>
<td>30 min</td>
<td>340 ppm (1.0)</td>
<td>34 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>NORD 1946</td>
<td>438</td>
<td>-----</td>
<td>30 min</td>
<td>438 ppm (1.0)</td>
<td>44 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>NORD 1946</td>
<td>243</td>
<td>-----</td>
<td>30 min</td>
<td>243 ppm (1.0)</td>
<td>24 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>NORD 1946</td>
<td>216</td>
<td>-----</td>
<td>30 min</td>
<td>216 ppm (1.0)</td>
<td>32 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>NORD 1946</td>
<td>1,022</td>
<td>-----</td>
<td>20 min</td>
<td>1,022 ppm (0.94)</td>
<td>98 ppm</td>
</tr>
<tr>
<td>Monkey</td>
<td>NORD 1946</td>
<td>145</td>
<td>-----</td>
<td>1 min</td>
<td>44 ppm (0.32)</td>
<td>4.6 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1933</td>
<td>-----</td>
<td>50</td>
<td>5 min</td>
<td>28 ppm (0.55)</td>
<td>2.8 ppm</td>
</tr>
<tr>
<td>Mammal</td>
<td>Tab Biol Per 1933</td>
<td>-----</td>
<td>2.7</td>
<td>30 min</td>
<td>2.7 ppm (1.0)</td>
<td>0.3 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................
It has been reported that concentrations as low as 0.5 ppm for 2 hours caused definite pathological changes in the lungs of rats sacrificed 86 hours post exposure; the investigators believed some abnormalities were present 3 months after the rats had been exposed at 2 ppm for 80 minutes [Gross et al., 1965]. It has been calculated that based on acute toxicity data in humans, the lethal dose for a 30-minute exposure would be about 17 ppm [Diller 1978]. It has been stated that 25 ppm for 30 to 60 minutes is dangerous and brief exposure to 50 ppm may be rapidly fatal [Henderson and Haggard 1943]. It has also been stated that 5 ppm is probably lethal for a 30-minute exposure [Jacobs 1967].

Other human data ........................................

393
Revised IDLH: 2 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Diller 1978; Jacobs 1967], the original IDLH for phosgene (2 ppm) is not being revised at this time.

REFERENCES:

9. Tab BioI Per (1933); 3:231 (in German).
Phosphine

CAS number .................................................. 7803-51-2
NIOSH REL .................................................. 0.3 ppm (0.4 mg/m³) TWA, 1 ppm (1 mg/m³) STEL
Current OSHA PEL ........................................... 0.3 ppm (0.4 mg/m³) TWA
1988 OSHA PEL .................................................. 0.3 ppm (0.4 mg/m³) TWA
1993-1994 ACGIH TLV ......................................... 0.3 ppm (0.42 mg/m³) TWA, 1 ppm (1.4 mg/m³) STEL

Description of substance .................................... Colorless gas with a fish- or garlic-like odor.

LEL .......................................................... 1.79% (10% LEL, 1,790 ppm)
Original (SCP) IDLH ........................................ 200 ppm

Basis for original (SCP) IDLH ................................ The chosen IDLH is based on the statement by Patty [1963] that 290 to 430 ppm is dangerous to life after 1 hour, and 100 to 200 ppm is the maximum amount for 0.5 to 1 hour [Henderson and Haggard 1943].

Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Flury 1928</td>
<td>-</td>
<td>1,500</td>
<td>5 min</td>
<td>550 ppm (0.55)</td>
<td>55 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1992</td>
<td>270</td>
<td>-</td>
<td>2 hr</td>
<td>431 ppm (1.4)</td>
<td>43 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Izmerov et al. 1992</td>
<td>-</td>
<td>100</td>
<td>4 hr</td>
<td>200 ppm (2.0)</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Izmerov et al. 1992</td>
<td>30</td>
<td>-</td>
<td>2 hr</td>
<td>80 ppm (1.6)</td>
<td>8.0 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Schulz 1890</td>
<td>2,500</td>
<td>-</td>
<td>20 min</td>
<td>2,400 ppm (0.96)</td>
<td>240 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1933</td>
<td>-</td>
<td>1,000</td>
<td>5 min</td>
<td>550 ppm (0.55)</td>
<td>55 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Marias and Brown 1975</td>
<td>11</td>
<td>-</td>
<td>4 hr</td>
<td>22 ppm (2.0)</td>
<td>2.2 ppm</td>
</tr>
</tbody>
</table>

Other human data ............................................. Symptoms such as diarrhea, nausea and vomiting, tightness of the chest, cough, headache, and dizziness have been reported in workers exposed intermittently to concentrations up to 35 ppm [Jones et al. 1964]. It has been stated that 290 to 430 ppm is dangerous to life after 1 hour, and 100 to 200 ppm is the maximum amount for 0.5 to 1 hour [Henderson and Haggard 1943].

Revised IDLH: 50 ppm

Basis for revised IDLH: The revised IDLH for phosphine is 50 ppm based on acute inhalation toxicity data in humans [Jones et al. 1964; Tab Biol Per 1933]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 35 ppm.

REFERENCES:

7. Tab Biol Per [1933], 3:231 (in German).
Phosphoric acid

CAS number ...................................... 7664-38-2
NIOSH REL ......................................
Current OSHA PEL ................................
1989 OSHA PEL ................................
1993-1994 ACGIH TLV .....................
Description of substance ...................... Thick, colorless, odorless, crystalline solid.
LEL ............................................... Noncombustible Solid
Original (SCP) IDLH* ......................... 10,000 mg/m³ [Note: "Effective" IDLH = 2,000 mg/m³ — see discussion below.]

According to MCA [1958], phosphoric acid does not cause any systemic effect, and the chance of pulmonary edema from mist or spray inhalation is very remote. The rat oral LD₅₀ of 1,530 mg/kg [Biofax 1970] cited by NIOSH provides a calculated IDLH of about 10,000 mg/m³. However, for this draft technical standard, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL (i.e., 2,000 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 2,000 mg/m³.

Short-term exposure guidelines .................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀  (mg/kg)</th>
<th>LD₉₀  (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Biofax 1970</td>
<td>oral</td>
<td>1.530</td>
<td>——</td>
<td>10,710 mg/m³</td>
<td>1.071 mg/m³</td>
</tr>
</tbody>
</table>

Human data .................................................. It has been stated that phosphoric acid does not cause any systemic effect and that the chance of pulmonary edema from mist or spray inhalation is very remote [MCA 1958].

Revised IDLH: 1,000 mg/m³

Baseline for revised IDLH: The revised IDLH for phosphoric acid is 1,000 mg/m³ based on acute oral toxicity data in animals [Biofax 1970]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

Phosphorus (yellow)

CAS number ........................................ 7723-14-0
NIOSH REL ...........................................
Current OSHA PEL .................................... 0.1 mg/m³ TWA
1989 OSHA PEL ...................................... Same as current PEL
1993-1994 ACGIH TLV ............................ 0.02 ppm (0.1 mg/m³) TWA
Description of substance ..................... White to yellow, soft, waxy solid with acrid fumes in air.
LEL .................................................. Unknown
Original (SCP) IDLH* ............................... No Evidence [*Note: "Effective" IDLH = 200 mg/m³ -- see discussion below.]
Basis for original (SCP) IDLH ................. There is no evidence of an IDLH because, as ACGIH [1971] stated, acute effects rarely result from inhalation of phosphorus vapor. ACGIH [1971] also reported that rabbits survived daily 30-minute exposures to 150 to 160 mg/m³ [Maruo 1955]. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 0.1 mg/m³ (i.e., 200 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 200 mg/m³.

Short-term exposure guidelines ............ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Cheng-Chun et al. 1975</td>
<td>oral</td>
<td>3.03</td>
<td>-----</td>
<td>31 mg/m³</td>
<td>2.1 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Cheng-Chun et al. 1975</td>
<td>oral</td>
<td>6.82</td>
<td>-----</td>
<td>34 mg/m³</td>
<td>3.4 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Yakkyoku 1977</td>
<td>oral</td>
<td>10</td>
<td>10</td>
<td>70 mg/m³</td>
<td>7.0 mg/m³</td>
</tr>
<tr>
<td>Cat</td>
<td>Yakkyoku 1977</td>
<td>oral</td>
<td>4</td>
<td>4</td>
<td>28 mg/m³</td>
<td>4.0 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data ................................ It has been reported that rabbits have survived daily 30-minute exposures to 150 to 160 mg/m³ [Maruo 1955].

Human data ........................................ Death has reportedly resulted from a single dose of 1 mg/kg [Smyth 1956]. Severe toxic symptoms have been reported following a single oral dose of 15 mg [Sollmann 1943]. However, survival of ingestion up to 1.5 grams has also been reported [Diaz-Rivers et al. 1950; Newburger et al. 1948]. [Note: An oral dose of 15 mg is equivalent to a 70-kg worker being exposed to 10 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 5 mg/m³

Basis for revised IDLH: The revised IDLH for phosphorus (yellow) is 5 mg/m³ based on acute oral toxicity data in humans [Sollmann 1943] and animals [Cheng-Chun et al. 1975; Yakkyoku 1977].

REFERENCES:

Phosphorus (yellow) (continued)

**Phosphorus pentachloride**

**CAS number** ......................................... 10025-13-8
**NIOSH REL** .................................. 1 mg/m³ TWA
**Current OSHA PEL** .................................. Same as current PEL
**1989 OSHA PEL** .................................. 0.05 mg/m³ (0.1 ppm) TWA
**1983-1984 ACGIH TLV** .............................. White to pale-yellow, crystalline solid with a pungent, unpleasant odor.
**LEL** ............................................. Noncombustible Solid
**Original (SCP) IDLH** .................................. 200 mg/m³
**Basis for original (SCP) IDLH** ......................... The chosen IDLH is based on an analogy with phosphorus trichloride (PCl₃) and statements by Henderson and Haggard (1943) that 2 to 4 ppm PCl₃ is the maximum concentration allowable for short exposures (0.5 to 1 hour) and 50 to 90 ppm is dangerous for short exposures. Therefore, 200 mg/m³ (24 ppm) is chosen as the IDLH for phosphorus pentachloride.

**Short-term exposure guidelines** ....................... None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀</th>
<th>LC₅₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Henderson and Haggard 1943</td>
<td>1,020 mg/m³</td>
<td>704 mg/m³</td>
<td>10 min</td>
<td>704 mg/m³ (1.45)</td>
<td>70 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Molodkina 1973</td>
<td>205 mg/m³</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Molodkina 1973</td>
<td>oral</td>
<td>660</td>
<td>?</td>
<td>462 mg/kg</td>
<td>462 mg/kg</td>
</tr>
</tbody>
</table>

**Other data** .............................................. The vapors of phosphorus pentachloride decompose in the presence of moisture with the subsequent liberation of hydrochloric and phosphoric acids [Henderson and Haggard 1943].

**Human data** ............................................. None relevant for use in determining the revised IDLH.

**Revised IDLH:** 70 mg/m³

**Basis for revised IDLH:** The revised IDLH for phosphorus pentachloride is 70 mg/m³ based on acute inhalation toxicity data in animals [Henderson and Haggard 1943]. This may be a conservative value due to the lack of relevant acute toxicity data for workers. However, an IDLH of 70 mg/m³ for phosphorus pentachloride (PCl₃) is roughly equivalent on a "chlorine basis" to the revised IDLH of 50 ppm (i.e., 75 mg/m³) for hydrogen chloride (HCl) which may be appropriate since PCl₃ decomposes in the presence of moisture to HCl [Henderson and Haggard 1943].

**REFERENCES:**

Phosphorus pentasulfide

CAS number ........................................... 1314-80-3
NIOSH REL .................................................. “
Current OSHA PEL ................................. 1 mg/m³ TWA
1989 OSHA PEL .......................................... 1 mg/m³ TWA
1993-1994 ACGIH TLV .......................... 1 mg/m³ TWA
Description of substance ........................... Greenish-gray to yellow, crystalline solid with an odor of rotten eggs.

LEL ..............................................................
Original (SCP) IDLH ............................... 750 mg/m³
Basis for original (SCP) IDLH ................ No data on acute inhalation toxicity are available on which to base the IDLH for phosphorus pentasulfide (P₂S₅). MCA [1958] reported that P₂S₅ is a compound which by itself possesses little toxicity; P₂S₅, however, hydrolyses rapidly on contact with water or even with moisture present in the atmosphere to cause the liberation of hydrogen sulfide (H₂S) gas.* For this draft technical standard, therefore, the chosen IDLH has been based on an analogy with H₂S assuming complete conversion of P₂S₅ into H₂S gas. [Note: The complete conversion of 750 mg/m³ of P₂S₅ will result in about 400 ppm H₂S]. Patty [1963] reported that 400 to 700 ppm H₂S is dangerous after exposure for 0.5 to 1 hour [Henderson and Haggard 1943]. The chosen IDLH for H₂S is 300 ppm.

Short-term exposure guidelines ................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₃ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Marhold 1972</td>
<td>oral</td>
<td>389</td>
<td>----</td>
<td>2,723 mg/m³</td>
<td>272 mg/m³</td>
</tr>
</tbody>
</table>

Other data .............................................. Phosphorus pentasulfide (P₂S₅) rapidly hydrolyzes to hydrogen sulfide (H₂S) and phosphoric acid on contact with water or with moisture present in the air [ACGIH 1991].

Human data .............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 250 mg/m³
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for phosphorus pentasulfide (P₂S₅). Therefore, the revised IDLH for phosphorus pentasulfide is 250 mg/m³ based on acute oral toxicity data in animals [Marhold 1972] and an analogy to hydrogen sulfide [ACGIH 1991] which has a revised IDLH of 150 ppm. [Note: The complete conversion of 270 mg/m³ P₂S₅ will result in 150 ppm H₂S.]

REFERENCES:

Phosphorus trichloride

CAS number ........................................ 7719-12-2
NIOSH REL ........................................
Current OSHA PEL .............................. 0.5 ppm (3 mg/m³) TWA
1989 OSHA PEL .................................. 0.2 ppm (1.5 mg/m³) TWA
1993-1994 ACGIH TLV ..................... 0.2 ppm (1.1 mg/m³) TWA

Description of substance .................. Colorless to yellow, fuming liquid with an odor like hydrochloric acid.

EL ........................................ Noncombustible Liquid
Original (SCP) IDLH .......................... 50 ppm
Basis for original (SCP) IDLH ........... The chosen IDLH is based on the statement by ACGIH [1971] that serious disturbances in animals resulted from exposure to 50 to 90 ppm for 1 hour [Butjagin 1904].

Short-term exposure guidelines ........ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Weeks et al. 1964</td>
<td>104</td>
<td>-----</td>
<td>4 hr</td>
<td>208 ppm (2.0)</td>
<td>21 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Weeks et al. 1964</td>
<td>50</td>
<td>-----</td>
<td>4 hr</td>
<td>100 ppm (2.0)</td>
<td>10 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Parent 1990</td>
<td>oral</td>
<td>19</td>
<td>-----</td>
<td>22 ppm</td>
<td>2.2 ppm</td>
</tr>
</tbody>
</table>

Other animal data ....................... Cats and guinea pigs exposed for 6 hours at 0.7 ppm showed only mild signs of intoxication and a 1-hour exposure to 2 to 4 ppm failed to produce severe signs of poisoning; however, a single 1-hour exposure at 50 to 90 ppm resulted in serious disturbances [Butjagin 1904].

Human data .............................. Workers exposed to concentrations ranging from 1.8 to 27 ppm had symptoms that included burning of the eyes and throat, irritation of the pharyngeal mucous membranes, and mild bronchitis within 2 to 6 hours after exposure [Sassi 1952].

Revised IDLH: 25 ppm
Basis for revised IDLH: The revised IDLH for phosphorus trichloride is 25 ppm based on acute inhalation toxicity data in humans [Sassi 1952] and animals [Butjagin 1904; Weeks et al. 1964].

REFERENCES:

Phthalic anhydride

CAS number
NIOSH REL
Current OSHA PEL
1989 OSHA PEL
1993-1994 ACGIH TLV
Description of substance

LEL
Original (SCP) IDLH
Basis for original (SCP) IDLH

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD$_{50}$ (mg/kg)</th>
<th>LD$_{50}$ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Biofax 1970</td>
<td>oral</td>
<td>4,020</td>
<td>28,140 mg/m$^3$</td>
<td>2,014 mg/m$^3$</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>1,520</td>
<td>10,500 mg/m$^3$</td>
<td>1,050 mg/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Marhold 1986</td>
<td>oral</td>
<td>800</td>
<td>5,600 mg/m$^3$</td>
<td>560 mg/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Patty 1983</td>
<td>oral</td>
<td>800-1,600</td>
<td>5,600-11,200 mg/m$^3$</td>
<td>560-1,120 mg/m$^3$</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Zhilova and Kasparov 1969</td>
<td>oral</td>
<td>2,210</td>
<td>15,470 mg/m$^3$</td>
<td>1,547 mg/m$^3$</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data

Human data

It has been reported that exposure of rats and rabbits to 10,000 mg/m$^3$ for 4 hours/day for several days produced a 25% fatality rate [Malten and Zielhuis 1964]. It has been reported that an exposure of 30 mg/m$^3$ is associated with conjunctivitis, while 25 mg/m$^3$ is associated with signs of mucous membrane irritation [Baader 1955]. It has been stated that phthalic anhydride has similar toxic effects (i.e., irritation of the skin, eyes, and upper respiratory system) as maleic anhydride, but has reduced potency [ACGIH 1981].

Revised IDLH: 60 mg/m$^3$

Basis for revised IDLH: Based on acute toxicity data in animals [Biofax 1970; Izmerov et al. 1982; Malten and Zielhuis 1964; Marhold 1986; Patty 1983; Zhilova and Kasparov 1969], a value between 800 and 3,000 mg/m$^3$ would have been appropriate. However, the revised IDLH for phthalic anhydride is 60 mg/m$^3$ (i.e., 10 times the NIOSH REL) based on acute inhalation data in humans [Baader 1955] and an analogy to maleic anhydride [ACGIH 1981] which has a revised IDLH that is 10 times its NIOSH REL. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 30 mg/m$^3$.

REFERENCES:

Phthalic anhydride (continued)

5. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT. p. 322.


Picric acid

CAS number ........................................ 88-89-1
NIOSH REL ...........................................
Current OSHA PEL ...................................
1989 OSHA PEL .......................... Same as current PEL
1993-1994 ACGIH TLV ......................... 0.1 mg/m³ TWA
Description of substance ..................... Yellow, odorless solid.
LEL ......................................................... Unknown
Original (SCP) IDLH ............................. 100 mg/m³
Basis for original (SCP) IDLH ................ Because no data on acute inhalation toxicity are available on which to base an IDLH for picric acid, the chosen IDLH has been estimated from data concerning the oral toxicity. According to ACGIH [1971], the ingestion of 1 or 2 grams of picric acid in man causes severe poisoning.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>100</td>
<td>700 mg/m³</td>
<td>70 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>250</td>
<td>1,750 mg/m³</td>
<td>175 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>von Ottingen 1941</td>
<td>oral</td>
<td>120</td>
<td>940 mg/m³</td>
<td>94 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................... The ingestion of 1 to 2 grams of picric acid has been reported to cause severe poisoning [ACGIH 1991]. [Note: An oral dose of 1 to 2 grams is equivalent to a worker being exposed to 660 to 1,330 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 75 mg/m³
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for picric acid. Therefore, the revised IDLH for picric acid is 75 mg/m³ based on acute oral toxicity data in humans [ACGIH 1991] and animals [Flury and Zernik 1935; von Ottingen 1941].

REFERENCES:


404
Pindone

CAS number ................................. 83-26-1
NIOSH REL .................................. 0.1 mg/m³ TWA
Current OSHA PEL .......................... 0.1 mg/m³ TWA
1989 OSHA PEL ........................... Same as current PEL
1993·1994 ACGIH TLV .................... 0.1 mg/m³ TWA

Description of substance ........................ Bright-yellow powder with almost no odor.

Original (SCP) IDLH .......................... 200 mg/m³

According to ACGIH [1971], the critical rodenticidal dosages of Pival® (pindone) and warfarin are similar. Therefore, the chosen IDLH is based on an analogy with warfarin which has an IDLH of 200 mg/m³.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Gaines 1960</td>
<td>oral</td>
<td>280</td>
<td></td>
<td>1.960 mg/m³</td>
<td>196 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Klimmer 1971</td>
<td>oral</td>
<td>75</td>
<td></td>
<td>5.25 mg/m³</td>
<td>53 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Perkow 1971/1976</td>
<td>oral</td>
<td>150</td>
<td></td>
<td>1.050 mg/m³</td>
<td>105 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data ................................ It has been reported that the critical rodenticidal dosages of Pival® (pindone) and warfarin are similar [ACGIH 1971].

Human data ..................................... It has been reported that 50 to 500 mg/kg is the probable lethal oral dose [Gosselin et al. 1984]. [Note: An oral dose of 50 to 500 mg/kg is equivalent to a 70-kg worker being exposed to about 2,330 to 23,300 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 100 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for pindone. Therefore, the revised IDLH for pindone is 100 mg/m³ based on acute oral toxicity data in humans [Gosselin et al. 1984] and animals [Gaines 1960; Klimmer 1971; Perkow 1971/1976] and an analogy to warfarin [ACGIH 1971] which has a revised IDLH of 100 mg/m³.

REFERENCES:

Platinum (soluble salts, as Pt)

<table>
<thead>
<tr>
<th>CAS number</th>
<th>Platinum (soluble salts, as Pt)</th>
<th>VARIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
<td>Platinum (soluble salts, as Pt)</td>
<td>VARIES</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>0.002 mg/m³ TWA</td>
<td></td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>0.002 mg/m³ TWA</td>
<td></td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
<td></td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>0.002 mg/m³ TWA</td>
<td></td>
</tr>
<tr>
<td>Description of substance</td>
<td>VARIES</td>
<td></td>
</tr>
<tr>
<td>Original (SCP) IDLH</td>
<td>No Evidence [&quot;Effective&quot; IDLH = 4 mg Pt/m³ — see discussion below.]</td>
<td></td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>Air concentrations at or slightly above the OSHA PEL for soluble platinum salts can elicit an allergic response in sensitized workers. Therefore, the IDLH cannot be set to protect these sensitized individuals. The available toxicological data do not indicate any toxic effects in nonsensitized individuals. Because there is no evidence of an IDLH for nonsensitized individuals, for this draft technical standard, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 0.002 mg Pt/m³ (i.e., 4 mg Pt/m³); only the “most protective” respirators are permitted for use in concentrations exceeding 4 mg Pt/m³.</td>
<td></td>
</tr>
<tr>
<td>Short-term exposure guidelines</td>
<td>None developed</td>
<td></td>
</tr>
</tbody>
</table>

ACUTE TOXICITY DATA

Animal or human data | None relevant for use in determining the revised IDLH.

Revised IDLH: 4 mg Pt/m³

Basis for revised IDLH: Since the available toxicological data do not indicate any acute toxic effects in nonsensitized individuals, the revised IDLH for soluble platinum salts is 4 mg Pt/m³ based on being 2,000 times the NIOSH REL or OSHA PEL (2,000 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the “most protective” respirators should be used for soluble platinum salts). Since air concentrations of soluble platinum salts slightly above the NIOSH REL and OSHA PEL can elicit allergic responses in sensitized individuals, the revised IDLH cannot be set to protect these sensitized individuals.
## Portland cement

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
<td>65997-15-1</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>10 mg/m³ (total dust) TWA, 5 mg/m³ (respirable dust) TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>50 mppcf TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>10 mg/m³ (total dust) TWA, 5 mg/m³ (respirable dust) TWA</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>10 mg/m³ (total dust) TWA</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Gray, odorless powder.</td>
</tr>
<tr>
<td>LEL</td>
<td>Noncombustible Solid</td>
</tr>
<tr>
<td>Original (SCP) IDLH</td>
<td>No Evidence [Note: 'Effective' IDLH = 25,000 mppcf - see discussion below.]</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>The available toxicological data show no evidence that an acute exposure to a high air concentration of Portland cement would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the &quot;most protective&quot; respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL (500 x 50 mppcf is 25,000 mppcf).</td>
</tr>
</tbody>
</table>

### Short-term exposure guidelines

**None developed.**

### ACUTE TOXICITY DATA

**Animal or human data**

None relevant for use in determining the revised IDLH.

---

**Revised IDLH: 5,000 mg/m³**

**Basis for revised IDLH:** The available toxicological data contain no evidence that an acute exposure to a high concentration of Portland cement would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for Portland cement is 5,000 mg/m³ based on being 500 times the NIOSH REL of 10 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).
Propane

CAS number: 74-98-6
NIOSH REL: 1.000 ppm (1,800 mg/m³) TWA
Current OSHA PEL: 1.000 ppm (1,800 mg/m³) TWA
1989 OSHA PEL: Same as current PEL
1993-1994 ACGIH TLV: Simple asphyxiant
Description of substance: Colorless, odorless gas.
LEL: 2.1% (10% LEL, 2,100 ppm)
Original (SCP) IDLH: 20,000 ppm [LEL]
Basis for original (SCP) IDLH: Propane is a simple asphyxiant and does not present an IDLH hazard at concentrations below its lower explosive limit (LEL). The chosen IDLH is based on the LEL of 21,000 ppm rounded down to 20,000 ppm.

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Animal data: None relevant for use in determining the revised IDLH.
Human data: It has been reported that brief inhalation exposures to 10,000 ppm propane cause no symptoms in humans [Braker and Mossman 1980]. Propane is considered to be a simple asphyxiant [ACGIH 1991].

Revised IDLH: 2,100 ppm [LEL]
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [ACGIH 1991; Braker 1980], a value much greater than 10,000 ppm would have been appropriate. However, the revised IDLH for propane is 2,100 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 2.1%).

REFERENCES:


408
n-Propyl acetate

CAS number .................................................. 109-60-4
NIOSH REL .................................................. 200 ppm (840 mg/m³) TWA, 250 ppm (1,050 mg/m³) STEL
Current OSHA PEL .......................................... 200 ppm (840 mg/m³) TWA
1989 OSHA PEL .............................................. 200 ppm (840 mg/m³) TWA, 250 ppm (1,050 mg/m³) STEL
1983-1984 ACGIH TLV ...................................... 200 ppm (685 mg/m³) TWA, 250 ppm (1,040 mg/m³) STEL
Description of substance ..................................
LEL (~100°F) .................................................. 1.7% (10% LEL (~100°F), 1,700 ppm)
Original (SCP) IDLH ........................................ 8,000 ppm

Short-term exposure guidelines ..........................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₆₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Flury and Wirth 1933</td>
<td>8,941</td>
<td>8,000</td>
<td>5 hr</td>
<td>19,223 ppm (2.15)</td>
<td>1,922 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1969</td>
<td>8,000</td>
<td>8,000</td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>1,600 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Jenner et al. 1964</td>
<td>oral</td>
<td>6,640</td>
<td>10,936</td>
<td>14,329 ppm</td>
<td>1,433 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Jenner et al. 1964</td>
<td>oral</td>
<td>6,640</td>
<td>10,936</td>
<td>14,329 ppm</td>
<td>1,433 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Munch 1972</td>
<td>oral</td>
<td>8,700</td>
<td>10,936</td>
<td>14,329 ppm</td>
<td>1,433 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1969</td>
<td>oral</td>
<td>6,640</td>
<td>10,936</td>
<td>14,329 ppm</td>
<td>1,433 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................

Human data ..............................................

Revised IDLH: 1,700 ppm

Based for revised IDLH: The revised IDLH for n-propyl acetate is 1,700 ppm based on acute inhalation toxicity data in animals [Flury and Wirth 1933; Smyth et al. 1989]. The revised IDLH is roughly the same as the revised IDLHs for ethyl acetate and n-butyl acetate and is also 10% of the lower explosive limit of 1.7% (which was determined at 100°F). This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

n-Propyl alcohol

CAS number ........................................ 71-23-8
NIOSH REL ............................................
Current OSHA PEL .................................... 200 ppm (500 mg/m³) TWA
1989 OSHA PEL ....................................... 200 ppm (500 mg/m³) TWA
1993-1994 ACGIH TLV ............................... 200 ppm (492 mg/m³) TWA, 250 ppm (614 mg/m³) STEL [skin]
Description of substance ............................. Colorless liquid with a mild, alcohol-like odor.
LEL ................................................... 2.2% (10% LEL, 2,200 ppm)
Original (SCP) IDLH .................................. 4,000 ppm
Basis for original (SCP) IDLH ....................... The chosen IDLH is based on the statement by Patty [1963] that 2 of 6 rats died following a 4-hour exposure to 4,000 ppm [Smyth et al. 1954]. In addition, Patty [1963] reported that deep narcosis was produced in 2 mice exposed to 4,100 ppm for 4 hours [Starrek 1938].

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>4,000 ppm</td>
<td>8,000 ppm</td>
<td>4 hr</td>
<td>800 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Munch and Schwartze 1925</td>
<td>oral</td>
<td>2,800 ppm</td>
<td>7,840 ppm</td>
<td>784 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Savini 1968</td>
<td>oral</td>
<td>6,800 ppm</td>
<td>19,040 ppm</td>
<td>1,904 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1954</td>
<td>oral</td>
<td>1,870 ppm</td>
<td>5,236 ppm</td>
<td>524 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ................................ RD₅₀ (mouse), 12,704 ppm [Alarie 1961]. It has been reported that deep narcosis was produced in 2 mice exposed to 4,100 ppm for 4 hours [Starrek 1938].

Human data ......................................... Mild irritation of the eyes, nose, and throat have been reported at 400 ppm [Nelson et al. 1943]. It has been reported that 5,700 mg/kg is the lethal oral dose [Durwald and Degen 1956]. [Note: An oral dose of 5,700 mg/kg is equivalent to a 70-kg worker being exposed to about 104,000 ppm for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 800 ppm

Basis for revised IDLH: The revised IDLH for n-propyl alcohol is 800 ppm based on acute inhalation toxicity data in humans [Nelson et al. 1943] and animals [Smyth et al. 1954]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 400 ppm.

REFERENCES:

n-Propyl alcohol (continued)


Propylene dichloride

CAS number ........................................ 78-87-5

NIOSH REL ........................................ None established; NIOSH considers propylene dichloride to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ........................................
1988 OSHA PEL ........................................ 75 ppm (350 mg/m³) TWA
1993-1994 ACGIH TLV ........................................ 75 ppm (347 mg/m³) TWA

Description of substance ................................ Colorless liquid with a chloroform-like odor.

LEL ........................................ 3.4% (10% LEL, 3,400 ppm)

Original (SCP) IDLH ........................................ 2,000 ppm

Basis for original (SCP) IDLH ........................................ The chosen IDLH is based on the rat 4-hour LC₅₀ of 2,000 ppm [Carpenter et al. 1949 cited by Spector 1956].

Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>2,000</td>
<td>-</td>
<td>4 hr</td>
<td>4,900 ppm (2.0)</td>
<td>400 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Clayton and Clayton 1981</td>
<td>720</td>
<td>-</td>
<td>10 hr</td>
<td>1,944 ppm (2.7)</td>
<td>194 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1959</td>
<td>2,980</td>
<td>-</td>
<td>8 hr</td>
<td>7,450 ppm (2.5)</td>
<td>745 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Marhold 1986</td>
<td>oral</td>
<td>280</td>
<td>-</td>
<td>1,281 ppm</td>
<td>128 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Pozzani et al. 1959</td>
<td>oral</td>
<td>1,947</td>
<td>-</td>
<td>2,900 ppm</td>
<td>290 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Sine 1993</td>
<td>oral</td>
<td>2,000</td>
<td>-</td>
<td>3,111 ppm</td>
<td>311 ppm</td>
</tr>
</tbody>
</table>

Other animal data ...................................

Animals exposed to 400 ppm for 7 hours per day, 5 days per week for 128 to 140 exposures had no histologic changes [Heppel et al. 1948].

Human data ...........................................

None relevant for use in determining the revised IDLH.

Revised IDLH: 400 ppm

Basis for revised IDLH: The revised IDLH for propylene dichloride is 400 ppm based on inhalation toxicity data in animals [Carpenter et al. 1949; Heppel et al. 1948]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for propylene dichloride at any detectable concentration.]

REFERENCES:

Propylene imine

CAS number ............................................. 75-55-8
NIOSH REL .............................................. 2 ppm (5 mg/m³) TWA [skin]; NIOSH considers propylene imine to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ......................................
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV .................................. 2 ppm (4.7 mg/m³) TWA [skin], A2

Description of substance ................................ Colorless, oily liquid with an ammonia-like odor.

LEL .......................................................... Unknown

Original (BCP) IDLH ..................................... 500 ppm

Basis for original (SCP) IDLH .................................. The chosen IDLH is based on the statements by Patty [1963] that 5 of 6 rats died from a 4-hour exposure to 500 ppm and 3 of 5 guinea pigs died from a 2-hour exposure to 500 ppm; at 500 ppm, rats survived a 2-hour exposure, and guinea pigs survived a 30-minute exposure [Carpenter et al. 1948].

Short-term exposure guidelines ................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₃₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 95-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>500</td>
<td>1000 ppm</td>
<td>4 hr</td>
<td>1000 ppm (2.0)</td>
<td>100 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Carpenter et al. 1949</td>
<td>LC₅₀: 500</td>
<td>625 ppm</td>
<td>1 hr</td>
<td>625 ppm (1.25)</td>
<td>63 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Carpenter et al. 1948</td>
<td>LC₅₀: 500</td>
<td>800 ppm</td>
<td>2 hr</td>
<td>800 ppm (2.6)</td>
<td>80 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Carpenter et al. 1948</td>
<td>LC₃₀: 500</td>
<td>1000 ppm</td>
<td>4 hr</td>
<td>1000 ppm (2.0)</td>
<td>100 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1948</td>
<td>LC₃₀: 500</td>
<td>1000 ppm</td>
<td>4 hr</td>
<td>1000 ppm (2.0)</td>
<td>100 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................. It has been reported that rats survived a 2-hour exposure to 500 ppm and guinea pigs survived a 30-minute exposure to 500 ppm [Carpenter et al. 1948].

Human data .............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for propylene imine is 100 ppm based on acute inhalation toxicity data in animals [Carpenter et al. 1948, 1949]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for propylene imine at concentrations above 2 ppm.]

REFERENCES:

Propylene oxide

CAS number ............................................. 75-56-9
NIOSH REL .............................................. None established; NIOSH considers propylene oxide to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL ..................................... 100 ppm (240 mg/m³) TWA
1993-1994 ACGIH TLV .............................. 20 ppm (50 mg/m³) TWA

Description of substance ............................. Colorless liquid with a benzene-like odor.

LEL ....................................................... 2.3% (10% LEL, 2,300 ppm)

Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the dog 4-hour LC₅₀ of 2,005 ppm and the mouse 4-hour LC₅₀ of 1,740 ppm [Jacobson et al. 1956 cited by NIOSH 1976].

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Jacobson et al. 1956</td>
<td>1,740</td>
<td>-----------</td>
<td>4 hr</td>
<td>3,480 ppm (2.0)</td>
<td>348 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Jacobson et al. 1956</td>
<td>2,005</td>
<td>-----------</td>
<td>4 hr</td>
<td>4,010 ppm (2.0)</td>
<td>401 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Jacobson et al. 1956</td>
<td>4,000</td>
<td>-----------</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Rowe et al. 1956</td>
<td>4,000</td>
<td>-----------</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1969</td>
<td>4,000</td>
<td>-----------</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₁₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Gig Tr Prof Zabol 1981</td>
<td>oral</td>
<td>660</td>
<td>106</td>
<td>1,909 ppm</td>
<td>191 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Pugaeva et al. 1970</td>
<td>oral</td>
<td>380</td>
<td>100</td>
<td>1,099 ppm</td>
<td>110 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Pugaeva et al. 1970</td>
<td>oral</td>
<td>440</td>
<td>130</td>
<td>1,273 ppm</td>
<td>127 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1943</td>
<td>oral</td>
<td>1,140</td>
<td>330</td>
<td>3,298 ppm</td>
<td>330 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Smyth et al. 1943</td>
<td>oral</td>
<td>690</td>
<td>483</td>
<td>4,830 ppm</td>
<td>483 ppm</td>
</tr>
</tbody>
</table>

Human data ............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 400 ppm

Basis for revised IDLH: The revised IDLH for propylene oxide is 400 ppm based on acute inhalation toxicity data in animals [Jacobson et al. 1956]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for propylene oxide at any detectable concentration.]

REFERENCES:
5. Rowe VK, Hollingsworth RL, Oyen F, McCollister DD, Spencer HC [1956]. Toxicity of propylene oxide determined on experimental animals. AMA Arch Ind Health 13:228-236.
n-Propyl nitrate

CAS number ........................................ 627-13-4
NIOSH REL ...........................................
Current OSHA PEL ................................. 25 ppm (105 mg/m³) TWA
1989 OSHA PEL .................................... 25 ppm (105 mg/m³) TWA
1993-1994 ACGIH TLV ............................. 25 ppm (107 mg/m³) TWA
Description of substance ........................... Colorless to straw-colored liquid with an ether-like odor.
LEL .................................................. 2% (10% LEL, 2,000 ppm)
Original (SCP) IDLH ................................ 2,000 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statement by ACGIH (1971) that the dog 4-hour LC₅₀ is 2,000 to 2,500 ppm [Rinehart et al. 1958].

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Hood 1953</td>
<td>50,000</td>
<td>20,000</td>
<td>4 hr</td>
<td>20,000 ppm (2.0)</td>
<td>2,000 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Rinehart et al. 1958</td>
<td>9,000-10,000</td>
<td>18,000-20,000</td>
<td>4 hr</td>
<td>18,000-20,000 ppm (2.0)</td>
<td>1,800-2,000 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Rinehart et al. 1958</td>
<td>6,000-7,000</td>
<td>12,000-14,000</td>
<td>4 hr</td>
<td>12,000-14,000 ppm (2.0)</td>
<td>1,200-1,400 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>Rinehart et al. 1958</td>
<td>2,000-2,500</td>
<td>4,000-5,000</td>
<td>4 hr</td>
<td>4,000-5,000 ppm (2.0)</td>
<td>400-500 ppm</td>
</tr>
</tbody>
</table>

Human data ............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 500 ppm

Revision for revised IDLH: The revised IDLH for n-propyl nitrate is 500 ppm based on acute inhalation toxicity data in animals [Rinehart et al. 1958].

REFERENCES:

Pyrethrum

<table>
<thead>
<tr>
<th>CAS number</th>
<th>8003-34-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>5 mg/m³ TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>5 mg/m³ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Same as current PEL</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>5 mg/m³ TWA</td>
</tr>
</tbody>
</table>

Description of substance
Brown, viscous oil or solid.

LEL
Unknown

Original (SCP) IDLH
5,000 mg/m³

Basis for original (SCP) IDLH
The chosen IDLH has been estimated from the rat oral LD₅₀ of 820 mg/kg [Carpenter et al. 1950 cited by ACGIH 1971]. In addition, ACGIH [1971] reported that rats experienced moderate lung congestion when exposed for 30 minutes to 6,000 mg/m³ pyrethrum in peanut oil [Carpenter et al. 1950]. None developed.

Short-term exposure guidelines

**ACUTE TOXICITY DATA**

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1950</td>
<td>oral</td>
<td>820</td>
<td>5,740 mg/m³</td>
<td>574 mg/s³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Hayes 1982</td>
<td>oral</td>
<td>200-1,870</td>
<td>1,400-13,090 mg/m³</td>
<td>140-1,309 mg/s³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Malone and Brown 1968</td>
<td>oral</td>
<td>272-794</td>
<td>1,911-5,572 mg/m³</td>
<td>191-557 mg/s³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Miyamoto 1976</td>
<td>oral</td>
<td>170</td>
<td>2,590 mg/m³</td>
<td>259 mg/s³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Shimkin and Anderson 1936</td>
<td>oral</td>
<td>1,000</td>
<td>7,000 mg/m³</td>
<td>700 mg/s³</td>
<td></td>
</tr>
</tbody>
</table>

**Other animal data**

It has been reported that rats experienced moderate lung congestion when exposed for 30 minutes to 6,000 mg/m³ pyrethrum in peanut oil [Carpenter et al. 1950].

**Human data**

It has been estimated that the fatal human dose might be between 1 and 2 g/kg [Gosselin et al. 1984; Lehman 1949]. [Note: An oral dose of 1 to 2 g/kg is equivalent to a 70-kg worker being exposed to about 47,000 to 83,000 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 5,000 mg/m³ [Unchanged]

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for pyrethrum. Therefore, based on acute oral toxicity data in humans [Gosselin et al. 1984; Lehman 1949], the original IDLH for pyrethrum (5,000 mg/m³) is not being revised at this time.

**REFERENCES:**

Pyridine

CAS number ............................................. 110-86-1
NIOSH REL .................................................. 
Current OSHA PEL ....................................... 5 ppm (15 mg/m³) TWA
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV ................................... 5 ppm (16 mg/m³) TWA
Description of substance ................................ Colorless to yellow liquid with a nauseating, fish-like odor.
LEL .................................................... 1.8% (10% LEL, 1,800 ppm)
Original (SCP) IDLH .................................. 3,600 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the statement by Patty [1963] that 2 of 3 rats died following a 6-hour exposure to 3,600 ppm [Fassett and Roudabush 1953].

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Fassett and Roudabush 1953</td>
<td>LC₅₀: 5 ppm</td>
<td>6 hr</td>
<td>8,280 ppm (2.3)</td>
<td>828 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>LC₅₀: 5 ppm</td>
<td>4 hr</td>
<td>8,000 ppm (2.0)</td>
<td>800 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Vemot et al. 1977</td>
<td>LC₅₀: 9 ppm</td>
<td>1 hr</td>
<td>11,250 ppm (1.25)</td>
<td>1,125 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Biofax 1970</td>
<td>oral</td>
<td>891</td>
<td>-----</td>
<td>1,896 ppm</td>
<td>190 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Leslie et al. 1973</td>
<td>oral</td>
<td>1,500</td>
<td>-----</td>
<td>3,131 ppm</td>
<td>313 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>oral</td>
<td>1,580</td>
<td>-----</td>
<td>3,362 ppm</td>
<td>336 ppm</td>
</tr>
</tbody>
</table>

Human data .............................................. Nausea, headache, insomnia, nervousness, and low back or abdominal discomfort with urinary frequency have occurred in individuals exposed to concentrations averaging 125 ppm for 4 hours/day for 1 to 2 weeks [Patty 1963]. Chronic poisoning with mild symptoms of central nervous system injury occurred in workers at a plant where pyridine vapor concentrations ranged from 8 to 12 ppm [Teisinger 1948].

Revised IDLH: 1,000 ppm

Basis for revised IDLH: The revised IDLH for pyridine is 1,000 ppm based on acute inhalation toxicity data in animals [Vemot et al. 1977].

REFERENCES:

Quinone

CAS number ........................................ 106-51-4
NIOSH REL .................................................
Current OSHA PEL ...........................................
1989 OSHA PEL ............................................ Same as current PEL
1993-1994 ACGIH TLV ...................................... 0.44 mg/m³ (0.1 ppm) TWA
Description of substance ................................... Pale-yellow solid with an acrid, chlorine-like odor.
LEL ............................................................ Unknown
Original (SCP) IDLH ......................................... 300 mg/m³
Basis for original (SCP) IDLH ................................. The chosen IDLH is based on the mouse LC₅₀ of 320 mg/m³
[Zabolavani 1962 cited by NIOSH 1976]. No other data on acute inhalation toxicity are available on which to base the IDLH.

Short-term exposure guidelines .............................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₅₀ (mg/m³)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammal</td>
<td>Izmerov et al. 1982</td>
<td>s.c.</td>
<td>296</td>
<td>2.072 mg/m³</td>
<td>207 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Marquardt et al. 1947</td>
<td>s.c.</td>
<td>93.8</td>
<td>657 mg/m³</td>
<td>66 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Serif and Seymour 1963</td>
<td>i.p.</td>
<td>8.5</td>
<td>60 mg/m³</td>
<td>6.0 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Tomchin et al. 1976</td>
<td>?</td>
<td>5.8</td>
<td>39 mg/m³</td>
<td>3.9 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Woodward et al. 1949</td>
<td>oral</td>
<td>130</td>
<td>910 mg/m³</td>
<td>91 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Woodward et al. 1949</td>
<td>i.v.</td>
<td>25</td>
<td>175 mg/m³</td>
<td>18 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ....................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 100 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for quinone. Therefore, the revised IDLH for quinone is 100 mg/m³ based on acute oral toxicity data in animals [Woodward et al. 1949]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

1. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 25.
Rhodium (metal fume and insoluble compounds, as Rh)

CAS number ................................................................. 7440-16-6 (Metal)
NIDSH REL ................................................................. 0.1 mg/m³ TWA
Current OSHA PEL ........................................................ 0.1 mg/m³ TWA
OSHA PEL ................................................................. Same as current PEL
1993-1994 ACGIH TLV ................................................... 1 mg/m³ TWA

Description of substance ................................................. Varies

Original (SCP) IOLH* ..................................................... No Evidence [*Note: "Effective" IDLH = 200 mg Rh/m³ — see discussion below.]
Basis for original (SCP) IOLH ........................................... Because no evidence of an IDLH for rhodium (metal fume and insoluble compounds) is available, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 × the OSHA PEL of 0.1 mg Rh/m³ (i.e., 200 mg Rh/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 200 mg Rh/m³. None developed

Short-term exposure guidelines ........................................

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RhCl₂</td>
<td>Johnson 1981</td>
<td>oral</td>
<td>&gt;500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Veselov 1977</td>
<td>oral</td>
<td>1.902</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Na₂RhCl₄</td>
<td>Johnson 1981</td>
<td>oral</td>
<td>&gt;500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Johnson 1981</td>
<td>oral</td>
<td>&gt;500</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Human data ............................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 100 mg Rh/m³
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for insoluble rhodium compounds. Therefore, the revised IDLH for insoluble rhodium compounds is 100 mg Rh/m³ based on acute oral toxicity data in animals [Johnson 1981; Veselov 1977]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

Rhodium (soluble compounds, as Rh)

| CAS number |  | Varies |
| NIOSH REL |  | 0.001 mg/m³ TWA |
| Current OSHA PEL |  | 0.001 mg/m³ TWA |
| 1989 OSHA PEL |  | Same as current PEL |
| 1993-1994 ACGIH TLV |  | 0.01 mg/m³ TWA |
| Description of substance |  | Varies |
| Original (SCP) IDLH* |  | No evidence [*Note: "Effective" IDLH = 2 mg Rh/m³ – see discussion below.]

There is no indication from experimental data or industrial experience that the soluble compounds of rhodium produce toxic effects in man. Therefore, because no evidence of an IDLH exists, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 × the OSHA PEL of 0.001 mg Rh/m³ (i.e., 2 mg Rh/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 2 mg Rh/m³.

None developed

ACUTE TOXICITY DATA

Animal or human data | None relevant for use in determining the revised IDLH.

Revised IDLH: 2 mg Rh/m³

Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of soluble rhodium compounds would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for soluble rhodium compounds is 2 mg Rh/m³ based on being 2,000 times the NIOSH REL and OSHA PEL of 0.001 mg Rh/m³ (2,000 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for soluble rhodium compounds).
Ronnel

CAS number ........................................... 299-54-3
NIOSH REL .................................................. ..........................
Current OSHA PEL ........................................ 10 mg/m³ TWA
1989 OSHA PEL ........................................... 15 mg/m³ TWA
1993-1994 ACGIH TLV .................................. 10 mg/m³ TWA
Description of substance ................................ White to light-tan, crystalline solid.
LEL .............................................................. Noncombustible Solid
Original (SCP) IDLH ...................................... 5,000 mg/m³
Basis for original (SCP) IDLH ................................. No useful data on acute inhalation toxicity are available on which to base the IDLH for Ronnel. The chosen IDLH, therefore, has been estimated from the statement by ACGIH [1971] that the dog oral LD₅₀ is greater than 500 mg/kg.

Short-term exposure guidelines .............................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>2,000</td>
<td>-----</td>
<td>7,000 mg/m³</td>
<td>700 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>420</td>
<td>-----</td>
<td>2,940 mg/m³</td>
<td>234 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>1,400</td>
<td>-----</td>
<td>9,800 mg/m³</td>
<td>860 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Klimmer 1971</td>
<td>oral</td>
<td>500</td>
<td>-----</td>
<td>3,500 mg/m³</td>
<td>350 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Gig Sanit 1990</td>
<td>oral</td>
<td>625</td>
<td>-----</td>
<td>4,375 mg/m³</td>
<td>438 mg/m³</td>
</tr>
</tbody>
</table>

Human data .................................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 300 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for Ronnel. Therefore, the revised IDLH for Ronnel is 300 mg/m³ based on acute oral toxicity in animals [AAPCO 1966; Klimmer 1971]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:

Rotenone

CAS number ........................................ 83-79-4
NIOSH REL ............................................ 5 mg/m³ TWA
Current OSHA PEL .................................. 5 mg/m³ TWA
1989 OSHA PEL ....................................... Same as current PEL
1993-1994 ACGIH TLV ............................. 5 mg/m³ TWA

Description of substance ............................... Colorless to red, odorless, crystalline solid.

LEL ...................................................... Unknown [Note: "Effective" IDLH = 5,000 mg/m³ — see discussion below.]

Basis for original (SCP) IDLH .................. ACGIH [1971] reported that Lehman [1949], on the basis of his own work and a literature survey, estimated the fatal human oral dose to be about 200 grams. Accordingly, this is a relatively nontoxic compound for humans, and thus respirators have been assigned based on the assigned protection factor afforded by each device up to 1,000 × the OSHA PEL of 5 mg/m³ (i.e., 5,000 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 5,000 mg/m³.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kenaga 1979</td>
<td>oral</td>
<td>40</td>
<td>——</td>
<td>420 mg/m³</td>
<td>42 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>132</td>
<td>——</td>
<td>924 mg/m³</td>
<td>92 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Lightbody and Matthews 1936</td>
<td>oral</td>
<td>25</td>
<td>——</td>
<td>175 mg/m³</td>
<td>18 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Soloway 1976</td>
<td>oral</td>
<td>2.8</td>
<td>——</td>
<td>20 mg/m³</td>
<td>2.0 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................... The fatal oral dose has been reported to be 200 grams [Lehman 1949]. [Note: An oral dose of 200 grams is equivalent to a worker being exposed to about 130,000 mg/m³ for 30 minutes, assuming a breathing rate of 50 litres per minute and 100% absorption.]

Revised IDLH: 2,500 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for rotenone. Therefore, the revised IDLH for rotenone is 2,500 mg/m³ based on acute oral toxicity data in humans [Lehman 1949] and being 500 times the NIOSH REL and OSHA PEL (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).

REFERENCES:


423
Selenium compounds (as Se)

CAS number ................................................. 7782-49-2 (Elemental)
NIOSH REL ................................................. 0.2 mg/m³ TWA
Current OSHA PEL ......................................... 0.2 mg/m³ TWA
1989 OSHA PEL ............................................. Same as current PEL
1993·1994 ACGIH TLV ...................................... 0.1 mg/m³ TWA
Description of substance ........................................ Unknown [*Note: "Effective" IDLH = 100 mg Se/m³ — see discussion below.]

Basis for original (SCP) IDLH ................................ ACGIH [1971] reported that the LD₅₀ values of soluble selenium compounds (selenite and selenate) for various animals and by different routes of administration ranged from 1.5 to 5 mg/kg [Hall et al. 1951]. However, respirators have been selected based on the assigned protection factor afforded by each device up to 500 x the OSHA PEL of 0.2 mg Se/m³ (i.e., 100 mg Se/m³): only the "most protective" respirators are permitted for use in concentrations exceeding 100 mg Se/m³.

Short-term exposure guidelines ........................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Se</td>
<td>Zapp 1946</td>
<td>5.590 mg/m³</td>
<td>6.590 mg/m³</td>
<td>10 min</td>
<td>3.228 mg Se/m³ (0.69)</td>
<td>323 mg Se/m³</td>
</tr>
<tr>
<td>Goats</td>
<td>Zapp 1946</td>
<td>6.590 mg/m³</td>
<td>6.590 mg/m³</td>
<td>10 min</td>
<td>3.228 mg Se/m³ (0.69)</td>
<td>323 mg Se/m³</td>
</tr>
<tr>
<td>Sheep</td>
<td>Zapp 1946</td>
<td>6.590 mg/m³</td>
<td>6.590 mg/m³</td>
<td>10 min</td>
<td>3.228 mg Se/m³ (0.69)</td>
<td>323 mg Se/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Se</td>
<td>Cummins and Kimura 1971</td>
<td>oral</td>
<td>6,700</td>
<td>-----</td>
<td>46,900 mg Se/m³</td>
<td>4,690 mg Se/m³</td>
</tr>
<tr>
<td>SeO₂Na</td>
<td>Cummins and Kimura 1971</td>
<td>oral</td>
<td>7</td>
<td>-----</td>
<td>22 mg Se/m³</td>
<td>2.2 mg Se/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Olson 1986</td>
<td>oral</td>
<td>13</td>
<td>-----</td>
<td>42 mg Se/m³</td>
<td>4.2 mg Se/m³</td>
</tr>
<tr>
<td>Pig</td>
<td>Olson 1986</td>
<td>oral</td>
<td>9.9</td>
<td>-----</td>
<td>32 mg Se/m³</td>
<td>3.2 mg Se/m³</td>
</tr>
<tr>
<td>Goats</td>
<td>Olson 1986</td>
<td>oral</td>
<td>3.3</td>
<td>-----</td>
<td>11 mg Se/m³</td>
<td>1.1 mg Se/m³</td>
</tr>
<tr>
<td>Sheep</td>
<td>Olson 1986</td>
<td>oral</td>
<td>3.3</td>
<td>-----</td>
<td>11 mg Se/m³</td>
<td>1.1 mg Se/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Pletnikova 1970a</td>
<td>oral</td>
<td>7.0E</td>
<td>-----</td>
<td>23 mg Se/m³</td>
<td>2.3 mg Se/m³</td>
</tr>
<tr>
<td>C. pig</td>
<td>Pletnikova 1970a</td>
<td>oral</td>
<td>5.0E</td>
<td>-----</td>
<td>16 mg Se/m³</td>
<td>1.6 mg Se/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Pletnikova 1970b</td>
<td>oral</td>
<td>2.35</td>
<td>-----</td>
<td>7.2 mg Se/m³</td>
<td>0.7 mg Se/m³</td>
</tr>
<tr>
<td>Horse</td>
<td>Stowe 1980</td>
<td>oral</td>
<td>13</td>
<td>-----</td>
<td>42 mg Se/m³</td>
<td>4.2 mg Se/m³</td>
</tr>
<tr>
<td>SeOCl₂</td>
<td>Wilber 1980</td>
<td>skin</td>
<td>2</td>
<td>-----</td>
<td>6.7 mg Se/m³</td>
<td>0.7 mg Se/m³</td>
</tr>
</tbody>
</table>

Human data .................................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 1 mg Se/m³

Basis for revised IDLH: The revised IDLH for selenium compounds is 1 mg Se/m³ based on acute toxicity data in animals (Olson 1986; Pletnikova 1970a, 1970b). This may be a conservative value for selenium compounds in general since it is based on sodium selenite, which is orders of magnitude more toxic than many other selenium compounds.

Further, this may also be a conservative value due to the lack of relevant acute toxicity data for workers.
Selenium compounds (as Se) (continued)

REFERENCES:

Selenium hexafluoride (as Se)

CAS number .............................................. 7783-79-1
NIOSH REL ..............................................
Current OSHA PEL ......................................
1989 OSHA PEL ......................................... Same as current PEL
1993-1994 ACGIH TLV ................................ 0.05 ppm (0.16 mg/m³) TWA
Description of substance ............................ Colorless gas.
LEL .......................................................... Nonflammable Gas
Original (SCP) IDLH ...................................... 5 ppm
Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the statements by ACGIH [1971] that 5 ppm for 4 hours resulted in pulmonary edema from which rabbits, guinea pigs, rats, and mice survived [Kimmerle 1960]: exposures to 10 ppm and greater for 4 hours were uniformly fatal to the exposed animals [Kimmerle 1960].

Short-term exposure guidelines ....................... None

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{10} (ppm)</th>
<th>LC_{50} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kimmerle 1960</td>
<td>10</td>
<td>10</td>
<td>1 hr</td>
<td>12 ppm (1.25)</td>
<td>2.3 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Kimmerle 1960</td>
<td>10</td>
<td>10</td>
<td>1 hr</td>
<td>13 ppm (1.25)</td>
<td>1.9 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Kimmerle 1960</td>
<td>10</td>
<td>10</td>
<td>1 hr</td>
<td>13 ppm (1.25)</td>
<td>1.3 ppm</td>
</tr>
</tbody>
</table>

Other animal data ..................................... It has been reported that 5 ppm for 4 hours resulted in pulmonary edema from which rabbits, guinea pigs, rats, and mice survived [Kimmerle 1960].

Human data ............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 2 ppm

Basis for revised IDLH: The revised IDLH for selenium hexafluoride is 2 ppm based on acute inhalation toxicity data in animals [Kimmerle 1960].

REFERENCES:

**Silica, amorphous**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
<td>7631-86-9</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>6 mg/m³ TWA</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>20 mppcf TWA; 80 mg/m³/1%SiO₂ TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>6 mg/m³ TWA</td>
</tr>
<tr>
<td>1993-1994 ACGIH TLV</td>
<td>10 mg/m³ TWA</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Transparent to gray, odorless powder.</td>
</tr>
<tr>
<td>LEL</td>
<td>Noncombustible Solid</td>
</tr>
<tr>
<td>Original (SCP) IDLH*</td>
<td>No Evidence [Note: &quot;Effective&quot; IDLH = 500 times the OSHA PEL — see discussion below.]</td>
</tr>
</tbody>
</table>

**Basis for original (SCP) IDLH**

The available toxicological data contain no evidence that an acute exposure to a high concentration of amorphous silica would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL.

**Short-term exposure guidelines**

None developed

**ACUTE TOXICITY DATA**

**Animal or human data**

None relevant for use in determining the revised IDLH.

**Revised IDLH: 3,000 mg/m³**

**Basis for revised IDLH:** The available toxicological data contain no evidence that an acute exposure to a high concentration of amorphous silica would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for amorphous silica is 3,000 mg/m³ based on being 500 times the NIOSH REL of 6 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).
### Silica, crystalline (as respirable dust)

<table>
<thead>
<tr>
<th>CAS number</th>
<th>14808-60-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>0.05 mg/m³ TWA; NIOSH considers crystalline silica to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1989]</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>Crystalline quartz (respirable): 250 mppcf/(%SiO₂ +5) TWA 10 mg/m³/(%SiO₂ +2) TWA</td>
</tr>
<tr>
<td></td>
<td>Crystalline quartz (total dust): 30 mg/m³/(%SiO₂ +2) TWA</td>
</tr>
<tr>
<td></td>
<td>Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz; Tridymite: Use ½ the value calculated from the formulae for quartz</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>Cristobalite: 0.05 mg/m³ TWA Tridymite: 0.05 mg/m³ TWA Quartz: 0.1 mg/m³ TWA Tripoli: 0.1 mg/m³ TWA</td>
</tr>
<tr>
<td>1983-1994 ACGIH TLV</td>
<td>Quartz (respirable dust): 0.1 mg/m³ TWA Cristobalite (respirable dust): 0.05 mg/m³ TWA Tridymite (respirable dust): 0.05 mg/m³ TWA</td>
</tr>
<tr>
<td>Description of substance</td>
<td>No Evidence [Note: &quot;Effective&quot; IDLH = 500 times the OSHA PEL — see discussion below.]</td>
</tr>
<tr>
<td>Original (SCP) IDLH*</td>
<td>Varies</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>The available toxicological data show no evidence that indicates an acute exposure to a high concentration of crystalline silica would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the &quot;most protective&quot; respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL.</td>
</tr>
<tr>
<td>Short-term exposure guidelines</td>
<td>None developed</td>
</tr>
<tr>
<td>ACUTE TOXICITY DATA</td>
<td>None relevant for use in determining the revised IDLH.</td>
</tr>
</tbody>
</table>

**Revised IDLH:** 25 mg/m³ (Cristobalite & Tridymite); 50 mg/m³ (Quartz & Tripoli)  
*Basis for revised IDLH:* The available toxicological data contain no evidence that an acute exposure to a high concentration of crystalline silica would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLHs for crystalline silica are 25 mg/m³ for Cristobalite and Tridymite and 50 mg/m³ for Quartz and Tripoli, based on being 500 times the 1989 OSHA PELs of 0.05 mg/m³ and 0.1 mg/m³, respectively (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates). [Note: NIOSH recommends that the "most protective" respirators be worn for all varieties of crystalline silica at concentrations above 25 mg/m³.]
Silver (metal dust and soluble compounds, as Ag)

CAS number ........................................... 7440-22-4 (Metal)
NIOSH REL .............................................. 0.01 mg/m³ TWA
Current OSHA PEL ...................................... 0.01 mg/m³ TWA
1989 OSHA PEL ......................................... Same as current PEL
1993-1994 ACGIH TLV ................................. Metal: 0.1 mg/m³ TWA;
Soluble compounds: 0.01 mg/m³ TWA

Description of substance .............................

No Evidence [*Note: "Effective" IDLH = 20 mg Ag/m³ – see discussion below.]

Basis for original (SCP) IDLH ........................... The available toxicological data contain no evidence that an
acute exposure by inhalation to silver metal or the soluble
compounds of silver could impede escape. For this draft
technical standard, therefore, respirators have been selected
on the basis of the assigned protection factor afforded by each
device up to 2,000 x the OSHA PEL of 0.01 mg Ag/m³ (i.e.,
20 mg Ag/m³); only the "most protective" respirators are
permitted for use in concentrations exceeding 20 mg Ag/m³.

Short-term exposure guidelines ........................ None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AgNO₃,</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>-----</td>
<td>800</td>
<td>3.556 mg Ag/m³</td>
<td>356 mg Ag/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Flury and Zernik 1935</td>
<td>oral</td>
<td>-----</td>
<td>20</td>
<td>69 mg Ag/m³</td>
<td>6.9 mg Ag/m³</td>
</tr>
<tr>
<td>Ag₂O</td>
<td>Smyth et al. 1969</td>
<td>oral</td>
<td>2,820</td>
<td>-----</td>
<td>18,385 mg Ag/m³</td>
<td>1,839 mg Ag/m³</td>
</tr>
</tbody>
</table>

Human data .............................................. It has been reported that 29 mg/kg is the probable lethal
dose [Arena 1970]. [*Note: A dose of 29 mg/kg is equivalent to a
70-kg worker being exposed to 135 mg/m³ for 30 minutes,
assuming a breathing rate of 50 liters per minute and 100%
absorption.]

Revised IDLH: 10 mg Ag/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for silver (metal dust and
soluble compounds). Therefore, the revised IDLH for silver (metal dust and soluble compounds) is 10 mg Ag/m³ based on
acute oral toxicity data in humans [Arena 1970] and animals [Flury and Zernik 1935].

REFERENCES:

2. Flury F, Zernik F [1935]. Zusammenstellung der toxischen und letalen dosen für die gebräuchlichsten giftige und
   Am Ind Hyg Assoc J 30(5):470-476.
Soapstone

<table>
<thead>
<tr>
<th>Description of substance</th>
<th>Description: Odorless, white-gray powder. Noncombustible Solid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>No Evidence [*Note: &quot;Effective&quot; IDLH = 10,000 mppcf -- see discussion below.]</td>
</tr>
</tbody>
</table>

The available toxicological data contain no evidence that an acute exposure to a high concentration of soapstone would impede escape or cause any irreversible health effects within 30 minutes. The toxic effects of talc that are described in the literature result from chronic exposures to this substance. Talc is a major constituent of soapstone [Miller and Sayers 1941 as cited by ACGIH 1971]. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL (500 x 20 mppcf is 10,000 mppcf).

None developed

Animal or human data | None relevant for use in determining the revised IDLH.

Revised IDLH: 3,000 mg/m³
Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of soapstone would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for soapstone is 3,000 mg/m³ based on being 500 times the NIOSH REL of 6 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).

REFERENCES:
Sodium fluoroacetate

CAS number ........................................ 62-74-8
NIOSH REL ...........................................
Current OSHA PEL ................................. 0.05 mg/m³ TWA
1989 OSHA PEL .................................. 0.05 mg/m³ TWA
1993-1994 ACGIH TLV ........................... 0.05 mg/m³ TWA
Description of substance ....................... Fluffy, colorless to white (sometimes dyed black), odorless powder.

LEL ................................................... Noncombustible Solid
Original (SCP) IDLH .............................. 5 mg/m³
Basis for original (SCP) IDLH ..................... The chosen IDLH is based on the statement by Deichmann and Gerarde [1969] that the probable lethal oral dose for an adult is 50 mg. No data on acute inhalation toxicity are available on which to base the IDLH for this highly toxic compound.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₀</th>
<th>LD₅₀</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>1.7</td>
<td>-----</td>
<td>12 mg/m³</td>
<td>1.2 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>McIlroy 1982</td>
<td>oral</td>
<td>0.34</td>
<td>-----</td>
<td>2.4 mg/m³</td>
<td>0.24 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Ward 1946</td>
<td>oral</td>
<td>0.1</td>
<td>-----</td>
<td>0.7 mg/m³</td>
<td>0.07 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Ward 1946</td>
<td>oral</td>
<td>0.3</td>
<td>-----</td>
<td>2.3 mg/m³</td>
<td>0.23 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Yakkyoku 1977</td>
<td>oral</td>
<td>0.1</td>
<td>-----</td>
<td>0.7 mg/m³</td>
<td>0.07 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................ The probable oral lethal dose has been reported to be 50 mg [Deichmann and Gerarde 1969]. [Note: An oral dose of 50 mg is equivalent to a worker being exposed to about 30 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 2.5 mg/m³
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for sodium fluoroacetate. Therefore, the revised IDLH for sodium fluoroacetate is 2.5 mg/m³ based on acute oral toxicity data in humans [Deichmann and Gerarde 1969].

REFERENCES:


431
Sodium hydroxide

CAS number: 1310-73-2

NIOSH REL: Noncombustible Solid

Cumulative OSHA PEL: 2 mg/m³ CEILING

1989 OSHA PEL: 2 mg/m³ CEILING

1993-1994 ACGIH: 2 mg/m³ CEILING

Description of substance: Colorless to white, odorless solid (flakes, beads, granular form).

LEL: Noncombustible Solid

Original (SCP) IDLH: 250 mg/m³

Existing short-term exposure guidelines:

10-minute EEGL: 2 mg/m³
30-minute EEGL: 2 mg/m³
60-minute EEGL: 2 mg/m³

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Fazekas 1937</td>
<td>oral</td>
<td>-----</td>
<td>500</td>
<td>2,500 mg/m³</td>
<td>350 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Nofre et al. 1963</td>
<td>i.p.</td>
<td>40</td>
<td>280 mg/m³</td>
<td>28 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data: Workplace concentrations ranging from 2 to 8 mg/m³ have been associated with irritation of the respiratory system [Ott et al. 1977].

Revised IDLH: 10 mg/m³

Basis for revised IDLH: The revised IDLH for sodium hydroxide is 10 mg/m³ based on acute inhalation toxicity data in workers [Ott et al. 1977]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 8 mg/m³.

REFERENCES:

Stibine

CAS number .................................................. 7803-52-3
NIOSH REL .................................................. 0.1 ppm (0.5 mg/m³) TWA
Current OSHA PEL ......................................... 0.1 ppm (0.5 mg/m³) TWA
1988 OSHA PEL .............................................. Same as current PEL
1993·1994 ACGIH TLV ...................................... 0.1 ppm (0.51 mg/m³) TWA
Description of substance .................................. Colorless gas with a disagreeable odor like hydrogen sulfide.
LEL .................................................................... Unknown
Original (SCP) IDLH ......................................... 40 ppm
Basis for original (SCP) IDLH .............................. The chosen IDLH is based on the statement by AIHA [1960] that exposure of dogs and cats to 40 to 45 ppm for 1 hour has proven dangerous [Webster 1946].

Short-term exposure guidelines ............................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse Browning 1961</td>
<td>100</td>
<td>125 ppm (1.25)</td>
<td>13 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. pig Browning 1961</td>
<td>92</td>
<td>115 ppm (1.25)</td>
<td>12 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dog Browning 1961</td>
<td>40</td>
<td>50 ppm (1.25)</td>
<td>5 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ............................................. It has been reported that exposure of dogs and cats to 40 to 45 ppm for 1 hour has proven dangerous [Webster 1946].

Human data ..................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 5 ppm
Basis for revised IDLH: The revised IDLH for stibine is 5 ppm based on acute inhalation toxicity data in animals (Browning 1961).

REFERENCES:

Stoddard solvent

CAS number: 8052-41-3
NIOSH REL: 800 mg/m³ (15-minute CEILING), 350 mg/m³ TWA, 1,800 mg/m³ 15-minute CEILING
Current OSHA PEL: 2,900 mg/m³ (500 ppm) TWA
1989 OSHA PEL: 525 mg/m³ (100 ppm) TWA
1993-1994 ACGIH TLV: 525 mg/m³ (100 ppm) TWA

Description of substance: Colorless liquid with a kerosene-like odor.

LEL: Unknown

Original (SCP) IDLH: 29,500 mg/m³

The chosen IDLH is based on the statements by AIHA [1975] that the atmospheric concentration immediately hazardous to life is probably between 5,000 ppm and 10,000 ppm when high temperature or other factors make these concentrations attainable, and exposure to levels approaching 5,000 ppm should be avoided [Rector et al. 1966]. [Note: A concentration of 5,000 ppm is equivalent to about 29,500 mg/m³ assuming an approximate molecular weight of 144 for Stoddard solvent.]

Human data: It has been reported that the atmospheric concentration immediately hazardous to life is probably between 5,000 and 10,000 ppm when high temperature or other factors make these concentrations attainable and exposure to levels approaching 5,000 ppm should be avoided [Rector et al. 1966]. [Note: A concentration of 5,000 ppm is equivalent to about 29,500 mg/m³ assuming an approximate molecular weight of 144 for Stoddard solvent.]

Revised IDLH: 20,000 mg/m³

Basis for revised IDLH: The revised IDLH for Stoddard solvent is 20,000 mg/m³ based on acute inhalation toxicity data in humans [Rector et al. 1966].

REFERENCES:

Strychnine

CAS number ........................................ 57-24-9
NIOSH REL ........................................ 0.15 mg/m³ TWA
Current OSHA PEL .................................. 0.15 mg/m³ TWA
1989 OSHA PEL ...................................... Same as current PEL
1993-1994 ACGIH TLV .............................. 0.15 mg/m³ TWA

Description of substance: Colorless to white, odorless, crystalline solid.

LEL ................................................................ Unknown

Original (SCP) IDLH .................................. 3 mg/m³

No data on acute inhalation toxicity are available on which to base the IDLH for strychnine. The chosen IDLH, therefore, has been estimated from the statement by Gleason et al. [1969] that 30 mg by the oral route is usually a threat to an adult’s life [Withhaus 1911].

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Flury and Zemik 1935</td>
<td>oral</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>4.2 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Moraillon and Pinault 1978</td>
<td>oral</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>3.5 mg/m³</td>
</tr>
<tr>
<td>Cat</td>
<td>Moraillon and Pinault 1978</td>
<td>oral</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>3.5 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Prasad et al. 1981</td>
<td>oral</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>14 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Specter 1956</td>
<td>oral</td>
<td>16</td>
<td>-</td>
<td>-</td>
<td>112 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Ward and Crabtree 1942</td>
<td>oral</td>
<td>2.35</td>
<td>-</td>
<td>-</td>
<td>17 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................... It has been reported that the probable lethal oral dose is 1.5 to 2 mg/kg [Gosselin et al. 1984]. [Note: An oral dose of 1.5 to 2 mg/kg is equivalent to a 70-kg worker being exposed to 70 to 90 mg/m³ for 30 minutes assuming a 50 liter per minute breathing rate and 100% absorption.]

Revised IDLH: 3 mg/m³ [Unchanged]

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for strychnine. However, based on acute oral toxicity data in humans [Gosselin et al., 1984] the original IDLH for strychnine (3 mg/m³) is not being revised at this time.

REFERENCES:

**Styrene**

**CAS number** .................................. 100-42-5
**NIOSH PEL** .................................. 50 ppm (215 mg/m³) TWA, 100 ppm (425 mg/m³) STEL
**Current OSHA PEL** ............................ 100 ppm TWA, 200 ppm CEILING.

**1989 OSHA PEL** ............................ 50 ppm (215 mg/m³) TWA, 100 ppm (425 mg/m³) STEL

**1993-1994 ACGIH TLV** ........................ 50 ppm (213 mg/m³) TWA.

**Original (SCP) IDLH** ........................ 100 ppm (426 mg/m³) CEILING (skin)

**Basis for original (SCP) IDLH** ................. The chosen IDLH is based on the statement by Patty [1963] that rats and guinea pigs exposed to 5,000 ppm become unconscious within 1 hour [Spencer et al. 1942]. None developed

**Short-term exposure guidelines** ................. None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀ (ppm)</th>
<th>LC₅₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 8.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>2.194</td>
<td>-----</td>
<td>4 hr</td>
<td>4.328 ppm (2.0)</td>
<td>633 ppm</td>
</tr>
<tr>
<td>Human</td>
<td>Lefaux 1978</td>
<td>----</td>
<td>10,000</td>
<td>30 min</td>
<td>10,000 ppm (3.0)</td>
<td>3,000 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Spencer et al. 1942</td>
<td>----</td>
<td>2,771</td>
<td>14 hr</td>
<td>8,314 ppm (3.0)</td>
<td>831 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Tiunov et al. 1982</td>
<td>5.543</td>
<td>-----</td>
<td>4 hr</td>
<td>11,085 ppm (3.0)</td>
<td>1,109 ppm</td>
</tr>
</tbody>
</table>

**Other animal data** ................................ RD₅₀ (mouse), 960 ppm [Alarie 1981].

**Other human data** ................................ Volunteers exposed to 376 ppm for up to 7 hours experienced unpleasant subjective symptoms and objective signs of neurologic impairment [Stewart et al. 1968]. Drowsiness, nausea, headache, fatigue, and dizziness have been reported in workers exposed to 200 to 700 ppm [AIHA 1959].

**Revised IDLH: 700 ppm**

**Basis for revised IDLH:** The revised IDLH for styrene is 700 ppm based on acute inhalation toxicity data in humans [AIHA 1959; Stewart et al. 1968].

**REFERENCES:**

3. Izmerov NF, Sandrosky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 106.
Sulfur dioxide

CAS number ................................................. 7446-09-5
NIOSH REL .................................................. 2 ppm (5 mg/m³) TWA, 5 ppm (13 mg/m³) STEL
Current OSHA PEL .............................. 5 ppm (13 mg/m³) TWA
1988 OSHA PEL ............................ 2 ppm (5 mg/m³) TWA, 5 ppm (13 mg/m³) STEL
1993-1994 ACGIH TLV ......................... 2 ppm (5.2 mg/m³) TWA, 5 ppm (13 mg/m³) STEL

Description of substance .......................... Colorless gas with a characteristic, irritating, pungent odor.

LEL .......................................................... Nonflammable Gas
Original (SCP) IDLH .............................. 100 ppm
Basis for original (SCP) IDLH ........................ The chosen IDLH is based on the statement by AIHA [1955] that 50 to 100 ppm is considered the maximum concentration for exposures of 0.5 to 1 hour [Henderson and Haggard 1943]. With regard to the atmospheric concentration immediately hazardous to life, AIHA [1955] reported that 400 to 500 ppm is considered dangerous for even short periods of exposure [Henderson and Haggard 1943] and that exposure to undurable concentrations is not necessarily hazardous if escape is made within a few minutes.


- 10-minute EEGL: 30 ppm
- 30-minute EEGL: 20 ppm
- 60-minute EEGL: 10 ppm
- 24-hour EEGL: 5 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Flury and Zernik 1935</td>
<td>993</td>
<td>3,000</td>
<td>20 min</td>
<td>864 ppm (0.87)</td>
<td>86 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Flury and Zernik 1935</td>
<td>611</td>
<td>1,314</td>
<td>5 hr</td>
<td>1,314 ppm (2.15)</td>
<td>211 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Flury and Zernik 1935</td>
<td>764</td>
<td>685 ppm (0.87)</td>
<td>67 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Hilado and Machado 1977</td>
<td>3,000</td>
<td>1,000 ppm (1.0)</td>
<td>300 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Kinkead and Zernik 1935</td>
<td>2,520</td>
<td>3,150 ppm (2.15)</td>
<td>315 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>Shupe et al. 1972</td>
<td>1,000</td>
<td>690 ppm (0.69)</td>
<td>69 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td>Tab Biol Per 1953</td>
<td>3,000</td>
<td>1,500 ppm (0.5)</td>
<td>150 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ........................................ RD₅₀ (mouse), 117 ppm [Alarie 1981].
Other human data ........................................ The maximum concentration for exposures of 0.5 to 1 hour is considered to be 50 to 100 ppm [Henderson and Haggard 1943]. It has been reported that 400 to 500 ppm is considered dangerous for even short periods of exposure [Henderson and Haggard 1943].

Revised IDLH: 100 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Henderson and Haggard 1943; Shupe et al. 1972; Tab Biol Per 1953]; the original IDLH for sulfur dioxide (100 ppm) is not being revised at this time.

REFERENCES:

Sulfur dioxide (continued)

3. Flury F, Zernik F (1935). Zusammenstellung der toxischen und letalen dosen für die gebräuchlichsten giftig und
[1972]. Reclassification of materials listed as transportation health hazards. Wright-Patterson Air Force Base, OH:
6570th Aerospace Medical Research Laboratory. Report No. TSA-20-72-3, pp. A250 to A251.]


Air Force Systems Command, Air Force Aerospace Medical Division, Aerospace Medical Research Laboratory.
Technical Report AFAMRL·TR-84-069.

National Academy Press, Committee on Toxicology, Board on Toxicology and Environmental Health Hazards,
Commission on Life Sciences, National Research Council, pp. 95-102.


Sulfuric acid

CAS number ................................................................. 7664-93-9
NIOSH REL ................................................................. 1 mg/m³ TWA
Current OSHA PEL .......................................................... 1 mg/m³ TWA
1989 OSHA PEL ............................................................. Same as current PEL
1993-1994 ACGIH TLV .................................................... 1 mg/m³ TWA, 3 mg/m³ STEL

Description of substance .................................................. Colorless to dark-brown, oily, odorless liquid.

LEL .................................................................................. Noncombustible Liquid

Original (SCP) IDLH ............................................................ 80 mg/m³

Existing short-term exposure guidelines .................................. The chosen IDLH is based on the statement by ACGIH [1971] that guinea pigs died after 2.75 hours of exposure at 87 mg/m³ [Treon et al. 1950].

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₀₁₀</th>
<th>LC₉₀₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Amdur et al. 1952a</td>
<td>50 mg/m³</td>
<td>------</td>
<td>8 hr</td>
<td>125 mg/m³ (2.5)</td>
<td>13 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>520 mg/m³</td>
<td>------</td>
<td>2 hr</td>
<td>816 mg/m³ (1.6)</td>
<td>82 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>320 mg/m³</td>
<td>------</td>
<td>2 hr</td>
<td>512 mg/m³ (1.6)</td>
<td>51 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Raule 1954</td>
<td>16 mg/m³</td>
<td>------</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>G. pig</td>
<td>Treon et al. 1950</td>
<td>------</td>
<td>8⁷ mg/m³</td>
<td>2.75 hr</td>
<td>164 mg/m³ (1.75)</td>
<td>15 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₀₁₀ (mg/kg)</th>
<th>LD₉₀₀ (mg/kg)</th>
<th>Adjusted LD (mg/kg)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Smyth et al. 1969</td>
<td>oral</td>
<td>2.140</td>
<td>------</td>
<td>14,980 mg/kg</td>
<td>3,498 mg/kg</td>
</tr>
</tbody>
</table>

Human data ................................................................. In exposures of 5 to 15 minutes, some volunteers found 5 mg/m³ to be very objectionable, while others found it less so [Amdur et al. 1952b]. The lethal oral dose has been reported to be 135 mg/kg [Arena 1970]. [Note: An oral dose of 135 mg/kg is equivalent to a worker being exposed to about 8,300 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 15 mg/m³

Baseline for revised IDLH: The revised IDLH for sulfuric acid is 15 mg/m³ based on acute inhalation toxicity data in humans [Amdur et al. 1952b] and animals [Amdur et al. 1952a; Treon et al. 1950]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 5 mg/m³.

REFERENCES:


439
Sulfuric acid (continued)


Sulfur monochloride

CAS number ........................................... 10625-67-9
NIOSH REL ........................................... 1 ppm (6 mg/m³) CEILING
Current OSHA PEL ................................... 1 ppm (6 mg/m³) TWA
1989 OSHA PEL ....................................... 1 ppm (6 mg/m³) CEILING
1993-1994 ACGIH TLV ................................ 1 ppm (5.5 mg/m³) CEILING

Description of substance: Light-amber to yellow-red, oily liquid with a pungent, nauseating, irritating odor.

LEL ....................................................... Unknown
Original (SCP) IDLH .................................. 10 ppm
Base for original (SCP) IDLH: Very little data are available on which to base the IDLH for sulfur monochloride. The chosen IDLH has been estimated from the statement by ACGIH [1971] that 12 ppm for 15 minutes was tolerated by cats, but four times that concentration, also for 15 minutes, could lead to death after a few days [Flury and Zernik 1931]. No other useful data are available on which to base the IDLH.

Baala for revised IDLH: The revised IDLH for sulfur monochloride is 5 ppm based on acute inhalation toxicity data in animals [Flury and Zernik 1931; Henderson and Haggard 1943].

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>L_{50} (ppm)</th>
<th>L_{10} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.6-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Flury and Zernik 1931</td>
<td>------</td>
<td>150</td>
<td>1 min</td>
<td>48 ppm (0.32)</td>
<td>4.8 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Henderson and Haggard 1943</td>
<td>LC_{10}</td>
<td>60</td>
<td>15 min</td>
<td>47 ppm (0.79)</td>
<td>4.7 ppm</td>
</tr>
</tbody>
</table>

It has been reported that cats have tolerated 15-minute exposures to 12 ppm, while 48 ppm could lead to death after a few days [Flury and Zernik 1931].

Other animal data: None relevant for use in determining the revised IDLH.

Human data: None developed

REFERENCES:

Sulfur pentafluoride

CAS number ........................................... 5714-22-7
NIOSH REL ........................................... 0.01 ppm (0.1 mg/m^3) CEILING
Current OSHA PEL .................................. 0.01 ppm (0.1 mg/m^3) CEILING
1989 OSHA PEL ...................................... 0.025 ppm (0.25 mg/m^3) TWA
1993-1994 ACGIH TLV ............................. 0.01 ppm (0.1 mg/m^3) CEILING

Description of substance
Colorless liquid or gas (above 84°F) with an odor like sulfur dioxide.

LEL ....................................................... Noncombustible Liquid/Nonflammable Gas

Original (SCP) IDLH .......... 1 ppm

Basis for original (SCP) IDLH ........................ The chosen IDLH is based on the statement by ACGIH [1971] that a 1-hour exposure to 1 ppm caused severe congestion of the lungs of rats [Greenberg and Lester 1950]. According to ACGIH [1971], sulfur pentafluoride is more toxic than phosgene; the TLV of 0.025 ppm for sulfur pentafluoride reflects its greater toxicity in comparison with phosgene. The chosen IDLH also reflects the greater toxicity of sulfur pentafluoride in comparison with phosgene, which has an IDLH of 2 ppm.

Short-term exposure guideline ................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50}</th>
<th>LC_{30}</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>NDRC 1946</td>
<td>2,000 mg/m^3</td>
<td>--</td>
<td>10 min</td>
<td>130 ppm (0.69)</td>
<td>13 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>NDRC 1946</td>
<td>1,000 mg/m^3</td>
<td>--</td>
<td>10 min</td>
<td>66 ppm (0.69)</td>
<td>6.6 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>NDRC 1946</td>
<td>4,000 mg/m^3</td>
<td>--</td>
<td>10 min</td>
<td>262 ppm (0.69)</td>
<td>26 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>NDRC 1946</td>
<td>4,000 mg/m^3</td>
<td>--</td>
<td>10 min</td>
<td>262 ppm (0.69)</td>
<td>26 ppm</td>
</tr>
<tr>
<td>Dog</td>
<td>NDRC 1946</td>
<td>4,000 mg/m^3</td>
<td>--</td>
<td>10 min</td>
<td>262 ppm (0.69)</td>
<td>26 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................... It has been reported that exposure for 1 hour at 10 ppm caused multiple diffuse hemorrhagic lesions in the lungs of rats. one hour at 1 ppm caused severe congestion of the lungs, and 1 hour at 0.1 ppm had no effect [Greenberg and Lester 1950].

Human data .................................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 1 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in animals [Greenberg and Lester 1950], the original IDLH for sulfur pentafluoride (1 ppm) is not being revised at this time.

REFERENCES:

Sulfuryl fluoride

CAS number .................................................. 2699-79-8
NIOSH REL .......................................................... 5 ppm (20 mg/m³) TWA, 10 ppm (40 mg/m³) STEL
Current OSHA PEL .................................................. 5 ppm (20 mg/m³) TWA
1989 OSHA PEL .................................................. 5 ppm (20 mg/m³) TWA, 10 ppm (40 mg/m³) STEL
1993-1994 ACGIH TLV ................................................. 5 ppm (21 mg/m³) TWA, 10 ppm (42 mg/m³) STEL

Description of substance ........................................... Colorless, odorless gas.

LEL ................................................................. Nonflammable Gas

Original (SCP) IDLH .................................................. 1,000 ppm

Basis for original (SCP) IDLH ........................................ The chosen IDLH is based on the report by Taxay [1966] that less than 5% mortality resulted from exposure of animals for 3 hours to 1,000 ppm. None developed

Short-term exposure guidelines ......................................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Nitschke et al. 1986</td>
<td>991</td>
<td>-----</td>
<td>4 hr</td>
<td>1,982 ppm (2.0)</td>
<td>158 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Truhaut et al. 1973</td>
<td>-----</td>
<td>3,200</td>
<td>1 hr</td>
<td>3,500 ppm (1.25)</td>
<td>150 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Truhaut et al. 1973</td>
<td>5,000</td>
<td>-----</td>
<td>1 hr</td>
<td>6,250 ppm (1.25)</td>
<td>625 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................................ It has been reported that less than 5% mortality resulted from exposure for 3 hours to 1,000 ppm [Taxay 1966].

Human data ......................................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 200 ppm

Basis for revised IDLH: The revised IDLH for sulfuryl fluoride is 200 ppm based on acute inhalation toxicity data in animals [Nitschke et al. 1986; Truhaut et al. 1973].

REFERENCES:

2,4,5-T

CAS number ........................................ 93-76-5
NIOSH REL .................................................. 
Current OSHA PEL .................................... 10 mg/m³ TWA
1989 OSHA PEL ........................................ 10 mg/m³ TWA
1993-1994 ACGIH TLV ................................. 10 mg/m³ TWA
Description of substance ................................ Colorless to tan, odorless, crystalline solid.
LEL .......................................................... 
Original (SCP) IDLH* .................................... Unknown [Note: "Effective" IDLH = 5,000 mg/m³ – see discussion below.]

Basis for original (SCP) IDLH .......................... According to ACGIH [1971], "the toxicity of this compound appears to be similar to the somewhat better known 2,4-D. According to Rowe and Hymas [1954], the oral LD₅₀ values fall in a range of 300 to 1,000 mg/kg for rats, mice, guinea pigs, and rabbits. Chronic exposure is not necessarily more hazardous. Drill and Hiratzka [1953] found that there were no deaths among dogs treated with 2, 5, or 10 mg/kg/day of 2,4,5-T (5 days/week for 13 weeks); some deaths occurred at 20 mg/kg/day. There are no reports of illness from occupational exposure. It appears that the TLV of 10 mg/m³ is justified on the basis of extrapolation from animal feeding studies and extensive use experience."

Based on the toxicological data cited above, 2,4,5-T is a relatively nontoxic compound. Because data on acute inhalation toxicity are not available for this substance and to be consistent with the IDLHs selected for similar, relatively nontoxic compounds, 5,000 mg/m³ (i.e., 500 x the OSHA PEL of 10 mg/m³) has been chosen as the concentration above which only the "most protective" respirators are permitted.

Short-term exposure guidelines ....................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>AAPCO 1966</td>
<td>oral</td>
<td>381</td>
<td>100</td>
<td>2,667 mg/m³</td>
<td>267 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Bailey and White 1965</td>
<td>oral</td>
<td>300</td>
<td>2,100 mg/m³</td>
<td>210 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Hamster</td>
<td>Grant 1979</td>
<td>oral</td>
<td>425</td>
<td>2,975 mg/m³</td>
<td>296 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Senczuk and Pogorzelska 1980</td>
<td>oral</td>
<td>242</td>
<td>1,894 mg/m³</td>
<td>189 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ................................ It has been reported that there were no deaths among dogs treated with 2, 5, or 10 mg/kg/day of 2,4,5-T (5 days/week for 13 weeks); some deaths occurred at 20 mg/kg/day [Drill and Hiratzka 1953].

Human data .............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 250 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for 2,4,5-T. Therefore, the revised IDLH for 2,4,5-T is 250 mg/m³ based on acute oral toxicity data in animals [AAPCO 1966; Bailey and White 1965; Grant 1979; Senczuk and Pogorzelska 1980]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

2,4,5-T (continued)


Talc

<table>
<thead>
<tr>
<th>Description of substance</th>
<th>Odorless, white powder.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original (SCP) IDLH*</td>
<td>Noncombustible Solid</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>No Evidence [*Note: &quot;Effective&quot; IDLH = 10,000 mppcf - see discussion below.]</td>
</tr>
</tbody>
</table>

**ACUTE TOXICITY DATA**

<table>
<thead>
<tr>
<th>Animal or human data</th>
<th>None relevant for use in determining the revised IDLH.</th>
</tr>
</thead>
</table>

**Revised IDLH:** 1,000 mg/m²

Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of talc would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for talc is 1,000 mg/m² based on being 500 times the NIOSH REL of 2 mg/m² (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).
Tantalum (metal and oxide dust, as Ta)

CAS number .......................................................... 7440-25-7 (Metal)
NIOSH REL ................................................................. 5 mg/m³ TWA, 10 mg/m³ STEL
Current OSHA PEL ...................................................... 5 mg/m³ TWA
1988 OSHA PEL ........................................................ 5 mg/m³ TWA
1993-1994 ACGIH TLV ................................................ 5 mg/m³ TWA

Description of substance

Original (SCP) IDLH* .................................................. No Evidence [*Note: "Effective" IDLH = 2,500 mg Ta/m³ — see discussion below.]

Basis for original (SCP) IDLH

Because no evidence of an IDLH is shown in the available toxicological data, respirators have been assigned on the basis of the assigned protection factor afforded by each device up to 500 x the OSHA PEL of 5 mg Ta/m³ (i.e., 2,500 mg Ta/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 2,500 mg Ta/m³.

Short-term exposure guidelines

None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₃₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ta₂O₅, Rat</td>
<td>Coulston and Korte 1975</td>
<td>oral</td>
<td>8,000</td>
<td>-----</td>
<td>45,856 mg Ta/m³</td>
<td>4,586 mg Ta/m³</td>
</tr>
</tbody>
</table>

Human data ........................................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 2,500 mg Ta/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for tantalum metal and oxide dust. Therefore, based on acute oral toxicity data in animals [Coulston and Korte 1975], a value of about 4,500 mg Ta/m³ would have been appropriate. However, the revised IDLH for tantalum metal and oxide dust is 2,500 mg Ta/m³ based on being 500 times the NIOSH REL and OSHA PEL of 5 mg Ta/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).

REFERENCE:

TEDP

CAS number ........................................ 89-24-5
NIOSH REL ..............................................
Current OSHA PEL .................................... 0.2 mg/m³ TWA [skin]
1989 OSHA PEL ....................................... Same as current PEL
LEL .........................................................
Original (SCP) IDLH .................................. 0.2 mg/m³ TWA [skin]
Basis for original (SCP) IDLH ........................ The chosen IDLH is based on the rat oral LD₅₀ of 5 mg/kg [Lehman 1951 cited by ACGIH 1971]. No other useful data are available on which to base the IDLH.

Short-term exposure guidelines ......... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀ (mg/m³)</th>
<th>LC₅₀ (mg/m³)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kimmerele and Klimmer 1974</td>
<td>38 mg/m³</td>
<td>---</td>
<td>4 hr</td>
<td>76 mg/m³ (2.0)</td>
<td>7.6 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Kimmerele and Klimmer 1974</td>
<td>40 mg/m³</td>
<td>---</td>
<td>4 hr</td>
<td>80 mg/m³ (2.0)</td>
<td>8.0 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₅₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Kimmerele and Klimmer 1974</td>
<td>oral</td>
<td>22</td>
<td>---</td>
<td>15 mg/m³</td>
<td>15 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Kimmerele and Klimmer 1974</td>
<td>oral</td>
<td>25</td>
<td>---</td>
<td>17.5 mg/m³</td>
<td>18 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Kimmerele and Klimmer 1974</td>
<td>oral</td>
<td>5</td>
<td>---</td>
<td>35 mg/m³</td>
<td>3.5 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Lehman 1951</td>
<td>oral</td>
<td>5</td>
<td>---</td>
<td>35 mg/m³</td>
<td>3.5 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data ........................................ It has been stated that TEDP is an organophosphate pesticide whose toxicity is similar to that of parathion [ACGIH 1991].

Human data ............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 10 mg/m³

Basis for revised IDLH: The revised IDLH for TEDP is 10 mg/m³ based on acute inhalation toxicity data in animals [Kimmerele and Klimmer 1974] and on an analogy with parathion [ACGIH 1991] which has a revised IDLH of 10 mg/m³.

REFERENCES:

Tellurium compounds (as Te)

CAS number .................................. 13494-80-9 (Metal)
NIOSH REL .................................. 0.1 mg/m³ TWA
Current OSHA PEL ............................ 0.1 mg/m³ TWA
1989 OSHA PEL .............................. Same as current PEL
1993-1994 ACGIH TLV ........................ 0.1 mg/m³ TWA

Description of substance ....................... Varies

Original (SCP) IDLH* ........................... No Evidence [*Note: "Effective" IDLH = 50 mg Te/m³ -- see discussion below.]

Basis for original (SCP) IDLH .................. Because no evidence of an IDLH for tellurium is shown in the available toxicological data, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 500 x the OSHA PEL of 0.1 mg Te/m³ (i.e., 50 mg Te/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 50 mg Te/m³.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Te:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>83</td>
<td>-----</td>
<td>581 mg Te/m³</td>
<td>58 mg Te/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>20</td>
<td>-----</td>
<td>140 mg Te/m³</td>
<td>14 mg Te/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>67</td>
<td>-----</td>
<td>469 mg Te/m³</td>
<td>47 mg Te/m³</td>
</tr>
<tr>
<td>S. pig</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>45</td>
<td>-----</td>
<td>315 mg Te/m³</td>
<td>32 mg Te/m³</td>
</tr>
<tr>
<td>TeCl₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Muehberger and Schrenk 1928</td>
<td>oral</td>
<td>56</td>
<td>-----</td>
<td>392 mg Te/m³</td>
<td>39 mg Te/m³</td>
</tr>
</tbody>
</table>

Human data .................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 25 mg Te/m³

Based for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for tellurium compounds. Therefore, the revised IDLH for tellurium compounds is 25 mg Te/m³ based on acute oral toxicity data in animals [Izmerov et al. 1982; Muehberger and Schrenk 1928].

REFERENCES:

1. Izmerov NF, Senotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 107.
Tellurium hexafluoride (as Te)  

CAS number ........................................... 7783-80-4  
NIOSH REL ........................................... 0.02 ppm (0.1 mg/m³) TWA  
Current OSHA PEL .................................... 0.02 ppm (0.2 mg/m³) TWA  
1989 OSHA PEL ........................................ Same as current PEL  
1993-1994 ACGIH TLV ............................... 0.02 ppm (0.10 mg/m³) TWA  
Description of substance ............................. Colorless gas with a repulsive odor.  
LEL .......................................................... Nonflammable Gas  
Original (SCP) IDLH .................................... 1 ppm  
Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the statements by ACGIH [1971] that "animals showed evidence of pulmonary edema (disturbed breathing) at the lowest exposure tested, 1 ppm for 4 hours; a 1-hour exposure at 1 ppm produced greatly accelerated respiration but no mortality" [Kimmerle 1960]. The IDLH has been conservatively set, but no other data on acute inhalation toxicity are available on which to base an IDLH. Exposure for 4 hours to higher concentrations (5, 10, 25, 50, and 100 ppm) invariably proved fatal to all exposed animals [Kimmerle 1960]. None developed  

Short-term exposure guidelines ..........................  
ACUTE TOXICITY DATA  
Lethal concentration data:  

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Kimmerle 1960</td>
<td>---</td>
<td>5</td>
<td>4 hr</td>
<td>10 ppm (2.0)</td>
<td>1.0 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Kimmerle 1960</td>
<td>---</td>
<td>5</td>
<td>1 hr</td>
<td>6.3 ppm (1.25)</td>
<td>0.6 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Kimmerle 1960</td>
<td>---</td>
<td>5</td>
<td>4 hr</td>
<td>10 ppm (2.0)</td>
<td>1.0 ppm</td>
</tr>
<tr>
<td>O. pig</td>
<td>Kimmerle 1960</td>
<td>---</td>
<td>5</td>
<td>4 hr</td>
<td>10 ppm (2.0)</td>
<td>1.0 ppm</td>
</tr>
</tbody>
</table>

Other animal data ...................................... It has been reported that animals showed evidence of pulmonary edema (disturbed breathing) at the lowest exposure tested, 1 ppm for 4 hours: a 1-hour exposure at 1 ppm produced greatly accelerated respiration but no mortality [Kimmerle 1960].  

Human data ............................................. None relevant for use in determining the revised IDLH.  

Revised IDLH: 1 ppm [Unchanged]  
Basis for revised IDLH: Based on acute inhalation toxicity data in animals [Kimmerle 1960], the original IDLH for tellurium hexafluoride (1 ppm) is not being revised at this time.  

REFERENCES:  
Arch Toxikol 18:140-144 (in German).
TEPP

CAS number ........................................... 107-49-3
NIOSH REL ..........................................
Current OSHA PEL ..................................
Same as current PEL
1989-1994 ACGIH TLV............................
0.004 ppm (0.47 mg/m³) TWA [skin]
Description of substance ......................... Colorless to amber liquid with a faint, fruity odor.
LEL ........................................... Noncombustible Liquid
Original (SCP) IDLH ................................. 10 mg/m³

Basis for original (SCP) IDLH ................. The chosen IDLH is based on the estimated oral lethal dose in

man of 100 mg cited by Patty [1963].

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₃ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Edson 1960</td>
<td>oral</td>
<td>0.5</td>
<td>3.5 mg/m³</td>
<td>0.4 mg/m³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td>Frawley et al. 1952</td>
<td>oral</td>
<td>2.3</td>
<td>16 mg/m³</td>
<td>1.6 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Kamimura et al. 1963</td>
<td>oral</td>
<td>3</td>
<td>21 mg/m³</td>
<td>2.1 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................... TEPP, a cholinesterase inhibitor, has been judged to be twice as
toxic as parathion; the American Conference of Governmental
Industrial Hygienists TLV for TEPP was based on an analogy to
parathion and was half that selected for parathion [ACGIH 1986].
It has been reported that the lethal oral dose is 1.429 mg/kg
[CDC 1956; Patty 1963]. [Note: An oral dose of 1.429 mg/kg is
equivalent to a 70-kg worker being exposed to 67 mg/m³ for
30 minutes assuming a 50 liter per minute breathing rate and
100% absorption.]

Revised IDLH: 5 mg/m³

Basis for revised IDLH: No inhalation data are available on which to base an IDLH for TEPP. Therefore, the revised
IDLH for TEPP is 5 mg/m³ based on acute oral toxicity data in humans [CDC 1956; Patty 1963] and an analogy to
parathion [ACGIH 1986] which has a revised IDLH of 10 mg/m³.

REFERENCES:

   Cincinnati, OH: American Conference of Governmental Industrial Hygienists, p. 556.
2. CDC [1956]. Clinical memoranda on economic poisons. Atlanta, GA: Communicable Disease Center, Bureau of State
   Publication No. 476, pp. 21-23.
Terphenyl (o-, m-, p-isomers)

CAS number ........................................... 26140-60-3 (mixed isomers)
NIOSH REL .............................................
Current OSHA PEL ......................................
1989 OSHA PEL ......................................
1993-1994 ACGIH TLV ..............................
Description of substance ..............................
LEL .......................................................... Unknown
Original (SCP) IDLH* ...................................
Basis for original (SCP) IDLH ............................ According to Testa and Masi [1964], workers have been exposed to 280 mg/m³ without adverse effect. For this draft technical standard, however, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 100 x the OSHA PEL of 9 mg/m³ (i.e., 900 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 900 mg/m³. This is a concentration unlikely to occur because of its low vapor pressure.
Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed isomers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Zhenjiang and Gengliang 1986</td>
<td>oral</td>
<td>13,200</td>
<td>92,400</td>
<td>9,240</td>
<td></td>
</tr>
<tr>
<td>o-Isomer</td>
<td>Cornish et al. 1962</td>
<td>oral</td>
<td>1,900</td>
<td>12,300</td>
<td>1,330</td>
<td></td>
</tr>
<tr>
<td>m-Isomer</td>
<td>Cornish et al. 1962</td>
<td>oral</td>
<td>2,400</td>
<td>16,800</td>
<td>1,680</td>
<td></td>
</tr>
<tr>
<td>p-Isomer</td>
<td>Cornish et al. 1962</td>
<td>oral</td>
<td>&gt;10,000</td>
<td>&gt;70,000</td>
<td>&gt;7,000</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>NRC 1953</td>
<td>oral</td>
<td>-----</td>
<td>500</td>
<td>350</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data
In 30-day feeding studies involving doses of 250 or 500 mg/kg/day, rats fed o-terphenyl showed elevated liver and kidney weight ratios, rats fed m-terphenyl showed elevated kidney weight ratios only, and rats fed p-terphenyl showed no elevation in liver or kidney weight ratios [Cornish et al. 1962].

Human data
It has been reported that workers have been exposed to 280 mg/m³ without adverse effect [Testa and Masi 1964].

Revised IDLH: 500 mg/m³
Basis for revised IDLH: Based on health considerations and acute toxicity data in animals [NRC 1953], a value of about 2,000 mg/m³ would have been appropriate for terphenyl. However, the revised IDLH for terphenyl is 500 mg/m³ based on being 100 times the NIOSH REL of 5 mg/m³ (100 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for terphenyl).

REFERENCES:


1,1,1,2-Tetrachloro-2,2-difluoroethane

CAS number .............................................. 76-11-6
NIOSH REL .....................................................
Current OSHA PEL ........................................... 500 ppm (4,170 mg/m³) TWA
1989 OSHA PEL ............................................... Same as current PEL
1983-1984 ACGIH TLV ....................................... 500 ppm (4,170 mg/m³) TWA
LEL .............................................................. Noncombustible solid
Description of substance .................................. Colorless solid with a slight, ether-like odor.
Original (SCP) IDLH ......................................... 15,000 ppm
Basis for original (SCP) IDLH ............................. The chosen IDLH is based on the statement by Patty [1963] that rats became slightly intoxicated after being exposed for 1.5 hours to 15,000 ppm [Greenberg and Lester 1950] and on the statement by ACGIH [1971] that rats died following a 4-hour exposure to 15,000 ppm [Clayton et al. 1966]. None developed

Short-term exposure guidelines ............................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>( LC_{50} ) (ppm)</th>
<th>( LC_{10} ) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Clayton et al. 1966</td>
<td>15,000</td>
<td>-------</td>
<td>4 hr</td>
<td>30,000 ppm (2.0)</td>
<td>1,000 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Torkelson et al. 1971</td>
<td>20,000</td>
<td>-------</td>
<td>30 min</td>
<td>20,000 ppm (1.0)</td>
<td>2,000 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................ Rats exposed to 10,000 ppm for 1.5 to 2 hours showed slight signs of intoxication but no loss of reflexes, while a concentration of 20,000 to 30,000 ppm was fatal in 1.0 to 2.5 hours [Greenberg and Lester 1950].

Human data .............................................. None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 ppm

Basis for revised IDLH: The revised IDLH for 1,1,1,2-tetrachloro-2,2-difluoroethane is 2,000 ppm based on acute inhalation toxicity data in animals [Torkelson et al. 1971] and to be consistent with the revised IDLH for the similar chlorofluorocarbon 1,1,2,2-tetrachloro-1,2-difluoroethane which has a revised IDLH of 2,000 ppm. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

1,1,2,2-Tetrachloro-1,2-difluoroethane

- **CAS number**: 75-12-0
- **NIOSH REL**: .................................. 
- **Current OSHA PEL**: 500 ppm (4.17 mg/m³) TWA
- **1989 OSHA PEL**: Same as current PEL
- **1993-1994 ACGIH TLV**: 500 ppm (4.17 mg/m³) TWA
- **Description of substance**: Colorless solid or liquid (above 77°F) with a slight, ether-like odor.
- **LEL**: ......................................... 
- **Original (SCP) IDLH**: 15,000 ppm
- **Easls for original (SCP) IDLH**: 
- **Short-term exposure guidelines**: 

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₁₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Clark and Tinston 1982</td>
<td>20,000</td>
<td>15,000</td>
<td>25 min</td>
<td>15,800 ppm (0.79)</td>
<td>2,580 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Clayton et al. 1966</td>
<td>15,000</td>
<td>20,000</td>
<td>4 hr</td>
<td>30,000 ppm (2.6)</td>
<td>3,000 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>14,522</td>
<td>23,235</td>
<td>2 hr</td>
<td>23,355 ppm (1.6)</td>
<td>2,324 ppm</td>
</tr>
</tbody>
</table>

Other animal data: Rats exposed to 10,000 ppm for 1.5 to 2 hours showed slight signs of intoxication but no loss of reflexes, while 20,000 to 30,000 ppm was fatal in 1.0 to 2.5 hours [Greenberg and Lester 1950].

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 2,000 ppm

**Basis for revised IDLH**: The revised IDLH for 1,1,2,2-tetrachloro-1,2-difluoroethane is 2,000 ppm based on acute inhalation toxicity data in animals [Greenberg and Lester 1950] and to be consistent with the revised IDLH for the similar chlorofluorocarbon 1,1,1,2-tetrachloro-2,2-difluoroethane which has a revised IDLH of 2,000 ppm. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

**REFERENCES:**

1. ACGIH [1971]. 1,1,2,2-Tetrachloro-1,2-difluoroethane. In: Documentation of the threshold limit values for substances in workroom air. 3rd ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, p. 249.
5. Izmerov NF, Sanotsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 54.
1,1,2,2-Tetrachloroethane

CAS number ..................................................... 79-34-5
NIOSH REL .................................................. 
Current OSHA PEL ............................................. 
1989 OSHA PEL ................................................ 
1993-1994 ACGIH TLV ........................................ 
Description of substance ....................................... 
LEL ..................................................................... 
Original (SCP) IDLH ............................................. 
Basis for original (SCP) IDLH ................................... 
Short-term exposure guidelines ................................... 

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>----</td>
<td>1,000</td>
<td>6 hr</td>
<td>2,000 ppm (2.0)</td>
<td>200 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Izmerov et al. 1982</td>
<td>----</td>
<td>643</td>
<td>2 hr</td>
<td>1,009 ppm (1.0)</td>
<td>103 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Lehmann et al. 1936</td>
<td>----</td>
<td>2,714</td>
<td>45 min</td>
<td>3,094 ppm (1.14)</td>
<td>309 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth 1956</td>
<td>1,000</td>
<td>----</td>
<td>4 hr</td>
<td>2,000 ppm (2.0)</td>
<td>200 ppm</td>
</tr>
</tbody>
</table>

Human data ......................................................... A 30-minute exposure to 146 ppm has caused vertigo, irritation of the mucous membranes, sense of pressure in the head, and fatigue; the same effects were noted after a 10-minute exposure to 335 ppm [Lehmann et al. 1936].

Revised IDLH: 100 ppm
Basis for revised IDLH: The revised IDLH for 1,1,2,2-tetrachloroethane is 100 ppm based on acute inhalation toxicity data in humans [Lehmann et al. 1936; Negherbon 1959] and animals [Izmerov et al. 1982]. [Note: NIOSH recommends as part of its carcinogen policy that the most protective respirators be worn for 1,1,2,2-tetrachloroethane at concentrations above 1 ppm.]

REFERENCES:

2. Izmerov NF, Samotskoy IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKN. p. 75.
Tetrachloroethylene

CAS number .................................. 127-18-4
NIOSH REL .................................. Minimize workplace exposure concentrations; NIOSH considers tetrachloroethylene to be a potential occupational carcinogen as defined by the OSHA carcinogen policy (29 CFR 1990).
Current OSHA PEL ............................ 100 ppm TWA, 200 ppm CEILING,
1989 OSHA PEL .................................. 300 ppm 5-minute MAXIMUM PEAK IN ANY 3 HOURS
1993-1994 ACGIH TLV ..................... 25 ppm (170 mg/m^3) TWA
Description of substance ....................... Colorless liquid with a mild, chloroform-like odor.
LEL ......................................... Noncombustible Liquid
Original (SCP) IDLH .......................... 500 ppm
Basis for original (SCP) IDLH .................. The chosen IDLH is based on the statement by Negherbon [1959] that a 95-minute exposure to 1,000 ppm produces slight drunkenness, but no narcosis [Rowe et al. 1952]. Negherbon [1959] also reported that a 20- to 30-minute exposure to 206 to 235 ppm causes dizziness in humans (along with eye irritation, sinus congestion, nasal discharge, and sleepiness) [Rowe et al. 1952]. An IDLH of 500 ppm is used to prevent disorientation during escape. None developed

Short-term exposure guidelines .................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_s (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat C.</td>
<td>Carpenter et al. 1949</td>
<td>4,000</td>
<td>-</td>
<td>4 hr</td>
<td>11,320 ppm (2.83)</td>
<td>1,132 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Friberg et al. 1953</td>
<td>5,200</td>
<td>-</td>
<td>4 hr</td>
<td>14,716 ppm (2.83)</td>
<td>1,472 ppm</td>
</tr>
<tr>
<td>Rat C.</td>
<td>Pozzani et al. 1959</td>
<td>4,864</td>
<td>-</td>
<td>8 hr</td>
<td>19,856 ppm (4.0)</td>
<td>1,986 ppm</td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 2.0 [ten Berge et al. 1986].

Human data .................................. It has been reported that 2,000 ppm caused slight narcosis in 5 minutes; 930-1185 ppm caused irritation of the eyes and throat, and marked dizziness after 2 minutes; 1,000 ppm caused slight drunkenness, but no narcosis after 95 minutes; 513-690 ppm caused eye, throat, and nose irritation, dizziness, loss of inhibition, and some incoordination after 10 minutes; 500 ppm for 2 hours caused slight discomfort; 206-356 ppm for 2 hours caused headache, burning of the eyes, sinus congestion, impaired coordination, and nausea; 206-235 ppm for 20-30 minutes caused eye irritation, sinus congestion, dizziness, and sleepiness; and 106 ppm caused only slight eye irritation [Negherbon 1959; Rowe et al. 1952].

Revised IDLH: 150 ppm

Basis for revised IDLH: The revised IDLH for tetrachloroethylene is 150 ppm based on acute inhalation toxicity data in humans [Negherbon 1959; Rowe et al. 1952] [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for tetrachloroethylene at any detectable concentration.

REFERENCES:

Tetrachloroethylene (continued)


Tetrachloronaphthalene

CAS number ......................................... 1335-88-2
NIOSH REL ........................................... 2 mg/m³ TWA [skin]
Current OSHA PEL .................................. 2 mg/m³ TWA [skin]
1989 OSHA PEL .................................... Same as current PEL
1993-1994 ACGIH TLV ............................ 2 mg/m³ TWA
Description of substance ........................... Colorless to pale-yellow solid with an aromatic odor.
LEL .................................................... Unknown [*Note: "Effective" IDLH = 20 mg/m³ — see discussion below.]
Original (SCP) IDLH* ............................... Unknown
Basis for original (SCP) IDLH ....................... No toxicological data are available concerning the effects of acute exposures to tetrachloronaphthalene. For this draft technical standard, however, an analogy with other chloronaphthalenes was used, and the respirators have been selected on the basis of the assigned protection factor afforded by each device up to 10 x the OSHA PEL of 2 mg/m³ (i.e., 20 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 20 mg/m³.
Short-term exposure guidelines ..................... None developed

ACUTE TOXICITY DATA

Animal data ........................................... It has been stated that tetrachloronaphthalene has been shown to be less toxic to the liver than more highly chlorinated derivatives of naphthalene [ACGIH 1986].
Human data .......................................... None relevant for use in determining the revised IDLH.

Revised IDLH: Unknown [Unchanged]
Basis for revised IDLH: Due to a lack of relevant acute toxicity data, the IDLH for tetrachloronaphthalene remains "Unknown." The "most protective" respirators will continue to be recommended for concentrations exceeding 20 mg/m³ based on being 10 times the NIOSH REL and OSHA PEL of 2 mg/m³ (10 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for tetrachloronaphthalene).

REFERENCE:
Tetraethyl lead (as Pb)

CAS number ........................................ 75-00-2
NIOSH REL ........................................ 0.075 mg/m³ TWA [skin]
Current OSHA PEL .................................. 0.075 mg/m³ TWA [skin]
1989 OSHA PEL ..................................... Same as current PEL
1993-1994 ACGIH TLV ................................ 0.1 mg/m³ TWA [skin]

Description of substance: Colorless liquid (unless dyed red, orange, or blue) with a pleasant, sweet odor.

LEL .......................................... 1.8% (10% LEL, 1,500 ppm)

Original (SCP) IDLH .................................. 40 mg Pb/m³

Based for original (SCP) IDLH: The chosen IDLH is based on the rat LC₅₀ of 6 ppm (approximately 80 mg/m³) [Saglik Dengisi 1963 cited by NIOSH 1974]. However, because of the unreliability of tetraethyl lead analytical methods utilized prior to 1968, 40 mg Pb/m³, which is approximately 50% of the LC₅₀, has been utilized as the IDLH.

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Akatsuka 1973</td>
<td>650 mg/m³</td>
<td>999 mg Pb/m³ (2.4)</td>
<td>7 hr</td>
<td>999 mg Pb/m³</td>
<td>100 mg Pb/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Cremer and Calloway 1961</td>
<td>400 mg/m³</td>
<td>600 mg Pb/m³ (1.28)</td>
<td>1 hr</td>
<td>600 mg Pb/m³</td>
<td>60 mg Pb/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀</th>
<th>LD₉₀</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Akatsuka 1973</td>
<td>oral</td>
<td>30</td>
<td>115 mg Pb/m³</td>
<td>14 mg Pb/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Magistretti et al. 1963</td>
<td>oral</td>
<td>35</td>
<td>157 mg Pb/m³</td>
<td>16 mg Pb/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Schepers 1964</td>
<td>oral</td>
<td>17</td>
<td>76 mg Pb/m³</td>
<td>70 mg Pb/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Schroeder et al. 1972</td>
<td>oral</td>
<td>12.5</td>
<td>55 mg Pb/m³</td>
<td>5.8 mg Pb/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Springman et al. 1963</td>
<td>oral</td>
<td>24</td>
<td>108 mg Pb/m³</td>
<td>11 mg Pb/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data: It has been stated that 100 mg Pb/m³ for 1 hour may produce illness [Fleming 1963].

Revised IDLH: 40 mg Pb/m³ [Unchanged]

Based for revised IDLH: Based on acute inhalation toxicity data in humans [Fleming 1963] and animals [Akatsuka 1973; Cremer and Calloway 1961], a value of about 100 mg Pb/m³ would have been appropriate for tetraethyl lead. However, the original IDLH for tetraethyl lead (40 mg Pb/m³) is not being revised at this time.

REFERENCES:

Tetrahydrofuran

CAS number .............................................................. 109-99-9

NIOSH REL .............................................................

Current OSHA PEL .....................................................

1989 OSHA PEL ..........................................................

1993-1994 ACGIH TLV .................................................

Description of substance ..............................................

Colorless liquid with an ether-like odor.

LEL .................................................................

Original (SCP) IDLH ...................................................

Easis for original (SCP) IDLH ........................................

Short-term exposure guidelines .....................................

None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC&lt;sub&gt;10&lt;/sub&gt; (ppm)</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Horiguchi et al. 1984</td>
<td>21,000</td>
<td>-</td>
<td>3 hr</td>
<td>37,800 ppm (1.8)</td>
<td>1,780 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg)</th>
<th>LD&lt;sub&gt;30&lt;/sub&gt; (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>GAF 1991</td>
<td>oral</td>
<td>1,650</td>
<td>-</td>
<td>3,850 ppm</td>
<td>345 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Pozdnyakov 1967</td>
<td>oral</td>
<td>2,200</td>
<td>-</td>
<td>5,367 ppm</td>
<td>537 ppm</td>
</tr>
<tr>
<td>G. pig</td>
<td>Pozdnyakov 1967</td>
<td>oral</td>
<td>2,200</td>
<td>-</td>
<td>5,367 ppm</td>
<td>537 ppm</td>
</tr>
</tbody>
</table>

Human data ...........................................................

It has been reported that exposure to 25,000 ppm will cause anesthesia and 17,000 ppm appears to be safe for 3 hours [Hofmann and Oettel 1954]. Therefore, 20,000 ppm has been chosen as the IDLH because it is the lower explosive limit (LEL) of tetrahydrofuran.

Revised IDLH: 2,000 ppm [LEL]

Basis for revised IDLH: Based on health considerations and acute inhalation toxicity data in humans [Hofmann and Oettel 1954], a value of at least 17,000 ppm would have been appropriate for tetrahydrofuran. However, the revised IDLH is 2,000 ppm based strictly on safety considerations (i.e., being 10% of the lower explosive limit of 2%).

REFERENCES:

Tetramethyl lead (as Pb)

CAS number ........................................ 75-74-1
NIOSH REL ........................................ 0.075 mg/m³ TWA [skin]
Current OSHA PEL ............................... 0.075 mg/m³ TWA [skin]
1989 OSHA PEL ................................... Same as current PEL
1993-1994 ACGIH TLV ........................... 0.15 mg/m³ TWA [skin]

Description of substance ....................... Colorless liquid (unless dyed red, orange, or blue) with a fruity odor.

LEL ................................................. Unknown

Original (SCP) IDLH .............................. 40 mg Pb/m³

Basis for original (SCP) IDLH ................. The chosen IDLH is based on an analogy with tetraethyl lead which has an IDLH of 40 mg Pb/m³.

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₆₃</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Castellino et al. 1963</td>
<td>40,800 mg/m³</td>
<td>-----</td>
<td>30 min</td>
<td>11,625 mg Pb/m³ (1.0)</td>
<td>3,163 mg Pb/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Cremer and Calloway 1961</td>
<td>8,870 mg/m³</td>
<td>-----</td>
<td>30 min</td>
<td>6,876 mg Pb/m³ (1.0)</td>
<td>688 mg Pb/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Marhold 1986</td>
<td>8,500 mg/m³</td>
<td>-----</td>
<td>30 min</td>
<td>6,589 mg Pb/m³ (1.0)</td>
<td>659 mg Pb/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₃ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Akatsuka 1973</td>
<td>oral</td>
<td>-----</td>
<td>24</td>
<td>130 mg Pb/m³</td>
<td>13 mg Pb/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Gekkan Yakuji 1980</td>
<td>oral</td>
<td>109</td>
<td>-----</td>
<td>591 mg Pb/m³</td>
<td>59 mg Pb/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Magistretti et al. 1961</td>
<td>oral</td>
<td>105</td>
<td>-----</td>
<td>570 mg Pb/m³</td>
<td>57 mg Pb/m³</td>
</tr>
</tbody>
</table>

Other animal data .................................... It has been reported that signs of acute tetramethyl lead intoxication in rats were similar to those seen after acute poisoning with tetraethyl lead (ACGIH 1991).

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 40 mg Pb/m³ [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in animals [Castellino et al. 1963; Cremer and Calloway 1961; Marhold 1986], a value of 150 mg Pb/m³ (i.e., 2,000 times the NIOSH REL) would have been appropriate for tetramethyl lead. However, based on an analogy to tetraethyl lead which has a revised IDLH of 40 mg Pb/m³, the original IDLH for tetramethyl lead (40 mg Pb/m³) is not being revised at this time.

REFERENCES:

Tetramethyl succinonitrile

CAS number ........................................ 3333-52-6
NIOSH REL ........................................ 3 mg/m³ (0.5 ppm) TWA [skin]
Current OSHA PEL ................................ 3 mg/m³ (0.5 ppm) TWA [skin]
1989 OSHA PEL .................................... Same as current PEL
1983-1984 ACGIH TLV .......................... 2.6 mg/m³ (0.5 ppm) TWA [skin]
Description of substance ........................ Colorless, odorless solid.
LEL .................................................. Unknown
Original (SCP) IDLH ............................... 5 ppm
Basis for original (SCP) IDLH .................. The chosen IDLH is based on the statement by ACGIH [1972] that 6 ppm for 30 hours was lethal to rats [Spolyar, 1948]. A concentration of 22 ppm is obviously too high to be chosen as the IDLH, because no mice survived a 3.5-hour exposure at this concentration [Hecht and Kimmerele, 1956-1957 as quoted by Reinl, 1957].

Short-term exposure guidelines .................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₆₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Hecht and Kimmerele 1956/1957</td>
<td>28</td>
<td>3 hr</td>
<td>50 ppm (1.8)</td>
<td>5.0 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Hecht and Kimmerele 1956/1957</td>
<td>LC₆₀ 22</td>
<td>3.5 hr</td>
<td>42 ppm (1.9)</td>
<td>4.2 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Spolyar, 1948</td>
<td>6</td>
<td>30 hr</td>
<td>24 ppm (3.91)</td>
<td>2.4 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₆₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Johannsen and Livinskas 1986</td>
<td>oral</td>
<td>38.9</td>
<td>48 ppm</td>
<td>48 ppm</td>
<td>4.8 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 5 ppm [Unchanged]
Basis for revised IDLH: Based on acute inhalation toxicity data in animals [Hecht and Kimmerele, 1956-1957], the original IDLH for tetramethyl succinonitrile (5 ppm) is not being revised at this time.

REFERENCES:

Tetranitromethane

CAS number ............................................. 509-14-8
NIOSH REL: ........................................... 
Current OSHA PEL ........................................... 1 ppm (8 mg/m³) TWA
1989 OSHA PEL .......................................... Same as current PEL
1993-1994 ACGIH TLV ................................... 0.005 ppm (0.04 mg/m³) TWA, A2

Description of substance .................................. Colorless to pale-yellow liquid or solid (below 57°F) with a pungent odor.

LEL ............................................................... 
Original (SCP) IDLH ............................. 5 ppm
Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the statement by AIHA (1964) that concentrations above 5 ppm may cause irreversible lung and systemic damage [Koelsch 1917]. Patty (1963) reported that a cat exposed to 10 ppm for 20 minutes died within 10 days [Flury and Zemik 1931], and 5 cats exposed to 7 to 25 ppm for periods ranging from 2.5 to 5 hours died within 1 to 5.5 hours [Sievers et al. 1947].

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>( LC_{50} ) (ppm)</th>
<th>( LC_{lo} ) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Horn 1953</td>
<td>( LC_{50} ): 33</td>
<td>( LC_{lo} )</td>
<td>6.5 hr</td>
<td>78 ppm (2.35)</td>
<td>7.8 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Kinkead et al. 1977</td>
<td>18</td>
<td>( LC_{lo} )</td>
<td>4 hr</td>
<td>16 ppm (2.0)</td>
<td>3.6 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>Marhold 1986</td>
<td>2.00</td>
<td>( LC_{lo} )</td>
<td>20 min</td>
<td>87 ppm (0.87)</td>
<td>8.9 ppm</td>
</tr>
<tr>
<td>House</td>
<td>USAF 1977</td>
<td>5.4</td>
<td>( LC_{lo} )</td>
<td>4 hr</td>
<td>108 ppm (2.0)</td>
<td>11 ppm</td>
</tr>
</tbody>
</table>

Other animal data ........................................... Cats exposed to 10 ppm for 20 min died within ten days [Flury and Zemik 1931]. It has been reported that cats exposed to 7 to 25 ppm for periods ranging from 2.5 to 5 hours died within 1 to 5.5 hours [Sievers et al. 1947].

Human data .................................................. It has been stated that concentrations above 5 ppm may cause irreversible lung and systemic damage [Koelsch 1917].

Revised IDLH: 4 ppm
Basis for revised IDLH: Based on acute inhalation toxicity data in humans [Koelsch 1917] and animals [Horn 1953; Kinkead et al. 1977]; the revised IDLH for tetranitromethane is 4 ppm.

REFERENCES:

Tetryl

CAS number ........................................ 479-45-8
NIOSH REL ......................................... 1.5 mg/m³ TWA [skin]
Current OSHA PEL .................................. 1.5 mg/m³ TWA [skin]
1989 OSHA PEL ....................................... Same as current PEL
1993-1994 ACGIH TLV ................................ 1.5 mg/m³ TWA
Description of substance ................................ Colorless to yellow, odorless, crystalline solid.
LEL ...................................................... Unknown
Original (SCP) IDLH .................................... No Evidence [Note: "Effective" IOLH = 3,000 mg/m³ – see discussion below.]
Basis for original (SCP) IDLH ......................... The available toxicological data contain no evidence that an acute exposure to a high concentration of tetryl would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been assigned on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 1.5 mg/m³ (i.e., 3,000 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 3,000 mg/m³.
The available toxicological data contain no evidence that an acute exposure to a high concentration of tetryl would impede escape or cause any irreversible health effects within 30 minutes. For this draft technical standard, therefore, respirators have been assigned on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 1.5 mg/m³ (i.e., 3,000 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 3,000 mg/m³.
Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Wells et al. 1920</td>
<td>s.c.</td>
<td>5,000</td>
<td>25,000 mg/m³²</td>
<td>3,500 mg/m³²</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................ Tetryl is highly irritating to the skin and mucous membranes and may cause severe upper respiratory tract irritation with coughing and epistaxis; heavy airborne exposures may also cause liver damage [Hardy and Maloof 1950]. No systemic poisoning was noted following chronic exposure to 1.5 mg/m³, other than some skin sensitization [Bergman 1952].

Revised IDLH: 750 mg/m³

Basis for revised IDLH: Based on acute subcutaneous toxicity data in animals [Wells et al. 1920], a value of about 3,500 mg/m³ would have been appropriate. However, the revised IDLH for tetryl is 750 mg/m³ based on being 500 times the NIOSH REL and OSHA PEL of 1.5 mg/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).

REFERENCES:

Thallium (soluble compounds, as TI)

CAS number ........................................... Varies
NIOSH REL ............................................
Current OSHA PEL ................................. 0.1 mg/m³ TWA [skin]
1989 OSHA PEL ........................................
1983-1984 ACGIH TLV .................................. 0.1 mg/m³ TWA [skin]
Description of substance .........................
Original (SCP) IDLH ....................................
Basis for original (SCP) IDLH ....................... Basis for revised IDLH: 15 mg Tl/m³

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TlCl</td>
<td>Tikhova 1964</td>
<td>oral</td>
<td>24</td>
<td>---</td>
<td>142 mg Tl/m³</td>
<td>14 mg Tl/m³</td>
</tr>
<tr>
<td>TlClO₃</td>
<td>Gekkan Yakuji 1980</td>
<td>oral</td>
<td>16</td>
<td>---</td>
<td>91 mg Tl/m³</td>
<td>9.1 mg Tl/m³</td>
</tr>
<tr>
<td></td>
<td>Tikhova 1964</td>
<td>oral</td>
<td>35.5</td>
<td>---</td>
<td>130 mg Tl/m³</td>
<td>13 mg Tl/m³</td>
</tr>
<tr>
<td>TlClO₇</td>
<td>Kusano 1969</td>
<td>oral</td>
<td>35</td>
<td>---</td>
<td>191 mg Tl/m³</td>
<td>19 mg Tl/m³</td>
</tr>
<tr>
<td></td>
<td>Venugopal and Luckey 1978</td>
<td>oral</td>
<td>42.3</td>
<td>---</td>
<td>225 mg Tl/m³</td>
<td>23 mg Tl/m³</td>
</tr>
<tr>
<td>Tl₂CO₅</td>
<td>Tikhova 1964</td>
<td>oral</td>
<td>21</td>
<td>---</td>
<td>128 mg Tl/m³</td>
<td>12 mg Tl/m³</td>
</tr>
<tr>
<td></td>
<td>Tikhova 1964</td>
<td>oral</td>
<td>---</td>
<td></td>
<td>140 mg Tl/m³</td>
<td>14 mg Tl/m³</td>
</tr>
</tbody>
</table>

Human data .................................................
Lethal oral doses ranging from 0.9 to 9.4 mg/kg have been reported [Gekkan Yakuji 1980; Tanaka et al. 1978; Venugopal and Luckey 1978; Yakkyoku 1977]. [Note: An oral dose ranging from 0.9 to 9.4 mg/kg is equivalent to a 70-kg worker being exposed to concentrations ranging from about 40 to 450 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 15 mg Tl/m³
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for soluble thallium compounds. Therefore, the revised IDLH for soluble thallium compounds is 15 mg Tl/m³ based on acute oral toxicity data in humans [Gekkan Yakuji 1980; Tanaka et al. 1978; Venugopal and Luckey 1978; Yakkyoku 1977] and animals [Kusano 1969; Tikhova 1964].
REFERENCES:

Thiram

CAS number .................................................. 137-26-8
NIOSH REL .................................................. 5 mg/m³ TWA
Current OSHA PEL ..... 5 mg/m³ TWA
1989 OSHA PEL .... Same as current PEL
1993-1994 ACGIH TLV .................. 1 mg/m³ TWA
Description of substance ..................... Colorless to yellow, crystalline solid with a characteristic odor.
LEL .................................................. Unknown
Original (SCP) IDLH .............. 1,500 mg/m³
Base for original (SCP) IDLH ................ The chosen IDLH has been estimated from the rabbit oral LD₅₀ of 210 mg/kg [Sakuramoto 1977 cited by NIOSH 1976]. Rats survived a 4-hour exposure to concentrations above 500 mg/m³ [Smyth 1937-1955 cited by ACGIH 1971].

Short-term exposure guidelines: ........................................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Marhold 1986</td>
<td>500 mg/m³</td>
<td>-----</td>
<td>4 hr</td>
<td>1,000 mg/m³ (2.0)</td>
<td>100 mg/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Archangel'skaya and Rosechina 1964</td>
<td>oral</td>
<td>1,350</td>
<td>-----</td>
<td>9,450 mg/m³</td>
<td>945 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Sakuramoto 1977</td>
<td>oral</td>
<td>210</td>
<td>-----</td>
<td>1,470 mg/m³</td>
<td>147 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Heise and Orzel 1967</td>
<td>oral</td>
<td>560</td>
<td>-----</td>
<td>3,920 mg/m³</td>
<td>392 mg/m³</td>
</tr>
</tbody>
</table>

Other animal data: Rats have survived a 4-hr exposure to concentrations exceeding 500 mg/m³ [Smyth 1937-1955].

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 100 mg/m³

REFERENCES:


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Tin (inorganic compounds, as Sn)

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD$_{50}$ (mg/kg)</th>
<th>LD$_{50}$ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SnCl$_2$, Rat</td>
<td>Calvery 1942</td>
<td>oral</td>
<td>700</td>
<td>1,087 mg Sn/m$^3$</td>
<td>305 mg Sn/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>WHO 1970</td>
<td>oral</td>
<td>10,000</td>
<td>44,100 mg Sn/m$^3$</td>
<td>4,410 mg Sn/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>WHO 1972</td>
<td>oral</td>
<td>350</td>
<td>1,103 mg Sn/m$^3$</td>
<td>110 mg Sn/m$^3$</td>
<td></td>
</tr>
</tbody>
</table>

*Human data* None relevant for use in determining the revised IDLH.

**Revised IDLH:** 100 mg Sn/m$^3$

**Basis for revised IDLH:** No inhalation toxicity data are available on which to base an IDLH for inorganic tin compounds.

Therefore, the revised IDLH for inorganic tin compounds is 100 mg Sn/m$^3$ based on acute oral toxicity data in animals [WHO 1972]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

1. ACGIH [1971]. Tin (inorganic compounds except SnH$_3$ and SnO$_2$) as Sn. In: Documentation of the threshold limit values for substances in workroom air. 3rd ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, p. 257.
Tin (organic compounds, as Sn)

CAS number .............................................. Varies
NIOSH REL .................................. 0.1 mg/m³ TWA [skin]
Current OSHA PEL .............................. 0.1 mg/m³ TWA
1989 OSHA PEL ...................................... 0.1 mg/m³ TWA [skin]
1993-1994 ACGIH TLV .............................. 0.1 mg/m³ TWA, 0.2 mg/m³ STEL
Description of substance .......................... Varies
Original (SCP) IDLH* .................................. Unknown ["Note: "Effective" IDLH = 200 mg Sn/m³ -- see discussion below."
Basis for original (SCP) IDLH ......................... Patty [1963], Browning [1969], and Deichmann and Gerarde [1969] all indicated that the trialkyltin compounds are generally the most toxic of the organic tin compounds. The only available acute inhalation toxicity data on which to base an IDLH are given by NIOSH [1976] which cited the following mouse LC₅₀ values for tri-n-butyltin iodide, triethyltin bromide, and tri-n-propyltin bromide, respectively: 1340 mg/m³, 1640 mg/m³, and 1650 mg/m³ [NDRC 1942]. The LC₅₀ is the lowest concentration of a substance, other than an LC₉₅ in air, that has been reported to cause death in man or to cause death in animals when they have been exposed for 24 hours or less. For this draft technical standard, however, respirators have been assigned on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 0.1 mg Sn/m³ (i.e., 200 mg Sn/m³): only the "most protective" respirators are permitted for use in concentrations exceeding 200 mg Sn/m³. None developed.

Short-term exposure guidelines ..................................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tri-n-butyltin iodide</td>
<td>Mouse</td>
<td>NDR 1942</td>
<td>1,340 mg/m³</td>
<td>10 min</td>
<td>263 mg Sn/m³ (0.69)</td>
<td>26 mg Sn/m³</td>
</tr>
<tr>
<td>Triethyltin bromide</td>
<td>Mouse</td>
<td>NDR 1942</td>
<td>1,640 mg/m³</td>
<td>10 min</td>
<td>470 mg Sn/m³ (0.69)</td>
<td>47 mg Sn/m³</td>
</tr>
<tr>
<td>Tri-n-propyltin bromide</td>
<td>Mouse</td>
<td>NDR 1942</td>
<td>1,650 mg/m³</td>
<td>10 min</td>
<td>413 mg Sn/m³ (0.69)</td>
<td>41 mg Sn/m³</td>
</tr>
</tbody>
</table>
Tin (organic compounds, as Sn) (continued)

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg)</th>
<th>LD&lt;sub&gt;10&lt;/sub&gt; (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triphenyltin acetate</td>
<td>Klimmer 1971</td>
<td>oral</td>
<td>21</td>
<td>43 mg Sn/m³</td>
<td>4.3 mg Sn/m³</td>
<td></td>
</tr>
<tr>
<td>G. pig</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Perkow 1971/1976</td>
<td>oral</td>
<td>30</td>
<td>61 mg Sn/m³</td>
<td>6.1 mg Sn/m³</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Stoner 1966</td>
<td>oral</td>
<td>81</td>
<td>164 mg Sn/m³</td>
<td>16 mg Sn/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Hartel 1958</td>
<td>oral</td>
<td>125</td>
<td>254 mg Sn/m³</td>
<td>25 mg Sn/m³</td>
<td></td>
</tr>
<tr>
<td>Dimethyltin bis(isoctylmercaptoacetate)</td>
<td>Hazleton 1972</td>
<td>oral</td>
<td>904</td>
<td>903 mg Sn/m³</td>
<td>90 mg Sn/m³</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tri-n-butyltin iodide</td>
<td>Akatsuka 1973</td>
<td>oral</td>
<td>100</td>
<td>196 mg Sn/m³</td>
<td>20 mg Sn/m³</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 25 mg Sn/m³

Basis for revised IDLH: The revised IDLH for organic tin compounds is 25 mg Sn/m³ based on acute inhalation toxicity data in animals (NDRC 1942). This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

Titanium dioxide

CAS number ........................................ 13463-67-7
NIOSH REL ........................................... None established; NIOSH considers titanium dioxide to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1989).

Current OSHA PEL ..................................... 15 mg/m³ TWA
1989 OSHA PEL .......................... 10 mg/m³ TWA
1993-1994 ACGIH TLV .................... 10 mg/m³ TWA

Description of substance .................. White, odorless powder.
LEL ................................................ No Evidence [*Note: "Effective" IDLH = 7,500 mg/m³ -- see discussion below.]

Original (SCP) IDLH* .......................... None Evidence for original (SCP) IDLH

Basis for original (SCP) IDLH ................. The available toxicological data contain no evidence that exposure to a high concentration of titanium dioxide would impede escape within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL (500 x 15 mg/m³ is 7,500 mg/m³).

Short-term exposure guideline ............. None developed

ACUTE TOXICITY DATA

Animal or human data ......................... None relevant for use in determining the revised IDLH.

Revised IDLH: 5,000 mg/m³

Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of titanium dioxide would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for titanium dioxide is 5,000 mg/m³ based on being 500 times the OSHA PEL of 10 mg/m³ promulgated in 1989 (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates). [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for titanium dioxide at any detectable concentration.]
Toluene

CAS number ........................................... 108-86-3
NIOSH REL ............................................ 100 ppm (375 mg/m³) TWA, 150 ppm (560 mg/m³) STEL
Current OSHA PEL ...................................... 200 ppm TWA, 300 ppm CEILING,
1989 OSHA PEL ........................................... 500 ppm 10-minute MAXIMUM PEAK
1993-1994 ACGIH TLV .................................. 100 ppm (375 mg/m³) TWA, 150 ppm (560 mg/m³) STEL
Description of substance .............................. Colorless liquid with a sweet, pungent, benzene-like odor.
LEL ......................................................... 1.1% (10% LEL, 1,100 ppm)
Original (SCP) IDLH ................................... 2,000 ppm
Basis for original (SCP) IDLH ......................... The chosen IDLH seems reasonable based on the statements by Patty [1963] and ANSI [1973]. Patty [1963] reported that with 600 ppm, extreme fatigue, mental confusion, exhilaration, nausea, headache, and dizziness resulted by the end of 3 hours [von Oettingen et al. 1942]. ANSI [1973] reported that exposures to concentrations greater or longer than 4,000 ppm for 5 minutes might limit self-rescue ability.

1-hour EEGL: 200 ppm
24-hour EEGL: 100 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 3.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Benignus 1961</td>
<td>&gt;26,700</td>
<td>-----</td>
<td>1 hr</td>
<td>&gt;33,375 ppm (1.25)</td>
<td>&gt;3,338 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Benignus 1961</td>
<td>400</td>
<td>-----</td>
<td>24 hr</td>
<td>1,440 ppm (3.6)</td>
<td>144 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Smyth and Carpenter 1944</td>
<td>-----</td>
<td>55,000</td>
<td>60 min</td>
<td>60,500 ppm (2.1)</td>
<td>6,050 ppm</td>
</tr>
</tbody>
</table>

Other animal data .................................... RD₅₀ (mouse), 5.300 ppm [Nielsen and Alarie 1982].

Human data ........................................... It has been reported that extreme fatigue, mental confusion, exhilaration, nausea, headache and dizziness resulted from exposures to 600 ppm by the end of 3 hours [von Oettingen et al. 1942]. In addition, the following observations have been made: some workers will tolerate concentrations ranging up to 200 ppm for 8 to 6 hours daily with no demonstrable ill effects; 200 to 500 ppm for 6 to 8 hours will cause tiredness and lassitude in most workers; and concentrations over 500 ppm for 1 to 3 hours are definitely dangerous and will cause symptoms attributable to depression of the central nervous system and the bone marrow [Wilson 1943]. It has also been reported that exposure to concentrations greater than 4,000 ppm for more than 5 minutes might limit self-rescue ability [ANSI 1973]. After 20 minutes, exposures to concentrations at 300, 500, or 700 ppm resulted in significant increases in reaction times; a significant decrease in perceptual speed resulted after a 20-minute exposure to 700 ppm [Gamberale and Hultengren 1972].

Revised IDLH: 500 ppm
Basis for revised IDLH: The revised IDLH for toluene is 500 ppm based on acute inhalation toxicity data in humans [Gamberale and Hultengren 1972; von Oettingen et al. 1942; Wilson 1943].
Toluene (continued)

REFERENCES:

**Toluene-2,4-diisocyanate**

<table>
<thead>
<tr>
<th>CAS number</th>
<th>584-84-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>None established; NIOSH considers toluene-2,4-diisocyanate to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].</td>
</tr>
</tbody>
</table>

**Current OSHA PEL**
- 1989 OSHA PEL: 0.005 ppm (0.04 mg/m³) TWA, 0.02 ppm (0.15 mg/m³) STEL
- 1993-1994 ACGIH TLV: 0.005 ppm (0.036 mg/m³) TWA, 0.02 ppm (0.14 mg/m³) STEL

**Description of substance**
- Colorless to pale-yellow solid or liquid (above 71°F) with a sharp, pungent odor.
- 0.9% (10% LEL, 800 ppm)
- 10 ppm

**Short-term exposure guidelines**
- None developed

**ACUTE TOXICITY DATA**

**Lethal concentration data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Duncan et al. 1962</td>
<td>24</td>
<td>----</td>
<td>4 hr</td>
<td>28 ppm (2.0)</td>
<td>2.8 ppm</td>
</tr>
<tr>
<td>Pig</td>
<td>Duncan et al. 1962</td>
<td>13.9</td>
<td>----</td>
<td>4 hr</td>
<td>28 ppm (2.0)</td>
<td>2.8 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Duncan et al. 1962</td>
<td>9.7</td>
<td>----</td>
<td>4 hr</td>
<td>19 ppm (2.0)</td>
<td>1.9 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Duncan et al. 1962</td>
<td>11</td>
<td>----</td>
<td>4 hr</td>
<td>22 ppm (2.0)</td>
<td>2.2 ppm</td>
</tr>
</tbody>
</table>

**Other animal data**
- RD50 (mouse), 0.38 ppm [Alarie 1981].

**Human data**
- None relevant for use in determining the revised IDLH.

**REVISED IDLH:** 2.5 ppm

**Basis for revised IDLH:** The revised IDLH for toluene-2,4-diisocyanate is 2.5 ppm based on acute inhalation toxicity data in animals [Duncan et al. 1962]. Since in sensitized individuals, even concentrations below the OSHA PEL are capable of triggering the allergic response, the revised IDLH has not been based on data obtained from the exposures of individuals or animals sensitized to TDI. The chosen IDLH is based on the 4-hour LC50 values for different species of animals, ranging from 9.7 to 13.9 ppm [Duncan et al. 1962 cited by AIHA 1987 and NIOSH 1973].

**REFERENCES:**

**o-Toluidine**

**CAS number** .................................. 95-53-4

**NIOSH REL** .................................. None established; NIOSH considers o-toluidine to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990] that may be absorbed through the skin.

**Current OSHA PEL** ..................................

**1989 OSHA PEL** ..................................

**1993-1994 ACGIH TLV** ......................... .

**Description of substance** ....................... . Colorless to pale-yellow liquid with an aromatic, aniline-like odor.

**LEL** ......................................... .

**Original (SCP) IDLH** ..................................

**Baala for original (SCP) IDLH** ................... . The chosen IDLH is based on the statement by Sax [1975] that 100 ppm is the maximum concentration endurable for 1 hour without serious consequences. No other data are available on which to base the IDLH.

**Short-term exposure guideline** ................. . None developed

**ACUTE TOXICITY DATA**

**Lethal dose data:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>IARC 1982</td>
<td>oral</td>
<td>670</td>
<td>----</td>
<td>1,052 ppm</td>
<td>105 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>IARC 1982</td>
<td>oral</td>
<td>520</td>
<td>----</td>
<td>816 ppm</td>
<td>82 ppm</td>
</tr>
<tr>
<td>Rabbit</td>
<td>IARC 1982</td>
<td>oral</td>
<td>840</td>
<td>----</td>
<td>1,318 ppm</td>
<td>132 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Jacobsen 1972</td>
<td>oral</td>
<td>900</td>
<td>----</td>
<td>1,433 ppm</td>
<td>141 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Jacobsen 1972</td>
<td>oral</td>
<td>940</td>
<td>----</td>
<td>1,475 ppm</td>
<td>148 ppm</td>
</tr>
</tbody>
</table>

**Other animal data** .................................

Rats have survived an 8-hour exposure to saturated vapors of o-toluidine [Smyth et al. 1962].

**Human data** ................................... . It has been reported that a 60-minute exposure to 40 ppm produces severe toxic effects [Goldblatt 1955]. It has been reported that 100 ppm is the maximum concentration endurable for 1 hour without serious consequences [Sax 1975].

**Revised IDLH:** 50 ppm

**Basis for revised IDLH:** The revised IDLH for o-toluidine is 50 ppm based on acute inhalation toxicity data in humans [Goldblatt 1955; Sax 1975]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for o-toluidine at any detectable concentration.]

**REFERENCES:**

Tributyl phosphate

CAS number ........................................ 126-73-8
NIOSH REL ..........................................
Current OSHA PEL ................................ 5 mg/m³ TWA
1989 OSHA PEL .................................... 0.2 ppm (2.5 mg/m³) TWA
1993-1994 ACGIH TLV .......................... 0.2 ppm (2.2 mg/m³) TWA
Description of substance .......................... Colorless to pale-yellow, odorless liquid.
LEL .................................................. Unknown
Original (SCP) IDLH ................................ 125 ppm
Basis for original (SCP) IDLH ..................... The chosen IDLH is based on the only available data on acute inhalation toxicity of exposure to tributyl phosphate. Patty [1963] reported that 0 of 3 rats succumbed to a 6-hour exposure to 123 ppm (1,337 mg/m³) [Fassett]. No other quantitative data are available on which to base the IDLH.

Short-term exposure guidelines ................. None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Eiller 1937</td>
<td>2.224</td>
<td>4,760</td>
<td>5 hr</td>
<td>476 ppm (2.18)</td>
<td>476 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>IPCS 1991</td>
<td>544-688</td>
<td>283</td>
<td>6 hr</td>
<td>28 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Kalinina 1971</td>
<td>117</td>
<td>7</td>
<td></td>
<td>7 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>TSCATS</td>
<td>117</td>
<td>7</td>
<td></td>
<td>7 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD50 (mg/kg)</th>
<th>LD10 (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Kalinina 1971</td>
<td>oral</td>
<td>1,189</td>
<td>752</td>
<td>75 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth and Carpenter 1944</td>
<td>oral</td>
<td>3,000</td>
<td>1,897</td>
<td>190 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Other animal data ................................ It has been reported that rats survived a 6-hour exposure to 123 ppm (1,337 mg/m³) [Patty 1963].

Human data ........................................ Nausea and headache have been reported in workers exposed to 15 mg/m³ (1.4 ppm) [Mastromatteo 1964].

Revised IDLH: 30 ppm
Basis for revised IDLH: The revised IDLH for tributyl phosphate is 30 ppm based on acute inhalation toxicity data in animals [IPCS 1991]. This may be a conservative value due to the lack of relevant acute toxicity data in humans exposed to concentrations above 1.4 ppm.

REFERENCES:

Tributyl phosphate (continued)


1,1,2-Trichloroethane

CAS number .............................................. 79-00-5
NIOSH REL .................................................. 10 ppm (45 mg/m³) TWA [skin]; NIOSH considers 1,1,2-trichloroethane to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].
Current OSHA PEL ........................................ 10 ppm (45 mg/m³) TWA [skin]
1989 OSHA PEL ........................................... Same as current PEL
1993-1994 ACGIH TLV .................................... 10 ppm (55 mg/m³) TWA [skin]
Description of substance .................................. Colorless liquid with a sweet, chloroform-like odor.
LEL .......................................................... 6% (10% LEL, 6,000 ppm)
Original (SCP) IDLH ....................................... 500 ppm
Basis for original (SCP) IDLH ................................
The chosen IDLH is based on the UCC [1972] report that 500 ppm killed 1 of 6 rats in 4 hours, and 4 of 6 rats in 8 hours.
Short-term exposure guidelines .......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Arch Hyg Bakteriol 1936</td>
<td>----</td>
<td>13,100 mg/m³</td>
<td>4.5 hr</td>
<td>4,957 ppm (2.1)</td>
<td>456 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Carpenter et al. 1949</td>
<td>----</td>
<td>2,000 ppm</td>
<td>4 hr</td>
<td>1,000 ppm (2.0)</td>
<td>540 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>UCC 1972</td>
<td>LC₅₀: 500 ppm</td>
<td>----</td>
<td>4 hr</td>
<td>1,000 ppm (2.0)</td>
<td>540 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LC₉₀: 500 ppm</td>
<td>----</td>
<td>8 hr</td>
<td>1,250 ppm (2.5)</td>
<td>125 ppm</td>
</tr>
</tbody>
</table>

Human data ............................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for 1,1,2-trichloroethane is 100 ppm based on acute inhalation toxicity data in animals [UCC 1972]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for 1,1,2-trichloroethane at concentrations above 10 ppm.]

REFERENCES:

1. Arch Hyg Bakteriol [1936]; 118:131 (in German).
Trichloroethylene

CAS number ........................................... 79-01-6
NIOSH REL .............................................

Current OSHA PEL .................................
1989 OSHA PEL ....................................
1993-1994 ACGIH TLV .........................

Description of substance ....................... Colorless liquid (unless dyed blue) with a chloroform-like odor.

LEL (77°F) ........................................... 8% (10% LEL(@77°F), 8,000 ppm)

Original (SCP) IDLH ............................... 1,000 ppm

Basis for original (SCP) IDLH .................

Existing short-term exposure guidelines ......

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>(L_{C_{50}}) (ppm)</th>
<th>(L_{C_{10}}) (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Bell 1951</td>
<td>2,900</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>G. pig</td>
<td>Davis et al. 1959</td>
<td>37,200</td>
<td>40 min</td>
<td>?</td>
<td>52.196 ppm (1.42)</td>
<td>5,320 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>Friberg et al. 1953</td>
<td>8,450</td>
<td>4 hr</td>
<td>114.095 ppm (13.5)</td>
<td>11,408 ppm</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Lehmann et al. 1936</td>
<td>9,952</td>
<td>2 hr</td>
<td>33,688 ppm (5.66)</td>
<td>3,369 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>NRC 1988</td>
<td>8,000</td>
<td>4 hr</td>
<td>108,000 ppm (13.5)</td>
<td>10,800 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Vernon et al. 1977</td>
<td>26,300</td>
<td>1 hr</td>
<td>62,594 ppm (2.38)</td>
<td>6,259 ppm</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>WHO 1970</td>
<td>11,000</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Conversion factor (CF) was determined with "n" = 0.8 [ten Berge et al. 1986].

Other human data .................................. Exposure of eight volunteers for 2 hours to 1,000 ppm resulted in decrements in visual perception and motor skills, but 2-hour exposures to 100 and 300 ppm did not [Vernon and Ferguson 1969]. Tachypnea and ventricular arrhythmias have been equated with inhaled concentrations greater than 15,000 ppm during usage as an anesthetic [Vernon and Ferguson 1969].

Revised IDLH: 1,000 ppm [Unchanged]

Basis for revised IDLH: Based on acute inhalation toxicity data in volunteers [Vernon and Ferguson 1969], the original IDLH for trichloroethylene (1,000 ppm) is not being revised at this time. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for trichloroethylene at concentrations above 25 ppm.]
Trichloroethylene (continued)

REFERENCES:

Trichloronaphthalene

CAS number ........................................ 1321-65-9
NIOSH REL ........................................ 5 mg/m³ TWA [skin]
Current OSHA PEL .................................. 5 mg/m³ TWA [skin]
1989 OSHA PEL ........................................ Same as current PEL
1993-1994 ACGIH TLV .................................. 5 mg/m³ TWA [skin]
Description of substance .......................... Colorless to pale-yellow solid with an aromatic odor.
LEL ..................................................... Unknown [*Note: "Effective" IDLH = 50 mg/m³ — see discussion below.]
Original (SCP) IDLH* .................................. Unknown
Basis for original (SCP) IDLH ....................... No toxicological data are available concerning the effects of acute exposures to trichloronaphthalene. For this draft technical standard, however, an analogy with other chloronaphthalenes was used, and the respirators were selected on the basis of the assigned protection factor afforded by each device up to 10 × the OSHA PEL of 5 mg/m³ (i.e., 50 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 50 mg/m³.

Short-term exposure guidelines ...................... None developed

ACUTE TOXICITY DATA

Animal data ........................................... Rats and mice exposed to a single 2-hour exposure to 200 mg/m³ had no adverse effects [Shakahnovskava 1953].
Human data ............................................ None relevant for use in determining the revised IDLH.

Revised IDLH: Unknown [Unchanged]
Basis for revised IDLH: Due to a lack of relevant acute toxicity data, the IDLH for trichloronaphthalene remains "Unknown." The "most protective" respirators will continue to be recommended for concentrations exceeding 50 mg/m³ based on being 10 times the NIOSH REL and OSHA PEL of 5 mg/m³ (10 is an assigned protection factor for respirators and was used during the Standards Completion Program for deciding when the "most protective" respirators should be used for chloronaphthalene). This may be a conservative value due to the lack of relevant acute toxicity data for workers at concentrations above 50 mg/m³ for trichloronaphthalene.

REFERENCE:

1,2,3-Trichloropropane

CAS number .......................... 96-18-4
NIOSH REL ........................... 10 ppm (60 mg/m³) TWA [skin]; NIOSH considers 1,2,3-trichloropropane to be a potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

Current OSHA PEL .......................... 50 ppm (300 mg/m³) TWA
1999 OSHA PEL ........................... 10 ppm (60 mg/m³) TWA
1993-1994 ACGIH TLV ......................... 10 ppm (50 mg/m³) TWA [skin]

Description of substance ...................... Colorless liquid with a chloroform-like odor.

LEL (@248°F) .................................. 3.2% (10% LEL(@248°F), 3,200 ppm)

Original (SCP) IDLH .......................... 1,000 ppm

Basis for original (SCP) IDLH ..................... UCC [1973] reported that 5 of 6 rats died following a 1-hour exposure to 5,600 ppm. Because several mice died following only a 20-minute exposure to 5,000 ppm [McOmie and Barnes 1949 as cited by ACGIH 1971], 5,000 ppm has not been chosen as the IDLH. The chosen IDLH is based on the rat 4-hour LC50 of 1,000 ppm [Smyth et al. 1992 cited by NIOSH 1976].

Short-term exposure guidelines ..................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC50 (ppm)</th>
<th>LC10 (ppm)</th>
<th>Time</th>
<th>Adjusted 0.8-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>555</td>
<td>----</td>
<td>2 hr</td>
<td>888 ppm (2.6)</td>
<td>89 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>McOmie and Barnes 1949</td>
<td>----</td>
<td>5,000</td>
<td>20 min</td>
<td>4,350 ppm (0.87)</td>
<td>435 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>McOmie and Barnes 1949</td>
<td>LC50: 700</td>
<td>LC10: 700</td>
<td>4 hr</td>
<td>1,400 ppm (2.0)</td>
<td>140 ppm</td>
</tr>
<tr>
<td>Mouse</td>
<td>McOmie and Barnes 1949</td>
<td>LC50: 1,000</td>
<td>LC10: 1,000</td>
<td>4 hr</td>
<td>2,000 ppm (2.0)</td>
<td>200 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1962</td>
<td>LC50: 5,600</td>
<td>LC10: 5,600</td>
<td>2 hr</td>
<td>7,000 ppm (1.25)</td>
<td>700 ppm</td>
</tr>
</tbody>
</table>

Human data .................................... It has been reported that objectionable ocular and mucosal irritation were experienced after 15 minutes of exposure to 100 ppm [Silverman et al. 1946].

Revised IDLH: 100 ppm

Basis for revised IDLH: The revised IDLH for 1,2,3-trichloropropane is 100 ppm based on acute inhalation toxicity data in humans [Silverman et al. 1946]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 100 ppm. [Note: NIOSH recommends as part of its carcinogen policy the "most protective" respirators be worn for 1,2,3-trichloropropane at concentrations above 10 ppm.]

REFERENCES:

1,1,2-Trichloro-1,2,2-trifluoroethane

CAS number .................................................. 76-13-1
NIOSH REL ...................................................... 1,000 ppm (7,600 mg/m³) TWA, 1,250 ppm (9,500 mg/m³) STEL
Current OSHA PEL .............................................. 1,000 ppm (7,600 mg/m³) TWA
1992 OSHA PEL .................................................... 1,000 ppm (7,670 mg/m³) TWA, 1,250 ppm (9,590 mg/m³) STEL
1993-1994 ACGIH TLV ........................................... 1,000 ppm (7,600 mg/m³) TWA, 1,250 ppm (9,500 mg/m³) STEL

Description of substance .................................... Colorless to water-white liquid with an odor like carbon tetrachloride at high concentrations.

LEL ................................................................. Unknown
Original (SCP) IDLH .............................................. 4,500 ppm
Basis for original (SCP) IDLH .................................. The chosen IDLH is based on the statement by AIHA [1968] and ACGIH [1971] that a 2.75-hour exposure to 4,500 ppm significantly impaired the psychomotor performance of human volunteers [Stopps and McLaughlin 1967].


1-hour EEGL: 1,500 ppm
24-hour EEGL: 500 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Burns et al. 1961</td>
<td>250,000</td>
<td>92,500</td>
<td>1.5 min</td>
<td>92,500 ppm (0.37)</td>
<td>9,250 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Clayton 1962</td>
<td>87,000</td>
<td>200,100</td>
<td>6 hr</td>
<td>200,100 ppm (2.3)</td>
<td>20,010 ppm</td>
</tr>
</tbody>
</table>

Other animal data ............................................ Dogs appear to tolerate 1,000 ppm, regardless of duration of exposure but exhibit cardiac abnormalities when exposed to 2,000 ppm for 5 hours and immediately challenged with epinephrine [Aviado 1975]. Also, dogs exposed for 5 minutes to 2,500 ppm or higher and then challenged with epinephrine developed cardiac sensitization [Reinhardt et al. 1973]. Others have reported that dogs exposed while running on a treadmill (to increase their own epinephrine concentration) were not sensitized at concentrations up to 20,000 ppm [Trochimowicz et al. 1974].

Human data ....................................................... Human volunteers exposed to 2,500 ppm had subjective symptoms of diminished concentration, somnolence, and head heaviness within 30 minutes of initiation of exposure and slight but definite further significant decrements at exposures for 2.75 hours at 4,500 ppm [Stopps and McLaughlin 1967]. No adverse changes were noted in volunteers exposed to 500 or 1,000 ppm for 6 hours per day, 5 days per week for 2 weeks [Reinhardt et al. 1971].

Revised IDLH: 2,000 ppm
Basis for revised IDLH: The revised IDLH for 1,1,2-trichloro-1,2,2-trifluoroethane is 2,000 ppm based on acute inhalation toxicity data in volunteers [Reinhardt et al. 1971; Stopps and McLaughlin 1967].

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REFERENCES:

Triethylamine

CAS number ........................................... 121-44-8
NIOSH REL ...........................................
Current OSHA PEL ................................. 25 ppm (100 mg/m³) TWA
1989 OSHA PEL .................................... 10 ppm (40 mg/m³) TWA, 15 ppm (50 mg/m³) STEL
1993-1994 ACGIH TLV ............................. 5 ppm (12 mg/m³) TWA, 15 ppm (36 mg/m³) STEL
Description of substance ........................... Colorless liquid with a strong, ammonia-like odor.
LEL ...................................................... 1.2% (10% LEL, 1200 ppm)
Original (SCP) IDLH ................................. 1,000 ppm
Basis for original (SCP) IDLH ...................... The chosen IDLH is based on the UCC [1970] report that a 4-hour exposure to 1,000 ppm killed 1 of 6 rats.
Short-term exposure guidelines ..................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₁₀₀₀ (ppm)</th>
<th>LC₁₂₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. pig</td>
<td>Carpenter et al. 1948</td>
<td>LC₁₀₀₀</td>
<td>LC₁₂₅</td>
<td>4 hr</td>
<td>2,000 ppm (2.6)</td>
<td>200 ppm</td>
</tr>
<tr>
<td>House</td>
<td>Izmerov et al. 1992</td>
<td>-----</td>
<td>1,425</td>
<td>2 hr</td>
<td>2,125 ppm (1.6)</td>
<td>228 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Smyth et al. 1951</td>
<td>LC₁₀₀₀</td>
<td>-----</td>
<td>4 hr</td>
<td>2,000 ppm (2.6)</td>
<td>200 ppm</td>
</tr>
</tbody>
</table>

Other animal data ................................... R⁰₈₀ (mouse), 184 ppm [Nielsen and Yamagwa 1989].
Human data .......................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 200 ppm

Basis for revised IDLH: The revised IDLH for triethylamine is 200 ppm based on acute inhalation toxicity data in animals [Carpenter et al. 1948; Izmerov et al. 1982; Nielsen and Yamagwa 1989; Smyth et al. 1951]. This may be a conservative value due to the lack of acute inhalation toxicity data for workers.

REFERENCES:

2. Izmerov NF, Santsky IV, Sidorov KK [1982]. Toxicometric parameters of industrial toxic chemicals under single exposure. Moscow, Russia: Centre of International Projects, GKNT, p. 115.

487
Trifluorobromomethane

CAS number ...................................... 75-63-8
NIOSH REL ........................................
Current OSHA PEL ................................
1989 OSHA PEL .................................... Same as current PEL
1993-1994 ACGIH TLV .......................... 1,000 ppm (6,090 mg/m³) TWA

Description of substance ........................ Colorless, odorless gas.

LEL .................................................. 50,000 ppm

Original (SCP) IDLH ..............................
Basis for original (SCP) IDLH .....................


30-minute EEGL: 40,000 ppm
1-hour EEGL: 25,000 ppm

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀ (ppm)</th>
<th>LC₉₀ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Chambers et al. 1950</td>
<td>----</td>
<td>744,000</td>
<td>15 min</td>
<td>658,860 ppm (0.79)</td>
<td>65,866 ppm</td>
</tr>
<tr>
<td>Cat</td>
<td>NRC 1984</td>
<td>LC₅₀: 370,000</td>
<td>----</td>
<td>7 hr</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>G. pig</td>
<td>NRC 1984</td>
<td>LC₅₀: 370,000</td>
<td>----</td>
<td>7 hr</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Mouse</td>
<td>NRC 1984</td>
<td>LC₅₀: 370,000</td>
<td>----</td>
<td>7 hr</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Rat</td>
<td>NRC 1984</td>
<td>LC₅₀: 370,000</td>
<td>----</td>
<td>7 hr</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Rabbit</td>
<td>NRC 1984</td>
<td>LC₅₀: 370,000</td>
<td>----</td>
<td>7 hr</td>
<td>----</td>
<td>----</td>
</tr>
</tbody>
</table>

Other animal data .............................. Dogs and rats exposed daily for 18 weeks at an average concentration of 23,000 ppm showed no toxic signs and no pathologic changes observable at autopsy [Comstock et al. 1953].

Human data ...................................... Volunteers exposed to 70,000 ppm for 3 minutes experienced light-headedness and disturbances in balance and ability to respond to visual stimuli [Reinhardt and Reink 1972]; 3 hours to 70,000 ppm caused decrements in mental performance tests [Harrison et al. 1982]. Exposure to 50,000 ppm for 20 to 25 minutes caused drowsiness, light-headedness, and a slight effect on judgment [Hine et al. 1986]. Three volunteers experienced mild nose and throat discomfort after 20 minutes of exposure to 71,000 ppm [Stewart et al. 1978]. Others reported that a 30-minute exposure at 43,000 to 45,000 ppm caused dizziness, light-headedness, euphoria, and disturbances in equilibrium and coordination [Stewart et al. 1978].

Revised IDLH: 40,000 ppm
Basis for revised IDLH: The revised IDLH for trifluorobromomethane is 40,000 ppm based on acute toxicity data in humans [Harrison et al. 1982; Hine et al. 1986; Reinhardt and Reink 1972; Stewart et al. 1978].
REFERENCES:


2,4,6-Trinitrotoluene

CAS number ........................................... 118-96-7
NIOSH REL .................................. 0.5 mg/m³ TWA (skin)
Current OSHA PEL .............................. 0.5 mg/m³ TWA (skin)
1989 OSHA PEL ................................. 0.5 mg/m³ TWA (skin)
1993-1994 ACGIH TLV ............................ 0.5 mg/m³ TWA (skin)
Description of substance ...................... Colorless to pale-yellow, odorless solid or crushed flakes.
LEL .............................................. Unknown
Original (SCP) IDLH* .......................... No Evidence [*Note: “Effective” IDLH = 3,000 mg/m³ – see discussion below.]
Basis for original (SCP) IDLH ............... Most of the data reported in the literature about trinitrotoluene (TNT) poisoning concern the effects caused by chronic exposures. The available toxicological data contain no evidence that an acute exposure to a high concentration of TNT would impede escape or cause irreversible health effects within 30 minutes. AIHA [1984] reported that both the short exposure tolerance to TNT and the atmospheric concentration immediately hazardous to life are not important parameters. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 2,000 x the OSHA PEL of 1.5 mg/m³ (i.e., 3,000 mg/m³; only the “most protective” respirators are permitted for use in concentrations exceeding 3,000 mg/m³).

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉⁰ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Dilley et al. 1982</td>
<td>oral</td>
<td>795</td>
<td>-----</td>
<td>5,565 mg/m³</td>
<td>557 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Dilley et al. 1982</td>
<td>oral</td>
<td>660</td>
<td>-----</td>
<td>4,620 mg/m³</td>
<td>462 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>MRC 1921</td>
<td>oral</td>
<td>500</td>
<td>350</td>
<td>350 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>MRC 1921</td>
<td>oral</td>
<td>1,850</td>
<td>1,295</td>
<td>1,295 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Human data ........................................ The probable lethal dose has been reported to be 2 grams [Deichmann and Gerarde 1969]. [Note: An oral dose of 2 grams is equivalent to a worker being exposed to about 1,300 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 500 mg/m³
Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for 2,4,6-trinitrotoluene. Therefore, the revised IDLH for 2,4,6-trinitrotoluene is 500 mg/m³ based on acute oral toxicity data in humans [Deichmann and Gerarde 1969] and animals [Dilley et al. 1982; MRC 1921].

REFERENCES:

Triorthocresyl phosphate

CAS number ........................................ 78-30-8
NIOSH REL ...........................................
Current OSHA PEL ................................ 0.1 mg/m³ TWA
1989 OSHA PEL .................................. 0.1 mg/m³ TWA
1993-1994 ACGIH TLV ............................ 0.1 mg/m³ TWA [skin]

Description of substance ...................... Colorless to pale-yellow, odorless liquid or solid (below 52°F).

LEL .................................................
Original (SCP) IDLH ................................ 40 mg/m³

Revised IDLH: 40 mg/m³ [Unchanged]

Short-term exposure guidelines ............... None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀</th>
<th>LD₉₀</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Bleiberg and Johnson 1965</td>
<td>oral</td>
<td>900</td>
<td>-----</td>
<td>6,300 mg/m³</td>
<td>630 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Gross and Grosse 1932</td>
<td>oral</td>
<td>-----</td>
<td>100</td>
<td>700 mg/m³</td>
<td>70 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Veronesi et al. 1984</td>
<td>oral</td>
<td>1,160</td>
<td>-----</td>
<td>8,120 mg/m³</td>
<td>812 mg/m³</td>
</tr>
</tbody>
</table>

Human data ........................................ It has been reported that serious paralysis has been produced by an oral dose of about 6.6 mg/kg [Deichmann and Gerarde 1969] and that the probable lethal dose is greater than 28 mg/kg [Patty 1963]. [Note: Oral doses of 6.5 or 28 mg/kg are equivalent to a 70-kg worker being exposed to about 300 or 1,300 mg/m³, respectively, for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

Revised IDLH: 40 mg/m³ [Unchanged]

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for triorthocresyl phosphate. However, based on acute oral toxicity data in humans [Deichmann and Gerarde 1969; Patty 1963], the original IDLH for triorthocresyl phosphate (40 mg/m³) is not being revised at this time.

REFERENCES:


491
Triphenyl phosphate

CAS number ................................. 115-88-6
NIOSH REL .................................. 
Current OSHA PEL .......................... 3 mg/m³ TWA
1989 OSHA PEL ............................ Same as current PEL
1993-1994 ACGIH TLV ......................... 3 mg/m³ TWA
Description of substance ...................... Colorless, crystalline powder with a phenol-like odor.
LEL ......................................... Unknown
Original (SCP) IDLH* ........................ No Evidence [*Note: "Effective" IDLH = 1,500 mg/m³ – see discussion below.]

The available toxicological data contain no evidence of an IDLH for triphenyl phosphate. AIHA [1970] reported that concentrations of triphenyl phosphate aerosol high enough to produce acute toxic effects in man have not been achieved. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 x the OSHA PEL (500 x 3 mg/m³ = 1,500 mg/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 1,500 mg/m³.

None developed

Short-term exposure guidelines

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Antonyuk [1974]</td>
<td>oral</td>
<td>1,320</td>
<td>---</td>
<td>9,240 mg/m³</td>
<td>924 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Hierholzer et al. [1957]</td>
<td>oral</td>
<td>1,500</td>
<td>---</td>
<td>24,500 mg/m³</td>
<td>2,450 mg/m³</td>
</tr>
</tbody>
</table>

Human data ................................ Workers exposed to an average air concentration of 3.5 mg/m³ for as long as ten years showed no evidence of adverse clinical effects [Sutton et al. 1960].

Revised IDLH: 1,000 mg/m³

Basis for revised IDLH: The revised IDLH for triphenyl phosphate is 1,000 mg/m³ based on acute oral toxicity data in animals [Antonyuk 1974].

REFERENCES:

Turpentine

CAS number .................................................. 8006-64-2
NIOSH REL .................................................. 
Current OSHA PEL ........................................... 100 ppm (560 mg/m³) TWA
1989 OSHA PEL .............................................. Same as current PEL
1993-1994 ACGIH TLV .................................... 100 ppm (560 mg/m³) TWA
Description of substance ................................... Colorless liquid with a characteristic odor.
LEL ............................................................. 0.8% (10% LEL, 800 ppm)
Original (SCP) IDLH .......................................... The chosen IDLH is based on the known human lethal concentration of 1,878 ppm [Albaugh 1915 in Jacobs as cited by AIHA 1971], the mouse LC₅₀ of 1,620 ppm, and the reported effects to human subjects after several hours of exposure to 750 to 1,000 ppm [Lehmann and Flury 1943 as cited by ACGIH 1971]. AIHA [1967] reported that 1,878 ppm for 1 to 4 hours is definitely toxic to man (Jacobs 1949). The effects of turpentine on the eyes and central nervous system at concentrations above 1,500 ppm might impede escape in the event of respirator failure.
Original (SCP) IDLH .......................................... 1.500 ppm

Short-term exposure guidelines .......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₅</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Sperling and Collins 1964</td>
<td>29,000 mg/m³</td>
<td>-----</td>
<td>2 hr</td>
<td>8,212 ppm (1.6)</td>
<td>821 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Sperling et al. 1967</td>
<td>12,000 mg/m³</td>
<td>-----</td>
<td>6 hr</td>
<td>4,385 ppm (2.3)</td>
<td>489 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Skramlik 1959</td>
<td>oral</td>
<td>5,760</td>
<td>-----</td>
<td>7,136 ppm</td>
<td>714 ppm</td>
</tr>
</tbody>
</table>

Human data ................................................ Exposure of volunteers for several hours at 750 to 1,000 ppm resulted in irritation of the eyes, headache, dizziness, nausea, and acceleration of the pulse [Lehmann and Flury 1943]. The lethal concentration has been reported to be 1,878 ppm [Albaugh 1915].

Revised IDLH: 800 ppm

References for revised IDLH: The revised IDLH for turpentine is 800 ppm based on acute toxicity data in humans [Lehmann and Flury 1943] and animals [Skramlik 1959; Sperling and Collins 1964]. Also, this value is 10% of the lower explosive limit of 0.8%.

References:

Uranium (insoluble compounds, as U)

CAS number ........................................... 7440-61-1 (Metal)
NIOSH REL .............................................
Current OSHA PEL ....................................
1989 OSHA PEL ........................................
1993-1994 ACGIH TLV ............................
Description of substance ..........................
Original (SCP) IDLH .................................
Basis for original (SCP) IDLH ......................

0.2 mg/m³ TWA, 0.6 mg/m³ STEL; NIOSH considers insoluble uranium compounds to be a potential occupational carcinogens as defined by the OSHA carcinogen policy [29 CFR 1990].

0.25 mg/m³ TWA

Description of substance ..........................

0.2 mg/m³ TWA, 0.6 mg/m³ STEL

0.2 mg/m³ TWA, 0.6 mg/m³ STEL

Variates

30 mg U/m³

ILO [1972] stated that insoluble compounds tend to be deposited and retained in tissues and organs for long periods. Prolonged irradiation of the thorax, at sites of uranium accumulation, may eventually result in osteosarcoma and pulmonary cancer. Experimental inhalations of uranium oxide (31 to 91 mg/m³) for 5 days led to the appearance of pneumosclerosis 16 months later at points where alpha-tracks were concentrated. After 22 to 23 months, there was hyperplasia of the bronchial epithelium, and, after 56 months, lung cancer was diagnosed [ILO 1972]. Both the chemical and radioactive properties of the metal must be considered.

None developed

ACUTE TOXICITY DATA

Animal data ............................................

Inhalation of 31 to 91 mg/m³ of uranium oxide for 5 days led to the appearance of pneumosclerosis 16 months later at points where alpha-tracks were concentrated; after 22 to 23 months, there was hyperplasia of the bronchial epithelium, and, after 56 months, lung cancer was diagnosed [ILO 1972].

None relevant for use in determining the revised IDLH.

Revised IDLH: 10 mg U/m³

Basis for revised IDLH: The revised IDLH for insoluble uranium compounds is 10 mg U/m³ based on subchronic inhalation toxicity data in animals [ILO 1972] and to be consistent with soluble uranium compounds which have a revised IDLH of 10 mg U/m³. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for insoluble uranium compounds at concentrations above 0.2 mg/m³.]

REFERENCE:

Uranium (soluble compounds, as U)

CAS number ........................................ Varies
NIOSH REL ...........................................
Current OSHA PEL ............................... 0.05 mg/m³ TWA; NIOSH considers soluble uranium compounds to be potential occupational carcinogens as defined by the OSHA carcinogen policy [29 CFR 1990].
1988 OSHA PEL ..................................... Same as current PEL.
1993·1914 ACGIH TLV ......................... 0.2 mg/m³ TWA, 0.8 mg/m³ STEL
Original (SCP) IDLH ............................... Varies.
Basis for original (SCP) IDLH .................. 20 mg U/m³

The chosen IDLH is based on the statement by Patty [1963] that UO₂(NO₃)₆·H₂O of respirable particle size and dusts and mists of UF₆, UO₂F₂, and UCl₃ were generally fatal to most laboratory species when exposed daily for 1 month at 20 mg/m³ [Wilson et al. 1953]. No useful data on acute inhalation toxicity are available on which to base the IDLH.

Short-term exposure guidelines ....................... None developed.

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UO₂(NO₃)₆·H₂O</td>
<td>Spector 1956</td>
<td>oral</td>
<td>12</td>
<td>328</td>
<td>1,666 mg/m³</td>
<td>238 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td></td>
<td>oral</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No grossly observable signs or symptoms were induced in mice, rats, guinea pigs, rabbits, or dogs following the first day of exposure to 20 mg/m³ of UF₆ (13.5 mg U/m³), UO₂F₂ (15.5 mg U/m³), UCl₃ (12.5 mg U/m³), or UO₂(NO₃)₆·H₂O (8.5 mg U/m³) [Wilson et al. 1953].

Human data ........................................ None relevant for use in determining the revised IDLH.

Revised IDLH: 10 mg U/m³

Basis for revised IDLH: The revised IDLH for soluble uranium compounds is 10 mg U/m³ based on chronic toxicity data in animals [Wilson et al. 1953]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for soluble uranium compounds at concentrations above 0.05 mg U/m³.]

REFERENCES:

Vanadium dust

CAS number ............................................. 1314-62-1
NIOSH REL .............................................. 0.05 mg V/m³ 15-minute CEILING
Current OSHA PEL ...................................... 0.5 mg V₂O₅/m³ (respirable dust) CEILING
1989 OSHA PEL ........................................... 0.05 mg V₂O₅/m³ (respirable dust) TWA
1993-1994 ACGIH TLV ................................. 0.05 mg V₂O₅/m³ (respirable dust) TWA

Description of substance .............................. Yellow-orange powder or dark-gray, odorless flakes dispersed in air.

LEL ........................................................... Noncombustible Solid
Original (SCP) IDLH ..................................... 70 mg/m³ (as V₂O₅)
Basis for original (SCP) IDLH ......................... The chosen IDLH is based on the statement by ACGIH [1971] that vanadium pentoxide dust at 70 mg/m³ is fatal to animals within a few hours [Hudson 1954]. AIHA [1957] reported that rabbits succumb from edema of the lungs at 200 mg/m³ after one 7-hour exposure [Sjoberg 1950]. None developed.

Short-term exposure guidelines ......................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀ (mg/m³)</th>
<th>LC₆₀₆ (mg/m³)</th>
<th>Time (min)</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Faulkner 1964</td>
<td>---</td>
<td>500</td>
<td>23</td>
<td>256 mg V/m³ (0.915)</td>
<td>26 mg V/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Izrael’son 1963</td>
<td>---</td>
<td>70</td>
<td>2</td>
<td>63 mg V/m³ (1.6)</td>
<td>6.3 mg V/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₆₀₆ (mg/kg)</th>
<th>Adjusted LD (mg/kg)</th>
<th>Derived value (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Arch Toxikol 1956</td>
<td>oral</td>
<td>10</td>
<td>10</td>
<td>39 mg V/m³</td>
<td>3.9 mg V/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Izmerov et al. 1982</td>
<td>oral</td>
<td>23</td>
<td>23</td>
<td>90 mg V/m³</td>
<td>9.0 mg V/m³</td>
</tr>
</tbody>
</table>

Human data .............................................. Respiratory irritation following exposures to V₂O₅ ranging from 1 to 48 mg V/m³ has been described in workers [Sjoberg 1955]. Vanadium intoxication (i.e., rhinitis, sneezing, lacrimation, and sore throat) has been reported in workers exposed to concentrations of V₂O₅ during the workshift ranging from 10 to 33 mg/m³ [Williams 1952]. Concentrations of V₂O₅ exceeding 56 mg V/m³ have resulted in local respiratory effects [Vintinner et al. 1955]. Other workers exposed intermittently to 56 mg V/m³ showed no evidence of intoxication [McTurk et al. 1956].

Revised IDLH: 35 mg V/m³

Based for revised IDLH: Based on acute inhalation toxicity data in workers [McTurk et al. 1956; Sjoberg 1955; Vintinner et al. 1955; Williams 1952], the revised IDLH for vanadium dust is 35 mg V/m³.

REFERENCES:

Vanadium dust (continued)

Vanadium fume

CAS number .............................................. 1314-62-1
NIOSH REL ................................................. 0.05 mg V/m³ 15-minute CEILING
Current OSHA PEL ........................................ 0.1 mg V₂O₅/m³ CEILING
1989 OSHA PEL ........................................... 0.05 mg V₂O₅/m³ CEILING
1993-1994 ACGIH TLV ...................................... 0.05 mg V₂O₅/m³ (respirable fume) TWA

Description of substance .............................. Finely divided particulate dispersed in air.
LEL .............................................................. Noncombustible Solid

Original (SCP) IDLH ......................................... 70 mg/m³ (as V₂O₅)
Basis for original (SCP) IDLH ......................... The available data concerning the physiological effects of vanadium pentoxide (V₂O₅) refer either to V₂O₅ dust or just to V₂O₅, and do not specifically mention V₂O₅ fume. Patty [1963] stated that the lower limit for a V₂O₅ fume is based on the recognized greater toxicity of fume compared with dusts of larger particle size. Because no quantitative data are available specifically for V₂O₅ fume, the chosen IDLH is based on the report by ACGIH [1971] that 70 mg/m³ V₂O₅ dust is a lethal concentration for animals after a few hours of exposure [Hudson]. A margin of safety is present in the IDLH for the dust, because the exposure is for a few hours. Therefore, although based on an analogy with V₂O₅ dust, the IDLH for the fume is probably reasonable.

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Animal data .......................................................... It has been reported that 70 mg/m³ V₂O₅ dust is a lethal concentration after a few hours of exposure [Hudson].
Human data .......................................................... None relevant for use in determining the revised IDLH.

| Revised IDLH: 35 mg V/m³ |
| Basis for revised IDLH: The revised IDLH for vanadium fume is 35 mg V/m³ based on an analogy to vanadium dust which has a revised IDLH of 35 mg V/m³. |

REFERENCES:

Vinyl toluene

CAS number ................................................. 25013-15-4
NIOSH REL .................................................
Current OSHA PEL ........................................ 100 ppm (480 mg/m³) TWA
1989 OSHA PEL ............................................. Same as current PEL
1993-1994 ACGIH TLV ...................................... 50 ppm (242 mg/m³) TWA, 100 ppm (483 mg/m³) STEL
Description of substance: Colorless liquid with a strong, disagreeable odor.
LEL .......................................................... 0.8% (10% LEL, 800 ppm)
Original (SCP) IDLH ........................................ 5,000 ppm
Basis for original (SCP) IDLH ................................ Because no data on acute inhalation toxicity are available on
which to base an IDLH for vinyl toluene, the chosen IDLH has
been based on an analogy with styrene, which has an IDLH of
5,000 ppm.

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC_{50} (ppm)</th>
<th>LC_{10} (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Krynskaya et al. 1969</td>
<td>615</td>
<td>----</td>
<td>4 hr</td>
<td>1,230 ppm (2.0)</td>
<td>123 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD_{50} (mg/kg)</th>
<th>LD_{10} (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Yang and Mackerer 1990</td>
<td>oral</td>
<td>2.065</td>
<td>2.055</td>
<td>2.255 ppm</td>
<td>322 ppm</td>
</tr>
</tbody>
</table>

Other animal data: RD_{50} (mouse), 16.4 ppm [DeCeaurriz et al. 1981].

Human data: Although eye and nasal irritation have been noted, 400 ppm has
been considered a safe concentration [ACGIH 1986].

Revised IDLH: 400 ppm

Revised for revised IDLH: The revised IDLH for vinyl toluene is 400 ppm based on acute inhalation toxicity data in humans
[ACGIH 1986]. This may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to
concentrations above 400 ppm.

REFERENCES:

   Cincinnati, OH: American Conference of Governmental Industrial Hygienists, pp. 275-276.
   Part B 1:77 [Abstract].
Warfarin

CAS number .......................... 81-81-2
NIOSH REL ............................ 0.1 mg/m³ TWA
Current OSHA PEL .................... 0.1 mg/m³ TWA
1988 OSHA PEL ........................ Same as current PEL
1993-1994 ACGIH TLV ................. 0.1 mg/m³ TWA
Description of substance .............. Colorless, odorless, crystalline powder.
LEL .................................. Unknown
Original (SCP) IDLH ................... 350 mg/m³ [Note: "Effective" IDLH = 200 mg/m³ — see discussion below.]

No data on acute inhalation toxicity are available on which to base the IDLH for warfarin. The IDLH of 350 mg/m³, therefore, is estimated from the rat oral lethal dose of 50 mg/kg [Sax 1975]. Because of the assigned protection factor afforded by each device, however, 2,000 × the OSHA PEL of 0.1 mg/m³ (i.e., 200 mg/m³) is the concentration above which only the "most protective" respirators are permitted. The chosen IDLH is probably conservative, because the rat is particularly susceptible to warfarin, and single doses are not usually as harmful as small, repeated doses.

None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Coumafene 1989</td>
<td>oral</td>
<td>3</td>
<td>21 mg/m³</td>
<td>21 mg/m³</td>
<td>2.1 mg/m³</td>
</tr>
<tr>
<td>Dog</td>
<td>Coumafene 1989</td>
<td>oral</td>
<td>3</td>
<td>21 mg/m³</td>
<td>21 mg/m³</td>
<td>2.1 mg/m³</td>
</tr>
<tr>
<td>Cat</td>
<td>Coumafene 1989</td>
<td>oral</td>
<td>3</td>
<td>42 mg/m³</td>
<td>42 mg/m³</td>
<td>4.2 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Hayes 1967</td>
<td>oral</td>
<td>1.6</td>
<td>11 mg/m³</td>
<td>11 mg/m³</td>
<td>1.1 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Sax 1975</td>
<td>oral</td>
<td>50</td>
<td>350 mg/m³</td>
<td>350 mg/m³</td>
<td>35 mg/m³</td>
</tr>
</tbody>
</table>

Human data ............................................ The sodium salt of warfarin has been used as an anticoagulant drug with a loading dose of 30 to 60 mg [ACGIH 1991] [Note: This is equivalent to a worker being exposed to 20 to 40 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]. It has been reported that 6.667 mg/kg is the lethal oral dose [Yakkyoku 1977] [Note: This is equivalent to a worker being exposed to about 300 mg/m³ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.].

Revised IDLH: 100 mg/m³

Basis for revised IDLH: No inhalation toxicity data are available on which to base an IDLH for warfarin. Therefore, the revised IDLH for warfarin is 100 mg/m³ based on acute toxicity data in human [Yakkyoku 1977]. This may be a conservative value due to the lack of acute inhalation toxicity data for workers.

REFERENCES:

Xylene (o-, m-, p-isomers)

<table>
<thead>
<tr>
<th>CAS numbers</th>
<th>95-47-6 (o-isomer), 108-38-3 (m-isomer), 106-42-3 (p-isomer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH REL</td>
<td>100 ppm (435 mg/m³) TWA, 150 ppm (655 mg/m³) STEL</td>
</tr>
<tr>
<td>Current OSHA PEL</td>
<td>100 ppm (435 mg/m³) TWA</td>
</tr>
<tr>
<td>1989 OSHA PEL</td>
<td>100 ppm (435 mg/m³) TWA, 150 ppm (655 mg/m³) STEL</td>
</tr>
<tr>
<td>1983-1984 ACGIH TLV</td>
<td>100 ppm (434 mg/m³) TWA, 150 ppm (851 mg/m³) STEL</td>
</tr>
<tr>
<td>Description of substance</td>
<td>Colorless liquid with an aromatic odor.</td>
</tr>
<tr>
<td>LEL</td>
<td>0.9-1.1% (10% LEL, 900-1,100 ppm)</td>
</tr>
<tr>
<td>Original (SCP) IDLH</td>
<td>1,000 ppm</td>
</tr>
<tr>
<td>Basis for original (SCP) IDLH</td>
<td>The chosen IDLH is based on the following statements by ANSI [1971]. “Exposure at 1,000 ppm for 5 minutes or less will probably allow self-rescue with no irreversible injury. Higher concentrations or longer exposure periods can cause eye and respiratory tract irritation, and the beginning of narcotic effects which may limit self-rescue ability. This information is based on human experience and extrapolation from animal data.” National Research Council [NRC 1984] Emergency Exposure Guidance Levels (EEGLs):</td>
</tr>
</tbody>
</table>

**ACUTE TOXICITY DATA**

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (ppm)</th>
<th>LC&lt;sub&gt;10&lt;/sub&gt; (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>o-Xylene Rat</td>
<td>Cameron et al. 1938</td>
<td>6.125</td>
<td>6.125</td>
<td>12 hr</td>
<td>73,500 ppm (2.9)</td>
<td>7,350 ppm</td>
</tr>
<tr>
<td>o-Xylene Human</td>
<td>Gekkan Yakuji 1980</td>
<td>6.125</td>
<td>6.125</td>
<td>12 hr</td>
<td>73,500 ppm (2.9)</td>
<td>7,350 ppm</td>
</tr>
<tr>
<td>m-Xylene Mouse</td>
<td>Cameron et al. 1938</td>
<td>2.010</td>
<td>8,500</td>
<td>24 hr</td>
<td>7,236 ppm (3.6)</td>
<td>724 ppm</td>
</tr>
<tr>
<td>m-Xylene Rat</td>
<td>Smyth et al. 1962</td>
<td>8,500</td>
<td>8,500</td>
<td>4 hr</td>
<td>16,000 ppm (2.0)</td>
<td>1,600 ppm</td>
</tr>
<tr>
<td>p-Xylene Mouse</td>
<td>Arch Exp Pathol Pharmacol 1929</td>
<td>2,401</td>
<td>2,401</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>p-Xylene Rat</td>
<td>Harper et al. 1977</td>
<td>4,550</td>
<td>4,550</td>
<td>4 hr</td>
<td>9,100 ppm (2.0)</td>
<td>910 ppm</td>
</tr>
<tr>
<td>Xylene Human</td>
<td>Morley et al. 1970</td>
<td>10,000</td>
<td>450</td>
<td>18 hr</td>
<td>33,000 ppm (3.3)</td>
<td>3,300 ppm</td>
</tr>
<tr>
<td>Xylene Rat</td>
<td>NPIRI 1974</td>
<td>5,000</td>
<td>450</td>
<td>4 hr</td>
<td>10,000 ppm (2.0)</td>
<td>1,000 ppm</td>
</tr>
<tr>
<td>o-pig</td>
<td>Smyth and Smyth 1928</td>
<td>450</td>
<td>450</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Other animal data

Other human data

RD<sub>50</sub> (mouse): 1,467 ppm [DeCasauntz et al. 1961].

It has been reported that 1,000 ppm for 5 minutes or less will probably allow self-rescue with no irreversible injury [ANSI 1971]. Volunteers found 200 ppm to be definitely irritating to the eyes, nose, and throat [Nelson et al. 1943]. Reaction time was not affected in 23 volunteers exposed to 100 or 200 ppm for 3 to 7 hours [Ogata et al. 1970]. No noticeable changes in reaction time or short-term memory tests were seen in 15 volunteers exposed to 100 or 300 ppm for 70 minutes [Gambarele et al. 1978].
Revised IDLH: 900 ppm

Basis for revised IDLH: The revised IDLH is 900 ppm based on acute inhalation toxicity data in animals [Cameron et al. 1938; DeCceauniz et al. 1981; Harper et al. 1977; NPIRI 1974]. Although this may be a conservative value due to the lack of relevant acute toxicity data for workers exposed to concentrations above 300 ppm, this value would have otherwise been selected for safety considerations (i.e., being 10% of the lower explosive limit of 0.9% for o-xylene).

REFERENCES:

Xylidine

CAS number ........................................... 1300-73-8 (mixed isomers)

NIOSH REL .............................................

Current OSHA PEL .....................................

1989 OSHA PEL ........................................

1993-1994 ACGIH TLV ............................... 0.5 ppm (2.5 mg/m³) TWA [skin], A2

Description of substance .............................. Pale-yellow to brown liquid with a weak, aromatic, amine-like odor.

Original (SCP) IDLH ..................................

1.0% (10% LEL, 1.000 ppm) 150 ppm

Basis for original (SCP) IDLH .......................... The chosen IDLH is based on the mouse 7-hour LC₉₀ of 149 ppm [von Oettingen et al. 1947 cited by ACGIH 1971].

Short-term exposure guidelines ......................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>L₉₀ (ppm)</th>
<th>L₈₅ (ppm)</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mice (2,4-)</td>
<td>von Oettingen et al. 1947</td>
<td>149</td>
<td>-----</td>
<td>7 hr</td>
<td>358 ppm (2.4)</td>
<td>36 ppm</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₉₀ (mg/kg)</th>
<th>LD₈₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>Deichmann and Gerarde 1969</td>
<td>oral</td>
<td>-----</td>
<td>833 ppm</td>
<td>358 ppm</td>
<td>36 ppm</td>
</tr>
<tr>
<td>Rat</td>
<td>Treon et al. 1949</td>
<td>oral</td>
<td>610 ppm</td>
<td>847 ppm</td>
<td>85 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat (2,3-+)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>920 ppm</td>
<td>1,292 ppm</td>
<td>129 ppm</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>1,070 ppm</td>
<td>1,486 ppm</td>
<td>149 ppm</td>
<td></td>
</tr>
<tr>
<td>House (2,4-)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>470 ppm</td>
<td>653 ppm</td>
<td>65 ppm</td>
<td></td>
</tr>
<tr>
<td>House (2,4-)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>250 ppm</td>
<td>347 ppm</td>
<td>347 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat (2,4-)</td>
<td>Lindstrom et al. 1969</td>
<td>oral</td>
<td>1,289 ppm</td>
<td>1,749 ppm</td>
<td>175 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat (2,5+)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>1,350 ppm</td>
<td>1,806 ppm</td>
<td>181 ppm</td>
<td></td>
</tr>
<tr>
<td>House (2,5+)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>840 ppm</td>
<td>1,167 ppm</td>
<td>117 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat (2,6-)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>1,230 ppm</td>
<td>1,708 ppm</td>
<td>171 ppm</td>
<td></td>
</tr>
<tr>
<td>House (2,6-)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>710 ppm</td>
<td>986 ppm</td>
<td>986 ppm</td>
<td>98 ppm</td>
</tr>
<tr>
<td>Rat (2,6-)</td>
<td>Short et al. 1983</td>
<td>oral</td>
<td>1,050 ppm</td>
<td>1,458 ppm</td>
<td>146 ppm</td>
<td></td>
</tr>
<tr>
<td>Rat (3,6-)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>810 ppm</td>
<td>1,125 ppm</td>
<td>125 ppm</td>
<td></td>
</tr>
<tr>
<td>House (3,4-)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>710 ppm</td>
<td>986 ppm</td>
<td>986 ppm</td>
<td>98 ppm</td>
</tr>
<tr>
<td>Rat (3,5-)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>710 ppm</td>
<td>986 ppm</td>
<td>986 ppm</td>
<td>98 ppm</td>
</tr>
<tr>
<td>House (3,5-)</td>
<td>Vernot et al. 1977</td>
<td>oral</td>
<td>420 ppm</td>
<td>583 ppm</td>
<td>583 ppm</td>
<td>58 ppm</td>
</tr>
</tbody>
</table>

Human data ........................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 50 ppm

Basis for revised IDLH: The revised IDLH for xylidine is 50 ppm based on acute toxicity data in animals [Deichmann and Gerarde 1968; Treon et al. 1949; Vernot et al. 1977; von Oettingen et al. 1947]. This may be a conservative value due to the lack of relevant acute toxicity data for workers.

REFERENCES:


503
Xylidine (continued)


Yttrium compounds (as Y)

CAS number ........................................... 7440-85-5 (Metal)
NIOSH REL ............................................ 1 mg/m³ TWA
Current OSHA PEL .................................... 1 mg/m³ TWA
1968 OSHA PEL ........................................ Same as current PEL
1989 OSHA PEL ........................................ 1 mg/m³ TWA

Description of substance: Varies

Original (SCP) IDLH* .................................. No Evidence [*Note: "Effective" IDLH = 500 mg Y/m³ -- see discussion below.]

Basis for original (SCP) IDLH: From the data given by ACGIH [1971], it does not appear that exposure to a high concentration of yttrium could impede escape within 30 minutes. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device up to 500 x the OSHA PEL of 1 mg Y/m³ (i.e., 500 mg Y/m³); only the "most protective" respirators are permitted for use in concentrations exceeding 500 mg Y/m³.

Short-term exposure guidelines: None developed

ACUTE TOXICITY DATA

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₅ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y₂O₅</td>
<td>Spassky 1978</td>
<td>Oral</td>
<td>&gt;10,000</td>
<td>&gt;55,300 Y/m³</td>
<td>&gt;5.53 mg Y/m³</td>
<td>&gt;5,530 mg Y/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Spassky 1978</td>
<td>Oral</td>
<td>&gt;6,000</td>
<td>&gt;33,180 Y/m³</td>
<td>&gt;3.31 mg Y/m³</td>
<td>&gt;3,318 mg Y/m³</td>
</tr>
</tbody>
</table>

Human data: None relevant for use in determining the revised IDLH.

Revised IDLH: 500 mg Y/m³

Basis for revised IDLH: The available toxicological data contain no evidence that an acute exposure to a high concentration of yttrium compounds would impede escape or cause any irreversible health effects within 30 minutes. However, the revised IDLH for yttrium compounds is 500 mg Y/m³ based on being 500 times the NIOSH REL and OSHA PEL of 1 mg Y/m³ (500 is an assigned protection factor for respirators and was used arbitrarily during the Standards Completion Program for deciding when the "most protective" respirators should be used for particulates).

REFERENCES:

Zinc chloride fume

CAS number ........................................ 7646-85-7
NIOSH REL ........................................ 1 mg/m³ TWA, 2 mg/m³ STEL
Current OSHA PEL .................................. 1 mg/m³ TWA
1989 OSHA PEL ..................................... 1 mg/m³ TWA, 2 mg/m³ STEL
1993-1994 ACGIH TLV .............................. 1 mg/m³ TWA, 2 mg/m³ STEL
Description of substance ............................. White particulate dispersed in air.
LEL .................................................. Noncombustible Solid
Original (SCP) IDLH ................................. 4,800 mg/m³ [*Note: "Effective" IDLH = 2,000 mg/m³ – see discussion below.]
The chosen IDLH is based on the 30-minute human TLO of 4,800 mg/m³ zinc chloride [Ferry 1974 cited by NIOSH 1976]; and the toxic effects involved the respiratory system. No other data on acute inhalation toxicity are available on which to base the IDLH for zinc chloride fume. Because of the assigned protection factor afforded by each device, however, 2,000 = the OSHA PEL (i.e., 2,000 mg/m³) is the concentration above which only the "most protective" respirators are permitted.

Short-term exposure guidelines ........................................ None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₉₀</th>
<th>LCₑ₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Karlsson et al. 1986</td>
<td>LC₉₀: 1,960 mg/m³</td>
<td>----</td>
<td>10 min</td>
<td>1,352 mg/m³</td>
<td>135 mg/m³</td>
</tr>
<tr>
<td>Rat</td>
<td>Marrs et al. 1983</td>
<td>1,260 mg/m³</td>
<td>----</td>
<td>30 min</td>
<td>1,260 mg/m³</td>
<td>126 mg/m³</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Marrs et al. 1983</td>
<td>LC₉₀: 1,260 mg/m³</td>
<td>----</td>
<td>30 min</td>
<td>1,260 mg/m³</td>
<td>126 mg/m³</td>
</tr>
<tr>
<td>Mouse</td>
<td>Marrs et al. 1983</td>
<td>32.8 mg-min/m³</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀</th>
<th>LD₉₀</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Calvery 1942</td>
<td>oral</td>
<td>350</td>
<td>----</td>
<td>2,450 mg/kg</td>
<td>245 mg/kg</td>
</tr>
<tr>
<td>Mouse</td>
<td>Calvery 1942</td>
<td>oral</td>
<td>350</td>
<td>----</td>
<td>2,450 mg/kg</td>
<td>245 mg/kg</td>
</tr>
<tr>
<td>G. pig</td>
<td>Calvery 1942</td>
<td>oral</td>
<td>200</td>
<td>----</td>
<td>1,400 mg/kg</td>
<td>140 mg/kg</td>
</tr>
<tr>
<td>Rat</td>
<td>Domingo et al. 1988</td>
<td>oral</td>
<td>1,100</td>
<td>----</td>
<td>7,700 mg/kg</td>
<td>770 mg/kg</td>
</tr>
<tr>
<td>Mouse</td>
<td>Domingo et al. 1988</td>
<td>oral</td>
<td>1,330</td>
<td>----</td>
<td>8,750 mg/kg</td>
<td>875 mg/kg</td>
</tr>
</tbody>
</table>

Other animal data ........................................ It has been reported that 80 mg/m³ is the no observed adverse effect level (NOEL) for rat intratracheal fibrosis [Richards et al. 1989].

Human data ........................................... A 30-minute exposure to 4.8 mg/m³ has been reported to produce respiratory distress [Ferry 1974]. Exposure to 80 mg/m³ has caused nausea and coughing, and 120 mg/m³ for 2 minutes has caused nose and upper respiratory system irritation [Cullumbine 1957].

Revised IDLH: 50 mg/m³

Based for revised IDLH: The revised IDLH for zinc chloride fume is 50 mg/m³ based on acute toxicity data in humans [Cullumbine 1957] and animals [Richards et al. 1989].
REFERENCES:

Zinc oxide

CAS number ................................. 1314-13-2

Niosh REL .................................

Current OSHA PEL ............................ Fume: 5 mg/m³ TWA, 10 mg/m³ STEL;
Dust: 5 mg/m³ TWA, 15 mg/m³ CEILING.

1989 OSHA PEL ............................... Fume: 5 mg/m³ TWA;
Dust: 15 mg/m³ (total dust) TWA;
5 mg/m³ (respirable dust) TWA.

1993-1994 ACGIH TLV ........................ Fume: 5 mg/m³ TWA, 10 mg/m³ STEL;
Dust: 10 mg/m³ (total dust) TWA;
5 mg/m³ (respirable dust) TWA.

Description of substance ........................ White, odorless solid.

LEL ......................................... Noncombustible solid.

Original (SCP) IDLH* ........................ No Evidence* [*Note: "Effective" IDLH = 2,500 mg/m³] — see discussion below.

Basis for original (SCP) IDLH ............... The available toxicological data contains no evidence that an acute exposure to a high concentration of zinc oxide fume would impede escape within 30 minutes or cause any irreversible health effects. For this draft technical standard, therefore, respirators have been selected on the basis of the assigned protection factor afforded by each device. However, for some particulate substances for which no evidence of an IDLH exists, the determination of allowable respiratory protection based on protection factors may result in the assignment of respirators for concentrations that are not likely to be encountered in the occupational environment. Therefore, for all such particulate substances it has been arbitrarily determined that only the "most protective" respirators are permitted for use in concentrations exceeding 500 × the OSHA PEL of 5 mg/m³ (i.e., 2,500 mg/m³). None developed.

Short-term exposure guidelines .................

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₃₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Takahashi 1976</td>
<td>2,500 mg/m³</td>
<td>2,500 mg/m³</td>
<td>7</td>
<td>4,500-5,000 mg/m³ (2.8/2.0)</td>
<td>450-500 mg/m³</td>
</tr>
<tr>
<td>G. pig</td>
<td>Turner and Thompson 1926</td>
<td>-----</td>
<td>-----</td>
<td>3-4 hr</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₃₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Gig Santit 1984</td>
<td>oral</td>
<td>7.958</td>
<td>-----</td>
<td>56,450 mg/m³</td>
<td>5,565 mg/m³</td>
</tr>
</tbody>
</table>
Zinc oxide (continued)

Human data

Workers exposed to zinc concentrations between 320 to 580 mg/m$^3$ for 1-3 hours have experienced nausea on the job, and chills, shortness of breath, and severe chest pains 2 to 12 hours later [Hammond 1944]. Two men exposed to about 600 mg/m$^3$ for 10.5 to 12 minutes experienced headaches, chills, and fever with cough and a decrease in vital capacity which persisted for 15 hours after exposure [Sturgis and Thompson 1927]. When air concentrations approach 500 mg/m$^3$, it has been reported that visibility is occluded [Turner and Thompson 1926]. The lethal oral dose has been reported to be 500 mg/kg [Gekkan Yakuji 1980]. [Note: An oral dose of 500 mg/kg is equivalent to a 70-kg worker being exposed to about 22,300 mg/m$^3$ for 30 minutes, assuming a breathing rate of 50 liters per minute and 100% absorption.]

<table>
<thead>
<tr>
<th>Revised IDLH: 500 mg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis for revised IDLH: The revised IDLH for zinc oxide is 500 mg/m$^3$ based on acute inhalation toxicity data in humans [Hammond 1944; Sturgis and Thompson 1927].</td>
</tr>
</tbody>
</table>

REFERENCES:

Zirconium compounds (as Zr)

CAS number ........................................... 7440-67-7 (Metal)
NIOSH REL ........................................... 5 mg/m³ TWA, 10 mg/m³ STEL
Current OSHA PEL ........................................ 5 mg/m³ TWA
1989 OSHA PEL ........................................... 5 mg/m³ TWA, 10 mg/m³ STEL
1993-1994 ACGIH TLV ...................................... 5 mg/m³ TWA, 10 mg/m³ STEL
Description of substance .................................................. Varies
Original (SCP) IDLH ........................................... 500 mg Zr/m³
Basis for original (SCP) IDLH ........................................... The available toxicological data indicate that zirconium compounds possess a low order of toxicity. The chosen IDLH has been based on the citation by NIOSH [1976] that a 30-minute exposure to 500 mg/m³ of zirconium nitrate is the lowest concentration of this substance which has been shown to be lethal to rats [Mogilevskaya 1967].

Short-term exposure guidelines ........................................... None developed

ACUTE TOXICITY DATA

Lethal concentration data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>LC₅₀</th>
<th>LC₉₀</th>
<th>Time</th>
<th>Adjusted 0.5-hr LC (CF)</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zr(NO₃)₂, Rat</td>
<td>Mogilevskaya 1967</td>
<td>500 mg/m³</td>
<td>10 mg/m³</td>
<td>30 min</td>
<td>212 mg Zr/m³ (1.0)</td>
<td>21 mg Zr/m³</td>
</tr>
</tbody>
</table>

Lethal dose data:

<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Route</th>
<th>LD₅₀ (mg/kg)</th>
<th>LD₉₀ (mg/kg)</th>
<th>Adjusted LD</th>
<th>Derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZrF₂K, Mouse</td>
<td>Shalganova 1967</td>
<td>oral</td>
<td>98</td>
<td>-----</td>
<td>221 mg Zr/m³</td>
<td>22 mg Zr/m³</td>
</tr>
<tr>
<td>Zr(SO₄)₂, Rat</td>
<td>Cochran et al. 1950</td>
<td>oral</td>
<td>3,500</td>
<td>-----</td>
<td>7,886 mg Zr/m³</td>
<td>789 mg Zr/m³</td>
</tr>
<tr>
<td>ZrOCl₂, Mouse</td>
<td>Delongeas et al. 1983</td>
<td>oral</td>
<td>1,227</td>
<td>-----</td>
<td>4,398 mg Zr/m³</td>
<td>440 mg Zr/m³</td>
</tr>
<tr>
<td>ZrCl₂, Rat</td>
<td>Klieter and Doll 1964</td>
<td>oral</td>
<td>2,050</td>
<td>-----</td>
<td>10,573 mg Zr/m³</td>
<td>1,057 mg Zr/m³</td>
</tr>
<tr>
<td>ZrF₂, Mouse</td>
<td>ACGIH 1986</td>
<td>oral</td>
<td>1,688</td>
<td>-----</td>
<td>4,643 mg Zr/m³</td>
<td>464 mg Zr/m³</td>
</tr>
<tr>
<td>ZrF₂, Rat</td>
<td>ACGIH 1986</td>
<td>oral</td>
<td>90</td>
<td>-----</td>
<td>378 mg Zr/m³</td>
<td>37 mg Zr/m³</td>
</tr>
</tbody>
</table>

Human data ........................................... None relevant for use in determining the revised IDLH.

Revised IDLH: 25 mg Zr/m³

Basis for revised IDLH: The revised IDLH for zirconium compounds is 25 mg Zr/m³ based on acute toxicity data in animals [ACGIH 1986; Mogilevskaya 1967; Shalganova 1967]. This may be a conservative value due to the lack of relevant acute inhalation toxicity data for workers.

REFERENCES:

Zirconium compounds (as Zr) (continued)


