

3M Occupational Health and Environmental Safety Division  
**2009 Respirator Selection Guide**



**3M**

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# Respirator Selection Criteria

The 3M™ Respirator Selection Guide includes a list of chemicals for which 3M respirators can be recommended. This information can be used to supplement general industrial hygiene knowledge. Once workplace contaminants and their concentrations have been identified, the guide can be used to help select an appropriate 3M™ Respirator for nearly 700 chemicals with Threshold Limit Values (TLVs®) or other recommended exposure limits.

Because actual conditions vary from one worksite to another, this information is intended only as a guide. Selection of the most appropriate respirator will depend on the particular situation and should be made only by a person familiar with the working conditions and with the benefits and limitations of respiratory protection products. If you have any questions related to proper selection and use of

3M respirators, or the use of this guide, contact your local 3M OH&ESD representative or call our 3M OH&ESD Technical Service Line at 1-800-243-4630.

## Respirator Program Management

Where respirators are in use in the workplace, a formal respiratory protection program must be established covering the basic requirements outlined in the OSHA Respiratory Protection Standard (29 CFR 1910.134). Education and training must be properly emphasized and conducted periodically. Maintenance, cleaning, and storage programs must be established and routinely followed for reusable respirators.

## Respirator Fit

The OSHA Respiratory Protection Standard (29 CFR 1910.134) requires fit testing for all tight-fitting respirators. Whether you select a maintenance-free or a reusable respirator, the wearer must obtain a satisfactory fit as indicated by a qualitative or quantitative fit test. Worker comfort must also be considered. Removal of the respirator, even for short periods of time, dramatically reduces the protection afforded by the respirator.

## Protection Factors

The respirator selected must have an assigned protection factor adequate for the particular workplace exposure. Divide the air contaminant concentration by the occupational exposure limit (OEL) to obtain a hazard ratio. Then select a respirator with an assigned protection factor greater than or equal to that hazard ratio.

## Hazard Ratio

$$= \frac{\text{Airborne Contaminant Concentration}}{\text{OEL}}$$

Assigned protection factors\* currently recommended by 3M are as follows:

### Air Purifying Respirators

- Half facepiece (maintenance-free and dual cartridge).....10
- Full facepiece .....50

### Powered Air Purifying Respirators

- Loose-fitting facepiece (e.g., L-501, Airstream™) .....25
- Half facepiece .....50
- Full facepiece, helmet, or hood.....1000

## Supplied Air Respirators (airline)

- Continuous Flow
  - Loose-fitting facepiece (e.g., L-501) .....25
  - Half facepiece.....50
  - Full facepiece, helmet, or hood .....1000
- Pressure Demand with Full facepiece .....1000
- Pressure Demand Airline with Escape SCBA .....10,000, unknown and IDLH atmospheres
- Pressure Demand SCBA.....10,000, unknown and IDLH atmospheres

## Effects From Skin or Eye Contact

If a chemical can be absorbed through the skin, skin protection may be required in addition to respiratory protection. Eye protection may also be necessary if not provided by the respirator. Failure to provide adequate skin or eye protection can invalidate established exposure limits

and make respirator use ineffective for protection against certain workplace contaminants.

## Human Factors

Consider the entire package of safety equipment required for the job. The respirator selected must be compatible with hard hats, goggles, glasses, welding hoods, faceshields, etc. In addition, the worker must be able to communicate and perform required job duties without removing the respirator. If strenuous work is to be performed, or if the respirator is to be worn for an extended period of time, it may be desirable to select a lightweight respirator with low breathing resistance. If a respirator does not have good worker acceptance and does not stay on the worker's face, it will not provide the protection needed.

\*Assigned protection factors may vary for specific standards as promulgated by OSHA (e.g., continuous flow supplied air respirators are assigned a protection factor of 100 in the OSHA Asbestos Standards, 29 CFR 1910.1001 and 29 CFR 1926.1101). Where assigned protection factors in local, state, or federal standards are lower than those listed here, they should be used instead. For additional limitations of 3M respiratory protection products, refer to 3M respirator packaging and use instructions and limitations.

## Location Of Hazardous Area

When specifying supplied air respirators, consider the distance the worker must travel to get to an uncontaminated work area, as well as obstacles or equipment present in the area. If ladders or scaffolds must be climbed, an air purifying respirator or a combination air purifying/airline respirator may be appropriate.

## Respirator Characteristics, Capabilities, and Limitations

A respirator may not be able to help protect against all of the contaminants present in a particular work environment. Specific limitations are stated on the approval labels and are included with use instructions and limitations. These must be carefully reviewed for each respirator before use. General precautionary information is given below. Refer to respirator packaging or operating manuals for specific information.



**No respirator is capable of preventing all airborne contaminants from entering the wearer's breathing zone. Respirators help protect against certain airborne contaminants by reducing airborne contaminant concentrations in the breathing zone to below the TLV or other recommended exposure level. Misuse of respirators may result in overexposure to the contaminant and cause sickness or death. For this reason, proper respirator selection, training, use, and maintenance are mandatory in order for the wearer to be properly protected.**

**Use these respirators only for those specific chemical compounds for which they have been approved or recommended.**

## General Use Instructions

- Failure to follow all instructions and limitations on the use of these respirators and/or failure to wear them during all times of exposure can reduce respirator effectiveness and may result in sickness or death.
- Many of the contaminants that can be dangerous to a person's health include the ones that are so small they cannot be seen or smelled at dangerous levels.
- Before use of any respirator, the wearer must first be trained by the employer in proper respirator use in accordance with applicable safety and health standards.
- The OSHA Respiratory Protection Standard [29 CFR 1910.134(f)(1)] requires that the wearer of any tight-fitting respirator be fit tested.

- Leave the contaminated area immediately if dizziness or other distress occurs, if the respirator becomes damaged or breathing becomes difficult, if contaminants can be smelled or tasted, or if irritation occurs.

## General Use Limitations

- These respirators do not supply oxygen.
- Do not use when concentrations of contaminants are immediately dangerous to life or health, when concentrations are unknown, or in atmospheres containing less than 19.5% oxygen, unless using an SCBA or combination airline/SCBA.
- Do not abuse or misuse any respirator.
- Do not use tight-fitting respirators or loose-fitting facepieces with beards or other facial hair or conditions that prevent direct contact between the face and the edge of the respirator.
- Do not use when concentrations exceed maximum use concentrations established by regulatory agencies.



**These respirators help protect against airborne particles or gases and vapors only. Many of these substances can cause serious health effects, including sickness or death. Misuse of a respirator may result in sickness or death. For proper use, see a supervisor, refer to the respirator package, or call 3M OH&ESD Technical Service at 1-800-243-4630.**

## Format Explanation

### Chemical Name

Chemical names listed in this guide are generally those used in the Threshold Limit Values and Biological Exposure Indices for 2008 published by the American

Conference of Governmental Industrial Hygienists (ACGIH). Pesticides and chemicals without established occupational exposure limits are not included. Call 3M OH&ESD Technical Service for assistance in selecting respirators for these chemicals.

### IDLH Level

This is the concentration considered Immediately Dangerous to Life or Health (IDLH), as published by the National Institute for Occupational Safety and Health (NIOSH) (DHHS [NIOSH] Publication No. 90-117). It specifically refers to the acute respiratory exposure that poses an immediate threat of loss of life, immediate or delayed irreversible adverse effects on health, or acute eye exposure that would prevent escape from a hazardous atmosphere. The reasons NIOSH established an IDLH at a particular level for a specific chemical are described in Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs), NTIS Publication No. PB-94-195047,

May 1994. The 1994 IDLH values established by NIOSH used interim criteria, and OSHA stated in a May 21, 1996 memorandum that OSHA will use the older IDLH values while NIOSH conducts further study regarding the 1994 values. The 1990 IDLH values are used in this guide since OSHA uses these values for enforcement. For those substances with no IDLH listed, the manufacturer or supplier may have additional chemical information. The Chemical Referral Center operated by the Chemical Manufacturers Association can assist in providing telephone numbers for obtaining information from manufacturers. The lower explosive level (LEL) and the concentration that would result in an oxygen deficient atmosphere should also be considered to be IDLH.

### Odor Threshold\*

Odor thresholds can no longer be used as the primary indicator for changing gas and vapor cartridges as a result of the revised OSHA standard, 29 CFR 1910.134. The respirator program administrator, using

objective data and information, must now establish chemical cartridge change schedules. The established change schedule should result in replacing the cartridges with new ones before their service life is depleted under the conditions of that workplace. Reported odor thresholds will continue to be listed in the guide because odor can be useful as a secondary or backup indicator for cartridge change-out. The primary references for odor thresholds were VOCBASE and an American Industrial Hygiene Association (AIHA) publication. When an odor threshold value was not published in either of these two sources, the other references were used.

#### \*Odor Threshold References

1. Jensen, B., and P. Wolkoff. VOCBASE: Odor Thresholds, Mucous Membrane Irritation Thresholds and Physio-Chemical Parameters of Volatile Organic Compounds. [Computer Software]. National Institute of Occupational Health, Denmark, 1996.
2. Odor Thresholds for Chemicals with Established Occupational Health Standards. American Industrial Hygiene Association (1989).
3. Amoores, J.E. and E. Hautula. Odor as an Aid to Chemical Safety. J. Appl. Toxicol. 3(6):272-290 (1983).

A few odor thresholds published in other documents were used when not listed in the references below (e.g., AIHA WEEL documentation). The method of defining and determining odor thresholds varies widely, thereby giving rise to a significant range of reported odor thresholds for many substances. Individuals may also respond differently to the same odor. At a given concentration, one person may smell and recognize the odor, while another person may barely notice it. The odor thresholds reported in the literature are typically determined for a single constituent, with no other chemicals present in the air. The single constituent situation rarely occurs in the workplace. Therefore, caution must be exercised in using these numbers. They may not be representative of odor detection capabilities of individual workers in your facilities. On the other hand, experience may indicate better warning properties than what is indicated by the reported value.

### OEL

- The occupational exposure limits listed are 2008 ACGIH Threshold Limit Values (TLVs), unless otherwise stated. The concentrations are expressed in ppm — parts per million (parts of contaminant per million parts of air) — unless specifically stated as mg/m<sup>3</sup> (milligrams of contaminant per cubic meter of air) or some other unit.
- An asterisk(\*) indicates that the TLV is lower than the PEL.
- The OSHA Permissible Exposure Limit (PEL) is listed when it is more stringent than the current TLV.

- The 2008 Workplace Environmental Exposure Levels (WEEL) from the American Industrial Hygiene Association is listed when it is the most stringent value or there is no TLV or PEL.
- The occupational exposure limits refer to **Time Weighted Average (TWA)** concentrations for a normal eight (8) hour workday and a forty (40) hour workweek, unless referenced as a ceiling or STEL.
- **Ceiling OELs** refer to concentrations that should not be exceeded during any part of the working exposure.
- **Short-Term Exposure Limit (STEL)** is a 15-minute time weighted average exposure which should not be exceeded at any time during a workday.
- **Skin** notations indicate the substance can be absorbed through the skin. In these cases, appropriate measures must be taken to prevent skin and eye contact to avoid invalidating the OEL.
- For a more detailed explanation of TLVs and their proper application, refer to the TLV booklet available for a nominal fee from ACGIH, 1330 Kemper Meadow Drive, Cincinnati, OH 45240.

### Synonyms

Several common synonyms are listed in this column.

### Respirator Recommendations

(to 10X OEL)

This column lists the 3M recommended respirator for exposure levels not exceeding ten times (10X) the OEL. **Do not exceed maximum use concentrations established by regulatory agencies. When a chemical cartridge respirator is recommended (e.g., OV) it can only be used if a cartridge change schedule is established as described in 29 CFR 1910.134 (d)(3)(iii) (B)(2). If a**

4. Fazzuluri, F.A. Compilation of Odor and Taste Threshold Values Data. American Society for Testing and Materials (1978).
5. Verschuereen, K. Handbook of Environmental Data on Organic Chemicals. pp. 12-21. Van Nostrand Reinhold, NY (1977).
6. Warning Properties of Industrial Chemicals—Occupational Health Resource Center, Oregon Lung Association.
7. Electrical Safety Practices, ISA Monograph #113 (1972).
8. Documentation of TLVs and BEIs. American Conference of Governmental Industrial Hygienists. 7th edition (2008).
9. Gemert, L.J. Van and A.H. Nettenbreijer. Compilation of Odor Threshold Values in Air and Water. CIVO-TNO, Netherlands (1977).
10. Gemert, L.J. Van. Compilation of Odor Threshold Values in Air, Supplement IV, CIVO-TNO, Zeist, Netherlands (1982).
11. Workplace Environmental Exposure Levels, American Industrial Hygiene Association (2008).
12. Ruth, J.H. Odor Thresholds and Irritation Levels of Several Chemical Substances: A Review. Am. Ind. Hyg. Assoc. J. 47(3):A-142-A-151 (1986).

**change schedule is not established, an airline respirator must be used.** The SA code indicates that chemical cartridge respirators should not be used. Generally this is because of one of the three reasons described in the Comments column. These recommendations are valid only if the respirator selection process outlined on pages 11-14 is followed. The abbreviations used are explained in the Respirator Identification Key in the back pocket insert. All of these respirators have not been **specifically** tested against each compound listed. A review of chemical and physical properties of the materials, as well as adsorption or filtration characteristics of the respirators, forms the basis for the recommendations. The recommendations are for single substances. When two or more substances are present, a combination respirator may be appropriate. For example, with a spray paint that contains organic solvents and titanium dioxide, a respirator consisting of an organic vapor cartridge and a filter may be appropriate.

In cases where an air purifying respirator is not available for all of the substances of concern in a mixture, a supplied air respirator may be required. **In some cases, the respirator is preceded by an “(F)” designation. The Identification Key lists these respirators as full facepiece air purifying respirators. For concentrations not exceeding ten times (10X) the OEL, half facepiece respirators (maintenance-free or reusable) with equivalent filters or cartridges may be suitable if appropriate eye protection is provided.**

For concentrations greater than ten times (10X) the OEL, follow the protection factor or guidelines in specific OSHA standards, or refer to the instructions in the **Respirator Selection Criteria** and **How To Use This Guide** sections of this guide.

## Comments

Other information may be listed in this column:

A. **Short service life** means predicted cartridge life of less than 30 minutes at concentrations of ten times (10X) the OEL. Actual service life will vary considerably, depending on concentration levels, temperature, humidity, work rate, etc. See the following literature references for specific details on the conditions and limitations of these estimates:

1. 3M Company. 3M Respirator Service Life. [Computer Software] 3M OH&ESD, www.3M.com/OccSafety.
2. Smoot, D.M. Organic Vapor Respirator Service Life Prediction. Prepared Under NIOSH Contract No. 210-76-0108. Published October 1977.
3. Nelson, G.O. and C.A. Harder. Respirator Cartridge Efficiency

Studies: V. Effect of Solvent Vapor. Am. Ind. Hyg. Assoc. J. 35(7): 391-410 (1974).

Typically, an airline respirator is recommended because the service life may be so short that the frequency required for changing the cartridges may not be practical.

References to **Ineffective sorbents** or **Unknown sorbent effectiveness** indicate 3M does not make chemical cartridge respirators appropriate for these substances at this time or it is not known how effective the sorbents would be for these materials. 3M does not recommend using a chemical cartridge respirator or attempting to establish a change schedule for these chemicals.

B. References to a **respirator not being specifically approved** refer to approvals for that particular substance only. All respirators listed in this guide are

NIOSH approved for specific substances and/or conditions.

- C. References to **warning** refer to odor or irritation warning properties of the substances. Where listed as unknown, no literature reference was located. Where listed as questionable, a wide range of reported odor thresholds exists. Air purifying respirators may be acceptable for these substances if you follow the requirements for establishing a change schedule acceptable to OSHA.
- D. These compounds have been identified as possibly existing in both particulate and vapor phase by a method published by Perez and Soderholm. For these compounds, 3M recommends that a gas/vapor cartridge be used in addition to the traditionally accepted particulate filter. It is the user's responsibility to determine whether both forms coexist. Both chemical properties and use conditions/processes can affect the physical form in the workplace. Users should consider specific exposure data

and workplace conditions before making their final selection. If a chemical cartridge is used, a change schedule must be established to replace the cartridges before the end of their service life.\*

- E. These compounds have been identified as possibly existing in both vapor and particulate phase in the workplace by Perez and Soderholm. Even though these chemicals would be expected to be in the vapor phase, when other aerosols are present or there is high humidity, it is possible that the vapor may be adsorbed onto these coexisting particles or dissolved in available water droplets; therefore, 3M recommends a filter for the particulate phase be used in addition to the traditionally accepted chemical cartridge. It is the user's responsibility to determine whether both forms coexist. Both chemical properties and use conditions/processes can affect the physical form in the workplace. Users

\* See Perez, C. and S. C. Soderholm: Some Chemicals Requiring Special Consideration When Deciding Whether to Sample the Particle, Vapor, or Both Phases of an Atmosphere. Appl. Occup. Hyg. 6(10): 859-864 (1991).



should consider specific exposure data and workplace conditions before making their final selection.\*

- F. It is believed that an N-series filter is sufficient since these materials will not coat the filter fibers, but since this material may contain oil aerosols, an R- or P-series filter is recommended until further research or a regulatory agency takes a specific position.
- G. R- or P-series filters have been recommended pending more research as to how these materials affect the filter fibers.
- H. Listing of 3M **3510, 3530, 3550, or 3720** refers to a 3M™ Personal Air Monitor which may be used to measure the amount of contaminant in the air. Monitors may also be used to sample for other materials with analysis performed by a private laboratory. You should check with the laboratory to determine what other chemicals can be measured with the monitors.

An estimate of the airborne concentration is needed for making appropriate respirator selection and establishing a cartridge change schedule.

Contact the toll free 3M OH&ESD Technical Service Line at **1-800-243-4630** if you have questions about the use of this guide or the proper selection and use and limitations of any 3M respirators.

## Respirator Filter Definitions

### 3M 42 CFR 84 Filters

**N-Series Filters:** These filters are restricted to use in those atmospheres free of oil aerosols. They may be used for any solid or liquid airborne particulate hazard that does not contain oil. Generally these filters should be used and reused subject only to considerations of hygiene, damage, and increased breathing resistance.

**N95 Particulate Filter** -At least 95% filter efficient when tested with ~0.3 µm NaCl aerosol. 3M has replaceable filters and filtering facepiece respirators in this category.

**N100 Particulate Filter** -At least 99.97% filter efficient when tested with ~0.3 µm NaCl aerosol. 3M has a filtering facepiece respirator in this category.

**R-Series Filters:** A filter intended for removal of any particle including oil-based

liquid aerosol. They may be used for any solid or liquid airborne particulate hazard. If the atmosphere contains oil, the R-series filter should be used only for a single shift (or for 8 hours of continuous or intermittent use).

**R95 Particulate Filter** -At least 95% filter efficient when tested with ~0.3 µm DOP (Diocetyl Phthalate) aerosol. 3M makes filtering facepiece respirators in this category.

**P-Series Filters:** A filter intended for removal of any particle including oil-based liquid aerosols. They may be used for any solid or liquid particulate airborne hazard. NIOSH requires that respirator manufacturers establish time-use limitations for all P-series filters. 3M recommends that P-series filters should be used and reused for no more than 40 hours of use or 30 days, whichever occurs first, in atmospheres that

contain only oil aerosols, unless the filter needs to be changed for hygiene reasons, is damaged, or becomes difficult to breathe through before the time limit is reached. When used in atmospheres containing non-oil aerosol, 3M P-series filters should be used and reused subject to conditions of hygiene, damage and increased breathing resistance.

**P95 Particulate Filter** -At least 95% filter efficient when tested with ~0.3 µm DOP (Diocetyl Phthalate) aerosol. 3M makes replaceable filters and filtering facepiece respirators in this category.

**P100 Particulate Filter** -At least 99.97% filter efficient when tested with ~0.3 µm DOP (Diocetyl Phthalate) aerosol. 3M makes replaceable filters and filtering facepieces in this category.

**Oil:** Any of numerous mineral, vegetable and synthetic substances and animal and vegetable fats that are generally slippery, combustible, viscous, liquid or liquefiable at room temperatures, soluble in various organic solvents such as ether but not in water.

\* See Perez, C. and S. C. Soderholm: Some Chemicals Requiring Special Consideration When Deciding Whether to Sample the Particle, Vapor, or Both Phases of an Atmosphere. Appl. Occup. Hyg. 6(10): 859-864 (1991).

## How to Use This Guide

If a respirator is being selected for a single compound listed in this guide with an air concentration not exceeding 10 times the value in the **TLV** column, then the respirator identified in the **Respirator Recommended** column may be selected. If a particulate filter respirator is recommended (any respirator code with N95, N100, R95, P95 or P100 in it) and a mineral, vegetable or synthetic oil or other oily material is also present in the air, you must select a respirator that provides the same efficiency but is acceptable for oil aerosols (see Oil definition). For example, if a respirator is being selected for beryllium dust at a concentration 2 times the exposure limit, the guide lists **N95**. This code indicates a half facepiece respirator with an N95 particulate filter. If an oil mist is present (air concentration greater than 0.1 mg/m<sup>3</sup>, but less than the occupational exposure limit) either an R- or P-series filter must be selected, even though respiratory protection is not needed for the oil mist. Therefore, the minimum recommended respirator would be **R95** or **P95**. These codes indicate a half facepiece respirator with an R95 or P95 particulate filter. These codes

can be found in the **Respirator Codes and Descriptions** section located in the fold-out back cover of this guide.

If respiratory protection is desired for an atmosphere with more than one chemical or for an air concentration that exceeds either the IDLH value or 10 times the value in the TLV column, you must follow the directions below for proper respirator selection. If you need help, call 3M Technical Service at 1-800-243-4630.

**Oil:** Any of numerous mineral, vegetable and synthetic substances and animal and vegetable fats that are generally slippery, combustible, viscous, liquid or liquefiable at room temperatures, soluble in various organic solvents such as ether but not in water.

1. Identify the air contaminants present in the workplace. Include chemical name and form. Classify particulate contaminants as oil or non-oil material. If the chemical is listed in this guide, it is classified. For help, see definition of oil. The material safety data sheet (MSDS) can be helpful with this

step. Consider particulate contaminants oil if unknown or not sure. List the contaminants on the form contained in this guide or on your own form. Go to Step 2.

2. Determine the air concentration of the contaminant. Air sampling is recommended. Consideration should be given to TWA, short term and peak (ceiling) exposures, while keeping in mind seasonal and worker variability and the specific process being used. If air sampling data are not available and sampling is not practical, historical information from similar processes or analogous operations may be helpful for calculating maximum exposures and evaluating potential health effects. Record the airborne concentration(s) on the form provided or your own form. Go to Step 3.
3. Is the airborne concentration unknown?
  - a) If **yes**, go to Step 16.
  - b) If **no**, go to Step 4.
4. Is the oxygen concentration less than 19.5% or does the potential exist for the oxygen concentration to fall below 19.5%?
  - a) If **yes**, go to Step 16.

b) If **no**, go to Step 5.

5. Is the chemical listed in the guide?
  - a) If **yes**, go to Step 6.
  - b) If **no**, go to Step 15.
6. Record the IDLH value and the value from the TLV column on the form provided or on one you created. Determine the hazard ratio (see page 2) and record. Using this information, determine which condition describes your situation:
  - a) Does the airborne concentration exceed the IDLH value? If **yes**, go to Step 16.
  - b) Does the hazard ratio exceed (>) 1000? If **yes**, go to Step 16.
  - c) Does the hazard ratio exceed (>) 50? If **yes**, go to Step 7.
  - d) Does the hazard ratio exceed (>) 10? If **yes**, go to Step 8.
  - e) Is the hazard ratio less than or equal to (≤) 10? If **yes**, go to Step 9.
7. Select one of the following respirators: (1) a full facepiece, helmet or hood supplied air respirator or (2) a powered air purifying respirator (PAPR) with the same cartridge type as listed in the guide under the Respirator Recommended column.

To determine what type of PAPRs are available, check the Respirator Identification Key. If a PAPR is selected, use a HEPA filter if an N, R, or P-series filter is listed. If the guide lists SA or SA(F) even though the hazard ratio is less than or equal to 10, an SA(F) must be used. A PAPR cannot be used. For example: For an exposure to vinyl toluene with a hazard ratio of 90, an SA(F) or (F)PAPR/OV must be selected. The (F)PAPR/OV is acceptable because the OV cartridge is listed in the Respirator Recommended column. The service life of the OV cartridge must be considered to determine if the (F)PAPR or SA(F) is the better selection given the high exposure concentrations. If the exposure was to 4-vinylcyclohexene, an SA(F) must be selected. A PAPR could not be selected. Record the respirator you selected in the last column of the form for that chemical. Go to Step 10.

8. Select either a supplied air respirator or a full facepiece respirator with filters and/or chemical cartridges listed in the guide under the Respirator Recommended column.

If the guide lists SA or SA(F), you must select the respirator recommended. Do not use air purifying respirators. For example: For an exposure to benzene with a hazard ratio of 30 (15 ppm), an (F)OV could be selected. For the same exposure conditions to benzyl acetate, an SA must be selected. Record the respirator you selected in the last column of the form for that chemical. Go to Step 10.

9. Select the respirator listed in the Respirator Recommended column. Record the respirator you selected in the last column of the form for that chemical. Go to Step 10.
10. Are any other air contaminants present at the same time?
  - a) If **yes**, go to Step 2 and repeat the procedure, recording the appropriate information for the next chemical. When two or more contaminants that act upon the same organ system are present, consideration should be given to the combined effect rather than individual effects. Consult the current edition of Exposure Indices published by the American Conference of Governmental Industrial Hygienists for



- more information and the appropriate formula. If combined effects are considered, calculate the hazard ratio for the mixture.
- b) If **no**, go to Step 11.
11. Are any of the respirators listed in the last column a particulate filter respirator (i.e., does it have an N, R or P filter?)?
- a) If **yes**, go to Step 12.  
b) If **no**, go to Step 14.
12. Are only N-series particulate filter respirator(s) listed?
- a) If **yes**, go to Step 13.  
b) If **no**, go to Step 14.
13. Is airborne oil mist present that has not been considered as a result of one of the following conditions: (1) was not listed as a contaminant or (2) is the oil mist concentration greater than 0.1 mg/m<sup>3</sup> but less than the value in the TLV column of the guide? A respirator is not required for the oil. If a respirator is not being selected for the oil, the presence of the oil must still be considered when choosing the appropriate filter.
- a) If **yes**, a respirator with either an R- or P-series filter must be selected. R-series filters must be changed after 8 hours use or after the respirator is loaded with or exposed to 200 mg of aerosol. The manufacturer's service time recommendation must be followed for P-series filters. To choose a respirator that provides the same degree of protection as originally identified, but with an R- or P-series filter, consult the Respirator Identification Key. Record the respirator with the R- or P-series filter that is being selected. Go to Step 14.
- b) If **no**, record the respirator listed in the last column as the final respirator selected (bottom line). A respirator meeting this description can be found by locating the code on the Respirator Identification Key. Go to Step 17.
14. Was more than one respirator type required for the specific exposure situation (i.e., is there more than one respirator code included in the list made in the last column of the form?)? A respirator must be selected that satisfies all of the requirements listed in the last column.
- a) If **yes**, note all respirators recommended. If your list contains more than one respirator and all are air-purifying respirators, select from the Identification Key the one with the highest assigned protection factor (see page 2) and one that removes all of the contaminants, if available. If **SA** or **SA(F)** is one of the respirators listed in the last column, this respirator must be selected over all others. If any of the respirator codes contain the **(F)** designation, respirators with half facepieces cannot be used. If no air-purifying respirator will provide the protection required, select **SA** or **SA(F)** from the Respirator Identification Key. Go to Step 17.
- b) If **no**, go to Step 14.
15. If the chemical is not listed in the guide, an occupational exposure limit either does not exist or was not located. Since it is not known what an acceptable exposure level is, a respirator cannot be recommended. If you have an exposure level for the material and would like help, go to Step 17. If no exposure limit is known, go to Step 16.
16. These conditions (unknown, <19.5% O<sub>2</sub>, >IDLH) are generally considered as IDLH or the hazard ratio exceeds 1000. Select either a positive pressure self-contained breathing apparatus (SCBA) or combination respirator consisting of a positive pressure supplied air respirator with an auxiliary SCBA. The rated duration of the auxiliary SCBA should be sufficient to allow adequate time for escape. If 5 minutes is sufficient escape time, the 3M™ Air-Mate™ Combination Escape SCBA is acceptable (see Respirator Identification Key: Code SCBA). Record the respirator selected in the final row of the form. This is the minimum acceptable level of respiratory protection; the selection process is finished. If you need help, go to Step 17.
- Note: If a chemical cartridge respirator is selected, you must establish a change schedule based on objective information and data. The information relied upon and the basis for the cartridge change schedule and the basis for reliance on the data must be described in the respiratory protection program.
17. Do you need help?
- a) If **yes**, call 3M for assistance at 1-800-243-4630. Follow the recommendations given.  
b) If **no**, order the selected respirator(s) from the local 3M Sales Representative or Distributor.

### Respirator Selection Form

Chemical Name	Air Concentration	IDLH	TLV/PEL /WEEL	Hazard Ratio	Respirator Recommended
<b>Respirator Selected:</b>					

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Acetaldehyde	10,000	0.186	25* (ceiling)	Ethanal, Acetic aldehyde	(F)OV (F)Form	Short OV service life
Acetic acid	1000	0.016	10	Glacial acetic acid, Methane carboxylic acid, Ethanoic acid, Vinegar acid	(F)OV	
Acetic anhydride	1000	0.029	5	Ethanoic anhydride, Acetic acid anhydride, Acetyl oxide	(F)OV	
Acetone	20,000	4.58	500*	2-Propanone, Dimethyl ketone, Ketone propane	OV	3M 3530 Monitor
Acetone cyanohydrin		3	2 -skin- (AIHAWHEEL)	a-Hydroxy isobutyronitrile, 2-Propane cyanohydrin, 2-Cyano-2-propanol, 2-Methylactonitrile, 2-Hydroxy-2-methyl propanenitrile	OV	Poor warning. 4.7 ppm TLV-C.
Acetonitrile	4000	97.7	20 -skin-	Cyanomethane; Ethane nitrile; Ethyl nitrile; Methanecarbonitrile; Methyl cyanide	OV	Poor warning. 3M 3530 Monitor.
Acetophenone		0.363	10	Methyl phenyl ketone, Acetyl benzene, Benzoyl methide, Hyponone, 1-Phenylethanone	OV	See Comment E, page 8
Acetylene dichloride				(See 1,2-Dichloroethylene)		
Acetylsalicylic acid			5 mg/m <sup>3</sup>	Aspirin	N95	
Acrolein	5	0.174	0.1 (ceiling) -skin-	Acrylic aldehyde, Acrylaldehyde, Propenal, Allylaldehyde	(F)OV	Poor warning
Acrylamide			0.03 mg/m <sup>3</sup> * -skin-	Propenamide, Acrylamide monomer, Acrylic amide	OV/N95	See Comment D, page 7
Acrylic acid		0.4	2* -skin-	Acroleic acid, Propenoic acid	(F)OV	
Acrylonitrile	500	16.6	2 -skin-	Propenenitrile, AN, Vinyl cyanide	OV	Poor warning. SA if cartridge not disposed of after shift, per 29 CFR 1910.1045. 3M 3510 Monitor.
Adipic acid			5 mg/m <sup>3</sup>	Hexanedioic acid; 1,6-Hexanedioic acid; 1,4-butanedicarboxylic acid Adipinic Acid	(F)N95	
Adiponitrile			2 -skin-	Addipic acid dinitrile; Hexanedinitrile; 1,4-dicyanobutane; Tetramethylene cyanide	OV	Warning unknown
Allyl alcohol	150	0.47	0.5* -skin-	2-Propenol, 2-Propen-1-ol, Vinyl carbinol	(F)OV	3M 3510 Monitor

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Allyl chloride	300	0.489	1	3-Chloropropene, 1-Chloro-2-propene	OV	
Allyl glycidyl ether	270		1	AGE; 1-Allyloxy-2, 3-epoxy-propane	(F)OV	Warning unknown. PEL-10 ppm ceiling.
Allyl isothiocyanate		0.035	1 (AIHAWHEEL)	Oil of mustard, AITC, Allyl thiocarbamide, 3-Isothiocyanate-1-propene, Allyl isosulfocyanate	OV	15 minute TWA. SA if used with acids.
Allyl propyl disulfide			0.5	Onion oil, Propyl allyl disulfide, 2-Propenyl propyl disulfide	(F)OV	Warning unknown
<b>Aluminum Metal and Insoluble Compounds -Respirable Particulate Matter</b>				<b>1 mg/m<sup>3</sup></b>		<b>N95</b>
p-Aminobenzoic acid			5 mg/m <sup>3</sup> (AIHAWHEEL)	Aminobenzoic acid, 4-Aminobenzoic acid, PABA	(F)N95	
2-Aminoethanol				(See Ethanolamine)		
2-Aminopyridine	5		0.5	a-Aminopyridine	OV	Warning unknown
Aminotri (methylenephosphonic Acid)			10 mg/m <sup>3</sup> (AIHAWHEEL)	ATMP; Aminotris (methylenephosphonic acid), Briquest 302-500; Briquest 301-32S; Dequest 2000; Dequest 2001; Nitrilotrimethanephosphonic acid; NTMP; NTPA, NTF	AG/N95	If heated, AG cartridge may be needed
Ammonia	500	5.75	25*	Anhydrous ammonia	(F)AM	Irritation also provides warning
Ammonium chloride -Solids -Liquids			10 mg/m <sup>3</sup> 10 mg/m <sup>3</sup>		N95 AM/N95	
Ammonium perfluorooctanoate			0.01 mg/m <sup>3</sup> -skin-		OV/N95	See Comment D, page 7
n-Amyl acetate				(See Pentyl acetate)		
sec-Amyl acetate				(See Pentyl acetate)		
n-Amyl alcohol		0.1-0.3	100 (AIHAWHEEL)	Amyl alcohol, 1-Pentanol, Pentyl alcohol, Pentanol, n-Pentanol	F(OV)	
tert-Amyl methyl acetate			20	TAME	OV	
Aniline	100	0.676	2* -skin-	Aminobenzene, Phenylamine, Aniline oil	OV	
Anisidine (o-, p- isomers) -ortho-Anisidine -para-Anisidine	10		0.1* -skin-	o-Methoxyaniline (oil), p-Methoxyaniline (solid)	OV/P95 OV/N95	

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Antimony and compounds (as Sb)</b>	80 mg/m <sup>3</sup>		<b>0.5 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Arsenic, elemental and inorganic compounds (except arsine) (as As)</b>	100 mg/m <sup>3</sup>		<b>0.01 mg/m<sup>3</sup> (PEL)</b>		<b>N100</b>	
<b>Arsine</b>	6	<1.0	<b>0.05 ppm</b>	Hydrogen arsenide, Arsenic trihydride, Arseniuretted hydrogen, Arsenous hydride	<b>SA(F)</b>	Poor warning. Unknown sorbent effectiveness.
<b>Asbestos</b>			<b>0.1 fiber/cc (PEL)</b>	Chrysotile, Amosite, Crocidolite, Tremolite, Anthophyllite, Actinolite	<b>N100</b>	Dual cartridge as per 29 CFR 1910.1001, 1915.1001 and 1926.1101
<b>Asphalt (petroleum; bitumen) fumes (as benzene-soluble aerosol)</b>			<b>0.5 mg/m<sup>3</sup> inhalable</b>	Asphaltum, Bitumen, Hot mix asphalt, Mineral pitch, Petroleum asphalt	<b>OV/P95</b>	R or P95 alone may be suitable for some applications. See Comment F, page 9.
<b>Barium soluble compounds (as Ba)</b>	1100 mg/m <sup>3</sup>		<b>0.5 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Barium sulfate</b>			<b>10 mg/m<sup>3</sup>*</b>		<b>N95</b>	
<b>Benzaldehyde</b>		0.042	<b>2 (AIHAWHEEL)</b>	Benzoic aldehyde, Oil of bitter almond, Benzenecarbonal	<b>F(OV)</b>	
<b>Benzene</b>	3000	8.65	<b>0.5*</b>	Benzol, Coal tar naphtha	<b>OV</b>	Poor warning. SA if cartridges are not replaced at the start of each shift, per 29 CFR 1910.1028. 3M 3510 Monitor.
<b>Benzophenone</b>			<b>0.5 mg/m<sup>3</sup> (AIHAWHEEL)</b>	Benzoyl benzene, Diphenyl ketone, Diphenyl methanone, Phenyl ketone	<b>OV/N95</b>	See Comment D, page 7
<b>p-Benzoquinone</b>				(See Quinone)		
<b>Benzotrichloride</b>			<b>0.1 (ceiling) -skin-</b>	Toluene trichloride, Benzenyl trichloride, Benzoic trichloride, Phenyl chloroform, Trichloromethylbenzene	<b>(F)OV</b>	Warning unknown
<b>Benzoyl chloride</b>		0.007	<b>0.5 (ceiling)</b>	a-Chlorobenzaldehyde, Benzene carbonyl chloride, Benzoic acid chloride	<b>(F)OV/AG (F)MG</b>	
<b>Benzoyl peroxide</b>	7000 mg/m <sup>3</sup>		<b>5 mg/m<sup>3</sup></b>	Dibenzoyl peroxide	<b>OV/N95</b>	See Comment D, page 7
<b>Benzyl acetate</b>		0.145	<b>10</b>	Acetic acid benzyl ester, Acetic acid phenylmethyl ester, Phenylmethyl acetate	<b>OV/N95</b>	
<b>Benzyl alcohol</b>		5.55	<b>10 (AIHAWHEEL)</b>	a-Hydroxytoluene, Phenylmethanol, Phenylcarbinol	<b>(F)OV</b>	

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Benzyl chloride</b>	10	0.034	<b>1</b>	a-Chlorotoluene	<b>(F)OV/AG</b>	See Comment E, page 8. 3M 3510 Monitor.
<b>Beryllium and compounds (as Be)</b>	10 mg/m <sup>3</sup>		<b>0.002 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Biphenyl</b>	47.6	0.0093	<b>0.2</b>	Diphenyl, Phenylbenzene	<b>OV/N95</b>	
<b>Bis(2-dimethylamino-ethyl) ether</b>			<b>0.05 ppm -skin-</b>	DMAEE; Ethylamine, 2,2'-Oxybis (N.N-dimethyl)-; Niax [R] Catalyst A-99	<b>(FOV)</b>	
<b>Bismuth telluride</b>			<b>10 mg/m<sup>3</sup>*</b>	Bismuth sesquitelluride	<b>N95</b>	
<b>Bismuth telluride (Se-doped)</b>			<b>5 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Borate compounds, inorganic</b>						
- Boric acid			<b>2 mg/m<sup>3</sup></b>	Borofax; Boron trihydroxide; Hydrogen orthoborate; Kill-off; Kjel-sorb; Orthoboric acid; Three elephant; Trihydroxyborane	<b>N95</b>	
- Sodium borate, anhydrous			<b>2 mg/m<sup>3</sup></b>	Borates, tetrasodium salts, anhydrous; Borax fused; Boric acid, disodium salt; Disodium tetraborate; Sodium tetraborate, anhydrous	<b>N95</b>	
- Sodium borate, decahydrate			<b>2 mg/m<sup>3</sup></b>	Borates, tetrasodium salts, decahydrate; Borax; Borascu; Borocin; Disodium diborate decahydrate; Disodium tetraborate decahydrate; Sodium pyroborate decahydrate; Sodium tetraborate, decahydrate	<b>N95</b>	
- Sodium borate, pentahydrate			<b>2 mg/m<sup>3</sup></b>	Borates, tetrasodium salts, pentahydrate; Boric acid pentahydrate; Mule team borascu; Boron sodium oxide, pentahydrate; Sodium tetraborate, pentahydrate	<b>N95</b>	
<b>Boron oxide</b>			<b>10 mg/m<sup>3</sup>*</b>	Anhydrous boric acid, Boric anhydride, Boric oxide	<b>N95</b>	
<b>Boron tribromide</b>			<b>1 (ceiling)</b>	Boron bromide	<b>(F)AG</b>	Warning unknown
<b>Boron trifluoride</b>	100	1.5	<b>1 (ceiling)</b>		<b>(F)AG</b>	Poor warning

\* TLV is lower than PEL.



NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Bromine</b>	10	0.066	<b>0.1</b>		<b>(F)OV/AG</b>	0.2 ppm TLV-STEL. Irritation also provides warning.
<b>Bromine pentafluoride</b>			<b>0.1</b>		<b>AG</b>	Warning unknown
<b>Bromochloromethane</b>				(See Chlorobromomethane)		
<b>Bromoform</b>		0.447	<b>0.5 -skin-</b>	Tribromomethane	<b>(F)OV</b>	3M 3510 Monitor
<b>1-Bromopropane</b>			<b>10</b>	n-Propylbromide, Propylbromide	<b>OV</b>	
<b>1,3-Butadiene</b>	20,000	0.455	<b>1 (PEL)</b>	Butadiene, Divinyl, Biethylene, Erythrene	<b>OV</b>	Cartridges must be replaced, per 29CFR 1910.1051
<b>Butane</b>		204	<b>1000</b>	n-Butane, Methylene methane	<b>SA</b>	Short OV service life
<b>n-Butanethiol</b>				(See Butyl mercaptan)		
<b>2-Butanone</b>				(See Methyl ethyl ketone)		
<b>1-Butene</b>			250	a-Butene, But-1-ene, a-Butylene, 1-Butylene, Ethylethylene	<b>OV</b>	
<b>2-Butene</b>			250	B-Butene, B-Butylene, Dimethylethylene, Pseudobutylene	<b>OV</b>	
<b>cis-2-Butene</b>			250	cis-Butene, cis-Butene-2, B-cis-Butylene, cis-1,2-Dimethylethylene	<b>OV</b>	
<b>trans-2-Butene</b>			250	trans-Butene, 2-trans-Butene, B-trans-Butylene, trans-1,2-Dimethylethylene	<b>OV</b>	
<b>2-Butoxyethanol</b>	700	0.001	<b>20*</b>	Butyl Cellosolve®, Ethylene glycol monobutylether	<b>(F)OV</b>	See Comment E, page 8
<b>2-Butoxyethyl acetate</b>			<b>20</b>	Acetic acid 2-butoxyethyl ester; 2-Butoxyethanol acetate; Butyl Cellusolve acetate; Butylglycol acetate; Ektasolve EB acetate; Ethylene glycol monobutyl ether acetate; EGBA; Glycol monobutyl ether acetate	<b>OV</b>	
<b>n-Butyl acetate</b>	10,000	0.007	<b>150</b>	Butyl acetate, Butyl ethanoate, Acetic acid butyl ester	<b>(F)OV</b>	See Comment E, page 8. 3M 3510 Monitor.
<b>sec-Butyl acetate</b>	10,000	3-7	<b>200</b>	1-Methylpropylacetate	<b>(F)OV</b>	See Comment E, page 8. 3M 3510 Monitor.
<b>tert-Butyl acetate</b>	10,000	4-47	<b>200</b>	Acetic acid tert-butyl ester	<b>(F)OV</b>	3M 3510 Monitor
<b>Butyl acrylate</b>		0.003	<b>2</b>	2-Propenoic acid butyl ester, Butyl-2-propenoate	<b>OV</b>	3M 3510 Monitor
<b>n-Butyl alcohol</b>	8000	0.03	<b>20*</b>	1-Butanol, Butyl alcohol; Butyl hydroxide; Butyric alcohol; 1-Hydroxybutane; Methylolpropane; n-Propyl carbinol, n-Butanol	<b>(F)OV</b>	25 ppm TLV-ceiling proposed. 3M 3510 Monitor.

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
sec-Butyl alcohol	10,000	1	100	2-Butanol, Methyl ethyl carbinol	(F)OV	3M 3510 Monitor
tert-Butyl alcohol	8000	21.5	100	2-Methyl-2-propanol, TBA, Trimethyl-carbinol	(F)OV	3M 3510 Monitor
Butylamine	2000	0.053	5 (ceiling) -skin-	n-Butylamine, 1-Aminobutane	AM	Not specifically approved, but better service life than OV
Butylated hydroxytoluene (as inhalable aerosol and/or vapor)			2 mg/m <sup>3</sup>	BHT; DBPD; 2,6-Di-tert-butyl-p-cresol 2,6-bis(1,1-Dimethylethyl)-4-methylphenol	F(OV)/N95	
4-tert-Butylcatechol			2 mg/m <sup>3</sup> -skin- (AIHAWHEEL)	p-tert-Butylcatechol; 4-(1,1-Dimethylethyl)-1,2-benzenediol; 4-tert-Butyl pyrocatechol; 4-tert-Butyl 1-1,2-dihydroxy benzene	(F)N95	
tert-Butyl chromate (as CrO <sub>3</sub> )	30 mg/m <sup>3</sup>		0.1 mg/m <sup>3</sup> (ceiling) -skin-	Chromic acid, di-tert-Butyl ester	N95	
Butylene oxide		0.06	2 (AIHAWHEEL)	1,2-Epoxybutane; 1-Butene oxide; 1,2-Butene oxide; 1,2-Butylene oxide; Epoxy-butane; BO	OV	
n-Butyl glycidyl ether	3500		3* -skin-	BGE; 1,2-Epoxy-3-butoxy-propane	OV	Warning unknown 3M 3510 Monitor
n-Butyl lactate		7.06	5	Lactic acid butylester	OV	Irritation also provides warning
Butyl mercaptan	2500	0.001	0.5*	n-Butanethiol, 1-Mercaptobutane	OV	
o-sec-Butylphenol			5 -skin-	2-sec-Butylphenol	OV/P95	
p-tert-Butyltoluene	1000	5.02	1*	1-Methyl-4-tert-butylbenzene	OV	Poor warning. 3M 3510 Monitor.
Butyraldehyde		0.009	25 (AIHAWHEEL)	Butal, Butaldehyde, Butalyde, Butanol, Butanaldehyde, Butyl aldehyde, Butyral butyric aldehyde	(F)FORM	Not specifically approved, but better service life than OV
Cadmium, elemental and compounds (as Cd)	50 mg/m <sup>3</sup> dust 9 mg/m <sup>3</sup> fume		0.005 mg/m <sup>3</sup> (PEL)		N100	0.002 mg/m <sup>3</sup> TLV-TWA for respirable dust
Calcium arsenate (as As)	100 mg/m <sup>3</sup>		0.01 mg/m <sup>3</sup> (PEL)	Tricalcium arsenate, Tricalcium o-arsenate, Cucumber dust	N100	
Calcium carbonate			15 mg/m <sup>3</sup> (PEL)	Marble, Limestone	N95	
Calcium chromate			0.001 mg/m <sup>3</sup>	Calcium chrome yellow	N95	
Calcium cyanamide			0.5 mg/m <sup>3</sup>	Lime nitrogen, Calcium carbimide	N95	
Calcium fluoride (as F)			2.5 mg/m <sup>3</sup>	Fluorite, Fluorspar	N95	
Calcium hydroxide			5 mg/m <sup>3</sup> *	Calcium hydrate, Hydrated lime, Caustic lime	N95	

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Calcium oxide			2 mg/m <sup>3*</sup>	Quicklime, Pebble lime	N95	
Calcium silicate (as inhalable particulate mass)			10 mg/m <sup>3*</sup>	Calcium metasilicate, Portland cement, Wallastonite	N95	
Calcium sulfate			10 mg/m <sup>3</sup>	Gypsum, Plaster of Paris	N95	
Camphor	33	0.051	2	2-Camphonone, Synthetic camphor, Gum camphor, Laurel camphor	(F)OV/N95	3M 3510 Monitor
Caprolactam (Inhalable aerosol and vapor)		0.064	5 mg/m <sup>3</sup>	Aminocaproic lactam, 2-Oxohexamethyleneimine	OV/N95	
Captan inhalable fraction			5 mg/m <sup>3</sup>	N-(Trichloromethylthio)-4-cyclohexene-1,2-dicarboximide	N95	
Carbon black			3.5 mg/m <sup>3</sup>	Channel black, Lamp black, Furnace black, Thermal black, Acetylene black	N95	
Carbon dioxide	50,000	74,000	5,000	Carbonic acid gas, Dry ice	SA	Poor warning. Ineffective sorbents.
Carbon disulfide	500	0.096	1 -skin-	Carbon bisulfide, Carbon disulphide, Carbon bisulphide, Carbon bisulfur, Dithiocarbonic anhydride, Carbon sulfide, Sulphocarbonic anhydride, Weevitox	OV	
Carbon monoxide	1500	100,000	25*	Monoxide	SA	Poor warning. Ineffective sorbents.
Carbon tetrabromide			0.1	Tetrabromomethane	(F)OV	Warning unknown
Carbon tetrachloride	300	40.7	5* -skin-	Tetrachloromethane	(F)OV	Poor warning. 3M 3510 Monitor.
Carbonyl chloride				(See Phosgene)		
Carbonyl fluoride			2	Fluoroformyl fluoride, Carbon oxyfluoride	(F)MG	Warning unknown
Catechol			5 -skin-	Pyrocatechol	OV/N95	
Cellulose			10 mg/m <sup>3*</sup>	Paper fiber	N95	
Cesium fluoride			2.5 mg/m <sup>3</sup>		N95	
Cesium hydroxide			2 mg/m <sup>3</sup>	Cesium hydrate	N95	
Chloramphenicol			0.5 mg/m <sup>3</sup> (AIHAWHEEL)	Chloromycetin; Levomycetin; [R-(R*,R*)]-2,2-dichloro-N-[2-hydroxy-1-(hydroxy methyl)-2-(4-nitrophenyl)ethyl] acetamide	N95	
Chlorinated diphenyl oxide			0.5 mg/m <sup>3</sup>	Hexachlorodiphenyl oxide	OV/P95	Warning unknown
Chlorine	30	0.05	0.5		(F)AG	Irritation also provides warning. PEL-1 ppm ceiling.
Chlorine dioxide	10	9.24	0.1	Chlorine oxide, Chlorine peroxide	AG	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Chlorine trifluoride	20		<b>0.1 (ceiling)</b>	Chlorine fluoride	<b>MG</b>	Warning unknown
Chloroacetaldehyde	100	0.917	<b>0.05* -skin-</b>	2-Chloroethanal, Chloroacetaldehyde (40% aqueous)	<b>(F)OV</b>	Poor warning
Chloroacetone			<b>1 (ceiling) -skin-</b>	Monochloroacetone, 1-Chloro-2-propanone, Chloracetone	<b>(F)OV</b>	Warning unknown
a-Chloroacetophenone	16	0.026	<b>0.05</b>	Phenacyl chloride, Chloromethyl phenyl ketone, Phenyl chloromethyl ketone (tear gas)	<b>(F)OV/N95</b>	Irritation also provides warning
Chloroacetyl chloride			<b>0.05 -skin-</b>	Chloroacetyl chloride	<b>(F)OV/AG</b>	Warning unknown
Chlorobenzene	2400	0.741	<b>10*</b>	Monochlorobenzene, Chlorobenzol, Phenyl chloride, MCB	<b>OV</b>	3M 3510 Monitor
o-Chlorobenzylidene malononitrile	0.25		<b>0.05 (ceiling) -skin-</b>	OCBM, CS	<b>OV/N95</b>	5X OEL maximum. Low IDLH.
Chlorobromomethane	5000	399	<b>200</b>	Bromochloromethane, Methylene chlorobromide, CBM, Halon™ 1011	<b>OV</b>	Poor warning. Short OV service life.
1-Chloro-1,1-difluoroethane			<b>1000 (AIHAWHEEL)</b>	HCFC-142b, Dymel® 142b, Genetron™ 142b, Chlorodifluoroethane, a-chloroethylidene fluoride	<b>SA</b>	Short OV service life
2-Chloro-1,3-butadiene				(See B-Chloroprene)		
Chlorodifluoromethane			<b>1,000</b>	Freon® 22	<b>SA</b>	Warning unknown. Ineffective sorbents.
Chlorodiphenyl (42% chlorine)	10 mg/m³		<b>1 mg/m³ -skin-</b>	Polychlorinated biphenyl, PCB	<b>(F)OV/P95</b>	See Comment D, page 7
Chlorodiphenyl (54% chlorine)	5 mg/m³		<b>0.5 mg/m³ -skin-</b>	Polychlorinated biphenyl, PCB	<b>(F)OV/P95</b>	See Comment D, page 7
1-Chloro,2,3-epoxypropane				(See Epichlorohydrin)		
2-Chloroethanol				(See Ethylene chlorohydrin)		
Chloroethylene				(See Vinyl chloride)		
Chloroform	1000	11.7	<b>10*</b>	Trichloromethane	<b>OV</b>	Poor warning. 3M 3510 Monitor.
bis-(2-Chloroisopropyl) ether			<b>3 (AIHAWHEEL)</b>	DCIPE, Dichloroisopropyl ether	<b>(F)OV</b>	Warning unknown
bis-Chloromethyl ether			<b>0.001</b>	Dichloromethylether, BCME, Chloro (chloromethoxy) methane, Chloromethyl ether	<b>(F)OV</b>	Warning unknown
Chloropentafluoroethane			<b>1000</b>	FC-115, Monochloropentafluoroethane	<b>SA</b>	Warning unknown. Short service life.
Chloropicrin	4	1.08	<b>0.1</b>	Nitrotrichloromethane, Trichloronitromethane, Nitrochloroform	<b>(F)OV</b>	Irritation also provides warning
B-Chloroprene	400	14.9	<b>10* -skin-</b>	2-Chloro-1,3-Butadiene; Chlorobutadiene; beta-Chloroprene	<b>(F)OV</b>	Poor warning

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
1-Chloro-2-propanol			1 -skin-	1-Chloro-2-hydroxypropane; 1-Chloroisopropyl alcohol; sec-Propylene chlorohydrin	OV	
2-Chloro-1-propanol			1 -skin-	2-Chloropropanol; 2-Chloropropyl alcohol; 1-Hydroxy-2-chloropropane; Propylene chlorohydrin	OV	
2-Chloropropionic			50 (AIHAWHEEL)	Isopropyl chloride; 2-Propyl chloride, isoprid, 2-CP	OV	Short OV service life
2-Chloropropionic acid			0.1 -skin-	a-Chloropropionic acid	OV/AG	Warning unknown
o-Chlorostyrene			50	1-Chloro-2-ethenylbenzene, 2-Chlorostyrene	OV	Warning unknown. 3M 3510 Monitor.
Chlorosulfonic acid			0.1 (ceiling)	CSA, Chlorosulfuric acid	(F)AG/N95	HCl, SO <sub>2</sub> hydrolysis products
2-Chloro-1,1,1,2-tetrafluoroethane			1000 (AIHAWHEEL)	Chlorotetrafluoroethane, HCFC124, HFA124, Fluorocarbon 124	SA	Short OV service life
o-Chlorotoluene		0.219	50	2-Chloro-1-methylbenzene	OV	3M 3510 Monitor
Chlorotrifluoroethylene			5 (AIHAWHEEL)	CFE, CTFE, Trifluorovinylchloride, Trifluorochloroethylene	SA	Short OV service life
Chromates of lead and zinc (as Cr)				(See Lead, Zinc chromate)		

## Chromium, metal and inorganic compounds (as Cr)

-Metal and Cr III compounds			0.5 mg/m <sup>3</sup>		N95	
-Water-soluble Cr VI compounds, NOC (includes Chromic acid)	30 mg/m <sup>3</sup>		0.005 mg/m <sup>3</sup>		N95	
-Insoluble Cr VI compounds, NOC			0.01 mg/m <sup>3</sup>		N95	
Chromyl chloride			0.025	Chromium oxychloride, Chlorochromic anhydride	AG	Warning unknown
Coal dust						
-Bituminous or lignite			0.9 mg/m <sup>3*</sup> (respirable)		N95	≥5% quartz 0.1 mg/m <sup>3</sup> TLV
-Anthracite			0.4 mg/m <sup>3*</sup> (respirable)		N95	≥5% quartz 0.1 mg/m <sup>3</sup> TLV
Coal tar pitch volatiles (as Benzene solubles)	700 mg/m <sup>3</sup>		0.2 mg/m <sup>3</sup>		R or P95	8247, 8577 or respirators with 2076HF, 2078, 2096, 2097 or 7093C filters specifically recommended. See Comment F, page 9.
Cobalt, elemental and inorganic compounds (as Co)	20 mg/m <sup>3</sup>		0.02 mg/m <sup>3*</sup>		N95	
Cobalt carbonyl (as Co)			0.1 mg/m <sup>3</sup>		SA	Ineffective sorbents

\* TLV is lower than PEL.



NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Cobalt hydrocarbonyl (as Co)</b>			<b>0.1 mg/m<sup>3</sup></b>		<b>SA</b>	Ineffective sorbents
<b>Coke oven emissions</b>			<b>0.15 mg/m<sup>3</sup></b>		<b>R or P95</b>	8247, 8577 or respirators with 2076HF, 2078, 2096 or 2097 filters specifically recommended. See Comment F, page 9.
<b>Copper (as Cu) -Dust and mist -Fume</b>			<b>1 mg/m<sup>3</sup> 0.1 mg/m<sup>3</sup> (PEL)</b>		<b>N95 N95</b>	
<b>Cotton dust (raw)</b>			<b>0.2 mg/m<sup>3</sup>*</b>		<b>N95</b>	5X PEL maximum for disposables, per OSHA cotton dust standard. If oil aerosol present, use R or P95.
<b>Cresol (all isomers)</b>	250	0.00005-0.0079	<b>5 -skin-</b>	Cresylic acid	<b>OV/P95</b>	
<b>Cristobalite</b>				(See Silica, crystalline)		
<b>Crotonaldehyde</b>	400	0.135	<b>0.3 (ceiling)</b>	B-Methylacrolein, Propylene aldehyde, Crotonaldehyde	<b>(F)OV</b>	
<b>Cryolite (as F)</b>			<b>2.5 mg/m<sup>3</sup></b>	Greenland spar, Icetone	<b>N95</b>	
<b>Cumene</b>	8000	0.024	<b>50</b>	Isopropyl benzene, 2-Phenyl propane, Cumol	<b>OV</b>	3M 3510 Monitor
<b>Cumene hydroperoxide</b>		0.005	<b>1 -skin- (AIHAWHEEL)</b>	Isopropylbenzene hydroperoxide; CHP; a,a'-Dimethylbenzyl hydroperoxide; Cumyl hydroperoxide	<b>(F)OV</b>	
<b>Cyanamide</b>			<b>2 mg/m<sup>3</sup></b>	Cyanogenamide, Carbodiimide	<b>N95</b>	
<b>Cyanides (as CN)</b>	50 mg/m <sup>3</sup>		<b>5 mg/m<sup>3</sup> (ceiling) -skin-</b>		<b>SA</b>	Poor warning
<b>Cyanogen</b>		231	<b>10</b>	Dicyan, Oxalonitrile	<b>SA</b>	Poor warning. Unknown sorbent effectiveness.
<b>Cyanogen chloride</b>		0.976	<b>0.3 (ceiling)</b>	CNCl	<b>SA(F)</b>	Poor warning. Short service life.
<b>Cyclohexane</b>	10,000	83.8	<b>100</b>	Hexahydrobenzene, Hexamethylene	<b>(F)OV</b>	Irritation also provides warning. 3M 3510 Monitor.
<b>Cyclohexanol</b>	3500	0.068	<b>50 -skin-</b>	Hexalin, Hydralin, Hydroxycyclohexane, Anol, Hexahydrophenol, Cyclohexyl alcohol	<b>OV</b>	See Comment E, page 8. 3M 3510 Monitor.

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Cyclohexanone	5000	0.019	20 -skin-	Pimelic ketone, Cyclohexyl ketone	OV	3M 3510 Monitor
Cyclohexene	10,000	0.363	300	Benzene tetrahydride	OV	3M 3510 Monitor
Cyclohexylamine		2.66	10	Hexahydroaniline, Aminocyclohexane	(F)OV	
Cyclonite			0.5 mg/m <sup>3</sup> -skin-	RDX; sym-Trimethylene trinitramine; Hexahydro-1,3,5-trinitro-sym-triazine	N95	
Cyclopentadiene	2000	3.8	75	1,3-Cyclopentadiene	OV	
Cyclopentane			600	Pentamethylene	SA	Warning unknown. Short OV service life.
Decaborane	20	0.06	0.05 -skin-		SA	Poor warning. Unknown sorbent effectiveness.
Decabromodiphenyl oxide			5 mg/m <sup>3</sup> (AIHAWHEEL)	DBDPO, Decabromodiphenyl ether, bis-(pentabromophenyl) ether	N95	
1-Decene		7	100 (AIHAWHEEL)	Decylene, alpha-decene	OV	
Dehydrolinalool			2 (AIHAWHEEL)		OV	
Diacetone alcohol	2100	0.891	50	Diacetone, 4-Hydroxy-4-methyl-2-pentanone, 2-Methyl-2-pentanol-4-one	(F)OV	3M 3510 Monitor
Diallylamine		2-9	1 -skin- (AIHAWHEEL)	N-2-propenyl-2-propen-1-amine, Di-2-propenylamine	OV	Poor warning
1,2-Diaminoethane				(See Ethylenediamine)		
Diatomaceous earth (uncalcined)				(See Silica)		
Diazomethane	2		0.2	Azimethylene, Diazirine	SA	Warning unknown. Unknown sorbent effectiveness.
Diborane	40	1.8-3.5	0.1	Boroethane	SA	Poor warning. Unknown sorbent effectiveness.
Dibromochloropropane			1 ppb (PEL)	1-Chloro-2,3-dibromopropane; DBCP; 1,2-Dibromo-3-chloropropane	SA(F)	Warning unknown. OSHA requires SA(F); no change schedule allowed.
1,2-Dibromoethane				(See Ethylene dibromide)		
Dibutylamine		0.1	5 (ceiling) -skin- (AIHAWHEEL)	1-Butanamine, n-Butyl, Di-n-butylamine, DNBA	F(OV)	See Comment E, page 8
2-N-Dibutylaminoethanol			0.5 -skin-	Dibutylaminoethanol; N,N-dibutyl-N-(2-hydroxyethyl) amine	(F)OV	Warning unknown
Dibutyl phenyl phosphate			0.3 -skin-	DBPP	R or P95	OV/P95 may be preferable if heat involved

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Dibutyl phosphate	125		1	Dibutyl acid-o-phosphate, Di-n-butyl hydrogen phosphate, Dibutyl phosphoric acid		<b>OV/P95</b>
Dibutyl phthalate	9300 mg/m <sup>3</sup>		5 mg/m <sup>3</sup>	DBP; Dibutyl; 1,2-Benzene-dicarboxylate	<b>OV/P95</b>	See Comment D, page 7
Dichloroacetic acid			0.5 - skin -	Acetic acid, dichloro-; 2,2-Dichloroacetic acid; Dichloroethanoic acid; Urmer's liquid	<b>F(OV/AG)</b>	
Dichloroacetylene			0.1 (ceiling)	Dichloroethyne	<b>SA(F)</b>	Warning unknown. Short OV service life.
o-Dichlorobenzene	1000	0.072	25	1,2-Dichlorobenzene; o-Dichloro-benzol	<b>(F)OV</b>	See Comment E, page 8. PEL-50 ppm ceiling. 3M 3510 Monitor.
p-Dichlorobenzene	1000	0.048	10*	1,4-Dichlorobenzene; Dichloride; PDCB	<b>(F)OV/N95</b>	3M 3510 Monitor
1,4-Dichloro-2-butene			0.005 -skin-	2-Butylenedichloride; DCB; 1,4-DCB; Dichlorobutene	<b>(F)OV</b>	Warning unknown
Dichlorodifluoromethane	50,000		1000	Refrigerant 12, Freon® 12	<b>SA</b>	Warning unknown. Short OV service life.
1,3-Dichloro-5,5-dimethylhydantoin		0.01	0.2 mg/m <sup>3</sup>	Halane, Dactin	<b>OV/N95</b>	
1,1-Dichloroethane	4000	255	100	Ethylidene chloride	<b>OV</b>	Poor warning
1,2-Dichloroethane				(See Ethylene dichloride)		
1,1-Dichloroethylene				(See Vinylidene chloride)		
1,2-Dichloroethylene	4000	19.1	200	Acetylene dichloride, Dioform	<b>OV</b>	
Dichloroethyl ether	250	0.049	5 -skin-	bis-(2-Chloroethyl) ether; 2,2'-Dichlorodiethyl ether	<b>(F)OV</b>	PEL-15 ppm ceiling
Dichlorofluoromethane	50,000		10*	Refrigerant 21, Freon® 21, Dichloromonofluoromethane	<b>SA</b>	Warning unknown. Short OV service life.
1,1-Dichloro-1-fluoroethane			500 (AIHAWHEEL)	HCFC141b, HFA141b, Fluorocarbon 141b	<b>SA</b>	Short OV service life
Dichloromethane				(See Methylene chloride)		
1,1-Dichloro-1-nitroethane	150		2		<b>OV</b>	Warning unknown. PEL-10 ppm ceiling.
2,4-Dichlorophenol		0.21	1 -skin- (AIHAWHEEL)	2,4-DCP; DCP; Phenol: 2,4-Dichloro	<b>OV</b>	R or P95 may also be needed if material is molten
1,2-Dichloropropane				(See Propylene dichloride)		
1,3-Dichloropropene			1 -skin-	1,3-Dichloropropylene	<b>(F)OV</b>	Warning unknown

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>2,2-Dichloropropionic acid</b>			<b>5 mg/m<sup>3</sup></b>	Dalapon™	<b>(F)OV/N95</b>	Warning unknown
<b>Dichlorotetra-fluoroethane</b>	50,000		<b>1000</b>	Freon® 114, Refrigerant 114, Halon™ 242, FC-114	<b>SA</b>	Warning unknown. Short OV service life.
<b>Dicyclopentadiene</b>		0.03	<b>5</b>		<b>OV/N95</b>	
<b>Dicyclopentadienyl iron</b>			<b>10 mg/m<sup>3</sup>*</b>	bis-Cyclopentadienyl iron	<b>N95</b>	
<b>Diesel Fuel (total hydrocarbons, vapor and aerosol)</b>			<b>100 mg/m<sup>3</sup> -skin-</b>	Astral oil, Gas oil, Coal oil, Fuel oil, Home heating oil, Marine diesel fuel	<b>OV/P95</b>	
<b>Diethanolamine</b>		0.025	<b>0.46 -skin-</b>	DEA, di-(2-Hydroxyethyl) amine	<b>OV</b>	See Comment E, page 8
<b>Diethylamine</b>	2000	0.186	<b>5* -skin-</b>		<b>(F)AM (F)OV</b>	AM not specifically approved
<b>Diethylaminoethanol</b>	500	0.034	<b>10 -skin-</b>	2-Diethylaminoethyl alcohol; N,N-Diethylethanolamine	<b>OV</b>	
<b>Diethylbenzenes, mixed</b>		<b>12</b>	<b>5</b>	DEB; Dowtherm J; 1,2-Diethylbenzene; 1,3-Diethylbenzene; 1,4-Diethylbenzene	<b>OV</b>	
<b>Diethylene glycol</b>			<b>10 mg/m<sup>3</sup> (AIHAWHEEL)</b>	DEG; Diglycol; 2,2'-Dihydroxy-diethyl ether	<b>R or P95</b>	See Comments D and G, pages 7 & 9
<b>Diethylene glycol monoethyl ether</b>		0.708	<b>25 (AIHAWHEEL)</b>	2-(2-Ethoxyethoxy) ethanol, DiGGE, Diethylene glycol ethyl ether, Glycol ether DE, Carbitol, Dioxitol	<b>OV</b>	
<b>Diethylene triamine</b>		9.3	<b>1 -skin-</b>		<b>(F)OV</b>	Poor warning
<b>Diethyl ether</b>				(See Ethyl ether)		
<b>Di-2-ethylhexyl phthalate</b>				(See Di-sec-octyl phthalate)		
<b>Diethyl ketone</b>		0.316	<b>200</b>	Metacetone, Propione, 3-Pentanone, Ethyl propionyl	<b>OV</b>	
<b>Diethyl phthalate</b>			<b>5 mg/m<sup>3</sup></b>	Ethylphthalate, DEP	<b>R or P95</b>	
<b>Difluorodibromo-methane</b>	2500		<b>100</b>	Dibromodifluoromethane, Freon® 12B2, DFBM	<b>OV</b>	Warning unknown
<b>1,1-Difluoroethane</b>			<b>1000 (AIHAWHEEL)</b>	HFC-152a, Freon® 152a, Dymel® 152a, Genetron™ 152a, Ethylidene fluoride	<b>SA</b>	Ineffective sorbents
<b>Difluoromethane</b>			<b>1000 (AIHAWHEEL)</b>	Refrigerant 32; R32; Hydrofluoro-carbon 32	<b>SA</b>	Warning unknown. Ineffective sorbents.
<b>Diglycidyl ether</b>	25	4.61	<b>0.01</b>	di-(Epoxypropyl) ether; bis-(2,3-Epoxypropyl)-ether; 2-Epoxypropyl ether; Diallyl ether dioxide; DGE	<b>(F)OV</b>	Poor warning
<b>Dihydroxybenzene</b>				(See Hydroquinone)		
<b>Diisobutylene</b>			<b>75 (AIHAWHEEL)</b>	Diisobutene	<b>OV</b>	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Diisobutyl ketone</b>	2000	0.339	<b>25*</b>	2,6-Dimethyl-4-heptanone; sym-Diisopropylacetone; Isovalerone; Valerone	<b>(F)OV</b>	See Comment E, page 8. 3M 3510 Monitor.
<b>Diisopropylamine</b>	1000	0.398	<b>5</b> <b>-skin-</b>		<b>(F)OV</b>	
<b>Dimethoxymethane</b>				(See Methylal)		
<b>Dimethyl acetamide</b>	400	47.9	<b>10</b> <b>-skin-</b>	N,N-Dimethyl acetamide; DMAC	<b>OV</b>	Poor warning
<b>Dimethylamine</b>	2000	0.081	<b>5*</b>	Anhydrous dimethylamine	<b>AM</b>	AM not specifically approved. Short OV service life.
<b>Dimethylaminobenzene</b>				(See Xylidine)		
<b>Dimethylaniline</b>	100	0.219	<b>5</b> <b>-skin-</b>	N,N-Dimethylaniline	<b>OV</b>	
<b>Dimethyl carbamoyl chloride</b>			<b>0.005</b>	Chloroformic acid dimethylamide; Dimethyl carbamic chloride; Dimethylcarbamyl chloride; DMCC	<b>(F)MG</b>	
<b>Dimethyldichlorosilane</b>			<b>2</b> <b>(ceiling)</b> <b>(AIHAWHEEL)</b>	Dichlorodimethylsilane	<b>OV/AG</b>	Warning unknown
<b>Dimethyl disulfide</b>			<b>0.5</b>	Dimethyldisulfide; Dimethyl disulphide; 2,3-Dithiabutane; DMDS	<b>OV/AG</b>	
<b>Dimethylethoxysilane</b>			<b>0.5</b>	Ethoxydimethyl silane	<b>SA(F)</b>	Unknown sorbent effectiveness
<b>Dimethylbenzene</b>				(See Xylene)		
<b>Dimethyl ether</b>		0.3-9.0	<b>1000</b> <b>(AIHAWHEEL)</b>	Methyl ether, Wood ether	<b>SA</b>	Very short OV service life
<b>Dimethyl formamide</b>	3500	100	<b>10</b> <b>-skin-</b>	N,N-Dimethyl formamide; DMF	<b>OV</b>	Poor warning
<b>2,6-Dimethyl-4-heptanone</b>				(See Diisobutyl ketone)		
<b>1,1-Dimethylhydrazine</b>	50	8.79	<b>0.01</b> <b>-skin-</b>	unsym-Dimethylhydrazine, UDMH	<b>SA(F)</b>	Poor warning. Unknown sorbent effectiveness.
<b>Dimethylphthalate</b>	9300 mg/m <sup>3</sup>		<b>5 mg/m<sup>3</sup></b>	DMP	<b>OV/P95</b>	See Comment D, page 7
<b>1,1-Dimethylpropyl acetate</b>				(See Pentyl acetate)		
<b>Dimethyl sulfide</b>		0.0025	<b>10</b>	DMS, Thiobis (methane)	<b>OV/AG</b>	AG recommended since H <sub>2</sub> S may also be present
<b>Dimethyl sulfoxide</b>			<b>250</b> <b>-skin-</b>	DMSO, Methylsulfoxide	<b>OV</b>	
<b>Dimethylsulfate</b>	10		<b>0.1*</b> <b>-skin-</b>	Methyl sulfate	<b>(F)OV</b>	Poor warning

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Dimethyl terephthalate			5 mg/m <sup>3</sup> (total dust) (AIHAWHEEL)		OV/N95	
Dinitrobenzene	29		0.15* -skin-	o-Dinitrobenzene, 1,2-Dinitrobenzene; m-Dinitrobenzene; 1,3-Dinitrobenzene; p-Dinitrobenzene, 1,4-Dinitrobenzene	OV/N95	
3,5-Dinitro-o-toluamide			1 mg/m <sup>3</sup>	Dinitolmide ; 2-Methyl-3, 5-dinitrobenzamide; Zoalene; Coccidin; Salcostat	N95	
Dinitrotoluene	200 mg/m <sup>3</sup>		0.2 mg/m <sup>3</sup> -skin-	DNT	OV/N95	See Comment D, page 7
Dioxane	2000	7.78	20* -skin-	Diethylene dioxide; Diethylene ether; p-Dioxane; 1,4-Dioxane	OV	3M 3510 Monitor
1,3-Dioxalane			20	1,3-Dioxacyclopentane; 1,3-Dioxolan; Dioxolane; 1,3-Dioxole, dihydroethylene glycol formal; Formal glycol; Glycolformal; Glycol methylene ether	OV	
Diphenyl				(See Biphenyl)		
Diphenylamine		0.022	10 mg/m <sup>3</sup>	DPA, N-phenylaniline	N95	OV/N95 may be preferable when odor is a problem
4,4-Diphenylmethane diisocyanate				(See Methylenebisphenyl isocyanate)		
Dipropylene glycol methyl ether		1000	100 -skin-	Dipropylene glycol monomethyl ether, Dowanol™ 50B	OV	Poor warning
Dipropyl ketone			50	Butyrane, 4-Heptanone	OV	Warning unknown
Di-sec-octyl phthalate			5 mg/m <sup>3</sup>	DOP, bis-(2-Ethylhexyl)phthalate, Di-2-ethylhexyl phthalate, DEHP	R or P95	
Divinyl benzene			10	DVB, Vinylstyrene	(F)OV	Warning unknown
Dodecyl mercaptan			0.1	1-Dodecanethiol, n-Dodecyl mercaptan, n-Lauryl mercaptan, 1-Mercaptododecane	OV	R or P filter may be needed with oily aerosols
Dowtherm™ Q (as inhalable aerosol and/or vapor)			1 (AIHAWHEEL)	1,1-Dipheylethane with ethylated benzenes	OV/P95	
Emery			10 mg/m <sup>3</sup> *	Corundum	N95	
Enflurane			75	2-Chloro-1,1,2-trifluoroethyl- difluoromethyl ether; Ethrane	SA	Warning unknown. Short OV service life. 3M 3510 Monitor.
Epichlorohydrin	250	0.934	0.5* -skin-	1-Chloro-2,3-epoxy-propane; 2-Chloropropylene oxide; g-Chloropropylene oxide	(F)OV	Poor warning. 3M 3510 Monitor.

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>1,2-Epoxypropane</b>				(See Propylene oxide)		
<b>2,3-Epoxy-1-propanol</b>				(See Glycidol)		
<b>Erythromycin</b>			<b>3 mg/m<sup>3</sup> (AIHAWHEEL)</b>	Dotycin, Erycin, Ericynum, E-Mycin™, Pentadecanoic acid	<b>N95</b>	
<b>Ethane</b>			<b>1000</b>	Dimethyl ethane, Methylmethane	<b>SA</b>	Short OV service life
<b>Ethanolamine</b>	1000	2.59	<b>3</b>	Ethylolamine, Monoethanolamine, B-Aminoethyl alcohol, 2-Aminoethanol, 2-Hydroxyethylamine	<b>OV</b>	
<b>2-Ethoxyethanol</b>	6000	1.22	<b>5* -skin-</b>	Ethylene glycol monoethyl ether, Glycol monoethyl ether, Cellosolve® solvent	<b>OV</b>	3M 3510 Monitor
<b>2-Ethoxyethyl acetate</b>	2500	0.182	<b>5* -skin-</b>	Cellosolve® acetate, Ethylene glycol monoethyl ether acetate	<b>OV</b>	3M 3510 Monitor
<b>Ethyl acetate</b>	10,000	0.61	<b>400</b>	Acetic ester, Acetic ether, Ethyl ethanoate	<b>(F)OV</b>	3M 3510 Monitor
<b>Ethyl acrylate</b>	2000	0.0009	<b>5* -skin-</b>	Acrylic acid ethyl ester	<b>(F)OV</b>	3M 3510 Monitor
<b>Ethyl alcohol</b>	15,000	0.136	<b>1000</b>	Ethanol	<b>OV</b>	Short OV service life at 10X OEL
<b>Ethylamine</b>	4000	0.324	<b>5* -skin-</b>	Anhydrous ethylamine, Aminoethane, Monoethylamine	<b>(F)AM</b>	AM not specifically approved. Short OV service life.
<b>Ethyl amyl ketone</b>	3000	6	<b>10</b>	EAK, 5-Methyl-3-heptanone	<b>(F)OV</b>	
<b>Ethyl benzene</b>	2000	2.3	<b>100</b>	Phenylethane, Ethylbenzol	<b>OV</b>	See Comment E, page 8. 3M 3510 Monitor.
<b>Ethyl bromide</b>	3500	3.09	<b>5* -skin-</b>	Bromoethane	<b>SA</b>	Short OV service life
<b>Ethyl butyl ketone</b>	3000	0.1-10	<b>50</b>	3-Heptanone	<b>OV</b>	See Comment E, page 8
<b>Ethyl chloride</b>	20,000	4.07	<b>100 -skin-</b>	Chloroethane, Monochloroethane, Hydrochloric ether	<b>SA</b>	Very short OV service life
<b>Ethyl cyanoacrylate</b>			<b>0.2</b>	2-Cyanoacrylic acid, ethyl ester; 2-Cyano-2 propenoic acid, ethyl ester; ECA; Ethyl alpha-cyanoacrylate; Ethyl 2-cyanoacrylate; Ethyl 2-cyano-2-propenoate	<b>OV</b>	Warning unknown
<b>Ethyl tert-butyl ether</b>			<b>5</b>	tert-Butyl ethyl ether; 1,1-Dimethyl-ethyl ether; ETBE; 2-Ethoxy-2-methylpropane; Ethyl tert-butyl oxide; Ethyl 1,1-dimethylethyl ether	<b>OV</b>	
<b>Ethylene</b>			<b>200</b>	Acetene, Bicarburetted hydrogen, Elayl, Ethene, Olefiant gas	<b>SA(F)</b>	
<b>Ethylene chlorohydrin</b>	10	0.402	<b>1* (ceiling) -skin-</b>	2-Chloroethanol, 2-Chloroethyl alcohol	<b>OV</b>	3M 3510 Monitor

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Ethylenediamine	2000	4.27	10	1,2-Diaminoethane; 1,2-Ethanediamine	(F)OV	
Ethylene dibromide	400	9.84	20 (PEL) -skin-	1,2-Dibromoethane	(F)OV	
Ethylene dichloride	1000	11.2	10*	Ethylene chloride; 1,2-Dichloroethane	OV	Poor warning. 3M 3510 Monitor.
Ethylene glycol, aerosol		60.3 mg/m <sup>3</sup>	100 mg/m <sup>3</sup> (ceiling)	Ethylene alcohol; Glycol; 1,2-Ethandiol	OV/P95	See Comments D and G, pages 7 & 9
Ethylene glycol dinitrate	82		0.05* -skin-	Glycol dinitrate, Nitroglycol	OV	Warning unknown. PEL-0.2 ppm ceiling.
Ethylene glycol methyl ether acetate				(See 2-Methoxyethyl acetate)		
Ethyleneimine	100	1.5	0.5 -skin-	Ethyleimine, Dimethylenimine, Dihydroazirine, Azirane, Aziridine, Aminoethylene	SA(F)	Poor warning. OSHA requires SA(F); see 29 CFR 1910.1003.
Ethylene oxide	800	851	1	Dimethylene oxide; 1,2-Epoxy ethane; Oxirane	SA(F)	Poor warning. OSHA requires SA(F); no change schedule allowed. 3M 3550 Monitor.
Ethyl ether	19,000	2.29	400	Diethyl ether, Ethyl oxide, Ether	OV	Short service life. 3M 3530 Monitor.
Ethyl formate	8000	18.6	100	Ethyl methanoate, Formic acid ethyl ester	(F)OV	Short service life
2-Ethylhexanoic acid (as inhalable aerosol and vapor)			5 mg/m <sup>3</sup>	Butylethylacetic acid; 2-Butylbutanoic acid; 2-Ethylcaproic acid; 2-Ethylhexoic acid; Ethylhexoic acid	OV/N95	
Ethylidene chloride				(See 1,1-Dichloroethane)		
Ethylidene norbornene		0.074	5 (ceiling)	ENB	(F)OV	
Ethyl mercaptan	2500	0.001	0.5*	Ethanethiol, Ethyl sulfhydrate	OV	
N-Ethylmorpholine	2000	0.275	5* -skin-	4-Ethylmorpholine	(F)OV	
Ethyl silicate	1000	3.6	10*	Tetraethyl silicate, Ethyl orthosilicate, Tetraethoxysilane	OV	
Ferric/Ferrous salts, soluble				(See Iron salts)		
Ferrovandium, dust			1 mg/m <sup>3</sup>		N95	
Fibrous glass, dust				(See Synthetic vitreous fibers - Continuous filament glass fibers)		
Flour dust (as inhalable particles)			0.5 mg/m <sup>3</sup>		N95	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Fluorides (as F)</b>	500 mg/m <sup>3</sup>		<b>2.5 mg/m<sup>3</sup></b>	Synonyms vary depending upon specific compound	<b>N95</b>	
<b>Fluorine</b>	25	0.126	<b>0.1 (PEL)</b>		<b>SA(F)</b>	Poor warning. Unknown reaction products with sorbent.
<b>Fluorotrichloromethane</b>				(See Trichlorofluoromethane)		
<b>Formaldehyde</b>	30	0.871	<b>0.3* (ceiling)</b>	Methylene oxide, Formalin	<b>(F)FORM</b>	Irritation also provides warning. 3M 3720 Monitor.
<b>Formamide</b>		80	<b>10* -skin-</b>	Methanamide	<b>OV</b>	Poor warning
<b>Formic acid</b>	30	28.2	<b>5</b>	Hydrogen carboxylic acid, Methanoic acid	<b>(F)OV</b>	Poor warning. 6X OEL maximum. Low IDLH.
<b>Furfural</b>	250	0.058	<b>2* -skin-</b>	2-Furaldehyde, Furfuraldehyde, Fural, 2-Furancarboxaldehyde	<b>(F)OV</b>	3M 3510 Monitor
<b>Furfuryl alcohol</b>	250	7.83	<b>10* -skin-</b>	2-Hydroxymethylfuran, 2-Furyl-methanol	<b>(F)OV</b>	See Comment E, page 8
<b>Gallium arsenide</b>			<b>0.3 µg/m<sup>3</sup></b>	Gallium monoarsenide	<b>N100</b>	
<b>Gasoline</b>		0.3	<b>300</b>	Petrol	<b>(F)OV</b>	
<b>Germanium tetrahydride</b>			<b>0.2</b>	Germane, Germanium hydride	<b>SA(F)</b>	Warning unknown. Unknown sorbent effectiveness.
<b>Glass, fibrous or dust</b>				(See Synthetic vitreous fibers)		
<b>Glutaraldehyde</b>		0.038	<b>0.05 (ceiling)</b>	1,5-Pentanedial	<b>(F)OV</b>	See Comment E, page 8
<b>Glycerin, mist</b>			<b>10 mg/m<sup>3</sup>*</b>	Glycerol	<b>R or P95</b>	
<b>Glycidol</b>	500		<b>2*</b>	2-Hydroxymethyloxiran; Hydroxymethyl ethylene oxide; Epoxypropyl alcohol; 3-Hydroxy-propylene oxide; 2,3-Epoxy-1-propanol	<b>OV</b>	Warning unknown
<b>Glycidyl methacrylate</b>			<b>0.5 (AIHAWHEEL) -skin-</b>	GMA	<b>OV</b>	
<b>Glycol monoethyl ether</b>				(See 2-Ethoxyethanol)		
<b>Glyoxal (as inhalable aerosol and/or vapor)</b>			<b>0.1 mg/m<sup>3</sup></b>	Ethanedial, Biformyl, Diformyl, Oxaldehyde, 1,2-Ethanedione	<b>(F)OV/N95</b>	Short OV service for vapor at 10X OEL
<b>Grain dust (oat, wheat, barley)</b>			<b>4 mg/m<sup>3</sup>* (respirable)</b>		<b>N95</b>	
<b>Graphite (natural)</b>			<b>2.5 mg/m<sup>3</sup>* (respirable)</b>	Plumbago, Potelot, Corbo minerals, Black lead, Silver lead	<b>N95</b>	
<b>Graphite (synthetic)</b>			<b>2 mg/m<sup>3</sup>* (respirable)</b>		<b>N95</b>	

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Gypsum</b>				(See Calcium sulfate)		
<b>Hafnium and compounds (as Hf)</b>			<b>0.5 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Halothane</b>		33	<b>50</b>	2-Bromo-2-chloro-1,1,1-trifluoroethane	<b>OV</b>	3M 3510 Monitor
<b>Heptane</b>	5000	9.77	<b>400*</b>	Normal heptane, n-Heptane	<b>OV</b>	3M 3510 Monitor
<b>2-Heptanone</b>				(See Methyl n-amyl ketone)		
<b>3-Heptanone</b>				(See Ethyl butyl ketone)		
<b>Hexachlorobenzene</b>		0.463 mg/m <sup>3</sup>	<b>0.002 mg/m<sup>3</sup> -skin-</b>	Perchlorobenzene	<b>N95</b>	
<b>Hexachlorobutadiene</b>			<b>0.02 -skin-</b>	Hexachloro-1,3-butadiene; perchlorobutadiene	<b>(F)OV</b>	Warning unknown
<b>Hexachlorocyclopentadiene</b>		0.03	<b>0.01</b>		<b>(F)OV</b>	Poor warning
<b>Hexachloroethane</b>	300	0.15	<b>1 -skin-</b>	Perchloroethane	<b>OV/N95</b>	
<b>Hexachloronaphthalene</b>	2 mg/m <sup>3</sup>		<b>0.2 mg/m<sup>3</sup> -skin-</b>	Halowax™ 1014	<b>OV/N95</b>	See Comment D, page 7
<b>1,4-Hexadiene</b>			<b>10 (AIHAWHEEL)</b>		<b>OV</b>	Warning unknown
<b>Hexafluoroacetone</b>			<b>0.1 -skin-</b>	1,1,1,3,3,3-Hexafluoro-2-propanone	<b>SA</b>	Warning unknown. Short OV service life.
<b>1,1,1,3,3,3-Hexafluoropropane</b>			<b>1000 (AIHAWHEEL)</b>	HFC-236 fa; FC-236 fa; hydrofluorocarbon 236 fa; FE-13	<b>SA</b>	Ineffective sorbents
<b>Hexafluoropropylene</b>			<b>0.1</b>	1,1,2,3,3,3-Hexafluoro-1-propene; 1,1,2,3,3,3-Hexafluoropropylene; Hexafluoropropene; Perfluoro-1-propene; Perfluoropropylene; Perfluoropropene; Fluorocarbon 1216; HFP	<b>SA</b>	Short OV service life.
<b>Hexahydrophthalic anhydride all isomers (as inhalable vapor and aerosol)</b>			<b>0.005 mg/m<sup>3</sup> (ceiling)</b>	1,2-Cyclohexanedicarboxylic acid anhydride; Cyclohexane-1, 2-dicarboxylic anhydride, cis and trans mixture; 1,2-Cyclohexanedicarboxylic anhydride; Hexahydrophthalic acid anhydride; Hexahydro-1, 3-isobenzofurandione; HHPA; HHPAA; 1,3-Isobenzofurandione, hexahdro	<b>OV/N95</b>	
<b>Hexamethylene diisocyanate</b>		0.01	<b>0.005</b>	HDI	<b>OV/N95</b>	Poor warning
<b>Hexane (n-Hexane)</b>	5000	21.9	<b>50* -skin-</b>	Hexyl hydride, Normal hexane	<b>OV</b>	3M 3510 Monitor
<b>Hexane (other isomers)</b>		65-248	<b>500</b>		<b>OV</b>	3M 3510 Monitor

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>1,6-Hexanediamine</b>			<b>1 (AIHAWHEEL)</b>	Hexamethylenediamine; 1,6-diaminohexane; HMDA; HMD	<b>OV/N95</b>	
<b>Hexanediol diacrylate</b>			<b>1 mg/m<sup>3</sup> (AIHAWHEEL)</b>	HDODA; Propenoic acid, 1,6-hexanediol ester	<b>OV/P95</b>	See Comment D, page 7
<b>2-Hexanone</b>				(See Methyl n-butyl ketone)		
<b>1-Hexene</b>			<b>50</b>	Butyl ethylene; Hexene; Hex-1-ene; Hexene-n-1; Hexylene	<b>OV</b>	Warning unknown
<b>Hexone</b>				(See Methyl isobutyl ketone)		
<b>sec-Hexyl acetate</b>	4000	0.219	<b>50</b>	1,3-Dimethylbutyl acetate; Methylamyl acetate; Methylisoamyl acetate; Methylisobutyl carbinol	<b>(F)OV</b>	See Comment E, page 8
<b>Hexylene glycol</b>		49.9	<b>25 (ceiling)</b>	4-Methyl-2,4-pentanediol	<b>(F)OV</b>	Irritation also provides warning
<b>HFE-7100</b>			<b>750 (AIHAWHEEL)</b>	Mixture of 1-Methoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane (40%) and 1-Methoxy-2-Trifluoromethyl-1,1,2,3,3,3-hexafluoropropane (60%); Mixture of 1-Methoxyperfluorobutane (40%) and 1-Methoxyperfluoroisobutane (60%)	<b>OV</b>	Warning unknown
<b>Hydrazine</b>	80	3.6	<b>0.01* -skin-</b>	Anhydrous hydrazine	<b>SA(F)</b>	Poor warning
<b>Hydrogenated terphenyls</b>			<b>0.5</b>		<b>R or P95</b>	
<b>Hydrogen bromide</b>		2	<b>2 (ceiling)</b>	Hydrobromic acid, HBr	<b>AG</b>	Not specifically approved for HBr
<b>Hydrogen chloride</b>	100	0.77	<b>2 (ceiling)</b>	Hydrochloric acid, HCl, Muriatic acid	<b>AG</b>	Irritation also provides warning
<b>Hydrogen cyanide</b>	50	0.603	<b>4.7* (ceiling) -skin-</b>	Hydrocyanic acid, Prussic acid	<b>SA(F)</b>	10X OEL maximum. Low IDLH.
<b>Hydrogen fluoride</b>	30	0.042	<b>0.5 -skin-</b>	Anhydrofluoric acid, HF, Etching acid, Fluorohydric acid, Fluoric acid	<b>(F)HF</b>	
<b>Hydrogen peroxide</b>	75		<b>1</b>	Peroxide, Hydrogen dioxide	<b>SA(F)</b>	Warning unknown. Unknown sorbent effectiveness.
<b>Hydrogen selenide (as Se)</b>	2	0.3	<b>0.05</b>	Selenium hydride	<b>(F)MG</b>	Poor warning
<b>Hydrogen sulfide</b>	300	0.0005	<b>10*</b>	Sulfuretted hydrogen, H <sub>2</sub> S, Hydrosulfuric acid, Hepatic gas	<b>SA AG-escape only</b>	Poor warning (olfactory fatigue)
<b>Hydroquinone</b>			<b>1 mg/m<sup>3</sup></b>	Quinol; Dihydroxybenzene; 1,4-Benzenediol	<b>(F)OV/N95</b>	See Comment D, page 7
<b>Hydrotreated kerosene</b>		0.1	<b>200 mg/m<sup>3</sup> -skin-</b>		<b>OV/P95</b>	When aerosols present, add a particulate prefilter.

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>4-Hydroxy-4-methyl-2-pentanone</b>				(See Diacetone alcohol)		
<b>2-Hydroxypropyl acrylate</b>			<b>0.5 -skin-</b>	HPA	<b>OV</b>	Warning unknown
<b>Indene</b>		0.009	<b>5</b>	Indonaphthene	<b>OV</b>	
<b>Indium and compounds (as In)</b>			<b>0.1 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Iodine and Iodides (inhalable fraction and vapor)</b>	10		<b>0.01 (ceiling)</b>		<b>(F)MG</b>	Warning unknown
<b>Iodoform</b>		0.000019-1.1	<b>0.6</b>	Triiodomethane	<b>(F)OV</b>	Questionable warning
<b>Iron oxide (as respirable particulate mass)</b>			<b>5 mg/m<sup>3*</sup></b>	Ferric oxide, Hematite, Burnt sienna, Burnt umber, Jeweler's rouge, Rouge	<b>N95</b>	
<b>Iron pentacarbonyl (as Fe)</b>			<b>0.1</b>	Iron carbonyl	<b>SA</b>	Warning unknown. Unknown sorbent effectiveness.
<b>Iron salts, soluble (as Fe)</b>			<b>1 mg/m<sup>3</sup></b>	Ferrous sulfate and chloride; Ferric chloride, nitrate and sulfate	<b>N95</b>	
<b>Isoamyl acetate</b>		0.004		(See Pentyl acetate)		
<b>Isoamyl alcohol</b>	10,000	0.045	<b>100</b>	3-Methyl-1-butanol, Isobutyl carbinol, Isopentyl alcohol, Fusel oil	<b>(F)OV</b>	See Comment E, page 8
<b>Isobutene</b>			250	1,1-Dimethylethene, 1,1-Dimethylethylene, Isobutylene, 2-Methylpropene, 2-Methylpropylene	<b>OV</b>	
<b>Isobutyl acetate</b>	7500	0.479	<b>150</b>	2-Methylpropyl acetate	<b>(F)OV</b>	
<b>Isobutyl alcohol</b>	8000	0.832	<b>50*</b>	Isobutanol, IBA, 2-Methyl-1-propanol, Isopropylcarbinol	<b>(F)OV</b>	3M 3510 Monitor
<b>Isobutane</b>			<b>1000</b>	Methylpropane; 2-methylpropane	<b>SA</b>	Short OV service life.
<b>Isobutyl nitrate (Inhalable aerosol and vapor)</b>			<b>1 (ceiling)</b>	IBN; Nitrous acid, isobutyl ester; Nitrous acid, 2-methylpropyl ester	<b>F(OV)N95</b>	See Comment E
<b>Isobutyraldehyde</b>			<b>25</b>	Isobutanal, 2-Methylpropanal, Isobutyric aldehyde, Isobutyl aldehyde, 2-Methylpropionaldehyde, 2-Methyl-1-propanal, Valine aldehyde	<b>OV</b>	Short OV service life.
<b>Isocyanuric acid</b>			<b>10 mg/m<sup>3</sup> (total) (AIHAWHEEL)</b> <b>5 mg/m<sup>3</sup> (respirable) (AIHAWHEEL)</b>	Cyanuric acid, s-Triazinetriol, s-Triazine-2,4,6(1H,3H,5H)-trione	<b>N95</b>	AM/N95 may be preferable, if wet
<b>Isooctyl alcohol</b>			<b>50 -skin-</b>	Isooctanol	<b>OV</b>	Warning unknown

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Isophorone	800	0.631	5* (ceiling)	3,5,5-Trimethyl-2-cyclohexene-1-one	OV	See Comment E, page 8. 3M 3510 Monitor.
Isophorone diisocyanate			0.005	IPDI	OV/N95	Warning unknown
Isophthalic acid			5 mg/m <sup>3</sup> (respirable) (AIHAWHEEL)	1,3-Dicarboxylic acid; m-Phthalic acid; IA; IPA	N95	
Isoprene			2 (AIHAWHEEL)	2-Methyl-1,3-butadiene	OV	Warning unknown
Isopropoxyethanol		0.738	25 -skin-	IPE, Isopropyl glycol, Ethylene glycol monoisopropyl ether, Isopropyl Cellosolve®	OV	
Isopropyl acetate	16,000	0.05-4.1	100	Isopropyl ester of acetic acid, sec-Propyl acetate	(F)OV	3M 3510 Monitor
Isopropylamine	4000	0.6	5	Monoisopropylamine, 2-Aminopropane	(F)AM (F)OV	AM not specifically approved
N-Isopropylaniline			2 -skin-	o-Isopropylaniline, o-Amino-isopropylbenzene	OV	Warning unknown
Isopropyl ether	10,000	0.055	250*	Diisopropyl ether	OV	
Isopropyl glycidyl ether	1000	297	50	Isopropoxymethyl-oxiran; 1,2-Epoxy-3-isopropoxy-propane; Isopropyl epoxypropyl ether; IGE	(F)OV	Poor warning
Kaolin			2 mg/m <sup>3</sup> * (respirable)	China clay, Aluminum silicate	N95	
Ketene			0.5	Carbomethene, Ethenone	SA(F)	Warning unknown. Ineffective sorbents.
Kerosene (Total hydrocarbon vapor)			200 mg/m <sup>3</sup> -skin-	Deobase, Kerosine, Diesel No. 1	OV/P95	When aerosols present, add a particulate prefilter.
Lacquer thinner				(See specific ingredients)		
Lead, elemental and inorganic compounds (as Pb)	700 mg/m <sup>3</sup>		0.05 mg/m <sup>3</sup>		N100	
Lead arsenate (as As)			0.01 mg/m <sup>3</sup> (PEL)		N100	
Lead chromate (as Cr)			0.012 mg/m <sup>3</sup> * (AIHAWHEEL)	Chrome orange, Red lead chromate	N100	
Limestone				(See Calcium carbonate)		
d-Limonene		0.437	30 (AIHAWHEEL)	1-methyl-4(1-methylethenyl)cyclohexene; 4-isopropyl-1-methylcyclohexene; p-mentha-1,8-diene; Cinene; Cajeputene	OV	
Lithium fluoride (as F)			2.5 mg/m <sup>3</sup>		N95	
Lithium hydride	55 mg/m <sup>3</sup>		0.025 mg/m <sup>3</sup>		N95	

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Lithium hydroxide			1 mg/m <sup>3</sup> (ceiling) (AIHAWHEEL)	Lithium hydroxide monohydrate	N95	
Lithium oxide			1 mg/m <sup>3</sup> (ceiling) (AIHAWHEEL)	Dilithium oxide, Lithium monoxide	N95	
LPG	19,000		1000	Liquefied petroleum gas, Bottled gas	SA	Warning unknown. Mixture with compounds with short OV service life.
Magnesite -Total dust			15 mg/m <sup>3</sup> (PEL)	Magnesium carbonate	N95	
-Respirable fraction			15 mg/m <sup>3</sup> (PEL)			
Magnesium oxide fume			10 mg/m <sup>3</sup> **	Magnesia fume	N95	
Maleic anhydride		0.318	0.1		(F)OV/N95	Poor warning
Manganese, elemental and inorganic compounds (as Mn)			0.2 mg/m <sup>3</sup> **		N95	
Manganese cyclopentadienyl tricarbonyl			0.1 mg/m <sup>3</sup> -skin-	MCT	SA	Properties of vapor unknown
Marble				(See Calcium carbonate)		
Melamine			10 mg/m <sup>3</sup> (inhalable) (AIHAWHEEL)	1,3,5-Triazine-2,4,6-triamine; 2,4,6-Triamino-1,3,5-Triazine, Cyanuramide	N95	
			5 mg/m <sup>3</sup> (respirable) (AIHAWHEEL)		N95	
2-Mercaptobenzothiazole		12 mg/m <sup>3</sup>	5 mg/m <sup>3</sup> -skin- (AIHAWHEEL)	Mercaptobenzothiazole; 2(3H)-Benzothiazolyl mercaptan; Benzothiazole-2-thione	N95	
Mercaptoethanol		0.12-0.64	0.2 -skin- (AIHAWHEEL)	2-Mercaptoethanol, 2ME, 1-Hydroxy-2-mercaptoethane, 2-Hydroxy-1-ethanethiol, 2-Hydroxyethylmercaptan, 2-Thioethanol, Thioethyleneglycol, Thioglycol	OV	Poor warning
Mercury (as Hg) -Vapor	28 mg/m <sup>3</sup>		0.025 mg/m <sup>3</sup> ** -skin-	Quicksilver, Hg	Hg	
-Alkyl compounds	10 mg/m <sup>3</sup>		0.01 mg/m <sup>3</sup> -skin-		SA	
-Aryl compounds	28 mg/m <sup>3</sup>		0.1 mg/m <sup>3</sup> (PEL) (ceiling) -skin-		N95	Dust with essentially no vapor pressure only

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>-Inorganic compounds</b>	28 mg/m <sup>3</sup>		<b>0.025 mg/m<sup>3</sup>*</b>		<b>N95</b>	Dust with essentially no vapor pressure only. Hg/N95 for volatile liquids.
<b>Mesityl oxide</b>	5000	0.056	<b>15*</b>	Isobutenyl methyl ketone, Methyl isobutenyl ketone, Isopropylidene acetone	<b>(F)OV</b>	3M 3510 Monitor
<b>Methacrylic acid</b>			<b>20 -skin-</b>	a-Methacrylic acid	<b>(F)OV</b>	Warning unknown
<b>Methane</b>			<b>1000</b>	Biogas; Fire damp; Marsh gas; Methylhydride; Natural gas; R 50 (refrigerant)	<b>SA</b>	Short OV service life.
<b>Methanethiol</b>				(See Methyl mercaptan)		
<b>2-Methoxyethanol</b>	2000	0.11	<b>0.1 -skin-</b>	Ethylene glycol monomethyl ether, Methyl Cellosolve®	<b>OV</b>	3M 3510 Monitor
<b>2-Methoxyethyl acetate</b>	4000	1.07	<b>0.1 -skin-</b>	Ethylene glycol methyl ether acetate, Ethylene glycol monomethyl ether acetate, Methyl Cellosolve® acetate	<b>OV</b>	3M 3510 Monitor
<b>4-Methoxyphenol</b>			<b>5 mg/m<sup>3</sup></b>	p-Methoxyphenol, Hydroquinone monomethyl ether	<b>N95</b>	
<b>3-Methoxypropyl amine</b>		2.7	<b>5 (AIHAWHEEL)</b>	1-Propanimine, 3-Methoxy	<b>(F)OV (F)AM</b>	Irritation also provides warning. AM not specifically approved.
<b>Methyl acetate</b>	10,000	6.17	<b>200</b>	Acetic acid, methyl ester; Methyl acetic ester; Methyl ethanoate	<b>OV</b>	
<b>Methyl acetylene</b>	15,000		<b>1000</b>	Propyne, Allylene	<b>SA</b>	Warning unknown. Very short OV service life.
<b>Methyl acetylene propadiene mixture</b>	15,000	100	<b>1000</b>	MAPP gas, Methyl acetylene-allene mixture, Propyne-allene mixture	<b>SA</b>	Very short OV service life
<b>Methyl acrylate</b>	1000	0.263	<b>2 -skin-</b>	Methyl propenoate	<b>(F)OV</b>	3M 3510 Monitor
<b>Methylacrylonitrile</b>		6.8	<b>1 -skin-</b>	2-Methyl-2-propenenitrile, Isoprene cyanide	<b>SA</b>	Poor warning
<b>Methylal</b>	15,000		<b>1000</b>	Dimethoxymethane, Methyl formal, Formal, Dimethylacetal formaldehyde	<b>SA</b>	Warning unknown
<b>Methyl alcohol</b>	25,000	141	<b>200 -skin-</b>	Methanol, Wood alcohol, Carbinol	<b>SA</b>	Very short OV service life
<b>Methylamine</b>	100	0.019	<b>5*</b>	Monomethylamine	<b>(F)AM</b>	
<b>Methyl amyl alcohol</b>	2000	1.1	<b>25 -skin-</b>	Methyl isobutyl carbinol	<b>OV</b>	

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Methyl n-amyl ketone</b>	4000	0.141	<b>50*</b>	n-Amyl methyl ketone, 2-Heptanone	<b>OV</b>	See Comment E, page 8
<b>Methylaniline</b>	100	1.74	<b>0.5* -skin-</b>	Monomethyl aniline, MA, N-Methyl aniline	<b>OV</b>	Poor warning
<b>Methyl bromide</b>	2000		<b>1* -skin-</b>	Bromomethane	<b>SA(F)</b>	Short OV service life. Use of 60928 Cartridge/ Filter recommended by 3M; not specifically approved for methyl bromide.
<b>2-Methylbutyl acetate</b>				(See Pentyl acetate)		
<b>Methyl n-butyl ketone</b>	5000	0.166	<b>5* -skin-</b>	2-Hexanone, MBK	<b>OV</b>	3M 3510 Monitor
<b>Methyl Cellosolve®</b>				(See 2-Methoxyethanol)		
<b>Methyl Cellosolve® acetate</b>				(See 2-Methoxyethyl acetate)		
<b>Methyl chloride</b>	10,000	10.2	<b>50* -skin-</b>	Chloromethane	<b>SA</b>	Very short OV service life
<b>Methyl chloroform</b>	1000	22.4	<b>350</b>	1,1,1-Trichloroethane	<b>OV</b>	3M 3510 Monitor
<b>Methyl 2-cyanoacrylate</b>		2.16	<b>0.2</b>	Mecrylate	<b>(F)OV</b>	Poor warning
<b>Methylcyclohexane</b>	10,000	500-630	<b>400*</b>	Cyclohexylmethane, Hexahydrotoluene	<b>OV</b>	Poor warning
<b>Methylcyclohexanol</b>	10,000	490	<b>50*</b>	Hexahydrocresols	<b>OV</b>	Poor warning
<b>o-Methylcyclohexanone</b>	2500		<b>50* -skin-</b>	2-Methylcyclohexanone	<b>(F)OV</b>	Irritation also provides warning
<b>2-Methylcyclopentadienyl manganese tricarbonyl (as Mn)</b>			<b>0.2 mg/m³ -skin-</b>		<b>OV/N95</b>	SA preferable if heat involved
<b>Methylenebisphenyl isocyanate</b>	9.7	0.384	<b>0.005*</b>	MDI; 4,4'-Diphenylmethane diisocyanate; Methylene-bis-(4-phenyl isocyanate)	<b>OV/N95</b>	Poor warning
<b>Methylene chloride</b>	5000	0.912	<b>25 (PEL)</b>	Dichloromethane, Methylene dichloride	<b>SA(F)</b>	OSHA requires SA(F); no change schedule allowed. Short OV service life. 3M 3530 Monitor.
<b>4,4'-Methylene-bis-(2-chloroaniline)</b>			<b>0.01 -skin-</b>	MOCA; DACPM; 4,4'-Methylene -bis-(2-chlorobenzamine)	<b>OV</b>	Warning unknown
<b>Methylene-bis-(4-cyclohexylisocyanate)</b>			<b>0.005</b>		<b>OV/N95</b>	Warning unknown
<b>4,4'-Methylene dianiline</b>			<b>0.01 (PEL) -skin-</b>	4,4'-Diaminodiphenylmethane; MDA	<b>N100</b>	Warning unknown. Use OV/N100 if heat is involved. See 29 CFR 1910.1050.
<b>Methyl ethyl ketone</b>	3000	0.27	<b>200</b>	MEK, 2-Butanone	<b>(F)OV</b>	3M 3510 Monitor

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Methyl ethyl ketone peroxide</b>			<b>0.2 (ceiling)</b>	MEKP	<b>(F)OV</b>	Warning unknown
<b>Methyl ethyl ketoxime</b>			<b>10 (AIHAWHEEL)</b>	2-Butanone oxime, MEKO	<b>OV</b>	Warning unknown
<b>Methyl formate</b>	5000	93.3	<b>100</b>	Methyl methanoate, Formic acid, Methyl ester	<b>SA</b>	Short OV service life
<b>5-Methyl-3-heptanone</b>				(See Ethyl amyl ketone)		
<b>Methyl hydrazine</b>	50	1.71	<b>0.01 -skin-</b>	Monomethyl hydrazine	<b>SA(F)</b>	Poor warning. Unknown sorbent effectiveness.
<b>Methyl iodide</b>	800		<b>2 -skin-</b>	Iodomethane	<b>SA(F)</b>	Warning unknown. Short OV service life.
<b>Methyl isoamyl ketone</b>		0.042	<b>50*</b>	5-Methyl-2-hexanone, 2-Methyl-5-hexanone, MIAK	<b>(F)OV</b>	
<b>Methyl isobutyl carbinol</b>				(See Methyl amyl alcohol)		
<b>Methyl isobutyl ketone</b>	3000	0.121	<b>50*</b>	MIBK, Hexone	<b>(F)OV</b>	3M 3510 Monitor
<b>Methyl isocyanate</b>	20	2.1	<b>0.02 -skin-</b>	Isocyanic acid, methyl ester	<b>SA</b>	Poor warning. Unknown sorbent effectiveness.
<b>Methyl isopropyl ketone</b>		4.47	<b>200</b>	MIPK, 3-Methyl-2-butanone	<b>(F)OV</b>	
<b>Methyl mercaptan</b>		0.001	<b>0.5*</b>	Mercaptomethane; Methanediol; Methyl sulfhydrate; Thiomethyl alcohol	<b>OV</b>	Very short OV service life
<b>Methyl methacrylate</b>	4000	0.085	<b>50</b>	Methacrylic acid, methyl ester	<b>OV</b>	3M 3510 Monitor
<b>1-Methylnaphthalene</b>			<b>0.5 -skin-</b>	a-Methylnaphthalene; a-Methyl naphthalene	<b>OV/R or P95</b>	
<b>2-Methylnaphthalene</b>			<b>0.5 -skin-</b>	B-Methylnaphthalene; B-Methyl naphthalene	<b>OV/R or P95</b>	
<b>Methyl propyl ketone</b>	5000	1.55	<b>150</b>	MPK, 2-Pentanone, Ethyl acetone	<b>(F)OV</b>	3M 3510 Monitor
<b>n-Methyl-2-pyrrolidone</b>			<b>10 -skin- (AIHAWHEEL)</b>	NMP; 1-Methyl-2-pyrrolidone; m-Pyrol; n-Methyl pyrrolidone	<b>OV</b>	Warning unknown
<b>Methyl silicate</b>			<b>1</b>	Tetramethoxy silane	<b>(F)OV</b>	Warning unknown
<b>a-Methyl styrene</b>	5000	0.003	<b>50</b>	1-Methyl-1-phenyl-ethylene, AMS	<b>OV</b>	See Comment E, page 8. PEL-100 ppm ceiling.
<b>Methyl tert-butyl ether</b>		0.053	<b>50</b>	2-Methoxy-2-methyl-propane; tert-Butyl methyl ether; MTBE; 2,2-MMOP	<b>OV</b>	3M 3510 Monitor
<b>Methyltrichlorosilane</b>			<b>1 (ceiling) (AIHAWHEEL)</b>	Trichloromethylsilane	<b>(F)AG/N95</b>	Irritation provides warning

\* TLV is lower than PEL.



NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Methyl vinyl ketone</b>		0.2	<b>0.2 (ceiling)-skin-</b>	Acetyl ethylene; 3-Buten-2-one; 3-Butene-2-one; Butenone; d(3)-2-Butenone; Methylene acetone; Methyl vinyl acetone; g-Oxo-a-Butylene	<b>OV</b>	
<b>Mica (less than 1% quartz)</b>			<b>3 mg/m<sup>3*</sup> (respirable)</b>		<b>N95</b>	
<b>Mineral spirits</b>				(See Stoddard solvent)		
<b>Mineral (rock), wool fiber</b>				(See Synthetic vitreous fibers–Glass, Rock or Slag wool fibers)		
<b>Molybdenum (as Mo)</b>						
–Soluble compounds (as respirable particulate)			<b>0.5 mg/m<sup>3</sup></b>		<b>N95</b>	
–Insoluble compounds (as inhalable particulate)			<b>10 mg/m<sup>3</sup></b>		<b>N95</b>	
(as respirable particulate)			<b>3 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Monochloroacetic acid (as inhalable fraction and vapor)</b>		0.045	<b>0.5 -skin-</b>	MCAA, Chloroethanoic acid	<b>(F)OV/N95</b>	
<b>Monochlorobenzene</b>				(See Chlorobenzene)		
<b>Monomethyl aniline</b>				(See Methyl aniline)		
<b>Monomethyl hydrazine</b>				(See Methyl hydrazine)		
<b>Morpholine</b>	8000	0.036	<b>20 -skin-</b>	Tetrahydro-1,4-oxazine; Diethylenimide oxide	<b>(F)OV</b>	
<b>Naphtha (coal tar)</b>	10,000		<b>100 (PEL)</b>	Naphtha, Crude solvent coal tar naphtha, High solvent naphtha, Rubber solvent	<b>(F)OV</b>	Odor variable. Irritation also provides warning.
<b>Naphthalene</b>	500	0.015	<b>10</b>	White tar, Naphthalin	<b>OV</b>	3M 3510 Monitor. See Comment E, page 8.
<b>Natural rubber latex (as inhalable total proteins)</b>			<b>0.0001 mg/m<sup>3</sup> -skin-</b>	Caoutchouc; India rubber; Natural latex; Natural rubber; NRL; Polyisoprene; Rubber	<b>N95</b>	
<b>Nickel (as Ni)</b>						
–Elemental/metal			<b>1.5 mg/m<sup>3</sup> (inhalable)</b>		<b>N95</b>	
–Insoluble compounds			<b>0.2 mg/m<sup>3</sup> (inhalable)</b>		<b>N95</b>	
–Soluble compounds			<b>0.1 mg/m<sup>3</sup> (inhalable)</b>		<b>N95</b>	
<b>Nickel carbonyl</b>	7	0.5-3.0	<b>0.001 (PEL)</b>	Nickel tetracarbonyl	<b>SA(F)</b>	0.05 ppm TLV-TWA. Unknown sorbent effectiveness.
<b>Nickel subsulfide</b>			<b>0.1 mg/m<sup>3</sup> (inhalable)</b>		<b>N95</b>	
<b>Nicotine</b>	35 mg/m <sup>3</sup>		<b>0.5 mg/m<sup>3</sup> -skin-</b>	3-(1-Methyl-2-pyrrolidyl) pyridine	<b>OV/P95</b>	See Comment D, page 7
<b>Nitric acid</b>	100	0.267	<b>2</b>	Aqua fortis, White fuming nitric acid (WFNA), Red fuming nitric acid (RFNA), Hydrogen nitrate	<b>SA(F)</b>	Ineffective sorbents

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Nitric oxide</b>	100		<b>25</b>	Nitrogen monoxide, NO	<b>SA</b>	Ineffective sorbents
<b>p-Nitroaniline</b>	300 mg/m <sup>3</sup>		<b>3 mg/m<sup>3</sup>* -skin-</b>	Azoic diazo component 37, p-Aminonitro-benzene, Fast red GG base, 4-Nitroaniline, PNA	<b>OV/N95</b>	See Comment D, page 7
<b>Nitrobenzene</b>	200	0.044	<b>1 -skin-</b>	Nitrobenzol, Oil of mirbane	<b>OV</b>	
<b>p-Nitrochlorobenzene</b>	344		<b>0.1* -skin-</b>	PNCB, PCNB, 4-Chloronitrobenzene, p-Chloronitrobenzene, 1-Chloro-4-nitrobenzene	<b>OV</b>	Warning unknown
<b>Nitroethane</b>	1000	2.11	<b>100</b>		<b>(F)OV</b>	
<b>Nitrogen dioxide</b>	50	0.186	<b>3</b>	Nitrogen tetroxide, NTO, Dinitrogen tetroxide, Nitrogen peroxide	<b>SA</b>	Ineffective sorbents. PEL-5 ppm ceiling.
<b>Nitrogen trifluoride</b>	2000		<b>10</b>	Nitrogen fluoride	<b>SA</b>	Warning unknown. Unknown sorbent effectiveness.
<b>Nitroglycerin (NG)</b>	53		<b>0.05* -skin-</b>	Glyceryl trinitrate, Trinitroglycerin	<b>OV</b>	Warning unknown
<b>Nitromethane</b>	1000	3.5	<b>20</b>	Nitrocarbol	<b>OV</b>	
<b>1-Nitropropane</b>	2300	7.09	<b>25</b>		<b>OV</b>	
<b>2-Nitropropane</b>	2300	4.85	<b>10*</b>	sec-Nitropropane	<b>OV</b>	
<b>Nitrotoluene</b>	200	0.017	<b>2* -skin-</b>	Nitrotoluol	<b>OV/N95</b>	See Comment D, page 7
<b>5-Nitro-o-toluidine (Inhalable particulate matter)</b>			<b>1 mg/m<sup>3</sup></b>	2-Methyl-5-nitrobenzenamine; 5-Nitro-2-toluidine; Azoic Diazo Compound 12	<b>OV/R or P95</b>	
<b>Nitrotrichloromethane</b>				(See Chloropicrin)		
<b>Nitrous oxide</b>			<b>50</b>	Dinitrogen monoxide	<b>SA</b>	Warning unknown. ineffective sorbents.
<b>Nonane</b>		1.26	<b>200</b>	n-Nonane	<b>OV</b>	
<b>Octachloronaphthalene</b>			<b>0.1 mg/m<sup>3</sup> -skin-</b>	Halowax™ 1051	<b>OV/N95</b>	See Comment D, page 7
<b>Octane (all isomers)</b>	5000	5.75	<b>300*</b>	Normal octane; Isooctane	<b>OV</b>	3M 3510 Monitor
<b>1-Octanol</b>		0.006	<b>50 (AIHAWHEEL)</b>	Alcohol C-8, Capryl alcohol, Heptyl carbinol, n-Octanol, 1-Hydroxyoctane, N-Octyl alcohol	<b>OV</b>	
<b>1-Octene</b>		2	<b>75 (AIHAWHEEL)</b>	a-Octylene, a-Octene	<b>OV</b>	
<b>Oil mist (mineral)</b>			<b>5 mg/m<sup>3</sup></b>	White mineral oil, Cutting oil, Heat-treating oil, Hydraulic oil, Cable oil, Lubricating oil	<b>R or P95</b>	As sampled by method that does not collect vapor. 0.005 mg/m <sup>3</sup> TLV-TWA proposed for oils that contain PNAs.

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Osmium tetroxide (as Os)</b>	0.1	0.002	<b>0.0002*</b>	Osmic acid	<b>SA(F)</b>	Poor warning. Unknown sorbent effectiveness.
<b>Oxalic acid</b>	500 mg/m <sup>3</sup>		<b>1 mg/m<sup>3</sup></b>	Oxalic acid dihydrate, Ethane dioic acid	<b>OV/N95</b>	See Comment D, page 7
<b>p,p'-Oxybis (Benzene-sulfonyl hydrazide)</b>			<b>0.1 mg/m<sup>3</sup></b>	Benzenesulfonic acid, 4,4'-Oxybis-dihydrazide; OBSH; Diphenyl ether 4,4'-disulfohydrazide	<b>N95</b>	
<b>Oxygen difluoride</b>	0.5	0.098	<b>0.05 (ceiling)</b>	Difluorine monoxide, Fluorine monoxide	<b>SA</b>	Poor warning. Unknown sorbent effectiveness.
<b>Ozone</b> -Heavy work -Moderate work -Light work	10	0.051	<b>0.05</b> <b>0.08</b> <b>0.1</b>	Triatomic oxygen	<b>OZ</b> <b>OZ</b> <b>OZ</b>	6000 with 2078 or 2097 filters recommended by 3M for 10X OEL. Not NIOSH approved for ozone.
<b>Paraffin wax fume</b>			<b>2 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Particulate polycyclic aromatic hydrocarbons (PPAH)</b>				(See Coal tar pitch volatiles)		
<b>Particulates Not Otherwise Regulated</b> -Total dust -Respirable fraction			<b>15 mg/m<sup>3</sup></b> <b>5 mg/m<sup>3</sup></b> <b>(PEL)</b>	Nuisance particulates	<b>N95</b>	This category includes many materials. For oils, and R or P95 filter/ respirator is recommended.
<b>(PPAH)</b>						
<b>PCBs</b>				(See Chlorodiphenyl)		
<b>Pentaborane</b>	3	0.97	<b>0.005</b>	Stable pentaborane, Pentaboron nonahydride	<b>SA</b>	Poor warning. Unknown sorbent effectiveness.
<b>Pentachloronaphthalene</b>			<b>0.5 mg/m<sup>3</sup></b>	Halowax™ 1013	<b>OV/N95</b>	See Comment D, page 7
<b>Pentaerythritol</b>			<b>10 mg/m<sup>3</sup>*</b>	Tetramethylolmethane	<b>N95</b>	
<b>Pentaerythritol triacrylate</b>			<b>1 mg/m<sup>3</sup></b> <b>(AIHAWHEEL)</b>	PETA; 2-Propenoic acid, 2-(hydroxymethyl)-2-[[[(1-oxo-2-propenyl) oxy] methyl]-1,3-propanediylester	<b>OV/P95</b>	See Comment D, page 7
<b>1,1,1,2,2-Pentafluoroethane</b>			<b>1000</b> <b>(AIHAWHEEL)</b>	Pentafluoroethane; HFC-125; Fluorocarbon 125	<b>SA</b>	Ineffective sorbents
<b>Pentane, all isomers</b>	15,000	31.6	<b>600*</b>	Normal pentane	<b>OV</b>	
<b>2-Pentanone</b>				(See Methyl propyl ketone)		
<b>1,1,1,3,3-Pentafluoropropane</b>			<b>300</b> <b>(AIHAWHEEL)</b>	HFC-245fa, R-245fa, Genetron 245fa	<b>SA</b>	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Pentyl acetate (all isomers)</b>	3000-9000 (depending on compound)		<b>50</b>	Isoamyl acetate, 1-pentanol acetate, 2-pentanol acetate, 3-Pentyl acetate, 2-Methylbutyl acetate, 1,1-Dimethyl-propyl acetate	<b>OV</b>	See Comment E, page 8. 3M 3510 Monitor.
<b>Perchloroethylene</b>	500	6.17	<b>25*</b>	Tetrachloroethylene, Perk	<b>(F)OV</b>	
<b>Perchloromethyl mercaptan</b>	10	0.097	<b>0.1</b>	PMM, Trichloromethyl sulfur chloride	<b>OV</b>	
<b>Perchloryl fluoride</b>	385	11	<b>3</b>	Chlorine oxyfluoride	<b>SA</b>	Poor warning. Unknown sorbent effectiveness.
<b>Perfluorobutyl ethylene</b>			<b>100</b>	1-Hexane, 3,3,4,4,5,5,6,6, 6-nonafluoro; 1H, 1H, 2H-Perflourhexene; PFBE	<b>OV</b>	Short OV service life
<b>Perfluoroisobutylene</b>			<b>0.01 (ceiling)</b>	Octafluoroisobutylene, Octafluoro-sec-butene, PFIB	<b>SA</b>	Warning unknown. Short OV service life.
<b>Persulfates</b>						
-Ammonium			<b>0.1 mg/m<sup>3</sup></b>		<b>N95</b>	
-Potassium			<b>0.1 mg/m<sup>3</sup></b>		<b>(F)N95</b>	
-Sodium			<b>0.1 mg/m<sup>3</sup></b>		<b>(F)N95</b>	
<b>Pesticides</b>				(Call 3M at 1-800-243-4630)		

<b>Petroleum distillates (naphtha)</b>	10,000		<b>500 (PEL)</b>	Petroleum naphtha, Aliphatic petroleum naphtha, Petroleum ether (95 to 115°C), Naphtha (See Gasoline, Stoddard solvent and VM&P Naphtha)	<b>OV</b>	Odor variable
<b>Phenacyl chloride</b>				(See a-Chloroacetophenone)		
<b>Phenol</b>	250	0.011	<b>5 -skin-</b>	Carbolic acid, Monohydroxy benzene	<b>OV/N95</b>	
<b>m-Phenylenediamine</b>			<b>0.1 mg/m<sup>3</sup></b>	1,3-Benzenediamine; m-Diaminobenzene	<b>OV/N95</b>	SA preferable if heat involved
<b>o-Phenylenediamine</b>			<b>0.1 mg/m<sup>3</sup></b>	1,2-Benzenediamine; o-Diaminobenzene; Orthamine	<b>OV/N95</b>	SA preferable if heat involved
<b>p-Phenylenediamine</b>			<b>0.1 mg/m<sup>3</sup> -skin-</b>	p-Diaminobenzene; 1,4-Diaminobenzene	<b>OV/N95</b>	SA preferable if heat involved
<b>Phenyl ether, vapor</b>		0.03	<b>1</b>	Diphenyl ether, Diphenyl oxide	<b>OV</b>	See Comment E, page 8. 3M 3510 Monitor.
<b>Phenyl ether-biphenyl mixture, vapor</b>		0.001-0.01	<b>1 (PEL)</b>	Dowtherm™ A, Diphenyl oxide-diphenyl mixture	<b>OV</b>	See Comment E, page 8
<b>Phenylethylene</b>				(See Styrene)		
<b>Phenyl glycidyl ether</b>			<b>0.1* -skin-</b>	Glycidyl phenyl ether; Phenyl epoxypropyl ether; 1,2-Epoxy-3-phenoxy propane; PGE	<b>OV</b>	Warning unknown
<b>Phenylhydrazine</b>	295		<b>0.1* -skin-</b>	Hydrazinobenzene	<b>(F)OV</b>	Warning unknown
<b>Phenyl mercaptan</b>		0.00094	<b>0.1 -skin-</b>	Benzenethiol, Thiophenol	<b>OV</b>	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Phenylphosphine</b>			<b>0.05 (ceiling)</b>		<b>OV</b>	Warning unknown
<b>Phosgene</b>	2	0.55	<b>0.1</b>	Carbonyl chloride, Carbon oxychloride, Chloroformyl chloride	<b>MG</b>	Poor warning
<b>Phosphine</b>	200	0.14	<b>0.3</b>	Hydrogen phosphide, Phosphorus hydride, Phosphorated hydrogen	<b>SA</b>	Unknown sorbent effectiveness. Fumigant.
<b>Phosphoric acid</b>	10,000 mg/m <sup>3</sup>		<b>1 mg/m<sup>3</sup></b>	White phosphoric acid, o-phosphoric acid, m-phosphoric acid	<b>(F)N95</b>	N95 with appropriate eye and face protection also acceptable
<b>2-Phosphono-1,2,4-butanetricarboxylic acid</b>			<b>10</b>	PBTC	<b>N95</b>	
<b>Phosphorus (yellow)</b>			<b>0.1 mg/m<sup>3</sup></b>	White phosphorus, WP	<b>SA</b>	If no phosphorus vapor or phosphine gas present, N95
<b>Phosphorus oxychloride</b>			<b>0.1</b>	Phosphoryl chloride	<b>(F)AG</b>	Warning unknown
<b>Phosphorus pentachloride</b>	200 mg/m <sup>3</sup>		<b>0.1*</b>	Phosphoric chloride	<b>AG</b>	Warning unknown
<b>Phosphorus pentasulfide</b>	750 mg/m <sup>3</sup>		<b>1 mg/m<sup>3</sup></b>	Phosphoric sulfide	<b>N95</b>	
<b>Phosphorus trichloride</b>	50		<b>0.2</b>	Phosphorus chloride	<b>(F)AG</b>	Warning unknown
<b>Phthalic anhydride</b>	1650	0.052	<b>1*</b>	PAN; 1,3-Isobenzofurandione	<b>OV/N95</b>	
<b>m-Phthalodinitrile</b>			<b>5 mg/m<sup>3</sup></b>	Isophthalodinitrile, IPN, m-Dicyanobenzene	<b>N95</b>	
<b>2-Picoline</b>		0.003	<b>2 -skin- (AIHAWHEEL)</b>	a-Picoline, 2-Methyl-pyridine	<b>OV</b>	
<b>3-Picoline</b>			<b>2 -skin- (AIHAWHEEL)</b>	b-Picoline, 3-Methyl-pyridine	<b>OV</b>	Warning unknown
<b>4-Picoline</b>			<b>2 -skin- (AIHAWHEEL)</b>	g-Picoline, 4-Methyl-pyridine	<b>OV</b>	Warning unknown
<b>Picric acid</b>		0.0005 mg/m <sup>3</sup>	<b>0.1 mg/m<sup>3</sup> -skin-</b>	2,4,6-Trinitrophenol, Lyddite, Pertite, Shimose, Melinite	<b>N95</b>	
<b>Piperazine dihydrochloride</b>			<b>5 mg/m<sup>3</sup></b>	Dihydrochloride salt of diethylenediamine	<b>N95</b>	
<b>Piperidine</b>		0.372	<b>1 (AIHAWHEEL)</b>	Hexahydropyridine	<b>(F)OV</b>	
<b>Plaster of Paris</b>				(See Calcium sulfate)		
<b>Platinum (as Pt) -Metal -Soluble salts</b>			<b>1 mg/m<sup>3</sup> 0.002 mg/m<sup>3</sup></b>		<b>N95 (F)N95</b>	
<b>Polychlorinated biphenyls</b>				(See Chlorodiphenyls)		
<b>Polyethylene glycols</b>			<b>10 mg/m<sup>3</sup> (AIHAWHEEL)</b>	PEG, Polyoxyethylene, PGE	<b>R or P95</b>	See Comment G, page 9

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Polypropylene glycols</b>			<b>10 mg/m<sup>3</sup> (AIHAWHEEL)</b>	PPG	<b>R or P95</b>	See Comment G, page 9
<b>Polyvinyl chloride</b>			<b>1 mg/m<sup>3</sup></b>	Cloroethylene homopolymer, Cloroethylene polymer, Cloroethene polymer, Polychloroethylene, Vinyl Chloride homoploymer, Vinyl chloride polymer, PVC	<b>N95</b>	
<b>Portland cement (less than 1% quartz)</b>			<b>10 mg/m<sup>3</sup>*</b>	Hydraulic cement, Cement, Portland cement silicate	<b>N95</b>	
<b>Potassium bromate</b>			<b>0.1 mg/m<sup>3</sup> (AIHAWHEEL)</b>	Bromic acid, Potassium salt	<b>N95</b>	
<b>Potassium hydroxide</b>			<b>2 mg/m<sup>3</sup> (ceiling)</b>	Caustic potash, Lye, Potassium hydrate	<b>N95</b>	
<b>Propane</b>		2690	<b>1,000</b>	Dimethyl methane n-Propane; Propane, various grades	<b>SA</b>	Ineffective sorbents
<b>n-Propanol</b>	4,000	2.6	<b>100 -skin-</b>	Alcohol, n-Propyl alcohol, 1-Propanol, Ethylcarbinol	<b>F(OV)</b>	See comment E, page 8
<b>2-Propanol</b>	12,000	0.44	<b>200 -skin-</b>	Isopropanol, IPA, Isopropyl alcohol, sec-Propyl alcohol	<b>F(OV)</b>	Irritation also provides warning. 3M 3530 Monitor
<b>Propargyl alcohol</b>		0.015	<b>1 -skin-</b>	2-Propyn-1-ol	<b>OV</b>	
<b>Propargyl bromide</b>		<2	<b>0.1 -skin- (AIHAWHEEL)</b>	Bromopropyne; Propyne, 3-bromo; 1-Bromo-2-propyne; 3-Bromopropyne, gamma-Bromoallylene	<b>OV</b>	Questionable warning properties
<b>2-Propenoic Acid, Isooctyl ester</b>		<1	<b>5 (AIHAWHEEL)</b>	Isooctyl acrylate; IOA	<b>OV</b>	
<b>B-Propiolactone</b>			<b>0.5</b>	Hydroacrylic acid, beta-lactone; 3-Hydroxypropionic acid; Propiolactone; 3-Hydroxy-beta-lactone; beta-Proprolactone; BPL	<b>(F)OV</b>	Warning unknown
<b>Propionaldehyde</b>		0.145	<b>20</b>	1-Propanal, Methylacetaldehyde, Propylaldehyde	<b>SA</b>	Very short OV service life.
<b>Propionic acid</b>		0.037	<b>10</b>	Methylacetic acid, Ethylformic acid	<b>(F)OV</b>	
<b>n-Propyl acetate</b>	8000	0.575	<b>200</b>	Propylacetate; Acetic acid, n-propyl ester	<b>(F)OV</b>	3M 3510 Monitor
<b>Propylene</b>		17	<b>500</b>	Propene, Methylethene, Methylethylene, 1-Propane, 1-Propylene	<b>SA</b>	
<b>Propylene dichloride</b>	2000	0.851	<b>10</b>	1,2-Dichloropropane	<b>OV</b>	3M 3510 Monitor
<b>Propylene glycol -Vapor and aerosol</b>			<b>50 (AIHAWHEEL)</b>	1,2-Propanediol; 1,2-Dihydroxy-propane; Methyl glycol	<b>OV/P95</b>	See Comment G, page 9
<b>-Aerosol only</b>			<b>10 mg/m<sup>3</sup> (AIHAWHEEL)</b>		<b>R or P95</b>	See Comment G, page 9
<b>Propylene glycol dinitrate</b>		0.231	<b>0.05 -skin-</b>	1,2-Propylene glycol dinitrate; 1,2-Propanediol dinitrate	<b>(F)OV</b>	Poor warning

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Propylene glycol monomethyl ether		0.003	100	1-Methoxy-2-propanol	OV	3M 3510 Monitor
Propylene glycol monomethyl ether acetate			50 (AIHAWHEEL)	Glycol ether PM acetate; PGMEA; 1-Methoxy-2-propanol acetate; 2-Methoxy-1-methylethyl acetate; 1-Methoxy-2-acetoxypropane	OV	Warning unknown. 3M 3510 Monitor.
Propylene imine	500		2* -skin-	2-Methylaziridine	(F)OV	Warning unknown
Propylene oxide	2000	33.1	2	1,2-Epoxypropane; Propene oxide; Methyloxirane; 2,3-Epoxypropane; 1,2-Propylene oxide	OV	Poor warning. 3M 3550 Monitor.
n-Propyl nitrate	2000	50	25	Nitric acid n-propylester	OV	Poor warning
Propyne				(See Methyl acetylene)		
Pyridine		0.17	1	Azabenzene, Azine	OV	
Pyrocatechol				(See Catechol)		
Quartz				(See Silica, crystalline)		
Quinoline		0.015	0.001 (AIHAWHEEL)	Chinoline, Leukoline, 1-Benzazine, 1-Azana-phthalene, Lencol	(F)OV	
Quinone	66	0.012	0.1	p-Benzoquinone	(F)OV/N95	
RDX				(See Cyclonite)		
Resorcinol			10	m-Dihydroxybenzene; 1,3-Benzenediol	N95	OV/N95 may be preferable if heat is involved
Rhodium (as Rh) -Metal			0.1 mg/m <sup>3</sup> (PEL)		N95	
-Insoluble compounds			0.1 mg/m <sup>3</sup> (PEL)		N95	
-Soluble compounds			0.001 mg/m <sup>3</sup> (PEL)		N95	
Rubber solvent				(See Naphtha [coal tar])		
Selenium and compounds (as Se)			0.2 mg/m <sup>3</sup>		N95	
Selenium hexafluoride	5		0.05		SA	Warning unknown. Unknown sorbent effectiveness.
Silane				(See Silicon tetrahydride)		
Silica, amorphous -Diatomaceous earth			0.80 mg/m <sup>3</sup> (PEL)	Diatomite, Silicon dioxide	N95	Assuming 100% SiO <sub>2</sub> (80 mg/m <sup>3</sup> divided by %SiO <sub>2</sub> )
Silica, crystalline -Cristobalite			0.025 mg/m <sup>3</sup> (respirable)		N95	
-Quartz			0.025 mg/m <sup>3</sup> * (respirable)		N95	
-Tripoli			0.1 mg/m <sup>3</sup> (respirable)		N95	

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Silicon</b>					<b>N95</b>	
-Total dust			15 mg/m <sup>3</sup> (PEL)			
-Respirable fraction			5 mg/m <sup>3</sup> (PEL)			
<b>Silicon carbide</b>					<b>N95</b>	
- Nonfibrous particles (containing no asbestos and <1% crystalline silica)			10 mg/m <sup>3</sup>		<b>N95</b>	
Inhalable particulate mass			3 mg/m <sup>3</sup>		<b>N95</b>	
Respirable particulate mass						
- Fibrous forms (including whiskers)			0.1 f/cc		<b>N95</b>	
Respirable fibers						
<b>Silicon tetrahydride</b>			5	Silane	<b>SA</b>	Warning unknown
<b>Silver, metal and soluble compounds (as Ag)</b>			0.01 mg/m <sup>3</sup> (PEL)		<b>N95</b>	
<b>Soapstone</b>			3 mg/m <sup>3</sup> (respirable)	Massive talc, Steatite, Soapstone silicate	<b>N95</b>	
<b>Sodium azide</b>				Hydrazoic acid		
-as Sodium azide			0.29 mg/m <sup>3</sup> (ceiling)		<b>N95</b>	
-as Hydrazoic acid vapor			0.11 (ceiling)		<b>SA</b>	Warning unknown. Unknown sorbent effectiveness.
<b>Sodium bisulfite</b>			5 mg/m <sup>3</sup>	Sodium hydrogen sulfite	<b>AG/N95</b>	N95 alone suitable if irritation eliminated
<b>Sodium chloroacetate</b>			2.5 mg/m <sup>3</sup> (AIHAWHEEL)	Monoxone, Sodium monofluoroacetate, Chloroacetic acid, Sodium salt	<b>N95</b>	
<b>Sodium fluoroacetate</b>	5 mg/m <sup>3</sup>		0.05 mg/m <sup>3</sup> -skin-	1080, Sodium monofluoroacetate, SFA	<b>N95</b>	
<b>Sodium hydroxide</b>	250 mg/m <sup>3</sup>		2 mg/m <sup>3</sup> (ceiling)	Caustic soda, Soda lye, Lye	<b>N95</b>	
<b>Sodium hypochlorite</b>			2 mg/m <sup>3</sup> (AIHAWHEEL)	Hypochlorous acid, sodium salt; Sodium oxychloride	<b>N95</b>	15 minute TWA
<b>Sodium metabisulfite</b>			5 mg/m <sup>3</sup>	Sodium pyrosulfite	<b>AG/N95</b>	N95 alone suitable if irritation eliminated
<b>Starch</b>			10 mg/m <sup>3</sup> *	Corn starch	<b>N95</b>	
<b>Stearates</b>			10 mg/m <sup>3</sup>	Aluminum stearate, Calcium stearate, Glyceryl stearate, Lithium stearate, Potassium stearate, Zinc stearate	<b>N95</b>	
<b>Stibine</b>	40		0.1	Hydrogen antimonide, Antimony trihydride	<b>SA</b>	Warning unknown. Unknown sorbent effectiveness.
<b>Stoddard solvent</b>	5150	1-30	100*	Dry cleaning safety solvent, Mineral spirits	<b>OV</b>	3M 3510 Monitor
<b>Strontium chromate (as Cr)</b>			0.0005 mg/m <sup>3</sup>	Strontium yellow, C.I. pigment yellow 32	<b>N95</b>	

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Strychnine</b>	3 mg/m <sup>3</sup>		<b>0.15 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Styrene</b>	5000	3.44	<b>20*</b>	Phenylethylene, Vinyl benzene, Cinnamene, Styrene monomer	<b>OV</b>	3M 3510 Monitor
<b>Subtilisins</b>			<b>0.00006 mg/m<sup>3</sup> (ceiling)</b>	Proteolytic enzymes as 100% crystalline enzyme	<b>SA</b>	Difficult to measure 10X OEL. N95 acceptable with suitable air sampling data.
<b>Sucrose</b>			<b>10 mg/m<sup>3</sup>*</b>	Table sugar, Saccharose	<b>N95</b>	
<b>Sulfur dioxide</b>	100	0.708	<b>2*</b>	SO <sub>2</sub>	<b>AG</b>	Irritation and taste also provide warning
<b>Sulfur hexafluoride</b>			<b>1000</b>	SF <sub>6</sub>	<b>SA</b>	Warning unknown. Unknown sorbent effectiveness.
<b>Sulfuric acid (Thoracic particulate mass)</b>			<b>0.2 mg/m<sup>3</sup></b>	Hydrogen sulfate; Matting acid; Oil of vitriol; Sulphuric acid; Vitriol brown oil	<b>(F)N95</b>	N95 with appropriate eye protection acceptable if irritation prevented
<b>Sulfur monochloride</b>	10	0.001	<b>1 (ceiling)</b>	Sulfur chloride, Sulfur subchloride	<b>(F)AG</b>	
<b>Sulfur pentafluoride</b>	1		<b>0.01 (ceiling)</b>	Disulfur decafluoride	<b>AG</b>	Warning unknown
<b>Sulfur tetrafluoride</b>			<b>0.1 (ceiling)</b>		<b>AG</b>	Warning unknown
<b>Sulfuryl fluoride</b>	1000		<b>5</b>		<b>SA</b>	Warning unknown. Unknown sorbent effectiveness.
<b>Synthetic vitreous fibers</b>						
-Continuous filament glass fibers			<b>1 f/cc</b>		<b>N95</b>	
-Glass wool fibers			<b>1 f/cc</b>		<b>N95</b>	
-Refractory ceramic fibers			<b>0.2 f/cc</b>		<b>N95</b>	
-Rock wool fibers			<b>1 f/cc</b>		<b>N95</b>	
-Slag wool fibers			<b>1 f/cc</b>		<b>N95</b>	
-Special purpose glass fibers			<b>1 f/cc</b>		<b>N95</b>	
<b>Talc (containing no asbestos)</b>			<b>2 mg/m<sup>3</sup>* (respirable)</b>	Hydrous magnesium silicate, Steatite talc, Non-fibrous talc, Non-asbestiform talc	<b>N95</b>	
<b>Talc (containing asbestos)</b>				(See Asbestos)		
<b>Tantalum, metal and oxide dusts (as Ta)</b>			<b>5 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Tellurium and compounds (as Te)</b>			<b>0.1 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Tellurium hexafluoride (as Te)</b>	1		<b>0.02</b>		<b>SA</b>	Warning unknown. Unknown sorbent effectiveness.

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Terephthalic acid</b>			<b>10 mg/m<sup>3</sup></b>	p-Phthalic acid; TPA; Benzene-p-dicarboxylic acid; 1,4 Benzenedicarboxylic acids, Tephthol	<b>N95</b>	
<b>Terphenyls</b>			<b>0.5* (ceiling)</b>	o-Terphenyl, m-Terphenyl, p-Terphenyl, Mixed terphenyls, Diphenyl benzenes	<b>N95</b>	OV/N95 may be preferable if heat involved
<b>1,1,2,2-Tetrabromoethane (as inhalable fraction and vapor)</b>		1	<b>0.1</b>	Acetylene tetrabromide Muthmann's liquid, Tetrabromoethane, Tetrabromoethylene	<b>OV</b>	
<b>1,1,1,2-Tetrachloro-2,2-difluoroethane</b>	15,000		<b>100</b>	Refrigerant 112a; Halocarbon 112a; 2,2-Difluoro-1, 1,1,2-tetrachloroethane; Freon® 112a	<b>OV</b>	Warning unknown
<b>1,1,1,2-Tetrachloro-1,2-difluoroethane</b>	15,000		<b>50</b>	Refrigerant 112, Halocarbon 112, Freon® 112	<b>OV</b>	Warning unknown
<b>1,1,1,2-Tetrachloroethane</b>	150	0.21	<b>1* -skin-</b>	Acetylene tetrachloride	<b>OV</b>	3M 3510 Monitor
<b>Tetrachloroethylene</b>				(See Perchloroethylene)		
<b>Tetrachloromethane</b>				(See Carbon tetrachloride)		
<b>Tetrachloronaphthalene</b>			<b>2 mg/m<sup>3</sup></b>	Halowax™, Seekay wax, Nibren wax	<b>OV/N95</b>	See Comment D, page 7
<b>2,3,5,6-Tetrachloropyridine</b>			<b>5 mg/m<sup>3</sup> (AIHAWHEEL)</b>	Pyridine, 2,3,5,6-tetrachloro	<b>OV/N95</b>	See Coment D, page 7
<b>Tetrachlorosilane</b>			<b>1 (ceiling) (AIHAWHEEL)</b>	Silicon tetrachloride, Silicon chloride	<b>AG/N95</b>	Warning unknown. Reacts rapidly with moisture yielding HCl and silica.
<b>Tetraethylene glycol diacrylate</b>			<b>1 mg/m<sup>3</sup> (AIHAWHEEL)</b>	TTEGDA; 2-Propionic acid, oxy-bis-(2,1-ethane-dioxy-2,1-ethanediol) ester	<b>OV/P95</b>	See Comment D, page 7
<b>Tetraethylene pentamine (aerosol)</b>			<b>5 mg/m<sup>3</sup> -skin- (AIHAWHEEL)</b>	1,2-Ethandiamine, N-(2-aminoethyl)-N'-(2-((2-amino)ethyl)); Tetran 1,4,7, 10,13-Pentaazatridecane; DEH 26; TEPA; Tetraethyl pentamine	<b>F(OV)</b>	
<b>Tetraethyl lead (as Pb)</b>	40 mg/m <sup>3</sup>		<b>0.075 mg/m<sup>3</sup> (PEL) -skin-</b>	TEL, Lead tetraethyl, Motor fuel anti-knock compound	<b>OV</b>	Warning unknown
<b>1,1,1,2-Tetrafluoroethane</b>			<b>1000 (AIHAWHEEL)</b>	Tetrafluoroethane, HFC134a, HFA134a, Fluorocarbon 134a	<b>SA</b>	Ineffective sorbents
<b>Tetrafluoroethylene</b>			<b>2</b>	Perfluoroethene; Perfluoroethylene; TFE Tetrafluoroethene; 1,1,2,2-Tetrafluoroethylene	<b>SA</b>	
<b>Tetrahydrofuran</b>		3.8	<b>50 -skin-</b>	Diethylene oxide, Tetramethylene oxide, THF	<b>OV</b>	3M 3510 Monitor
<b>Tetrahydrofurfuryl alcohol</b>			<b>0.05 (AIHAWHEEL)</b>	Tetrahydro-2-furanmethanol; Tetrahydro-2-furancarbinol; Tetrahydro-2 furylmethanol; THFA	<b>OV</b>	Warning unknown

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Tetrakis (hydroxymethyl) phosphonium chloride</b>			<b>2mg/m<sup>3</sup></b>	Proban CC; Pyroset TKC; Retardol C; THPC; Tetrahydroxymethyl phosphonium chloride	<b>N95</b>	
<b>Tetrakis (hydroxymethyl) phosphonium sulfate</b>			<b>2mg/m<sup>3</sup></b>	Octakis (hydroxymethyl) phosphonium sulfate; Pyroset TKO; Retardol S; THPS; bis tetrakis-(hydroxymethyl) phosphonium sulfate	<b>N95</b>	
<b>Tetramethyl lead (as Pb)</b>	40 mg/m <sup>3</sup>		<b>0.075 mg/m<sup>3</sup> (PEL) -skin-</b>	TML, Lead tetramethyl, Motor fuel anti-knock compound	<b>OV</b>	Warning unknown
<b>Tetramethyl succinonitrile, vapor</b>	5		<b>0.5 -skin-</b>	TMSN	<b>OV</b>	Warning unknown
<b>Tetranitromethane</b>	5		<b>0.005*</b>	Tetan	<b>OV</b>	Warning unknown
<b>Tetryl</b>			<b>1.5 mg/m<sup>3</sup></b>	2,4,6-Trinitrophenyl-methylnitramine; N-Methyl-N-2,4,6-tetranitroaniline; Nitramine; Tetralite	<b>N95</b>	
<b>Thallium -Elemental and soluble compounds (as Tl)</b>	20 mg/m <sup>3</sup>		<b>0.1 mg/m<sup>3</sup> -skin-</b>	Thallium acetate, Thallium carbonate, Thallium hydroxide, etc.	<b>N95</b>	
<b>4,4'-Thiobis(6-tert-butyl-m-cresol)</b>			<b>10 mg/m<sup>3</sup>*<sup>†</sup></b>	4,4'-Thiobis(3-methyl-6-tert-butyl phenol)	<b>N95</b>	
<b>Thioglycolic acid</b>			<b>1 -skin-</b>	Mercaptoacetic acid, Thioranic acid	<b>(F)OV</b>	Warning unknown
<b>Thionyl chloride</b>			<b>1 (ceiling)</b>	Sulfurous oxychloride, Sulfur oxychloride	<b>(F)AG</b>	Warning unknown
<b>Thiram (inhalable fraction and vapor)</b>			<b>0.05 mg/m<sup>3</sup></b>	TMT, TMTD, TMTDS, Tetramethylthioram disulfide	<b>OV/N95</b>	
<b>Tin (as Sn) -Metal and inorganic compounds (except SnH<sub>4</sub>) -Organic compounds</b>	400 mg/m <sup>3</sup>		<b>2 mg/m<sup>3</sup></b> <b>0.1 mg/m<sup>3</sup> -skin-</b>		<b>N95</b> <b>OV/N95</b>	See Comment D, page 7
<b>Titanium dioxide</b>			<b>10 mg/m<sup>3</sup>*<sup>†</sup></b>	Rutile, Anatase, Brookite	<b>N95</b>	
<b>Titanium tetrachloride</b>			<b>0.5 mg/m<sup>3</sup> (AIHAWHEEL)</b>	Titanium chloride	<b>AG/N95</b>	
<b>Toluene</b>	2000	0.16	<b>20* -skin-</b>	Aantisal 1a; Methacide; Methylbenzol; Methyl benzene; Monomethyl benzene; Tol, Tolu-sol; Toluol; Phenyl methane; Methyl benzene	<b>OV</b>	3M 3510 Monitor

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Toluene diamine</b>			<b>0.005 -skin- (AIHAWHEEL)</b>	Diaminotoluene; TDA; Tolyenediamine	<b>N95</b>	
<b>Toluene-2,4 or 2,6-diisocyanate (or as a mixture)</b>		0.17	<b>0.005*</b>	2,4 or 2,6-Toluene diisocyanate 2,4- or 2,6-TDI	<b>OV/N95</b>	Poor warning
<b>p-Toluenesulfonyl chloride</b>			<b>5 mg/m<sup>3</sup> (ceiling) (AIHAWHEEL)</b>	4-Methyl-benzenesulfonyl chloride, Tosyl chloride	<b>(F)OV/AG/N95</b>	See Comment D, page 7. HCl and p-toluene sulfuric acid produced by hydrolysis.
<b>m-Toluidine</b>		0.46-5.9	<b>2 -skin-</b>	m-Aminotoluene	<b>(F)OV</b>	Questionable warning
<b>o-Toluidine</b>	100	0.025-6.6	<b>2* -skin-</b>	o-Aminotoluene; o-Methylaniline; 1-Methyl-1,2-amino-benzene; 2-Methylaniline	<b>(F)OV</b>	Questionable warning
<b>p-Toluidine</b>		0.027-3.2	<b>2 -skin-</b>	p-Aminotoluene	<b>(F)OV</b>	Questionable warning
<b>Tributyl phosphate</b>	125		<b>0.2*</b>	Tri-n-butyl phosphate, TBP	<b>OV/P95</b>	
<b>Trichloroacetic acid</b>		0.295	<b>1</b>	TCA	<b>OV/AG</b>	Irritation also provides warning
<b>1,2,4-Trichlorobenzene</b>		2.91	<b>5 (ceiling)</b>		<b>OV</b>	
<b>1,1,1-Trichloroethane</b>				(See Methyl chloroform)		
<b>1,1,2-Trichloroethane</b>	500		<b>10 -skin-</b>	Vinyl trichloride, b-Trichloroethane	<b>(F)OV</b>	Warning unknown. 3M 3510 Monitor.
<b>Trichloroethylene</b>	1000	1.36	<b>10</b>	1-Chloro-2,2-dichloroethylene Ethylene trichloride, Triclene™, TCE, 1,1,2-TCE	<b>OV</b>	3M 3510 Monitor
<b>Trichlorofluoromethane</b>	10,000	16.3	<b>1000 (ceiling)</b>	FC-11, Freon® 11, Fluorotri-chloromethane, Trichloromono-fluoromethane	<b>SA</b>	Short OV service life
<b>Trichloronaphthalene</b>			<b>5 mg/m<sup>3</sup> -skin-</b>	Halowax™, Seekay wax, Nibren wax	<b>OV/N95</b>	See Comment D, page 7
<b>Trichloronitromethane</b>				(See Chloropicrin)		
<b>1,2,3-Trichloropropane</b>	1000	100	<b>10* -skin-</b>	Allyl trichloride, Glycerol trichlorohydrin, Glycerin trichlorohydrin, Trichlorohydrin	<b>(F)OV</b>	Poor warning
<b>Trichlorosilane</b>			<b>0.5 (ceiling)</b>	Silicochloroform	<b>(F)AG</b>	Warning unknown
<b>1,1,2-Trichloro-1,2,2-trifluoroethane</b>	4500	487	<b>1000</b>	Halocarbon 113, Refrigerant 113, TTE, Freon® 113, FC-113	<b>SA</b>	Short OV service life. 3M 3530 Monitor.

\* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>Tridymite</b>				(See Silica, crystalline)		
<b>Triethanolamine</b>			<b>5 mg/m<sup>3</sup></b>	Daltogen; 2,2',2''-Nitrilo-triethanol; Sterolamide; TEA; Trihydroxytriethylamine	<b>OV/P95</b>	Warning unknown. See Comment D, page 7.
<b>Triethoxysilane</b>			<b>0.05 (AIHAWHEEL)</b>	Silane, triethoxy	<b>SA(F)</b>	Unknown sorbent effectiveness
<b>Triethylamine</b>		0.001	<b>1 (AIHAWHEEL)</b>	N-Trimethylamine; N, N-Dimethylmethanamine; TMA	<b>F(OV)</b>	AIHA WEEL is lower than TLV of 5 ppm. AM suggested, not specifically approved
<b>Triethylene glycol diacrylate</b>			<b>1 mg/m<sup>3</sup> (AIHAWHEEL)</b>	TREGDA; 2-Propenoic acid, 2-ethanediyl-bis-(oxy-2,1-ethanediyl) ester	<b>OV/P95</b>	
<b>Triethylenetetramine</b>			<b>1 -skin-</b>	N,N'-bis(2-aminoethyl)-1,2,ethane diamine; 1,4,7,10-Tetraazadecane; 1,8-diamino-3,6-diazaoctane; 3,6-diazaoctane-1,8-diamine; Trientine; TETA; TECZA	<b>OV</b>	See Comment E, page 8. R or P filter, if filter is required.
<b>Trifluorobromomethane</b>	50,000	16.3	<b>1000</b>	Halon™ 1301, Halocarbon 13B1, Refrigerant 13B1, Bromotrifluoromethane, Freon® 13B1	<b>SA</b>	Short OV service life
<b>1,1,1-Trifluoro-2,2-dichloroethane</b>			<b>50</b>	HCFC-123; FC-123; Hydrofluorocarbon 123	<b>SA</b>	Short OV service life
<b>1,1,1-Trifluoroethane</b>			<b>1000 (AIHAWHEEL)</b>	HFC-143a; FC-143a; Hydrofluorocarbon 143a	<b>SA</b>	Ineffective sorbents
<b>2,2,2-Trifluoroethanol</b>			<b>0.3 (AIHAWHEEL)</b>	Ethanol, 2,2,2-Trifluoro; 2,2,2-Trifluoroethyl alcohol; TFE	<b>SA</b>	Warning unknown. Ineffective sorbent.
<b>1,3,5-Triglycidyl-s-triazinetrione</b>			<b>0.05 mg/m<sup>3</sup></b>	Araldite PT-810; TEPIC; 1,3,5-Triazine-2,4,6-(1H,3H,5H)-trione	<b>N95</b>	
<b>Trimellitic anhydride</b>			<b>0.0005 mg/m<sup>3</sup> (ceiling)</b>	TMA , TMAN, Anhydrotrimellitic acid, Trimellitic acid anhydride	<b>OV/N95</b>	Chemical manufacturer's recommendation. See Comment D, page 7.
<b>Trimethoxysilane</b>			<b>0.05 (AIHAWHEEL)</b>		<b>(F)OV</b>	Warning unknown
<b>Trimethylamine</b>		0.001	<b>1 (AIHAWHEEL)</b>	N-Trimethylamine; N,N-Dimethylmethanamine; TMA	<b>(F)AM</b>	AIHAWHEEL is lower than TLV of 5 ppm. AM not specifically approved.
<b>Trimethyl benzene</b>		2.4	<b>25</b>	Mesitylene, Pseudocumene, Hemimellitene	<b>OV</b>	3M 3510 Monitor
<b>Trimethylchlorosilane</b>			<b>5 (ceiling) (AIHAWHEEL)</b>	Chlorotrimethylsilane; trimethylchloro silicane; monochlorotrimethylsilicon	<b>(F)OV/AG</b>	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Trimethyl phosphite		0.001	2	Phosphorus acid trimethylester, Methyl phosphite	(F)OV	
Trimethylolpropane triacrylate			1 mg/m <sup>3</sup> (AIHAWHEEL)	2-Propenoic acid, 2-ethyl-2(((1-oxo-2-propenyl) oxy) methyl)-1,3-propanediyl ester	OV/P95	
Trimethylolpropane trimethacrylate			1 mg/m <sup>3</sup> (AIHAWHEEL)	Acrylic acid, triester w/2-ethyl 2 (hydroxymethyl) 1,3 propanediol	OV/P95	
2,4,6-Trinitrophenol				(See Picric acid)		
2,4,6-Trinitrotoluene (TNT)	1000 mg/m <sup>3</sup>		0.1 mg/m <sup>3</sup> * -skin-	TNT, Trinitrotoluol, Trinitrotoluene, sym-Trinitrotoluene	OV/N95	See Comment D, page 7
Triorthocresyl phosphate	40 mg/m <sup>3</sup>		0.1 mg/m <sup>3</sup> -skin-	o-Tritolyl phosphate, TCP, TOCP tricresylphosphate	R or P95	
Triphenyl amine			5 mg/m <sup>3</sup>		N95	
Triphenyl phosphate	1000 mg/m <sup>3</sup>		3 mg/m <sup>3</sup>	Phenyl phosphate, TPP	N95	OV/N95 preferable if heat involved
Tripoli				(See Silica, crystalline)		
Trisodium phosphate			5 mg/m <sup>3</sup> (AIHAWHEEL)	TSP, Sodium o-phosphate	(F)N95	N95 acceptable with appropriate eye/face protection. 15 min TWA.
Tungsten (as W) -Insoluble compounds -Soluble compounds			5 mg/m <sup>3</sup> 1 mg/m <sup>3</sup>		N95 N95	
Turpentine (wood)	1500	100-200	20	Gumspirits, Turps, Wood turpentine, Gum turpentine	(F)OV	See Comment E, page 8
Uranium (as U) -Insoluble compounds -Soluble compounds	30 mg/m <sup>3</sup> 20 mg/m <sup>3</sup>		0.05 mg/m <sup>3</sup> (PEL) 0.05 mg/m <sup>3</sup> (PEL)		N95 AG/N95 N95	See 10 CFR 20 Subpart H Halides Other
Urea			10 mg/m <sup>3</sup> (AIHAWHEEL)	Carbamide, Carbonyldiamide, Carbonyldiamine, isourea	N95	AM/N95 may be preferable if heat is involved
n-Valeraldehyde		0.006	50	Pentanal, Valeric aldehyde	(F)OV	
Vanadium pentoxide, respirable dust or fume (as V <sub>2</sub> O <sub>5</sub> )	70 mg/m <sup>3</sup>		0.05 mg/m <sup>3</sup> * (respirable)	Vanadic anhydride, Vanadium oxide	N95	
Vegetable oil, mists -Total dust -Respirable fraction			15 mg/m <sup>3</sup> (PEL) 5 mg/m <sup>3</sup> (PEL)		R or P95	
Vinyl acetate		0.603	10	1-Acetoxyethylene, Ethenyl acetate	(F)OV	3M 3510 Monitor
Vinyl benzene				(See Styrene)		

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 3.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Vinyl bromide			0.5	Bromoethylene	SA(F)	Warning unknown. Short OV service life.
Vinyl chloride		0.253	1 (PEL)	Chloroethylene, Chloroethene, Monochloroethylene, VC, Vinyl chloride monomer, VCM	SA	OSHA allows OV for very short use periods. See 29 CFR 1910.1017.
Vinyl cyanide				(See Acrylonitrile)		
4-Vinylcyclohexene			0.1	4-Vinyl-1-cyclohexene; 4-Vinylcyclohexene-1-butadiene dimer; 4-Ethenyl-1-1-cyclohexene; 1-Vinylcyclohexene-3,4-vinylcyclohex-1-ene; VCH	OV	Warning unknown
Vinyl cyclohexene dioxide			0.1 -skin-	Vinylcyclohexane dioxide, Vinylhexane dioxide	(F)OV	Warning unknown
Vinyl fluoride			1	Fluoroethene, Fluoroethylene, Monofluoroethylene	SA	Warning unknown. Short service life.
Vinylidene chloride		35.5	1 (PEL)	1,1-Dichloroethylene; VDC	OV	Poor warning
Vinylidene fluoride			500	1,1-Difluoroethene; 1,1-Difluoroethylene; Ethene, 1,1-difluoro; Ethylene, 1,1-difluoro; Halocarbon 1132A; VDF; Vinylidene difluoride	SA	Warning unknown. Ineffective sorbents.
N-Vinyl-2-pyrrolidone			0.05	1-Ethenyl-2-pyrrolidinone; Vinylbutyrlactam; Vinylpyrrolidinone; 1-Vinylpyrrolidinone; N-Vinylpyrrolidinone; Vinylpyrrolidone	OV	
Vinyl toluene	5000	10	50*	Methylstyrene, Tolyethylene	(F)OV	See Comment E, page 8. 3M 3510 Monitor.
Vinyltrichlorosilane			1 (ceiling) (AIHAWHEEL)	Trichlorovinylsilane; Trichlorovinyl silicon; Vinylsilicon trichloride; Silane trichlorovinyl; Silane trichloroethenyl; trichlorovinyl silicane	OV/AG	
VM & P Naphtha		1-40	300	Varnish Makers' & Painters' Naphtha, Ligroin	(F)OV	3M 3510 Monitor
Wood, dust (All varieties except Western Red Cedar) (Western Red Cedar)			1 mg/m <sup>3*</sup> 0.5 mg/m <sup>3*</sup>		N95 N95	
Xylene (o-, m-, and p-isomers)	1000	0.851 0.324 0.49	100	1,2-Dimethyl-benzene; 1,3-Dimethyl-benzene; 1,4-Dimethyl-benzene	OV	3M 3510 Monitor

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
<b>m-Xylene a,a'-diamine</b>			<b>0.1 mg/m<sup>3</sup> (ceiling) -skin-</b>	MXDA	<b>OV/N95</b>	See Comment D, page 7
<b>Xylidine (as inhalable aerosol and vapor)</b>	150	0.005-0.06	<b>0.5* -skin-</b>	Aminodimethyl benzene, Aminoxylene dimethylaniline, Dimethylaminobenzene	<b>OV/N95</b>	
<b>Yttrium, metal and compounds (as Y)</b>			<b>1 mg/m<sup>3</sup></b>	Specific compound	<b>N95</b>	
<b>Zinc chloride, fume</b>	4800 mg/m <sup>3</sup>		<b>1 mg/m<sup>3</sup></b>		<b>N95</b>	
<b>Zinc chromate (as Cr)</b>			<b>0.01 mg/m<sup>3</sup>*</b>	Basic zinc chromate, Zinc potassium chromate, Zinc yellow	<b>N95</b>	
<b>Zinc oxide (Respirable particulate mass)</b>			<b>2 mg/m<sup>3</sup></b>	Zincite, Zinc white	<b>N95</b>	
<b>Zinc stearate</b>			<b>10 mg/m<sup>3</sup>*</b>	Synpro stearate, Zinc distearate, Dermarone	<b>N95</b>	
<b>Zirconium and compounds (as Zr)</b>	500 mg/m <sup>3</sup>		<b>5 mg/m<sup>3</sup></b>		<b>N95</b>	

\* TLV is lower than PEL.

## 3M™ Health and Safety Software Library

3M offers the only software library that helps you choose the right respirator and comply with respiratory protection and hearing conservation regulations.

### 3M™ Select Software®

- Helps you select the most appropriate respirator for the job.
- Just point and click to select the appropriate respirator.
- You'll know which respirator to use in a variety of different environments.
- Analyze combinations of over 600 different contaminants in varying concentrations.

### 3M™ Respirator Compliance Software

- Helps you develop and manage your respiratory protection program.
- Eliminates the guesswork. Helps you develop a complete respiratory protection program that complies with the latest regulations.

- Alerts you when fit testing, training sessions, exposure assessments and medical updates are due.
- Choose from General industry, Automotive aftermarket or Construction versions.

### 3M™ Hearing Compliance Software

- Helps you develop and manage your hearing conservation program.
- Helps you develop a customized program manual.
- Organizes record keeping.
- Provides extensive reporting capability.
- Integrates with 3M™ Respirator Compliance Software.

### PC System Requirements:

**Computer:** Minimum 486 IBM PC or fully compatible, CD-ROM drive required to install software on hard drive. VGA graphics or compatible adapter. 15 MB required on hard drive for each program.

**Operating System:** Windows® 3.1, Windows® 98, Windows® NT®, Windows® XP or Windows® for Workgroups.

**Memory:** 16 MB RAM memory and a minimum of an additional 16 MB virtual memory.

### 3M™ Service Life Software

3M's Service Life Software helps calculate end of service life for 3M organic vapor respirator cartridges based on workplace conditions such as contaminant concentration, temperature, work rate and atmospheric pressure.

3M™ Service Life Software can be accessed at the 3M web site:  
[www.3M.com/OccSafety](http://www.3M.com/OccSafety).

### 3M™ Select Software®

3M Select Software® helps you choose the proper respirator for different hazardous environments.

3M Select Software®	
Features	Benefits
Simple to use	Just point and click, then follow the prompts to select an appropriate respirator. Interactive user's manual is on-line.
Accurate	Knowing the contaminants and their concentrations, the program leads you to an appropriate respirator recommendation.
Explains the solution	Helps you understand the selection process.
Combines contaminant reference information from a variety of resources	Includes IDLH, exposure limit, odor threshold, molecular weight and more. No need to acquire and wrestle with a pile of documents. Saves time.
Uses health hazard data to calculate proper solutions when multiple contaminants are present	Analyzes combinations of over 600 different contaminants in varying concentrations.
Traceable audit reports	OSHA requires an audit trail. View or print the audit trail based on the contaminants and concentrations you've selected.

Data for this guide compiled  
December 2008.

Always refer to latest TLV Guide and OSHA standards  
for possible changes and rulings.

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- Technical Assistance 1-800-243-4630
- Internet [www.3M.com/OccSafety](http://www.3M.com/OccSafety)

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**Respirator Codes and Descriptions**