3M Occupational Health and Environmental Safety Division

2010 Respirator Selection Guide

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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 facepiece1000

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.

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

*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.

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.

⚠WARNING

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.

⚠WARNING

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. A few odor thresholds published in other documents were used when not listed in the references below (e.g., AIHAWEEL 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 2009 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^3 (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 2009 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 work-week, 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.

***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. Amoore, J.E. and E. Hautula. Odor as an Aid to Chemical Safety. J. Appl. Toxicol. 3(6):272-290 (1983).
4. Fazzuluri, F.A. Compilation of Odor and Taste Threshold Values Data. American Society for Testing and Materials (1978).
5. Verschueren, 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 (2009).
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 (2009).
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).

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 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 on the inside back cover. 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 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 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 ecommended 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 (Dioctyl 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 (Dioctyl 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 (Dioctyl 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/m3, 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/m³ 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**, go to Step 14.

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**, 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.

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%O2, >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
Respirator Selected:					

NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

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- (AIHAWEEL)**	a-Hydroxy isobutyronitrile, 2-Propane cyanohydrin, 2-Cyano-2-propanol, 2-Methyllactonitrile, 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, Hypnone, 1-Phenylethanone	**OV**	See Comment E, page 9

Acetylene dichloride				(See 1,2-Dichloroethylene)		
Acetylsalicylic acid			**5 mg/m³**	Aspirin	**N95**	
Acrolein	5	0.174	**0.1 (ceiling) -skin-**	Acrylic aldehyde, Acrylaldehyde, Propenal, Allylaldehyde	**(F)OV**	Poor warning
Acrylamide			**0.03 mg/m³* -skin-**	Propenamide, Acrylamide monomer, Acrylic amide	**OV/N95**	See Comment D, page 8
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/m³**	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 4.

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 (AIHAWEEL)**	Oil of mustard, AITC, Allyl thiocarbanimide, 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
Aluminum Metal and Insoluble Compounds –Respirable Particulate Matter				**1 mg/m^3**	**N95**	
p-Aminobenzoic acid			**5 mg/m^3 (AIHAWEEL)**	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/m³ (AIHAWEEL)**	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/m³** **10 mg/m³**		 **N95** **AM/N95**	
Ammonium perfluorooctanoate			**0.01 mg/m³ -skin-**		**OV/N95**	See Comment D, page 8
n-Amyl acetate				(See Pentyl acetate)		
sec-Amyl acetate				(See Pentyl acetate)		
n-Amyl alcohol		0.1-0.3	**100 (AIHAWEEL)**	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**	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Antimony and compounds (as Sb)	80 mg/m³		**0.5 mg/m³**		**N95**	
Arsenic, elemental and inorganic compounds (except arsine) (as As)	100 mg/m³		**0.01 mg/m³ (PEL)**		**N100**	
Arsine	6	<1.0	**0.05 ppm**	Hydrogen arsenide, Arsenic trihydride, Arseniuretted hydrogen, Arsenous hydride	**SA(F)**	Poor warning. Unknown sorbent effectiveness.
Asbestos			**0.1 fiber/cc (PEL)**	Chrysotile, Amosite, Crocidolite, Tremolite, Anthophyllite, Actinolite	**N100**	Dual cartridge as per 29 CFR 1910. 1001, 1915.1001 and 1926.1101
Asphalt (petroleum; bitumen) fumes (as benzene-soluble aerosol)			**0.5 mg/m³ inhalable**	Asphaltum, Bitumen, Hot mix asphalt, Mineral pitch, Petroleum asphalt	**OV/P95**	R or P95 alone may be suitable for some applications. See Comment F, page 9.
Barium soluble compounds (as Ba)	1100 mg/m³		**0.5 mg/m³**		**N95**	
Barium sulfate			**10 mg/m³***		**N95**	
Benzaldehyde		0.042	**2 (AIHAWEEL)**	Benzoic aldehyde, Oil of bitter almond, Benzenecarbonal	**F(OV)**	

Benzene	3000	8.65	**0.5***	Benzol, Coal tar naphtha	**OV**	Poor warning. SA if cartridges are not replaced at the start of each shift, per 29 CFR 1910.1028. 3M 3510 Monitor.
Benzophenone			**0.5 mg/m³ (AIHAWEEL)**	Benzoyl benzene, Diphenyl ketone, Diphenyl methanone, Phenyl ketone	**OV/N95**	See Comment D, page 8
p-Benzoquinone				(See Quinone)		
Benzotrichloride			**0.1 (ceiling) -skin-**	Toluene trichloride, Benzenyl trichloride, Benzoic trichloride, Phenyl chloroform, Trichloromethylbenzene	**(F)OV**	Warning unknown
Benzoyl chloride		0.007	**0.5 (ceiling)**	a-Chlorobenzaldehyde, Benzene carbonyl chloride, Benzoic acid chloride	**(F)OV/AG (F)MG**	
Benzoyl peroxide	7000 mg/m³		**5 mg/m³**	Dibenzoyl peroxide	**OV/N95**	See Comment D, page 8
Benzyl acetate		0.145	**10**	Acetic acid benzyl ester, Acetic acid phenylmethyl ester, Phenylmethyl acetate	**OV/N95**	
Benzyl alcohol		5.55	**10 (AIHAWEEL)**	a-Hydroxytoluene, Phenylmethanol, Phenylcarbinol	**(F)OV**	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Benzyl chloride	10	0.034	**1**	a-Chlorotoluene	**(F)OV/AG**	See Comment E, page 9. 3M 3510 Monitor.
Beryllium and compounds (as Be) Inhalable particulate matter	10 mg/m^3		**0.00005 mg/m^3 -skin-**		**N95**	
Biphenyl	47.6	0.0093	**0.2**	Diphenyl, Phenylbenzene	**OV/N95**	
Bis(2-dimethylamino-ethyl) ether			**0.05 ppm -skin-**	DMAEE; Ethylamine, 2,2'-Oxybis (N.N-dimethyl)-; Niax [R] Catalyst A-99	**(FOV)**	
Bis-(2-Chloroisopropyl) Ether			**3**	bis-2-chloro-1-methylethyl ether; bis-(1-methyl-2-chloroethyl) ether; dichloroisopropyl ether; BCIPE	**(F)OV**	
Bismuth telluride			**10 mg/m^3***	Bismuth sesquitelluride	**N95**	
Bismuth telluride (Se-doped)			**5 mg/m^3**		**N95**	

Borate compounds, inorganic						
- Boric acid			**2 mg/m³**	Borofax; Boron trihydroxide; Hydrogen orthoborate; Kill-off; Kjel-sorb; Orthoboric acid; Three elephant; Trihydroxyborane	**N95**	
- Sodium borate, anhydrous			**2 mg/m³**	Borates, tetrasodium salts, anhydrous; Borax fused; Boric acid, disodium salt; Disodium tetraborate; Sodium tetraborate, anhydrous	**N95**	
- Sodium borate, decahydrate			**2 mg/m³**	Borates, tetrasodium salts, decahydrate; Borax; Borascu; Borocin; Disodium diborate decahydrate; Disodium tetraborate decahydrate; Sodium pyroborate decahydrate; Sodium tetraborate, decahydrate	**N95**	
- Sodium borate, pentahydrate			**2 mg/m³**	Borates, tetrasodium salts, pentahydrate; Boric acid pentahydrate; Mule team borascu; Boron sodium oxide, pentahydrate; Sodium tetraborate, pentahydrate	**N95**	
Boron oxide			**10 mg/m³***	Anhydrous boric acid, Boric anhydride, Boric oxide	**N95**	
Boron tribromide			**1 (ceiling)**	Boron bromide	**(F)AG**	Warning unknown
Boron trifluoride	100	1.5	**1 (ceiling)**		**(F)AG**	Poor warning

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Bromine	10	0.066	**0.1**		**(F)OV/AG**	0.2 ppm TLV-STEL. Irritation also provides warning.
Bromine pentafluoride			**0.1**		**AG**	Warning unknown
Bromochloromethane				(See Chlorobromomethane)		
Bromoform		0.447	**0.5 -skin-**	Tribromomethane	**(F)OV**	3M 3510 Monitor
1-Bromopropane			**10**	n-Propylbromide, Propylbromide	**OV**	
1,3-Butadiene	20,000	0.455	**1 (PEL)**	Butadiene, Divinyl, Biethylene, Erythrene	**OV**	Cartridges must be replaced, per 29 CFR 1910.1051
Butane		204	**1000**	n-Butane, Methylethyl methane	**SA**	Short OV service life
n-Butanethiol				(See Butyl mercaptan)		
2-Butanone				(See Methyl ethyl ketone)		
1-Butene			250	a-Butene, But-1-ene, a-Butylene, 1-Butylene, Ethylethylene	**OV**	
2-Butene			250	B-Butene, B-Butylene, Dimethylethylene, Pseudobutylene	**OV**	
cis-2-Butene			250	cis-Butene, cis-Butene-2, B-cis-Butylene, cis-1, 2-Dimethylethylene	**OV**	

trans-2-Butene			250	trans-Butene, 2-trans-Butene, B-trans-Butylene, trans-1, 2-Dimethylethylene	**OV**	
2-Butoxyethanol	700	0.001	**20***	Butyl Cellosolve®, Ethylene glycol monobutylether	**(F)OV**	See Comment E, page 9
2-Butoxyethyl acetate			**20**	Acetic acid 2-butoxyethyl ester; 2-Butoxyethanol acetate; Butyl Cellusolve acetate; Butylglycol acetate; Ektasolve EB acetate; Ethylene glycol monobutyl ether acetate; EGBA; Glycol monbutyl ether acetate	**OV**	
n-Butyl acetate	10,000	0.007	**150**	Butyl acetate, Butyl ethanoate, Acetic acid butyl ester	**(F)OV**	See Comment E, page 9. 3M 3510 Monitor.
sec-Butyl acetate	10,000	3-7	**200**	1-Methylpropylacetate	**(F)OV**	See Comment E, page 9. 3M 3510 Monitor.
tert-Butyl acetate	10,000	4-47	**200**	Acetic acid tert-butyl ester	**(F)OV**	3M 3510 Monitor
Butyl acrylate		0.003	**2**	2-Propenoic acid butyl ester, Butyl-2-propenoate	**OV**	3M 3510 Monitor
n-Butyl alcohol	8000	0.03	**20***	1-Butanol, Butyl alcohol; Butyl hydroxide; Butyric alcohol; 1-Hydroxybutane; Methylolpropane; n-Propyl carbinol, n-Butanol	**(F)OV**	25 ppm TLV-ceiling proposed. 3M 3510 Monitor.
sec-Butyl alcohol	10,000	1	**100**	2-Butanol, Methyl ethyl carbinol	**(F)OV**	3M 3510 Monitor

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
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/m³**	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/m³ -skin- (AIHAWEEL)**	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_3)	30 mg/m³		**0.1 mg/m³ (ceiling) -skin-**	Chromic acid, di-tert-Butyl ester	**N95**	
Butylene oxide		0.06	**2 (AIHAWEEL)**	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 (AIHAWEEL)**	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^3 dust 9 mg/m^3 fume		**0.005 mg/m^3 (PEL)**		**N100**	0.002 mg/m^3 TLV-TWA for respirable dust
Calcium arsenate (as As)	100 mg/m^3		**0.01 mg/m^3 (PEL)**	Tricalcium arsenate, Tricalcium o-arsenate, Cucumber dust	**N100**	
Calcium carbonate			**15 mg/m^3 (PEL)**	Marble, Limestone	**N95**	
Calcium chromate			**0.001 mg/m^3**	Calcium chrome yellow	**N95**	
Calcium cyanamide			**0.5 mg/m^3**	Lime nitrogen, Calcium carbimide	**N95**	
Calcium fluoride (as F)			**2.5 mg/m^3**	Fluorite, Fluorspar	**N95**	
Calcium hydroxide			**5 mg/m^3***	Calcium hydrate, Hydrated lime, Caustic lime	**N95**	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Calcium oxide			**2 mg/m³***	Quicklime, Pebble lime	**N95**	
Calcium silicate (as inhalable particulate mass)			**10 mg/m³***	Calcium metasilicate, Portland cement, Wallastonite	**N95**	
Calcium sulfate			**10 mg/m³**	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/m³**	Aminocaproic lactam, 2-Oxohexamethyleneimine	**OV/N95**	
Captan inhalable fraction			**5 mg/m³**	N-(Trichloromethylthio)-4-cyclohexene-1,2-dicarboximide	**N95**	
Carbon black			**3.5 mg/m³**	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/m³***	Paper fiber	**N95**	
Cesium fluoride			**2.5 mg/m³**		**N95**	
Cesium hydroxide			**2 mg/m³**	Cesium hydrate	**N95**	
Chloramphenicol			**0.5 mg/m³ (AIHAWEEL)**	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/m³**	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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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Chlorine trifluoride	20		**0.1 (ceiling)**	Chlorine fluoride	**MG**	Warning unknown
Chloroacetaldehyde	100	0.917	**1**	2-Chloroethanal, Chloroacetaldehyde (40% aqueous)	**(F)OV**	Poor warning
Chloroacetone			**1 (ceiling) -skin-**	Monochloroacetone, 1-Chloro-2-propanone, Chloracetone	**(F)OV**	Warning unknown
Chloroacetyl chloride			**0.05 -skin-**	Chloracetyl chloride	**(F)OV/AG**	Warning unknown
Chlorobenzene	2400	0.741	**10***	Monochlorobenzene, Chlorobenzol, Phenyl chloride, MCB	**OV**	3M 3510 Monitor
Chlorobromomethane	5000	399	**200**	Bromochloromethane, Methylene chlorobromide, CBM, Halon™ 1011	**OV**	Poor warning. Short OV service life.
1-Chloro-1,1-difluoro-ethane			**1000 (AIHAWEEL)**	HCFC-142b, Dymel® 142b, Genetron™ 142b, Chlorodifluoro-ethane, a-chloroethylidene fluoride	**SA**	Short OV service life
2-Chloro-1,3-butadine				(See B-Chloroprene)		
Chlorodifluoromethane			**1,000**	Freon® 22	**SA**	Warning unknown. Ineffective sorbents.

Chlorodiphenyl (42% chlorine)	10 mg/m³		**1 mg/m³ -skin-**	Polychlorinated biphenyl, PCB	**(F)OV/P95**	See Comment D, page 8
Chlorodiphenyl (54% chlorine)	5 mg/m³		**0.5 mg/m³ -skin-**	Polychlorinated biphenyl, PCB	**(F)OV/P95**	See Comment D, page 8
1-Chloro,2,3-epoxy-propane				(See Epichlorohydrin)		
2-Chloroethanol				(See Ethylene chlorohydrin)		
Chloroethylene				(See Vinyl chloride)		
Chloroform	1000	11.7	**10***	Trichloromethane	**OV**	Poor warning. 3M 3510 Monitor.
bis-Chloromethyl ether			**0.001**	Dichloromethylether, BCME, Chloro (chloromethoxy) methane, Chloromethyl ether	**(F)OV**	Warning unknown. OSHA requires SA with hood for certain applications; see 29 CFR 1910.1003.
Chloropentafluoro-ethane			**1000**	FC-115, Monochloropentafluoroethane	**SA**	Warning unknown. Short service life.
Chloropicrin	4	1.08	**0.1**	Nitrotrichloromethane, Trichloronitromethane, Nitrochloroform	**(F)OV**	Irritation also provides warning
B-Chloroprene	400	14.9	**10* -skin-**	2-Chloro-1,3-Butadiene; Chlorobutadiene; beta-Chloroprene	**(F)OV**	Poor warning

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

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 (AIHAWEEL)**	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_2 hydrolysis products
2-Chloro-1,1,1,2-tetra-fluoroethane			**1000 (AIHAWEEL)**	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 (AIHAWEEL)**	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/m³**		**N95**	
–Water-soluble Cr VI compounds, NOC (includes Chromic acid)	30 mg/m³	**0.005 mg/m³**		**N95**	
–Insoluble Cr VI compounds, NOC		**0.01 mg/m³**		**N95**	
Chromyl chloride		**0.025**	Chromium oxychloride, Chlorochromic anhydride	**AG**	Warning unknown
Coal dust					
-Bituminous or lignite		**0.9 mg/m³* (respirable)**		**N95**	≥5% quartz 0.1 mg/m³ TLV
-Anthracite		**0.4 mg/m³* (respirable)**		**N95**	≥5% quartz 0.1 mg/m³ TLV
Coal tar pitch volatiles (as Benzene solubles)	700 mg/m³	**0.2 mg/m³**		**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/m³	**0.02 mg/m³***		**N95**	
Cobalt carbonyl (as Co)		**0.1 mg/m³**		**SA**	Ineffective sorbents

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Cobalt hydrocarbonyl (as Co)			**0.1 mg/m³**		**SA**	Ineffective sorbents
Coke oven emissions			**0.15 mg/m³**		**R or P95**	8247, 8577 or respirators with 2076HF, 2078, 2096 or 2097 filters specifically recommended. See Comment F, page 9.
Copper (as Cu) **–Dust and mist** **–Fume**			 **1 mg/m³** **0.1 mg/m³ (PEL)**		 **N95** **N95**	
Cotton dust (raw)			**0.2 mg/m³***		**N95**	5X PEL maximum for disposables, per OSHA cotton dust standard. If oil aerosol present, use R or P95.
Cresol (all isomers)	250	0.00005-0.0079	**5 -skin-**	Cresylic acid	**OV/P95**	
Cristobalite				(See Silica, crystalline)		
Crotonaldehyde	400	0.135	**0.3 (ceiling)**	B-Methylacrolein, Propylene aldehyde, Crotontonic aldehyde	**(F)OV**	

Cryolite (as F)			**2.5 mg/m³**	Greenland spar, Icetone	**N95**	
Cumene	8000	0.024	**50**	Isopropyl benzene, 2-Phenyl propane, Cumol	**OV**	3M 3510 Monitor
Cumene hydroperoxide		0.005	**1 -skin- (AIHAWEEL)**	Isopropylbenzene hydroperoxide; CHP; a,a'-Dimethylbenzyl hydroperoxide; Cumyl hydroperoxide	**(F)OV**	
Cyanamide			**2 mg/m³**	Cyanogenamide, Carbodiimide	**N95**	
Cyanides (as CN)	50 mg/m³		**5 mg/m³ (ceiling) -skin-**		**SA**	Poor warning
Cyanogen		231	**10**	Dicyan, Oxalonitrile	**SA**	Poor warning. Unknown sorbent effectiveness.
Cyanogen chloride		0.976	**0.3 (ceiling)**	CNCl	**SA(F)**	Poor warning. Short service life.
Cyclohexane	10,000	83.8	**100**	Hexahydrobenzene, Hexamethylene	**(F)OV**	Irritation also provides warning. 3M 3510 Monitor.
Cyclohexanol	3500	0.068	**50 -skin-**	Hexalin, Hydralin, Hydroxycyclohexane, Anol, Hexahydrophenol, Cyclohexyl alcohol	**OV**	See Comment E, page 9. 3M 3510 Monitor.
Cyclohexanone	5000	0.019	**20 -skin-**	Pimelic ketone, Cyclohexyl ketone	**OV**	3M 3510 Monitor

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Cyclohexene	10,000	0.363	**300**	Benzene tetrahydride	**OV**	3M 3510 Monitor
Cyclohexylamine		2.66	**10**	Hexahydroaniline, Aminocyclohexane	**(F)OV**	
Cyclonite			**0.5 mg/m³ -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/m³ (AIHAWEEL)**	DBDPO, Decabromodiphenyl ether, bis-(pentabromophenyl) ether	**N95**	
1-Decene		7	**100 (AIHAWEEL)**	Decylene, alpha-decene	**OV**	
Dehydrolinalool			**2 (AIHAWEEL)**		**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- (AIHAWEEL)**	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- (AIHAWEEL)**	1-Butanamine, n-Butyl, Di-n-butylamine, DNBA	**F(OV)**	See Comment E, page 9
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 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Dibutyl phosphate	125		**5 mg/m³ - skin -**	Dibutyl acid-o-phosphate, Di-n-butyl hydrogen phosphate, Dibutyl phosphoric acid		**OV/P95**
Dibutyl phthalate	9300 mg/m³		**5 mg/m³**	DBP; Dibutyl; 1,2-Benzene-dicarboxylate	**OV/P95**	See Comment D, page 8
Dichloroacetic acid			**0.5 - skin -**	Acetic acid, dichloro-; 2,2-Dichloroacetic acid; Dichloroehanoic acid; Urmer's liquid	**F(OV/AG)**	
Dichloroacetylene			**0.1 (ceiling)**	Dichloroethyne	**SA(F)**	Warning unknown. Short OV service life.
o-Dichlorobenzene	1000	0.072	**25**	1,2-Dichlorobenzene; o-Dichloro-benzol	**(F)OV**	See Comment E, page 9. PEL-50 ppm ceiling. 3M 3510 Monitor.
p-Dichlorobenzene	1000	0.048	**10***	1,4-Dichlorobenzene; Dichloricide; PDCB	**(F)OV/N95**	3M 3510 Monitor
1,4-Dichloro-2-butene			**0.005 -skin-**	2-Butylenedichloride; DCB; 1,4-DCB; Dichlorobutene	**(F)OV**	Warning unknown
Dichlorodifluoromethane	50,000		**1000**	Refrigerant 12, Freon® 12	**SA**	Warning unknown. Short OV service life.

1,3-Dichloro-5,5-dimethylhydantoin		0.01	**0.2 mg/m³**	Halane, Dactin	**OV/N95**	
1,1-Dichloroethane	4000	255	**100**	Ethylidene chloride	**OV**	Poor warning
1,2-Dichloroethane				(See Ethylene dichloride)		
1,1-Dichloroethylene				(See Vinylidene chloride)		
1,2-Dichloroethylene	4000	19.1	**200**	Acetylene dichloride, Dioform	**OV**	
Dichloroethyl ether	250	0.049	**5 -skin-**	bis-(2-Chloroethyl) ether; 2,2'-Dichlorodiethyl ether	**(F)OV**	PEL-15 ppm ceiling
Dichlorofluoro-methane	50,000		**10***	Refrigerant 21, Freon® 21, Dichloromonofluoromethane	**SA**	Warning unknown. Short OV service life.
1,1-Dichloro-1-fluoro-ethane			**500 (AIHAWEEL)**	HCFC141b, HFA141b, Fluorocarbon 141b	**SA**	Short OV service life
Dichloromethane				(See Methylene chloride)		
1,1-Dichloro-1-nitroethane	150		**2**		**OV**	Warning unknown. PEL-10 ppm ceiling.
2,4-Dichlorophenol		0.21	**1 -skin- (AIHAWEEL)**	2,4-DCP; DCP; Phenol: 2,4-Dichloro	**OV**	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	**(F)OV**	Warning unknown
2,2-Dichloropropionic acid			**5 mg/m³**	Dalapon™	**(F)OV/N95**	Warning unknown

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Dichlorotetra-fluoroethane	50,000		**1000**	Freon® 114, Refrigerant 114, Halon™ 242, FC-114	**SA**	Warning unknown. Short OV service life.
Dicyclopentadiene		0.03	**5**		**OV/N95**	
Dicyclopentadienyl iron			**10 mg/m³***	bis-Cyclopentadienyl iron	**N95**	
Diesel Fuel (total hydrocarbons, vapor and aerosol)			**100 mg/m³ -skin-**	Astral oil, Gas oil, Coal oil, Fuel oil, Home heating oil, Marine diesel fuel	**OV/P95**	
Diethanolamine (Inhalable fraction and vapor)		0.025	**1 mg/m³ -skin-**	DEA, di-(2-Hydroxyethyl) amine; N,N-Diethanolamine; 2,2'-dihydroxydiethyl amine; Diolamine; 2,2'-Iminobisethanol; Butadiene Dioxide	**OV**	See Comment E, page 9
Diethylamine	2000	0.186	**5* -skin-**		**(F)AM (F)OV**	AM not specifically approved
Diethylaminoethanol	500	0.034	**2 -skin-**	2-Diethylaminoethyl alcohol; N,N-Diethylethanolamine	**OV**	
Diethylbenzenes, mixed		**12**	**5**	DEB; Dowtherm J; 1,2-Diethylbenzene; 1,3-Diethylbenzene; 1,4-Diethylbenzene	**OV**	
Diethylene glycol			**10 mg/m³ (AIHAWEEL)**	DEG; Diglycol; 2,2'-Dihydroxy-diethyl ether	**R or P95**	See Comments D and G, pages 8 & 9

Diethylene glycol monoethyl ether		0.708	**25 (AIHAWEEL)**	2-(2-Ethoxyethoxy) ethanol, DiGGE, Diethylene glycol ethyl ether, Glycol ether DE, Carbitol, Dioxitol	**OV**	
Diethylene triamine		9.3	**1 -skin-**		**(F)OV**	Poor warning
Diethyl ether				(See Ethyl ether)		
Di-2-ethylhexyl phthalate				(See Di-sec-octyl phthalate)		
Diethyl ketone		0.316	**200**	Metacetone, Propione, 3-Pentanone, Ethyl propionyl	**OV**	
Diethyl phthalate			**5 mg/m³**	Ethylphthalate, DEP	**R or P95**	
Difluorodibromo-methane	2500		**100**	Dibromodifluoromethane, Freon® 12B2, DFBM	**OV**	Warning unknown
1,1-Difluoroethane			**1000 (AIHAWEEL)**	HFC-152a, Freon® 152a, Dymel® 152a, Genetron™ 152a, Ethylidene fluoride	**SA**	Ineffective sorbents
Difluoromethane			**1000 (AIHAWEEL)**	Refrigerant 32; R32; Hydrofluoro-carbon 32	**SA**	Warning unknown. Ineffective sorbents.
Diglycidyl ether	25	4.61	**0.01**	di-(Epoxypropyl) ether; bis-(2,3-Epoxypropyl)-ether; 2-Epoxypropyl ether; Diallyl ether dioxide; DGE	**(F)OV**	Poor warning
Dihydroxybenzene				(See Hydroquinone)		
Diisobutylene			**75 (AIHAWEEL)**	Diisobutene	**OV**	

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Diisobutyl ketone	2000	0.339	**25***	2,6-Dimethyl-4-heptanone; sym-Diisopropylacetone; Isovalerone; Valerone	**(F)OV**	See Comment E, page 9. 3M 3510 Monitor.
Diisopropylamine	1000	0.398	**5 -skin-**		**(F)OV**	
Dimethoxymethane				(See Methylal)		
Dimethyl acetamide	400	47.9	**10 -skin-**	N,N-Dimethyl acetamide; DMAC	**OV**	Poor warning
Dimethylamine	2000	0.081	**5***	Anhydrous dimethylamine	**AM**	AM not specifically approved. Short OV service life.
Dimethylaminobenzene				(See Xylidine)		
Dimethylaniline	100	0.219	**5 -skin-**	N,N-Dimethylaniline	**OV**	
Dimethyl carbamoyl chloride			**0.005**	Chloroformic acid dimethylamide; Dimethyl carbamic chloride; Dimethylcarbamyl chloride; DMCC	**(F)MG**	
Dimethyldichlorosilane			**2 (ceiling) (AIHAWEEL)**	Dichlorodimethylsilane	**OV/AG**	Warning unknown
Dimethyl disulfide			**0.5**	Dimethyldisulfide; Dimethyl disulphide; 2,3-Dithiabutane; DMDS	**OV/AG**	

Dimethylethoxysilane			**0.5**	Ethoxydimethyl silane	**SA(F)**	Unknown sorbent effectiveness
Dimethylbenzene				(See Xylene)		
Dimethyl ether		0.3-9.0	**1000 (AIHAWEEL)**	Methyl ether, Wood ether	**SA**	Very short OV service life
Dimethyl formamide	3500	100	**10 -skin-**	N,N-Dimethyl formamide; DMF	**OV**	Poor warning
2,6-Dimethyl-4-heptanone				(See Diisobutyl ketone)		
1,1-Dimethylhydrazine	50	8.79	**0.01 -skin-**	unsym-Dimethylhydrazine, UDMH	**SA(F)**	Poor warning. Unknown sorbent effectiveness.
Dimethylphthalate	9300 mg/m^3		**5 mg/m^3**	DMP	**OV/P95**	See Comment D, page 8
N,N-Dimethyl-para-toluidine			**0.5 (AIHAWEEL)**	DMPT; N,N,4-trimethylaniline; 4-Dimethylaminotoluene; N,N,4-Trimethylbenzenamine	**OV**	
1,1-Dimethylpropyl acetate				(See Pentyl acetate)		
Dimethyl sulfide		0.0025	**10**	DMS, Thiobis (methane)	**OV/AG**	AG recommended since H_2S may also be present
Dimethyl sulfoxide			**250 -skin-**	DMSO, Methylsulfoxide	**OV**	
Dimethylsulfate	10		**0.1* -skin-**	Methyl sulfate	**(F)OV**	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/m³ (total dust) (AIHAWEEL)**		**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/m³**	Dinitolmide ; 2-Methyl-3, 5-dinitrobenzamide; Zoalene; Coccidin; Salcostat	**N95**	
Dinitrotoluene	200 mg/m³		**0.2 mg/m³ -skin-**	DNT	**OV/N95**	See Comment D, page 8
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/m³**	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/m³**	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 (AIHAWEEL)**	1,1-Dipheylethane with ethylated benzenes	**OV/P95**	
Emery			**10 mg/m³***	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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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
1,2-Epoxypropane				(See Propylene oxide)		
2,3-Epoxy-1-propanol				(See Glycidol)		
Erythromycin			**3 mg/m³ (AIHAWEEL)**	Dotycin, Erycin, Ericynum, E-Mycin™, Pentadecanoic acid	**N95**	
Ethane			**1000**	Dimethyl ethane, Methylmethane	**SA**	Short OV service life
Ethanolamine	1000	2.59	**3**	Ethylolamine, Monoethanolamine, B-Aminoethyl alcohol, 2-Aminoethanol, 2-Hydroxyethylamine	**OV**	
2-Ethoxyethanol	6000	1.22	**5* -skin-**	Ethylene glycol monoethyl ether, Glycol monoethyl ether, Cellosolve® solvent	**OV**	3M 3510 Monitor
2-Ethoxyethyl acetate	2500	0.182	**5* -skin-**	Cellosolve® acetate, Ethylene glycol monoethyl ether acetate	**OV**	3M 3510 Monitor
Ethyl acetate	10,000	0.61	**400**	Acetic ester, Acetic ether, Ethyl enthanoate	**(F)OV**	3M 3510 Monitor
Ethyl acrylate	2000	0.0009	**5* -skin-**	Acrylic acid ethyl ester	**(F)OV**	3M 3510 Monitor
Ethyl alcohol	15,000	0.136	**1000 STEL**	Ethanol	**OV**	Short OV service life at 10X OEL

Ethylamine	4000	0.324	**5* -skin-**	Anhydrous ethylamine, Aminoethane, Monoethylamine	**(F)AM**	AM not specifically approved. Short OV service life.
Ethyl amyl ketone	3000	6	**10**	EAK, 5-Methyl-3-heptanone	**(F)OV**	
Ethyl benzene	2000	2.3	**100**	Phenylethane, Ethylbenzol	**OV**	See Comment E, page 9. 3M 3510 Monitor.
Ethyl bromide	3500	3.09	**5* -skin-**	Bromoethane	**SA**	Short OV service life
Ethyl butyl ketone	3000	0.1-10	**50**	3-Heptanone	**OV**	See Comment E, page 9
Ethyl chloride	20,000	4.07	**100 -skin-**	Chloroethane, Monochloroethane, Hydrochloric ether	**SA**	Very short OV service life
Ethyl cyanoacrylate			**0.2**	2-Cyanoacrylic acid, ethyl ester; 2-Cyano-2 propenoic acid, ethyl ester; ECA; Ethyl alpha-cyanoacrylate; Ethyl 2-cyanoacrylate; Ethyl 2-cyano-2-propenoate	**OV**	Warning unknown
Ethyl tert-butyl ether			**5**	tert-Butyl ethyl ether; 1.1-Dimethyl-ehtyl ether; ETBE; 2-Ethoxy-2-methylpropane; Ethyl tert-butyl oxide; Ethyl 1,1-dimethylethyl ether	**OV**	
Ethylene			**200**	Acetene, Bicarburetted hydrogen, Elayl, Ethene, Olefiant gas	**SA(F)**	
Ethylene chlorohydrin	10	0.402	**1* (ceiling) -skin-**	2-Chloroethanol, 2-Chloroethyl alcohol	**OV**	3M 3510 Monitor

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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^3	**100 mg/m^3 (ceiling)**	Ethylene alcohol; Glycol; 1,2-Ethanediol	**OV/P95**	See Comments D and G, pages 8 & 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	**0.05 -skin-**	Ethyleimine, Dimethylenimine, Dihydroazirine, Azirane, Aziridine, Aminoethylene	**(F)MG**	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/m³**	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)		
Ferrovanadium, dust			**1 mg/m³**		**N95**	
Fibrous glass, dust				(See Synthetic vitreous fibers - Continuous filament glass fibers)		
Flour dust (as inhalable particles)			**0.5 mg/m³**		**N95**	

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Fluorides (as F)	500 mg/m³		**2.5 mg/m³**	Synonyms vary depending upon specific compound	**N95**	
Fluorine	25	0.126	**0.1 (PEL)**		**SA(F)**	Poor warning. Unknown reaction products with sorbent.
Fluorotrichloromethane				(See Trichlorofluoromethane)		
Formaldehyde	30	0.871	**0.3* (ceiling)**	Methylene oxide, Formalin	**(F)FORM**	Irritation also provides warning. 3M 3720 Monitor.
Formamide		80	**10* -skin-**	Methanamide	**OV**	Poor warning
Formic acid	30	28.2	**5**	Hydrogencarboxylic acid, Methanoic acid	**(F)OV**	Poor warning. 6X OEL maximum. Low IDLH.
Furfural	250	0.058	**2* -skin-**	2-Furaldehyde, Furfuraldehyde, Fural, 2-Furancarboxaldehyde	**(F)OV**	3M 3510 Monitor
Furfuryl alcohol	250	7.83	**10* -skin-**	2-Hydroxymethylfuran, 2-Furyl-methanol	**(F)OV**	See Comment E, page 9
Gallium arsenide			**0.3 µg/m³**	Gallium monoarsenide	**N100**	
Gasoline		0.3	**300**	Petrol	**(F)OV**	

Germanium tetrahydride			**0.2**	Germane, Germanium hydride	**SA(F)**	Warning unknown. Unknown sorbent effectiveness.
Glass, fibrous or dust				(See Synthetic vitreous fibers)		
Glutaraldehyde		0.038	**0.05 (ceiling)**	1,5-Pentanedial	**(F)OV**	See Comment E, page 9
Glycerin, mist			**10 mg/m³***	Glycerol	**R or P95**	
Glycidol	500		**2***	2-Hydroxymethyloxiran; Hydroxymethyl ethylene oxide; Epoxypropyl alcohol; 3-Hydroxy-propylene oxide; 2,3-Epoxy-1-propanol	**OV**	Warning unknown
Glycidyl methacrylate			**0.5 (AIHAWEEL) -skin-**	GMA	**OV**	
Glycol monoethyl ether				(See 2-Ethoxyethanol)		
Glyoxal (as inhalable aerosol and/or vapor)			**0.1 mg/m³**	Ethanedial, Biformyl, Diformyl, Oxaldehyde, 1,2-Ethanedione	**(F)OV/N95**	Short OV service for vapor at 10X OEL
Grain dust (oat, wheat, barley)			**4 mg/m³* (respirable)**		**N95**	
Graphite (natural)			**2.5 mg/m³* (respirable)**	Plumbago, Potelot, Corbo minerals, Black lead, Silver lead	**N95**	
Graphite (synthetic)			**2 mg/m³* (respirable)**		**N95**	

* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Gypsum				(See Calcium sulfate)		
Hafnium and compounds (as Hf)			**0.5 mg/m³**		**N95**	
Halothane		33	**50**	2-Bromo-2-chloro-1,1,1-trifluoroethane	**OV**	3M 3510 Monitor
Heptane	5000	9.77	**400***	Normal heptane, n-Heptane	**OV**	3M 3510 Monitor
2-Heptanone				(See Methyl n-amyl ketone)		
3-Heptanone				(See Ethyl butyl ketone)		
Hexachlorobenzene		0.463 mg/m³	**0.002 mg/m³ -skin-**	Perchlorobenzene	**N95**	
Hexachlorobutadiene			**0.02 -skin-**	Hexachloro-1,3-butadiene; perchlorobutadiene	**(F)OV**	Warning unknown
Hexachlorocyclopentadiene		0.03	**0.01**		**(F)OV**	Poor warning
Hexachloroethane	300	0.15	**1 -skin-**	Perchloroethane	**OV/N95**	
Hexachloronaphthalene	2 mg/m³		**0.2 mg/m³ -skin-**	Halowax™ 1014	**OV/N95**	See Comment D, page 8
1,4-Hexadiene			**10 (AIHAWEEL)**	1-Allylpropene	**OV**	Warning unknown

Hexafluoroacetone			**0.1 -skin-**	1,1,1,3,3,3-Hexafluoro-2-propanone	**SA**	Warning unknown. Short OV service life.
1,1,1,3,3,3-Hexafluoro-propane			**1000 (AIHAWEEL)**	HFC-236 fa; FC-236 fa; hydro-fluorocarbon 236 fa; FE-13	**SA**	Ineffective sorbents
Hexafluoropropylene			**0.1**	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	**SA**	Short OV service life
Hexahydrophthalic anhydride all isomers (as inhalable vapor and aerosol)			**0.005 mg/m³ (ceiling)**	1,2-Cyclohexanedicarboxylic acid anhydride; Cyclohexane-1, 2-dicarboxylic anhydride, cis and trans mixture; 1,2-Cyclohexanedi-carboxylic anhydride; Hexahydroph-thalic acid anhydride; Hexahydro-1, 3-isobenzofurandione; HHPA; HHPAA; 1,3-Isobenzofurandione, hexahdro	**OV/N95**	
Hexamethylene diisocyanate		0.01	**0.005**	HDI	**OV/N95**	Poor warning
Hexane (n-Hexane)	5000	21.9	**50* -skin-**	Hexyl hydride, Normal hexane	**OV**	3M 3510 Monitor
Hexane (other isomers)		65-248	**500**		**OV**	3M 3510 Monitor

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
1,6-Hexanediamine			**0.5**	Hexamethylenediamine; 1,6-diaminohexane; HMDA; HMD	**OV/N95**	
Hexanediol diacrylate			**1 mg/m³ (AIHAWEEL)**	HDODA; Propenoic acid, 1,6-hexanediol ester	**OV/P95**	See Comment D, page 8
2-Hexanone				(See Methyl n-butyl ketone)		
1-Hexene			**50**	Butyl ethylene; Hexene; Hex-1-ene; Hexene-n-1; Hexylene	**OV**	Warning unknown
Hexone				(See Methyl isobutyl ketone)		
sec-Hexyl acetate	4000	0.219	**50**	1,3-Dimethylbutyl acetate; Methylamyl acetate; Methylisoamyl acetate; Methylisobutyl carbinol	**(F)OV**	See Comment E, page 9
Hexylene glycol		49.9	**25 (ceiling)**	4-Methyl-2,4-pentanediol	**(F)OV**	Irritation also provides warning
HFE-7100			**750 (AIHAWEEL)**	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-Methyoxyperfluoroisobutane (60%)	**OV**	Warning unknown

Hydrazine	80	3.6	**0.01* -skin-**	Anhydrous hydrazine	**SA(F)**	Poor warning
Hydrogenated terphenyls			**0.5**		**R or P95**	
Hydrogen bromide		2	**2 (ceiling)**	Hydrobromic acid, HBr	**AG**	Not specifically approved for HBr
Hydrogen chloride	100	0.77	**2 (ceiling)**	Hydrochloric acid, HCl, Muriatic acid	**AG**	Irritation also provides warning
Hydrogen cyanide	50	0.603	**4.7* (ceiling) -skin-**	Hydrocyanic acid, Prussic acid	**SA(F)**	10X OEL maximum. Low IDLH.
Hydrogen fluoride	30	0.042	**0.5 -skin-**	Anhydrofluoric acid, HF, Etching acid, Fluorohydric acid, Fluoric acid	**(F)HF**	
Hydrogen peroxide	75		**1**	Peroxide, Hydrogen dioxide	**SA(F)**	See technical data bulletin 185
Hydrogen selenide (as Se)	2	0.3	**0.05**	Selenium hydride	**(F)MG**	Poor warning
Hydrogen sulfide	300	0.0005	**10***	Sulfuretted hydrogen, H_2S, Hydrosulfuric acid, Hepatic gas	**AG**	Poor warning (olfactory fatigue)
Hydroquinone			**1 mg/m³**	Quinol; Dihydroxybenzene; 1,4-Benzenediol	**(F)OV/N95**	See Comment D, page 8
Hydrotreated kerosene		0.1	**200 mg/m³ -skin-**		**OV/P95**	When aerosols present, add a particulate prefilter
4-Hydroxy-4-methyl-2-pentanone				(See Diacetone alcohol)		

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
2-Hydroxypropyl acrylate			**0.5 -skin-**	HPA	**OV**	Warning unknown
Indene		0.009	**5**	Indonaphthene	**OV**	
Indium and compounds (as In)			**0.1 mg/m³**		**N95**	
Iodine and Iodides (inhalable fraction and vapor)	10		**0.01 (ceiling)**		**(F)MG**	Warning unknown
Iodoform		0.000019-1.1	**0.6**	Triiodomethane	**(F)OV**	Questionable warning
Iron oxide (as respirable particulate mass)			**5 mg/m³***	Ferric oxide, Hematite, Burnt sienna, Burnt umber, Jeweler's rouge, Rouge	**N95**	
Iron pentacarbonyl (as Fe)			**0.1**	Iron carbonyl	**SA**	Warning unknown. Unknown sorbent effectiveness.
Iron salts, soluble (as Fe)			**1 mg/m³**	Ferrous sulfate and chloride; Ferric chloride, nitrate and sulfate	**N95**	
Isoamyl acetate		0.004		(See Pentyl acetate)		
Isoamyl alcohol	10,000	0.045	**100**	3-Methyl-1-butanol, Isobutyl carbinol, Isopentyl alcohol, Fusel oil	**(F)OV**	See Comment E, page 9

Isobutene			**250**	1,1-Dimethylethene, 1,1-Dimethylethylene, Isobutylene, 2-Methylpropene, 2-Methylpropylene	**OV**	
Isobutyl acetate	7500	0.479	**150**	2-Methylpropyl acetate	**(F)OV**	
Isobutyl alcohol	8000	0.832	**50***	Isobutanol, IBA, 2-Methyl-1-propanol, Isopropylcarbinol	**(F)OV**	3M 3510 Monitor
Isobutane			**1000**	Methylpropane; 2-methylpropane	**SA**	Short OV service life
Isobutyl nitrite (Inhalable aerosol and vapor)			**1 (ceiling)**	IBN; Nitrous acid, isobutyl ester; Nitrous acid, 2-methylpropyl ester	**F(OV)N95**	See Comment E, page 9
Isobutyraldehyde			**25**	Isobutanal, 2-Methylpropanal, Isobutyric aldehyde, Isobutyl aldehyde, 2-Methylpropionaldehyde, 2-Methyl-1-propanal, Valine aldehyde	**OV**	Short OV service life
Isocyanuric acid			**10 mg/m³ (total) (AIHAWEEL) 5 mg/m³ (respirable) (AIHAWEEL)**	Cyanuric acid, s-Triazinetriol, s-Triazine-2,4,6(1H,3H,5H)-trione	**N95**	AM/N95 may be preferable, if wet
Isooctyl alcohol			**50 -skin-**	Isooctanol	**OV**	Warning unknown
Isophorone	800	0.631	**5* (ceiling)**	3,5,5-Trimethyl-2-cyclohexene-1-one	**OV**	See Comment E, page 9. 3M 3510 Monitor.

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Isophorone diisocyanate			**0.005**	IPDI	**OV/N95**	Warning unknown
Isophthalic acid			**5 mg/m³ (respirable) (AIHAWEEL)**	1,3-Dicarboxylic acid; m-Phthalic acid; IA; IPA	**N95**	
Isoprene			**2 (AIHAWEEL)**	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/m³* (respirable)**	China clay, Aluminum silicate	**N95**	
Ketene			**0.5**	Carbomethene, Ethenone	**SA(F)**	Warning unknown. Ineffective sorbents.
Kerosene (Total hydrocarbon vapor)			**200 mg/m³ -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/m³		**0.05 mg/m³**		**N100**	
Lead arsenate (as As)			**0.01 mg/m³ (PEL)**		**N100**	
Lead chromate (as Cr)			**0.012 mg/m³***	Chrome orange, Red lead chromate	**N100**	
Limestone				(See Calcium carbonate)		
d-Limonene		0.437	**30 (AIHAWEEL)**	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/m³**		**N95**	
Lithium hydride	55 mg/m³		**0.025 mg/m³**		**N95**	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Lithium hydroxide			**1 mg/m³ (ceiling) (AIHAWEEL)**	Lithium hydroxide monohydrate	**N95**	
Lithium oxide			**1 mg/m³ (ceiling) (AIHAWEEL)**	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** **-Respirable fraction**			 **15 mg/m³ (PEL)** **5 mg/m³ (PEL)**	Magnesium carbonate	**N95**	
Magnesium oxide fume			**10 mg/m³***	Magnesia fume	**N95**	
Maleic anhydride		0.318	**0.1**		**(F)OV/N95**	Poor warning
Manganese, elemental and inorganic compounds (as Mn)			**0.2 mg/m³***		**N95**	
Manganese cyclopenta-dienyl tricarbonyl			**0.1 mg/m³ -skin-**	MCT	**SA**	Properties of vapor unknown

Marble				(See Calcium carbonate)		
Melamine			**10 mg/m³ (inhalable) (AIHAWEEL)** **5 mg/m³ (respirable) (AIHAWEEL)**	1,3,5-Triazine-2,4,6-triamine; 2,4,6-Triamino-1,3,5-Triazine, Cyanuramide	**N95** **N95**	
2-Mercaptobenzo-thiazole		12 mg/m³	**5 mg/m³ -skin- (AIHAWEEL)**	Mercaptobenzothiazole; 2(3H)-Benzothiazolyl mercaptan; Benzothiazole-2-thione	**N95**	
Mercaptoethanol		0.12-0.64	**0.2 -skin- (AIHAWEEL)**	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/m³		**0.025 mg/m³* -skin-**	Quicksilver, Hg	**Hg**	
–Alkyl compounds	10 mg/m³		**0.01 mg/m³ -skin-**		**SA**	
–Aryl compounds	28 mg/m³		**0.1 mg/m³ -skin-**		**N95**	Dust with essentially no vapor pressure only

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
–Inorganic compounds	28 mg/m^3		**0.025 mg/m^3***		**N95**	Dust with essentially no vapor pressure only. Hg/N95 for volatile liquids.
Mesityl oxide	5000	0.056	**15***	Isobutenyl methyl ketone, Methyl isobutenyl ketone, Isopropylidene acetone	**(F)OV**	3M 3510 Monitor
Methacrylic acid			**20 -skin-**	a-Methacrylic acid	**(F)OV**	Warning unknown
Methane			**1000**	Biogas; Fire damp; Marsh gas; Methylhydride; Natural gas; R 50 (refrigerant)	**SA**	Short OV service life
Methanethiol				(See Methyl mercaptan)		
2-Methoxyethanol	2000	0.11	**0.1 -skin-**	Ethylene glycol monomethyl ether, Methyl Cellosolve®	**OV**	3M 3510 Monitor
2-Methoxyethyl acetate	4000	1.07	**0.1 -skin-**	Ethylene glycol methyl ether acetate, Ethylene glycol monomethyl ether acetate, Methyl Cellosolve® acetate	**OV**	3M 3510 Monitor
4-Methoxyphenol			**5 mg/m^3**	p-Methoxyphenol, Hydroquinone monomethyl ether	**N95**	

3-Methoxypropyl amine		2.7	**5 (AIHAWEEL)**	1-Propanimine, 3-Methoxy	**(F)OV (F)AM**	Irritation also provides warning. AM not specifically approved.
Methyl acetate	10,000	6.17	**200**	Acetic acid, methyl ester; Methyl acetic ester; Methyl ethanoate	**OV**	
Methyl acetylene	15,000		**1000**	Propyne, Allylene	**SA**	Warning unknown. Very short OV service life.
Methyl acetylene propadiene mixture	15,000	100	**1000**	MAPP gas, Methyl acetylene-allene mixture, Propyne-allene mixture	**SA**	Very short OV service life
Methyl acrylate	1000	0.263	**2 -skin-**	Methyl propenoate	**(F)OV**	3M 3510 Monitor
Methylacrylonitrile		6.8	**1 -skin-**	2-Methyl-2-propenenitrile, Isoprene cyanide	**SA**	Poor warning
Methylal	15,000		**1000**	Dimethyoxymethane, Methyl formal, Formal, Dimethylacetal formaldehyde	**SA**	Warning unknown
Methyl alcohol	25,000	141	**200 -skin-**	Methanol, Wood alcohol, Carbinol	**SA**	Very short OV service life
Methylamine	100	0.019	**5***	Monomethylamine	**(F)AM**	
Methyl amyl alcohol	2000	1.1	**25 -skin-**	Methyl isobutyl carbinol	**OV**	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Methyl n-amyl ketone	4000	0.141	**50***	n-Amyl methyl ketone, 2-Heptanone	**OV**	See Comment E, page 9
Methylaniline	100	1.74	**0.5*** **-skin-**	Monomethyl aniline, MA, N-Methyl aniline	**OV**	Poor warning
Methyl bromide	2000		**1*** **-skin-**	Bromomethane	**SA(F)**	Short OV service life. Use of 60928 Cartridge/ Filter recommended by 3M; not specifically approved for methyl bromide.
2-Methylbutyl acetate				(See Pentyl acetate)		
Methyl n-butyl ketone	5000	0.166	**5*** **-skin-**	2-Hexanone, MBK	**OV**	3M 3510 Monitor
Methyl Cellosolve®				(See 2-Methoxyethanol)		
Methyl Cellosolve® acetate				(See 2-Methoxyethyl acetate)		
Methyl chloride	10,000	10.2	**50*** **-skin-**	Chloromethane	**SA**	Very short OV service life
Methyl chloroform	1000	22.4	**350**	1,1,1-Trichloroethane	**OV**	3M 3510 Monitor
Methyl 2-cyanoacrylate		2.16	**0.2**	Mecrylate	**(F)OV**	Poor warning
Methylcyclohexane	10,000	500-630	**400***	Cyclohexylmethane, Hexahydrotoluene	**OV**	Poor warning

Methylcyclohexanol	10,000	490	**50***	Hexahydrocresols	**OV**	Poor warning
o-Methylcyclohexanone	2500		**50* -skin-**	2-Methylcyclohexanone	**(F)OV**	Irritation also provides warning
2-Methylcyclopentadienyl manganese tricarbonyl (as Mn)			**0.2 mg/m^3 -skin-**		**OV/N95**	SA preferable if heat involved
Methylenebisphenyl isocyanate	9.7	0.384	**0.005***	MDI; 4,4'-Diphenylmethane diisocyanate; Methylene-bis-(4-phenyl isocyanate)	**OV/N95**	Poor warning
Methylene chloride	5000	0.912	**25 (PEL)**	Dichloromethane, Methylene dichloride	**SA(F)**	OSHA requires SA(F); no change schedule allowed. Short OV service life. 3M 3530 Monitor.
4,4'-Methylene-bis-(2-chloroaniline)			**0.01 -skin-**	MOCA; DACPM; 4,4'-Methylene -bis-(2-chlorobenzamine)	**OV**	Warning unknown
Methylene-bis-(4-cyclohexylisocyanate)			**0.005**		**OV/N95**	Warning unknown
4,4'-Methylene dianiline			**0.01 (PEL) -skin-**	4,4'-Diaminodiphenylmethane; MDA	**N100**	Warning unknown. Use OV/N100 if heat is involved. See 29 CFR 1910.1050.
Methyl ethyl ketone	3000	0.27	**200**	MEK, 2-Butanone	**(F)OV**	3M 3510 Monitor

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Methyl ethyl ketone peroxide			**0.2 (ceiling)**	MEKP	**(F)OV**	Warning unknown
Methyl ethyl ketoxime			**10 (AIHAWEEL)**	2-Butanone oxime, MEKO	**OV**	Warning unknown
Methyl formate	5000	93.3	**100** Methyl ester	Methyl methanoate, Formic acid,	**SA**	Short OV service life
5-Methyl-3-heptanone				(See Ethyl amyl ketone)		
Methyl hydrazine	50	1.71	**0.01 -skin-**	Monomethyl hydrazine	**SA(F)**	Poor warning. Unknown sorbent effectiveness.
Methyl iodide	800		**2 -skin-**	Iodomethane	**SA(F)**	Warning unknown. Short OV service life.
Methyl isoamyl ketone		0.042	**50***	5-Methyl-2-hexanone, 2-Methyl-5-hexanone, MIAK	**(F)OV**	
Methyl isobutyl carbinol				(See Methyl amyl alcohol)		
Methyl isobutyl ketone	3000	0.121	**50***	MIBK, Hexone	**(F)OV**	3M 3510 Monitor
Methyl isocyanate	20	2.1	**0.02 -skin-**	Isocyanic acid, methyl ester	**SA**	Poor warning. Unknown sorbent effectiveness.
Methyl isopropyl ketone		4.47	**200**	MIPK, 3-Methyl-2-butanone	**(F)OV**	

Methyl mercaptan		0.001	**0.5***	Mercaptomethane; Methanediol; Methyl sulfhydrate; Thiomethyl alcohol	**OV**	Very short OV service life
Methyl methacrylate	4000	0.085	**50**	Methacrylic acid, methyl ester	**OV**	3M 3510 Monitor
1-Methylnaphthalene			**0.5 -skin-**	a-Methylnaphthalene; a-Methyl naphthalene	**OV/R or P95**	
2-Methylnaphthalene			**0.5 -skin-**	B-Methylnaphthalene; B-Methyl naphthalene	**OV/R or P95**	
Methyl propyl ketone	5000	1.55	**150 STEL**	MPK, 2-Pentanone, Ethyl acetone	**(F)OV**	3M 3510 Monitor
n-Methyl-2-pyrrolidone			**10 -skin- (AIHAWEEL)**	NMP; 1-Methyl-2-pyrrolidone; m-Pyrol**;** n-Methyl pyrrolidone	**OV**	Warning unknown
Methyl silicate			**1**	Tetramethoxy silane	**(F)OV**	Warning unknown
a-Methyl styrene	5000	0.003	**50**	1-Methyl-1-phenyl-ethylene, AMS	**OV**	See Comment E, page 9. PEL-100 ppm ceiling.
Methyl tert-butyl ether		0.053	**50**	2-Methoxy-2-methyl-propane; tert-Butyl methyl ether; MTBE; 2,2-MMOP	**OV**	3M 3510 Monitor
Methyltrichlorosilane			**1 (ceiling) (AIHAWEEL)**	Trichloromethylsilane	**(F)AG/N95**	Irritation provides warning

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Methyl vinyl ketone		0.2	**0.2 (ceiling) -skin-**	Acetyl ethylene; 3-Buten-2-one; 3-Butene-2-one; Butenone; d(3)-2-Butenone; Methylene acetone; Methyl vinyl acetone; g-Oxo-a-Butylene	**OV**	
Mica (less than 1% quartz)			**3 mg/m³* (respirable)**		**N95**	
Mineral spirits				(See Stoddard solvent)		
Mineral (rock), wool fiber				(See Synthetic vitreous fibers–Glass, Rock or Slag wool fibers)		
Molybdenum (as Mo) –Soluble compounds (as respirable particulate)			**0.5 mg/m³**		**N95**	
–Insoluble compounds (as inhalable particulate)			**10 mg/m³**		**N95**	
(as respirable particulate)			**3 mg/m³**		**N95**	
Monochloroacetic acid (as inhalable fraction and vapor)		0.045	**0.5 -skin-**	MCAA, Chloroethanoic acid	**(F)OV/N95**	
Monochlorobenzene				(See Chlorobenzene)		
Monomethyl aniline				(See Methyl aniline)		
Monomethyl hydrazine				(See Methyl hydrazine)		

Morpholine	8000	0.036	**20 -skin-**	Tetrahydro-1,4-oxazine; Diethylenimide oxide	**(F)OV**	
Naphtha (coal tar)	10,000		**100 (PEL)**	Naphtha, Crude solvent coal tar naphtha, High solvent naphtha, Rubber solvent	**(F)OV**	Odor variable. Irritation also provides warning.
Naphthalene	500	0.015	**10**	White tar, Naphthalin	**OV**	3M 3510 Monitor. See Comment E, page 9.
Natural rubber latex (as inhalable total proteins)			**0.0001 mg/m³ -skin-**	Caoutchouc; India rubber; Natural latex; Natural rubber; NRL; Polyisoprene; Rubber	**N95**	
Nickel (as Ni)						
–Elemental/metal			**1 mg/m³ (PEL)**		**N95**	
–Insoluble compounds			**0.2 mg/m³ (inhalable)**		**N95**	
–Soluble compounds			**0.1 mg/m³ (inhalable)**		**N95**	
Nickel carbonyl	7	0.5-3.0	**0.001 (PEL)**	Nickel tetracarbonyl	**SA(F)**	0.05 ppm TLV-TWA. Unknown sorbent effectiveness.
Nickel subsulfide			**0.1 mg/m³ (inhalable)**		**N95**	
Nicotine	35 mg/m³		**0.5 mg/m³ -skin-**	3-(1-Methyl-2-pyrrolidyl) pyridine	**OV/P95**	See Comment D, page 8

* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Nitric acid	100	0.267	**2**	Aqua fortis, White fuming nitric acid (WFNA), Red fuming nitric acid (RFNA), Hydrogen nitrate	**SA(F)**	Ineffective sorbents
Nitric oxide	100		**25**	Nitrogen monoxide, NO	**SA**	Ineffective sorbents
p-Nitroaniline	300 mg/m^3		**3 mg/m^3* -skin-**	Azoic diazo component 37, p-Aminonitro-benzene, Fast red GG base, 4-Nitroaniline, PNA	**OV/N95**	See Comment D, page 8
Nitrobenzene	200	0.044	**1 -skin-**	Nitrobenzol, Oil of mirbane	**OV**	
p-Nitrochlorobenzene	344		**0.1* -skin-**	PNCB, PCNB, 4-Chloronitrobenzene, p-Chloronitrobenzene, 1-Chloro-4-nitrobenzene	**OV**	Warning unknown
Nitroethane	1000	2.11	**100**		**(F)OV**	
Nitrogen dioxide	50	0.186	**3**	Nitrogen tetroxide, NTO, Dinitrogen tetroxide, Nitrogen peroxide	**SA**	Ineffective sorbents. PEL-5 ppm ceiling.
Nitrogen trifluoride	2000		**10**	Nitrogen fluoride	**SA**	Warning unknown. Unknown sorbent effectiveness.
Nitroglycerin (NG)	53		**0.05* -skin-**	Glyceryl trinitrate, Trinitroglycerin	**OV**	Warning unknown

Nitromethane	1000	3.5	**20**	Nitrocarbol	**OV**	
1-Nitropropane	2300	7.09	**25**		**OV**	
2-Nitropropane	2300	4.85	**10***	sec-Nitropropane	**OV**	
Nitrotoluene	200	0.017	**2*** **-skin-**	Nitrotoluol	**OV/N95**	See Comment D, page 8
5-Nitro-o-toluidine (Inhalable particulate matter)			**1 mg/m³**	2-Methyl-5-nitrobenzenamine; 5-Nitro-2-toluidine; Azoic Diazo Compound 12	**OV/R or P95**	
Nitrotrichloromethane				(See Chloropicrin)		
Nitrous oxide			**50**	Dinitrogen monoxide	**SA**	Warning unknown. ineffective sorbents.
Nonane		1.26	**200**	n-Nonane	**OV**	
Octachloronaphthalene			**0.1 mg/m³** **-skin-**	Halowax™ 1051	**OV/N95**	See Comment D, page 8
Octane (all isomers)	5000	5.75	**300***	Normal octane; Isooctane	**OV**	3M 3510 Monitor
1-Octanol		0.006	**50** **(AIHAWEEL)**	Alcohol C-8, Capryl alcohol, Heptyl carbinol, n-Octanol, 1-Hydroxyoctane, N-Octyl alcohol	**OV**	
1-Octene		2	**75** **(AIHAWEEL)**	a-Octylene, a-Octene	**OV**	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Oil mist (mineral)			**5 mg/m³**	White mineral oil, Cutting oil, Heat-treating oil, Hydraulic oil, Cable oil, Lubricating oil	**R or P95**	As sampled by method that does not collect vapor. 0.005 mg/m³ TLV-TWA proposed for oils that contain PNAs.
Osmium tetroxide (as Os)	0.1	0.002	**0.0002***	Osmic acid	**SA(F)**	Poor warning. Unknown sorbent effectiveness.
Oxalic acid	500 mg/m³		**1 mg/m³**	Oxalic acid dihydrate, Ethane dioic acid	**OV/N95**	See Comment D, page 8
p,p'-Oxybis (Benzene-sulfonyl hydrazide)			**0.1 mg/m³**	Benzenesulfonic acid, 4,4'-Oxybis-dihydrazide; OBSH; Diphenyl ether 4,4'-disulfohydrazide	**N95**	
Oxygen difluoride	0.5	0.098	**0.05 (ceiling)**	Difluorine monoxide, Fluorine monoxide	**SA**	Poor warning. Unknown sorbent effectiveness.
Ozone	10	0.051		Triatomic oxygen		6000 with 2078 or 2097 filters recommended by 3M for 10X OEL. Not NIOSH approved for ozone.
–Heavy work			**0.05**		**OZ**	
–Moderate work			**0.08**		**OZ**	
–Light work			**0.1**		**OZ**	

Paraffin wax fume			**2 mg/m³**		**N95**	
Particulate polycyclic aromatic hydrocarbons (PPAH)				(See Coal tar pitch volatiles)		
Particulates Not Otherwise Regulated **-Total dust** **-Respirable fraction**			**15 mg/m³** **5 mg/m³ (PEL)**	Nuisance particulates	**N95**	This category includes many materials. For oils, and R or P95 filter/respirator is recommended.
(PPAH)						
PCBs				(See Chlorodiphenyl)		
Pentaborane	3	0.97	**0.005**	Stable pentaborane, Pentaboron nonahydride	**SA**	Poor warning. Unknown sorbent effectiveness.
Pentachloronaphthalene			**0.5 mg/m³**	Halowax™ 1013	**OV/N95**	See Comment D, page 8
Pentaerythritol			**10 mg/m³***	Tetramethylolmethane	**N95**	
Pentaerythritol triacrylate			**1 mg/m³ (AIHAWEEL)**	PETA; 2-Propenoic acid, 2-(hydroxymethyl)-2-[[(1-oxo-2 propenyl) oxy] methyl]-1,3-propanediylester	**OV/P95**	See Comment D, page 8
1,1,1,2,2-Pentafluoro-ethane			**1000 (AIHAWEEL)**	Pentafluoroethane; HFC-125; Fluorocarbon 125	**SA**	Ineffective sorbents
Pentane, all isomers	15,000	31.6	**600***	Normal pentane	**OV**	
2-Pentanone				(See Methyl propyl ketone)		

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
1,1,1,3,3-Pentafluoro-propane			**300 (AIHAWEEL)**	HFC-245fa, R-245fa, Genetron 245fa	**SA**	
Pentyl acetate (all isomers)	3000-9000 (depending on compound)		**50**	Isoamyl acetate, 1-pentanol acetate, 2-pentanol acetate, 3-Pentyl acetate, 2-Methylbutyl acetate, 1,1-Dimethyl-propyl acetate	**OV**	See Comment E, page 9. 3M 3510 Monitor.
Perchloroethylene	500	6.17	**25***	Tetrachloroethylene, Perk	**(F)OV**	
Perchloromethyl mercaptan	10	0.097	**0.1**	PMM, Trichloromethyl sulfur chloride	**OV**	
Perchloryl fluoride	385	11	**3**	Chlorine oxyfluoride	**SA**	Poor warning. Unknown sorbent effectiveness.
Perfluorobutyl ethylene			**100**	1-Hexane, 3,3,4,4,5,5,6,6, 6-nonafluoro; 1H, 1H, 2H-Perflourohexene; PFBE	**OV**	Short OV service life
Perfluoroisobutylene			**0.01 (ceiling)**	Octafluoroisobutylene, Octafluoro-sec-butene, PFIB	**SA**	Warning unknown. Short OV service life.
Persulfates						
-Ammonium			**0.1 mg/m³**		**N95**	
-Potassium			**0.1 mg/m³**		**(F)N95**	
-Sodium			**0.1 mg/m³**		**(F)N95**	

Pesticides				(Call 3M at 1-800-243-4630)		
Petroleum distillates (naphtha)	10,000		**500 (PEL)**	Petroleum naphtha, Aliphatic petroleum naphtha, Petroleum ether (95 to 115°C), Naphtha (See Gasoline, Stoddard solvent and VM&P Naphtha)	**OV**	Odor variable
Phenacyl chloride				(See a-Chloroacetophenone)		
Phenol	250	0.011	**5 -skin-**	Carbolic acid, Monohydroxy benzene	**OV/N95**	
m-Phenylenediamine			**0.1 mg/m³**	1,3-Benzenediamine; m-Diaminobenzene	**OV/N95**	SA preferable if heat involved
o-Phenylenediamine			**0.1 mg/m³**	1,2-Benzenediamine; o-Diaminobenzene; Orthamine	**OV/N95**	SA preferable if heat involved
p-Phenylenediamine			**0.1 mg/m³ -skin-**	p-Diaminobenzene; 1,4-Diamino-benzene	**OV/N95**	SA preferable if heat involved
Phenyl ether, vapor		0.03	**1**	Diphenyl ether, Diphenyl oxide	**OV**	See Comment E, page 9. 3M 3510 Monitor.
Phenyl ether-biphenyl mixture, vapor		0.001-0.01	**1 (PEL)**	Dowtherm™ A, Diphenyl oxide-diphenyl mixture	**OV**	See Comment E, page 9
Phenylethylene				(See Stryrene)		
Phenyl glycidyl ether			**0.1* -skin-**	Glycidyl phenyl ether; Phenyl epoxypropyl ether; 1,2-Epoxy-3-phenoxy propane; PGE	**OV**	Warning unknown
Phenylhydrazine	295		**0.1* -skin-**	Hydrazinobenzene	**(F)OV**	Warning unknown

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Phenyl mercaptan		0.00094	**0.1 -skin-**	Benzenethiol, Thiophenol	**OV**	
Phenylphosphine			**0.05 (ceiling)**		**OV**	Warning unknown
Phosgene	2	0.55	**0.1**	Carbonyl chloride, Carbon oxychloride, Chloroformyl chloride	**MG**	Poor warning
Phosphine	200	0.14	**0.3**	Hydrogen phosphide, Phosphorus hydride, Phosphorated hydrogen	**SA**	Unknown sorbent effectiveness. Fumigant.
Phosphoric acid	10,000 mg/m^3		**1 mg/m^3**	White phosphoric acid, o-phosphoric acid, m-phosporic acid	**(F)N95**	N95 with appropriate eye and face protection also acceptable
2-Phosphono-1,2,4-butanetricarboxylic acid			**10**	PBTC	**N95**	
Phosphorus (yellow)			**0.1 mg/m^3**	White phosphorus, WP	**SA**	If no phosphorus vapor or phosphine gas present, N95
Phosphorus oxychloride			**0.1**	Phosphoryl chloride	**(F)AG**	Warning unknown
Phosphorus pentachloride	200 mg/m^3		**0.1***	Phosphoric chloride	**AG**	Warning unknown
Phosphorus pentasulfide	750 mg/m^3		**1 mg/m^3**	Phosphoric sulfide	**N95**	

Phosphorus trichloride	50		**0.2**	Phosphorus chloride	**(F)AG**	Warning unknown
Phthalic anhydride	1650	0.052	**1***	PAN; 1,3-Isobenzofurandione	**OV/N95**	
m-Phthalodinitrile			**5 mg/m³**	Isophthalodinitrile, IPN, m-Dicyanobenzene	**N95**	
2-Picoline		0.003	**2 -skin- (AIHAWEEL)**	a-Picoline, 2-Methyl-pyridine	**OV**	
3-Picoline			**2 -skin- (AIHAWEEL)**	b-Picoline, 3-Methyl-pyridine	**OV**	Warning unknown
4-Picoline			**2 -skin- (AIHAWEEL)**	g-Picoline, 4-Methyl-pyridine	**OV**	Warning unknown
Picric acid		0.0005 mg/m³	**0.1 mg/m³ -skin-**	2,4,6-Trinitrophenol, Lyddite, Pertite, Shimose, Melinite	**N95**	
Piperazine dihydrochloride			**5 mg/m³**	Dihydrochloride salt of diethylenediamine	**N95**	
Piperidine		0.372	**1 (AIHAWEEL)**	Hexahydropyridine	**(F)OV**	
Plaster of Paris				(See Calcium sulfate)		
Platinum (as Pt)						
–Metal			**1 mg/m³**		**N95**	
–Soluble salts			**0.002 mg/m³**		**(F)N95**	
Polychlorinated biphenyls				(See Chlorodiphenyls)		

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Polyethylene glycols			**10 mg/m³ (AIHAWEEL)**	PEG, Polyoxyethylene, PGE	**R or P95**	See Comment G, page 9
Polypropylene glycols			**10 mg/m³ (AIHAWEEL)**	PPG	**R or P95**	See Comment G, page 9
Polyvinyl chloride			**1 mg/m³**	Cloroethylene homopolymer, Cloroethylene polymer, Cloroethene polymer, Polychloroethylene, Vinyl Chloride homoploymer, Vinyl chloride polymer, PVC	**N95**	
Portland cement (less than 1% quartz)			**10 mg/m³***	Hydraulic cement, Cement, Portland cement silicate	**N95**	
Potassium bromate			**0.1 mg/m³ (AIHAWEEL)**	Bromic acid, Potassium salt	**N95**	
Potassium hydroxide			**2 mg/m³ (ceiling)**	Caustic potash, Lye, Potassium hydrate	**N95**	
Propane		2690	**1,000**	Dimethyl methane n-Propane; Propane, various grades	**SA**	Ineffective sorbents
n-Propanol	4000	2.6	**100 -skin-**	Alcohol, n-Propyl alcohol, 1-Propanol, Ethylcarbinol	**F(OV)**	See comment E, page 9
2-Propanol	12,000	0.44	**200 -skin-**	Isopropanol, IPA, Isopropyl alcohol, sec-Propyl alcohol	**F(OV)**	Irritation also provides warning. 3M 3530 Monitor.

Propargyl alcohol		0.015	**1** **-skin-**	2-Propyn-1-ol	**OV**	
Propargyl bromide		<2	**0.1** **-skin-** **(AIHAWEEL)**	Bromopropyne; Propyne, 3-bromo; 1-Bromo-2-propyne; 3-Bromopropyne, gamma-Bromoallylene	**OV**	Questionable warning properties
2-Propenoic Acid, Isooctyl ester		<1	**5** **(AIHAWEEL)**	Isooctyl acrylate; IOA	**OV**	
B-Propiolactone			**0.5**	Hydroacrylic acid, beta-lactone; 3-Hydroxypropionic acid; Propiolactone; 3-Hydroxy-beta-lactone; beta-Proprolactone; BPL	**(F)OV**	Warning unknown. OSHA requires SA with hood for certain applications; see 29 CFR 1910.1003.
Propionaldehyde		0.145	**20**	1-Propanal, Methylacetaldehyde, Propylaldehyde	**SA**	Very short OV service life.
Propionic acid		0.037	**10**	Methylacetic acid, Ethylformic acid	**(F)OV**	
n-Propyl acetate	8000	0.575	**200**	Propylacetate; Acetic acid, n-propyl ester	**(F)OV**	3M 3510 Monitor
Propylene		17	**500**	Propene, Methylethene, Methylethylene, 1-Propane, 1-Propylene	**SA**	
Propylene dichloride	2000	0.851	**10**	1,2-Dichloropropane	**OV**	3M 3510 Monitor
Propylene glycol **–Vapor and aerosol**			**50** **(AIHAWEEL)**	1,2-Propanediol; 1,2-Dihydroxy-propane; Methyl glycol	**OV/P95**	See Comment G, page 9
–Aerosol only			**10 mg/m³** **(AIHAWEEL)**		**R or P95**	See Comment G, page 9

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Propylene glycol dinitrate		0.231	**0.05 -skin-**	1,2-Propylene glycol dinitrate; 1,2-Propanediol dinitrate	**(F)OV**	Poor warning
Propylene glycol monomethyl ether		0.003	**100**	1-Methoxy-2-propanol	**OV**	3M 3510 Monitor
Propylene glycol monomethyl ether acetate			**50 (AIHAWEEL)**	Glycol ether PM acetate; PGMEA; 1-Methyoxy-2-propanol acetate; 2-Methoxy-1-methylethyl acetate; 1-Methoxy-2-acetoxypropane	**OV**	Warning unknown. 3M 3510 Monitor.
Propylene imine	500		**0.2 -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 (AIHAWEEL)**	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/m³ (PEL)**		**N95**	
–Insoluble compounds			**0.1 mg/m³ (PEL)**		**N95**	
–Soluble compounds			**0.001 mg/m³ (PEL)**		**N95**	
Rubber solvent				(See Naphtha [coal tar])		
Selenium and compounds (as Se)			**0.2 mg/m³**		**N95**	
Selenium hexafluoride	5		**0.05**		**SA**	Warning unknown. Unknown sorbent effectiveness.
Silane				(See Silicon tetrahydride)		
Silica, amorphous						
–Diatomateous earth			**0.80 mg/m³ (PEL)**	Diatomite, Silicon dioxide	**N95**	Assuming 100% SiO_2 (80 mg/m³ divided by %SiO_2)
Silica, crystalline						
–Cristobalite			**0.025 mg/m³ (respirable)**		**N95**	
–Quartz			**0.025 mg/m³* (respirable)**		**N95**	
–Tripoli			**0.1 mg/m³ (respirable)**		**N95**	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Silicon					**N95**	
-Total dust			**15 mg/m³ (PEL)**			
-Respirable fraction			**5 mg/m³ (PEL)**			
Silicon carbide					**N95**	
- Nonfibrous particles (containing no asbestos and <1% cystalline silica)						
Inhalable particulate mass			**10 mg/m³**		**N95**	
Respirable particulate mass			**3 mg/m³**		**N95**	
- Fibrous forms (including whiskers)						
Respirable fibers			**0.1 f/cc**		**N95**	
Silicon tetrahydride			**5**	Silane	**SA**	Warning unknown
Silver, metal and soluble compounds (as Ag)			**0.01 mg/m³ (PEL)**		**N95**	
Soapstone			**3 mg/m³ (respirable)**	Massive talc, Steatite, Soapstone silicate	**N95**	
Sodium azide				Hydrazoic acid		
–as Sodium azide			**0.29 mg/m³ (ceiling)**		**N95**	
–as Hydrazoic acid vapor			**0.11 (ceiling)**		**SA**	Warning unknown. Unknown sorbent effectiveness.

Sodium bisulfite			**5 mg/m³**	Sodium hydrogen sulfite	**AG/N95**	N95 alone suitable if irritation eliminated
Sodium chloroacetate			**2.5 mg/m³ (AIHAWEEL)**	Monoxone, Sodium monofluoroacetate, Chloroacetic acid, Sodium salt	**N95**	
Sodium fluoroacetate	5 mg/m³		**0.05 mg/m³ -skin-**	1080, Sodium monofluoroacetate, SFA	**N95**	
Sodium hydroxide	250 mg/m³		**2 mg/m³ (ceiling)**	Caustic soda, Soda lye, Lye	**N95**	
Sodium hypochlorite			**2 mg/m³ (AIHAWEEL) STEL**	Hypochlorous acid, sodium salt; Sodium oxychloride	**N95**	
Sodium metabisulfite			**5 mg/m³**	Sodium pyrosulfite	**AG/N95**	N95 alone suitable if irritation eliminated
Starch			**10 mg/m³***	Corn starch	**N95**	
Stearates			**10 mg/m³**	Aluminum stearate, Calcium stearate, Glyceryl stearate, Lithium stearate, Potassium stearate, Zinc stearate	**N95**	
Stibine	40		**0.1**	Hydrogen antimonide, Antimony trihydride	**SA**	Warning unknown. Unknown sorbent effectiveness.
Stoddard solvent	5150	1-30	**100***	Dry cleaning safety solvent, Mineral spirits	**OV**	3M 3510 Monitor

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Strontium chromate (as Cr)			**0.0005 mg/m³**	Strontium yellow, C.I. pigment yellow 32	**N95**	
Strychnine	3 mg/m³		**0.15 mg/m³**		**N95**	
Styrene	5000	3.44	**20***	Phenylethylene, Vinyl benzene, Cinnamene, Styrene monomer	**OV**	3M 3510 Monitor
Subtilisins			**0.00006 mg/m³ (ceiling)**	Proteolytic enzymes as 100% crystalline enzyme	**SA**	Difficult to measure 10X OEL. N95 acceptable with suitable air sampling data.
Sucrose			**10 mg/m³***	Table sugar, Saccharose	**N95**	
Sulfur dioxide	100	0.708	**0.25 STEL**	SO_2	**AG**	Irritation and taste also provide warning
Sulfur hexafluoride			**1000**	SF_6	**SA**	Warning unknown. Unknown sorbent effectiveness.
Sulfuric acid (Thoracic particulate mass)			**0.2 mg/m³**	Hydrogen sulfate; Matting acid; Oil of vitriol; Sulphuric acid; Vitriol brown oil	**(F)N95**	N95 with appropriate eye protection acceptable if irritation prevented
Sulfur monochloride	10	0.001	**1 (ceiling)**	Sulfur chloride, Sulfur subchloride	**(F)AG**	

Sulfur pentafluoride	1	**0.01 (ceiling)**	Disulfur decafluoride	**AG**	Warning unknown
Sulfur tetrafluoride		**0.1 (ceiling)**		**AG**	Warning unknown
Sulfuryl fluoride	1000	**5**		**SA**	Warning unknown. Unknown sorbent effectiveness.
Synthetic vitreous fibers					
–Continuous filament glass fibers		**1 f/cc**		**N95**	
–Glass wool fibers		**1 f/cc**		**N95**	
–Refractory ceramic fibers		**0.2 f/cc**		**N95**	
–Rock wool fibers		**1 f/cc**		**N95**	
–Slag wool fibers		**1 f/cc**		**N95**	
–Special purpose glass fibers		**1 f/cc**		**N95**	
Talc (containing no asbestos)		**2 mg/m³* (respirable)**	Hydrous magnesium silicate, Steatite talc, Non-fibrous talc, Non-asbestiform talc	**N95**	
Talc (containing asbestos)			(See Asbestos)		
Tantalum, metal and oxide dusts (as Ta)		**5 mg/m³**		**N95**	
Tellurium and compounds (as Te)		**0.1 mg/m³**		**N95**	
Tellurium hexafluoride (as Te)	1	**0.02**		**SA**	Warning unknown. Unknown sorbent effectiveness.

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Terephthalic acid			**10 mg/m³**	p-Phthalic acid; TPA; Benzene-p-dicarboxylic acid; 1,4 Benzenedicarboxylic acids, Tephthol	**N95**	
Terphenyls			**5 mg/m³ (ceiling)**	o-Terphenyl, m-Terphenyl, p-Terphenyl, Mixed terphenyls, Diphenyl benzenes	**N95**	OV/N95 may be preferable if heat involved
1,1,2,2-Tetrabromoethane (as inhalable fraction and vapor)		1	**0.1**	Acetylene tetrabromide, Muthmann's liquid, Tetrabromoethane, Tetrabromoethylene	**OV**	
1,1,1,2-Tetrachloro-2,2-difluoroethane	15,000		**100**	Refrigerant 112a; Halocarbon 112a; 2,2-Difluoro-1, 1,1,2-tetrachloroethane; Freon® 112a	**OV**	Warning unknown
1,1,2,2-Tetrachloro-1,2-difluoroethane	15,000		**50**	Refrigerant 112, Halocarbon 112, Freon® 112	**OV**	Warning unknown
1,1,2,2-Tetrachloro-ethane	150	0.21	**1* -skin-**	Acetylene tetrachloride	**OV**	3M 3510 Monitor
Tetrachloroethylene				(See Perchloroethylene)		
Tetrachloromethane				(See Carbon tetrachloride)		

Tetrachloronaphthalene		**2 mg/m³**	Halowax™, Seekay wax, Nibren wax	**OV/N95**	See Comment D, page 8
2,3,5,6-Tetrachloropyridine		**5 mg/m³ (AIHAWEEL)**	Pyridine, 2,3,5,6-tetrachloro	**OV/N95**	See Coment D, page 8
Tetrachlorosilane		**1 (ceiling) (AIHAWEEL)**	Silicon tetrachloride, Silicon chloride	**AG/N95**	Warning unknown. Reacts rapidly with moisture yielding HCl and silica.
Tetraethylene glycol diacrylate		**1 mg/m³ (AIHAWEEL)**	TTEGDA; 2-Propionic acid, oxy-bis-(2,1-ethane-diyoxy-2,1-ethanediol) ester	**OV/P95**	See Comment D, page 8
Tetraethylene pentamine (aerosol)		**5 mg/m³ -skin- (AIHAWEEL)**	1,2-Ethandiamine, N-(2-aminoethyl) -N'-(2-((2-amino)ethyl); Tetran 1,4,7, 10,13-Pentaazatridecane; DEH 26; TEPA; Tetraethyl pentamine	**F(OV)**	
Tetraethyl lead (as Pb)	40 mg/m³	**0.075 mg/m³ (PEL) -skin-**	TEL, Lead tetraethyl, Motor fuel anti-knock compound	**OV**	Warning unknown
1,1,1,2-Tetrafluoroethane		**1000 (AIHAWEEL)**	Tetrafluoroethane, HFC134a, HFA134a, Fluorocarbon 134a	**SA**	Ineffective sorbents
Tetrafluoroethylene		**2**	Perfluoroethene; Perfluoroethylene; TFE Tetrafluoroethene; 1,1,2,2-Tetrafluoroethylene	**SA**	
2,3,3,3-Tetrafluoropropene		**500**	Diethylene oxide, Tetramethylene	**SA**	

* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Tetrahydrofuran		3.8	**50 -skin-**	Diethylene oxide, Tetramethylene oxide, THF	**OV**	3M 3510 Monitor
Tetrahydrofurfuryl alcohol			**0.05 (AIHAWEEL)**	Tetrahydro-2-furanmethanol; Tetrahydro-2-furancarbinol; Tetrahydro-2 furylmethanol; THFA	**OV**	Warning unknown
Tetrakis (hydroxymethyl) phosphonium chloride			**2mg/m³**	Proban CC; Pyroset TKC; Retardol C; THPC; Tetrahydroxymethyl phosphonium chloride	**N95**	
Tetrakis (hydroxymethyl) phosphonium sulfate			**2mg/m³**	Octakis (hydroxymethyl) phosphonium sulfate; Pyroset TKO; Retardol S; THPS; bis tetrakis-(hydroxymethyl) phosphonium sulfate	**N95**	
Tetramethyl lead (as Pb)	40 mg/m³		**0.075 mg/m³ (PEL) -skin-**	TML, Lead tetramethyl, Motor fuel anti-knock compound	**OV**	Warning unknown
Tetramethyl succinonitrile, vapor	5		**0.5 -skin-**	TMSN	**OV**	Warning unknown
Tetranitromethane	5		**0.005***	Tetan	**OV**	Warning unknown
Tetryl			**1.5 mg/m³**	2,4,6-Trinitrophenyl-methylnitramine; N-Methyl-N-2,4,6-tetranitroaniline; Nitramine; Tetralite	**N95**	

Thallium –Elemental and soluble compounds (as Tl)	20 mg/m³		**0.1 mg/m³ -skin-**	Thallium acetate, Thallium carbonate, Thallium hydroxide, etc.	**N95**	
4,4'-Thiobis(6-tert-butyl-m-cresol)			**10 mg/m³***	4,4'-Thiobis(3-methyl-6-tert-butyl phenol)	**N95**	
Thioglycolic acid			**1 -skin-**	Mercaptoacetic acid, Thioranic acid	**(F)OV**	Warning unknown
Thionyl chloride			**1 (ceiling)**	Sulfurous oxychloride, Sulfur oxychloride	**(F)AG**	Warning unknown
Thiram (inhalable fraction and vapor)			**0.05 mg/m³**	TMT, TMTD,TMTDS, Tetramethylthioram disulfide	**OV/N95**	
Tin (as Sn)						
–Metal and inorganic compounds (except SnH_4)	400 mg/m³		**2 mg/m³**		**N95**	
–Organic compounds			**0.1 mg/m³ -skin-**		**OV/N95**	See Comment D, page 8
Titanium dioxide			**10 mg/m³***	Rutile, Anatase, Brookite	**N95**	
Titanium tetrachloride			**0.5 mg/m³ (AIHAWEEL)**	Titanium chloride	**AG/N95**	
Toluene	2000	0.16	**20* -skin-**	Aantisal 1a; Methacide; Methylbenzol; Methyl benzene; Monomethyl benzene; Tol, Tolu-sol; Toluol; Phenyl methane; Methyl benzene	**OV**	3M 3510 Monitor

* TLV is lower than PEL.

NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Toluene diamine			**0.005 -skin- (AIHAWEEL)**	Diaminotoluene; TDA; Tolyenediamine	**N95**	
Toluene-2,4 or 2,6-diisocyanate (or as a mixture)		0.17	**0.005***	2,4 or 2,6-Toluene diisocyanate 2,4- or 2,6-TDI	**OV/N95**	Poor warning
p-Toluenesulfonyl chloride			**5 mg/m³ (ceiling) (AIHAWEEL)**	4-Methyl-benzenesulfonyl chloride, Tosyl chloride	**(F)OV/AG/N95**	See Comment D, page 8. HCl and p-toluene sulfuric acid produced by hydrololysis.
m-Toluidine		0.46-5.9	**2 -skin-**	m-Aminotoluene	**(F)OV**	Questionable warning
o-Toluidine	100	0.025-6.6	**2* -skin-**	o-Aminotoluene; o-Methylaniline; 1-Methyl-1,2-amino-benzene; 2-Methylaniline	**(F)OV**	Questionable warning
p-Toluidine		0.027-3.2	**2 -skin-**	p-Aminotoluene	**(F)OV**	Questionable warning
Tributyl phosphate	125		**0.2***	Tri-n-butyl phosphate, TBP	**OV/P95**	
Trichloroacetic acid		0.295	**1**	TCA	**OV/AG**	Irritation also provides warning

1,2,4-Trichlorobenzene		2.91	**5 (ceiling)**		**OV**	
1,1,1-Trichloroethane				(See Methyl chloroform)		
1,1,2-Trichloroethane	500		**10 -skin-**	Vinyl trichloride, b-Trichloroethane	**(F)OV**	Warning unknown. 3M 3510 Monitor.
Trichloroethylene	1000	1.36	**10**	1-Chloro-2,2-dichloroethylene Ethylene trichloride, Triclene™, TCE, 1,1,2-TCE	**OV**	3M 3510 Monitor
Trichlorofluoromethane	10,000	16.3	**1000 (ceiling)**	FC-11, Freon® 11, Fluorotrichloromethane, Trichloromonofluoromethane	**SA**	Short OV service life
Trichloronaphthalene			**5 mg/m³ -skin-**	Halowax™, Seekay wax, Nibren wax	**OV/N95**	See Comment D, page 8
Trichloronitromethane				(See Chloropicrin)		
1,2,3-Trichloropropane	1000	100	**10* -skin-**	Allyl trichloride, Glycerol trichlorohydrin, Glycerin trichlorohydrin, Trichlorohydrin	**(F)OV**	Poor warning
Trichlorosilane			**0.5 (ceiling)**	Silicochloroform	**(F)AG**	Warning unknown
1,1,2-Trichloro-1,2,2-trifluoroethane	4500	487	**1000**	Halocarbon 113, Refrigerant 113, TTE, Freon® 113, FC-113	**SA**	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 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Tridymite				(See Silica, crystalline)		
Triethanolamine			**5 mg/m³**	Daltogen; 2,2',2"-Nitrilo-triethanol; Sterolamide; TEA; Trihydroxytriethylamine	**OV/P95**	Warning unknown. See Comment D, page 8.
Triethoxysilane			**0.05 (AIHAWEEL)**	Silane, triethoxy	**SA(F)**	Unknown sorbent effectiveness
Triethylamine		0.001	**1 (AIHAWEEL)**	N-Trimethylamine; N, N-Dimethylmethanamine; TMA	**F(OV)**	AIHAWEEL is lower than TLV of 5 ppm. AM suggested, not specifically approved.
Triethylene glycol diacrylate			**1 mg/m³ (AIHAWEEL)**	TREGDA; 2-Propenoic acid, 2-ethanediyl-bis-(oxy-2,1-ethanediyl) ester	**OV/P95**	
Triethylenetetramine			**1 -skin-**	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	**OV**	See Comment E, page 9. R or P filter, if filter is required.
Trifluorobromomethane	50,000	16.3	**1000**	Halon™ 1301, Halocarbon 13B1, Refrigerant 13B1, Bromotrifluoromethane, Freon® 13B1	**SA**	Short OV service life

1,1,1-Trifluoro-2,2-dichloroethane		**50**	HCFC-123; FC-123; Hydrofluorocarbon 123	**SA**	Short OV service life
1,1,1-Trifluoroethane		**1000 (AIHAWEEL)**	HFC-143a; FC-143a; Hydrofluorocarbon 143a	**SA**	Ineffective sorbents
2,2,2-Trifluoroethanol		**0.3 (AIHAWEEL)**	Ethanol, 2,2,2-Trifluoro; 2,2,2-Trifluoroethyl alcohol; TFE	**SA**	Warning unknown. Ineffective sorbent.
1,3,5-Triglycidyl-s-triazinetrione		**0.05 mg/m³**	Araldite PT-810; TEPIC; 1,3,5-Triazine-2,4,6-(1H,3H,5H)-trione	**N95**	
Trimellitic anhydride		**0.0005 mg/m³ (ceiling)**	TMA, TMAN, Anhydrotrimellitic acid, Trimellitic acid anhydride	**OV/N95**	Chemical manufacturer's recommendation. See Comment D, page 8.
Trimethoxysilane		**0.05 (AIHAWEEL)**		**(F)OV**	Warning unknown
Trimethylamine	0.001	**1 (AIHAWEEL)**	N-Trimethylamine; N,N-Dimethylmethanamine; TMA	**(F)AM**	AIHAWEEL is lower than TLV of 5 ppm. AM not specifically approved.
Trimethyl benzene	2.4	**25**	Mesitylene, Pseudocumene, Hemimellitene	**OV**	3M 3510 Monitor
Trimethylchlorosilane		**5 (ceiling) (AIHAWEEL)**	Chlorotrimethylsilane; trimethylchloro silicane; monochlorotrimethylsilicon	**(F)OV/AG**	

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

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/m³ (AIHAWEEL)**	2-Propenoic acid, 2-ethyl-2(((1-oxo-2-propenyl) oxy) methyl)-1,3-propanediyl ester	**OV/P95**	
Trimethylolpropane trimethacrylate			**1 mg/m³ (AIHAWEEL)**	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/m³		**0.1 mg/m³* -skin-**	TNT, Trinitrotoluol, Trinitrotoluene, sym-Trinitrotoluene	**OV/N95**	See Comment D, page 8
Triorthocresyl phosphate	40 mg/m³		**0.1 mg/m³ -skin-**	o-Tritolyl phosphate, TCP, TOCP tricresylphosphate	**R or P95**	
Triphenyl phosphate	1000 mg/m³		**3 mg/m³**	Phenyl phosphate, TPP	**N95**	OV/N95 preferable if heat involved
Tripoli				(See Silica, crystalline)		
Trisodium phosphate			**5 mg/m³ (AIHAWEEL) STEL**	TSP, Sodium o-phosphate	**(F)N95**	N95 acceptable with appropriate eye/face protection.
Tungsten (as W)						
–Insoluble compounds			**5 mg/m³**		**N95**	
–Soluble compounds			**1 mg/m³**		**N95**	

Turpentine (wood)	1500	100-200	**20**	Gumspirits, Turps, Wood turpentine, Gum turpentine	**(F)OV**	See Comment E, page 9
Uranium (as U)						
–Insoluble compounds	30 mg/m³		**0.2 mg/m³**		**N95**	See 10 CFR 20 Subpart H
–Soluble compounds	20 mg/m³		**0.05 mg/m³ (PEL)**		**AG/N95**	Halides
					N95	Other
Urea			**10 mg/m³ (AIHAWEEL)**	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, (Inhalable particulate matter)	70 mg/m³		**0.05 mg/m³***	Vanadic anhydride, Vanadium oxide	**N95**	
Vanillin			**10 mg/m³**	Vanilla; Vanillaldehyde; Vanillic aldehyde	**N95**	
Vegetable oil, mists					**R or P95**	
-Total dust			**15 mg/m³ (PEL)**			
-Respirable fraction			**5 mg/m³ (PEL)**			
Vinyl acetate		0.603	**10**	1-Acetoxyethylene, Ethenyl acetate	**(F)OV**	3M 3510 Monitor
Vinyl benzene				(See Styrene)		
Vinyl bromide			**0.5**	Bromoethylene	**SA(F)**	Warning unknown. Short OV service life.

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NOTE: For explanation of column headings, refer to Format Explanation starting on page 4.

Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
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-vinyl-cyclohex-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-Difluoro-ethylene; 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 9. 3M 3510 Monitor.
Vinyltrichlorosilane			**1 (ceiling) (AIHAWEEL)**	Trichlorovinylsilane; Trichlorovinyl silicon; Vinylsilicon trichloride; Silane trichlorovinyl; Silane trichloroethenyl; trichlorovinyl silicane	**OV/AG**	
Wood, dust **(All varieties except Western Red Cedar)** **(Western Red Cedar)**			**1 mg/m³*** **0.5 mg/m³***		**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
m-Xylene a,a'-diamine			**0.1 mg/m³ (ceiling) -skin-**	MXDA	**OV/N95**	See Comment D, page 8
Xylidine (as inhalable aerosol and vapor)	150	0.005-0.06	**0.5* -skin-**	Aminodiymethyl benzene, Aminoxylene dimethylaniline, Dimethylaminobenzene	**OV/N95**	

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Chemical Name	IDLH (PPM)	Odor Threshold (PPM)	OEL (PPM)	Synonyms	Respirator Recommended (to 10X OEL)	Comments
Yttrium, metal and compounds (as Y)			**1 mg/m^3**	Specific compound	**N95**	
Zinc chloride, fume	4800 mg/m^3		**1 mg/m^3**		**N95**	
Zinc chromate (as Cr)			**0.01 mg/m^3***	Basic zinc chromate, Zinc potassium chromate, Zinc yellow	**N95**	
Zinc oxide (Respirable particulate mass)			**2 mg/m^3**	Zincite, Zinc white	**N95**	
Zinc stearate			**10 mg/m^3***	Synpro stearate, Zinc distearate, Dermarone	**N95**	
Zirconium and compounds (as Zr)	500 mg/m^3		**5 mg/m^3**		**N95**	

Abbreviations

(F)	Full Facepiece (with appropriate cartridges and filters)
AG	Acid Gas Respirator
AM	Ammonia/Methylamine Respirator
FORM	Formaldehyde Particulate Respirator
HF	Hydrogen Fluoride Respirator
Hg	Mercury Vapor or Chlorine Gas Respirator
MG	Multi-gas/Vapor Respirator
N100	N100 Particulate Respirator
N95	N95 Particulate Respirator
OV	Organic Vapor Respirator
OZ	Ozone Respirator
P100	P100 Particulate Respirator
P95	P95 Particulate Respirator
R95	R95 Particulate Respirator
SA	Supplied Air Respirator

Note: Respirator abbreviations may be combined.

For example, (F)OV/AG/P95 is a full facepiece respirator with an organic vapor/acid gas cartridge and a P95 particulate filter.

3M also offers 3M™ Select Software and 3M™ Service Life Software. Select Software helps you select the most appropriate respirator. Service Life Software estimates service life of 3M gas/vapor cartridges. Both programs are simple, accurate and give printable reports.

Data for this guide compiled December 2009.

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

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