The Power to Protect Your World

3M 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 PSD representative or call our 3M PSD Technical Service Line at 1-800-243-4630.

Respirator Program Management

In the United States, 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 filtering facepiece (disposable) respirator 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* per OSHA 29 CFR 1910.134 are as follows:

Air Purifying Respirators
- Half facepiece (filtering facepiece-disposable and reusable)..... 10
- Full facepiece 50

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

Supplied Air Respirators (airline)
- Continuous Flow
  - –Loose-fitting facepiece (e.g., L-501)..... 25
  - –Half facepiece 50
  - –Full facepiece, helmet, or hood .. 1000
- Pressure Demand with Full facepiece ... 1000

Pressure Demand Airline with Escape SCBA ..... 10,000, unknown and IDLH atmospheres

Pressure Demand SCBA ..... 10,000, unknown and IDLH atmospheres

Effects From Skin or Eye Contact

If a chemical can be absorbed through the skin, skin protection may be required in addition to respiratory protection. Eye protection may also be necessary if not provided by the respirator. Failure to provide adequate skin or eye protection can invalidate established exposure limits and make respirator use ineffective for protection against certain workplace contaminants.

Human Factors

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

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. 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, a supplied air respirator or a combination air purifying/supplied air respirator may not 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 user 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. Properly selected and used 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.

- 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 PSD 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 2011 published by the American Conference of Governmental Industrial Hygienists (ACGIH). Pesticides and chemicals without established occupational exposure limits are not included. Call 3M PSD Technical Service for assistance in selecting respirators for these chemicals.

CAS

Chemical abstract service registry numbers were established by the American Chemical Society to harmonize chemical identification regardless of the synonym used or differences in spelling.

Synonyms

Several common synonyms are listed in this column.

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) has been listed when an IDLH value was not located. The concentration that would result in an oxygen deficient atmosphere should also be considered to be IDLH.

OEL

- The occupational exposure limits listed are 2012 ACGIH Threshold Limit Values (TLVs), unless otherwise stated. From ACGIH®, 2012 TLVs® and BEIs® Book. Copyright 2012. Reprinted with permission. 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.
- The OSHA Permissible Exposure Limit (PEL) is listed when it is more stringent than the current TLV.
- The 2010 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.
- Time Weighted Average (TWA) exposure limits are for a normal eight (8) hour workday and a forty (40) hour work-week.
- Short-Term Exposure Limit (STEL) is a 15-minute time weighted average exposure which should not be exceeded at any time during a workday.
- Ceiling (C) exposure limits refer to concentrations that should not be exceeded during any part of the working exposure.
- Exposure limits for particulates are as total dust unless otherwise noted (e.g., inhalable fraction, respirable fraction, respirable fibers, etc.)
- 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.

Odor Threshold*

Odor thresholds cannot be used as the primary indicator for changing gas and vapor cartridges as a result of OSHA standard, 29 CFR 1910.134. The respirator program administrator, using objective data and information, must establish chemical cartridge change schedules. The established change schedule must 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

***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).

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.

Respirator Recommendations

(to 10X OEL)

This column lists the 3M recommended respirator for exposure levels not exceeding ten times (10X) the OEL. The abbreviations used are explained on the back cover. **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. 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 particle 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. This means full facepiece 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, or the contaminant's boiling point is less than 65C. 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 Service Life Software. 3M PSD, www.3M.com/OccSafety.
   2. 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).

   Sometimes, 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. {Comments regarding warning properties have been removed as OSHA allows air purifying respirators to be used against gases and vapors with poor or unknown warning properties. Instead cartridge changed schedules based on objective information and data must be established.}

D. These compounds have been identified as possibly existing in both particulate and vapor phase in the workplace. 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. 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 recommended pending more research as to how these materials affect the filter fibers.

H. Listing of 3M **3510, 3530, 3550,** or **3720** refers to a 3M™ Personal Air Monitor which may be used to measure the amount of contaminant in the air. Monitors may also be used to sample for other materials with analysis performed by a private laboratory.

   You should check with the laboratory to determine what other chemicals can be measured with the monitors. An estimate of the airborne concentration is needed for making appropriate respirator selection and establishing a cartridge change schedule.

Contact the toll free 3M PSD 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.

* 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).

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.

N100 Particulate Filter -At least 99.97% filter efficient when tested with ~0.3 µm NaCl aerosol.

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.

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 in atmospheres containing oil aerosols, P-series filters should be used and reused for no more than 40 hours of use or 30 days, whichever occurs first, 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.

P100 Particulate Filter -At least 99.97% filter efficient when tested with ~0.3 µm DOP (Dioctyl Phthalate) aerosol.

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.

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 **OEL** column, then the respirator identified in the **Respirator** 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 given previously). 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 required 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 OEL column, you must follow the directions below for proper respirator selection. If you need help, call 3M Technical Service at 1-800-243-4630.

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 as 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 highly 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 OEL column on the form provided or on one you created. **Determine the hazard ratio (see page 1) 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. If the hazard ratio exceeds 50, but is less than 1000: 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 column. 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), a PAPR **cannot** be used. If a gas or vapor respirator is selected, cartridge change schedules based on objective data must be established. Otherwise supplied air respirators must be used. The service life of gas or vapor cartridges should be considered to determine if supplied air respirators are a better selection given the high exposure concentrations. Record the respirator you selected in the last column of the form for that chemical. Go to Step 10.

8. If the hazard ratio exceeds 10 but is less than 50, select one of the following respirators: (1) If the guide lists SA or SA(F), a supplied air respirator must be used. Loose fitting facepieces may only be used if the hazard ratio is less than 25. (2) A powered air purifying respirator (PAPR) may be used with the cartridge and/or filter type listed under the Respirator column. Use a HEPA filter if an N, R, P-series filter is listed. Loose fitting facepiece may only be used if the hazard ratio is less than 25. (3) A full facepiece respirator that has been quantitatively fit tested may be used with cartridges and/or filters listed under the Respirator column. If a gas or vapor respirator is selected, cartridge change schedules based on objective data must be established. Otherwise supplied air respirators must be used. Record the respirator you selected in the last column of the form for that chemical. Go to Step 10.

9. If the hazard ratio is less than or equal to 10: Select the respirator listed in the Respirator column. If a gas or vapor respirator is selected, cartridge change schedules based on objective data must be established. Otherwise supplied air respirators must be used. 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 TLVs® and documentation 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 at a concentration greater than 0.1 mg/m³ but less than the value in the OEL column of the guide? (If a respirator is not being selected for 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. 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 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)**. Go to Step 17.
    b) If **no**, record the respirator listed in the last column as the final respirator selected (bottom line). Go to Step 17.

15. If the chemical is not listed in the guide, either it is a pesticide or an occupational exposure limit was not located. If an acceptable exposure level is not known, 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% oxygen, airborne concentration >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. 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.

17. Do you need help?
    a) If **yes**, call 3M for assistance at 1-800-243-4630.
    b) If **no**, order the selected respirator(s) from your local safety equipment distributor.

Respirator Selection Form

Chemical Name	Air Concentration	IDLH	OEL	Hazard Ratio	Respirator Recommended
Respirator Selected:					

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Acetaldehyde 75-07-0	Acetic aldehyde, Ethanal	10000	TWA=200 (OSHA) C=25	0.186	(F)OV (F)Form	Formaldehyde cartridge not specifically approved, but 3M recommended for longer service life
Acetic acid 64-19-7	Ethanoic acid, Glacial acetic acid, Methane carboxylic acid, Vinegar acid	1000	TWA=10 STEL=15	0.016	(F)OV	
Acetic anhydride 108-24-7	Acetic acid anhydride, Acetyl oxide, Ethanoic anhydride	1000	TWA=1 STEL=3	0.029	(F)OV	
Acetone 67-64-1	2-Propanone, Dimethyl ketone, Ketone propane	20000	TWA=500 STEL=750	4.58	OV	Short service life 3M 3530 Monitor
Acetone cyanohydrin 75-86-5	2-Cyano-2-propanol, 2-Hydroxy-2-methyl propanenitrile, 2-Methyllactonile, 2-Propane cyanohydrin, a-Hydroxy isobutyronitrile	22000	TWA=2 (AIHA) STEL=5 (AIHA) C=5 mg/m^3 (as CN) -skin-	3	OV	
Acetonitrile 75-05-8	Cyanomethane, Ethane nitrile, Ethyl nitrile, Methanecarbonitrile, Methyl cyanide	4000	TWA=20 -skin-	97.7	OV	3M 3530 Monitor

Acetophenone 98-86-2	1-Phenylethanone, Acetyl benzene, Benzoyl methide, Methyl phenyl ketone		TWA=10	0.363	OV	See comment E, page 9
Acetylsalicylic acid 50-78-2	Aspirin		TWA=5 mg/m^3		N95	
Acrolein 107-02-8	Acrylaldehyde, Acrylic aldehyde, Allylaldehyde, Propenal	5	TWA=0.1 (OSHA) C=0.1 -skin-	0.174	(F)OV	Short service life
Acrylamide 79-06-1	Acrylamide monomer, Acrylic amide, Propenamide		TWA=0.03 mg/m^3 (inhalable fraction and vapor) -skin-		OV/N95	See comment D, page 8
Acrylic acid 79-10-7	Acroleic acid, Propenoic acid	24000	TWA=2 -skin-	0.4	(F)OV	
Acrylonitrile 107-13-1	AN, Propenenitrile, Vinyl cyanide	500	TWA=2 -skin-	16.6	OV	SA if cartridge not disposed of after shift, per 29 CFR 1910.1045. 3M 3510 monitor.
Adipic acid 124-04-9	1,4-Butanedicarboxylic acid, 1,6-Hexanedioic acid, Adipinic acid, Hexanedioic acid		TWA=5 mg/m^3		(F)N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Adiponitrile 111-69-3	1,4-Dicyanobutane, Addipic acid dinitrile, Hexanedinitrile, Tetramethylene cyanide	17000	TWA=2 -skin-		OV	
Allyl alcohol 107-18-6	2-Propen-1-ol, 2-Propenol, Vinyl carbinol	150	TWA=0.5 -skin-	0.47	(F)OV	3M 3510 Monitor
Allyl Bromide 106-95-6	1-Bromo-2-propene; 1-Propene; 3-bromo-; 2-Propenyl bromide; 3-Bromo-1-propene; 3-Bromopropene; 3-Bromoproylene	44000	TWA=0.1, STEL=0.2, -skin-		(F)OV	
Allyl chloride 107-05-1	1-Chloro-2-propene, 3-Chloropropene	300	TWA=1 STEL=2 -skin-	0.489	OV	Short service life
Allyl glycidyl ether 106-92-3	1-Allyloxy-2,3-epoxy-propane, AGE	270	TWA=1 C=10 (OSHA)		(F)OV	
Allyl isothiocyanate 57-06-7	AITC, Allyl isosulfocyanate, Allyl thiocarbanimide, Oil of mustard, 3-Isothiocyanate-1-propene		STEL=1 (AIHA) -skin-	0.035	OV	SA if used with acids
Allyl propyl disulfide 2179-59-1	2-Propenyl propyl disulfide, Onion oil, Propyl allyl disulfide		TWA=0.5		(F)OV	

alpha-Alumina 1344-28-1			TWA=15 mg/m^3 (OSHA)		N95	
Aluminum metal and insoluble compounds 7429-90-5			TWA=15 mg/m^3 (OSHA) TWA=1 mg/m^3 (respirable fraction)		N95	
p-Aminobenzoic acid 150-13-0	4-Aminobenzoic acid, Aminobenzoic acid, PABA		TWA=5 mg/m^3 (AIHA)		(F)N95	
2-Aminopyridine 504-29-0	a-Aminopyridine	5	TWA=0.5		OV	
Aminotri (methylenephosphonic acid) 6419-19-8	ATMP, Briquest 301-32S, Briquest 302-500, Dequest 2000, Dequest 2001, Nitrilotrimethanephosphonic acid, NTF, NTMP, NTPA		TWA=10 mg/m^3 (AIHA)		AG/N95	If heated, AG cartridge may be needed
Ammonia 7664-41-7	Anhydrous ammonia	500	TWA=25 STEL=35	5.75	(F)AM	Irritation also provides warning
Ammonium chloride (liquids) 12125-02-9			TWA=10 mg/m^3 STEL=20 mg/m^3		AM/N95	
Ammonium chloride (solids) 12125-02-9			TWA=10 mg/m^3 STEL=20 mg/m^3		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Ammonium perfluorooctanoate 3825-26-1			TWA=0.01 mg/m^3 -skin-		OV/N95	See comment D, page 8
n-Amyl alcohol 71-41-0	1-Pentanol, Amyl alcohol, n-Butyl carbinol, n-Pentanol, Pentanol, Pentyl alcohol		TWA=100 (AIHA)	0.1-0.3	(F)OV	
tert-Amyl methyl ether 994-05-8	TAME		TWA=20		OV	
Aniline 62-53-3	Aminobenzene, Aniline oil, Phenylamine	100	TWA=2 -skin-	0.676	OV	
o-Anisidine 90-04-0	2-Methoxyaniline, o-Aminoanisole, o-Anisidine, o-Methoxyaniline (oil)	50 mg/m^3	TWA=0.5 mg/m^3 -skin-		OV/P95	
p-Anisidine 104-94-9	4-Methoxyaniline, p-Aminoanisole, p-Anisidine, p-Methoxyaniline (solid)	50 mg/m^3	TWA=0.5 mg/m^3 -skin-		OV/N95	
Antimony and compounds (as Sb) 7440-36-0		80 mg/m^3	TWA=0.5 mg/m^3		N95	

Arsenic, elemental 7440-38-2		100 mg/m^3	TWA=0.01 mg/m^3		N100	
Arsenic, inorganic compounds (except arsine) (as As)		100 mg/m^3	TWA=0.01 mg/m^3		MG/N100	No half mask respirators for arsenic trichloride because of skin adsorption. N100 may be appropriate if vapor concentrations are below exposure limits.
Arsenic, organic compounds (as As)			TWA=0.5 mg/m^3 (OSHA)		OV/N100	MG/N100 may be required for certain organic arsenic compounds
Arsine 7784-42-1	Arsenic hydride, Arsenic trihydride, Arseniuretted hydrogen, Arsenous hydride, Hydrogen arsenide	6	TWA=0.005	<1.0	(F)SA	Unknown sorbent effectiveness
Asbestos 1332-21-4	Actinolite, Amosite, Anthophyllite, Chrysotile, Crocidolite, Tremolite		TWA= 0.1 f/cc (respirable fibers)		N100	Dual cartridge as per 29 CFR 1910.1001, 1915.1001 and 1926.1101
Asphalt (petroleum; bitumen) fumes 8052-42-4	Asphaltic bitumen, Asphaltum, Bitumen, Hot mix asphalt, Mineral pitch, Petroleum asphalt, Road asphalt, Road tar		TWA=0.5 mg/m^3 (inhalable fraction as benzene-soluble aerosol)		OV/P95	R or P95 alone may be suitable for some applications. See Comment F, page 9.

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Barium and soluble compounds (as Ba) 7440-39-3		1100 mg/m^3	TWA=0.5 mg/m^3		N95	
Barium sulfate 7727-43-7			TWA=10 mg/m^3 TWA= 5 mg/m^3 (OSHA, respirable fraction)		N95	
Benzaldehyde 100-52-7	Benzenecarbonal, Benzoic aldehyde, Oil of bitter almond		TWA=2 (AIHA) STEL=4 (AIHA)	0.042	(F)OV	
Benzene 71-43-2	Benzol, Coal tar naptha	3000	TWA=0.5 STEL=2.5 -skin-	8.65	OV	SA if cartridges are not replaced at the start of each shift, per 20 CFR 1910.1028. 3M 3510 Monitor.
Benzophenone 119-61-9	Benzoyl benzene, Diphenyl ketone, Diphenyl methanone, Phenyl ketone		TWA=0.5 mg/m^3 (AIHA)		OV/N95	See comment D, page 8

Benzotrichloride 98-07-7	Benzenyl trichloride, Benzenylchloride, Benzoic trichloride, Benzyl trichloride, Phenyl chloroform, Toluene trichloride, Trichloromethylbenzene		C=0.1 -skin-		(F)OV	
Benzoyl chloride 98-88-4	a-Chlorobenzaldehyde, Benzene carbonyl chloride, Benzoic acid chloride		C=0.5	0.007	(F)OV/AG (F)MG	
Benzoyl peroxide 94-36-0	Dibenzoyl peroxide	7000 mg/m^3	TWA=5 mg/m^3		OV/N95	See comment D, page 8
Benzyl acetate 140-11-4	Acetic acid benzyl ester, Acetic acid phenylmethyl ester, Phenylmethyl acetate		TWA=10	0.145	OV/N95	
Benzyl alcohol 100-51-6	a-Hydroxytoluene, Phenylcarbinol, Phenylmethanol		TWA=10 (AIHA)	5.55	(F)OV	
Benzyl chloride 100-44-7	a-Chlorotoluene	10	TWA=1	0.034	(F)OV/AG	See comment E, page 9. 3M 3510 Monitor.
Beryllium and compounds (as Be) 7440-41-7		10 mg/m^3	TWA=0.00005 mg/m^3 (inhalable fraction) C=0.005 mg/m^3 (OSHA) -skin-		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Biphenyl 92-52-4	Diphenyl, Phenylbenzene	300 mg/m^3	TWA=0.2	0.009	OV/N95	
Bismuth telluride (undoped) 1304-82-1	Bismuth sesquitelluride		TWA=10 mg/m^3 TWA=5 mg/m^3 (OSHA, respirable fraction)		N95	
Bismuth telluride (Se-doped) (as Bi_2Te_3)			TWA=5 mg/m^3		N95	
Boric acid 10043-35-3	Borofax, Boron trihydroxide, Hydrogen orthoborate, Kill-off, Kjel-sorb, Orthoboric acid, Three elephant, Trihydroxyborane		TWA=2 mg/m^3 (inhalable fraction) STEL=6 mg/m^3 (inhalable fraction)		N95	
Boron oxide 1303-86-2	Anhydrous boric acid, Boric anhydride, Boric oxide		TWA=10 mg/m^3		N95	
Boron tribromide 10294-33-4	Boron bromide		C=1		(F)AG	
Boron trifluoride 7637-07-2		100	C=1	1.5	(F)AG	

Bromine 7726-95-6		10	TWA=0.1 STEL=0.2	0.066	(F)OV/AG	Irritation also provides warning
Bromine pentafluoride 7789-30-2			TWA=0.1		AG	
Bromoform 75-25-2	Tribromomethane		TWA=0.5	0.447	(F)OV	3M 3510 Monitor
1-Bromopropane 106-94-5	n-Propylbromide, Propylbromide		TWA=10		OV	
1,3-Butadiene 106-99-0	Biethylene, Divinyl, Erythrene	20000	TWA=1 (OSHA) STEL=5 (OSHA)	0.455	OV	Cartridges must be replaced, per 29 CFR 1910.1051
Butane 106-97-8	n-Butane, Methylethyl methane	16000	STEL=1000	204	SA	Short OV service life
1-Butene 106-98-9	1-Butylene, a-Butene, a-Butylene, But-1-ene, Ethylethylene		TWA=250		OV	Short service life
2-Butene (mixture of trans- and cis-) 107-01-7	b-Butene, b-Butylene, Dimethylethylene, Pseudobutylene		TWA=250		OV	Short service life
cis-2-Butene 590-18-1	b-cis-Butylene, cis-1,2-Dimethylethylene, cis-Butene, cis-Butene-2		TWA=250		OV	Short service life

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
trans-2-Butene 624-64-6	2-Butene,(E)-; 2-trans-Butene, b-trans-Butylene, trans-1,2-Dimethylethylene, trans-Butene		TWA=250		OV	Short service life
2-Butoxyethanol 111-76-2	Butyl Cellosolve®, Ethylene glycol monobutylether	700	TWA=20	0.001	(F)OV	See comment E, page 9
2-Butoxyethyl acetate 112-07-2	Acetic acid, 2-butoxyethyl ester; 2-Butoxyethanol acetate; Butyl Cellusolve acetate; Butylglycol acetate; EGBA; Ektasolve EB acetate; Ethylene glycol monobutyl ether acetate; Glycol monobutyl ether acetate	8800	TWA=20		OV	
n-Butyl acetate 123-86-4	Acetic acid butyl ester, Butyl acetate, Butyl ethanoate	10000	TWA=150 STEL=200	0.007	(F)OV	See comment E, page 9. 3M 3510 Monitor.
sec-Butyl acetate 105-46-4	1-Methylpropylacetate	10000	TWA=200	3-7	(F)OV	See comment E, page 9. 3M 3510 Monitor.
tert-Butyl acetate 540-88-5	Acetic acid tert-butyl ester	10000	TWA=200	4-47	(F)OV	3M 3510 Monitor
Butyl acrylate 141-32-2	2-Propenoic acid butyl ester, Butyl 2-propenoate	15000	TWA=2	0.003	OV	3M 3510 Monitor

n-Butyl alcohol 71-36-3	1-Butanol, 1-Hydroxybutane, Butyl alcohol, Butyl hydroxide, Butyric alcohol, Methylolpropane, n-Butanol, n-Propyl carbinol, Propyl methanol	8000	TWA=20	0.03	(F)OV	3M 3510 Monitor
sec-Butyl alcohol 78-92-2	2-Butanol, Methyl ethyl carbinol	10000	TWA=100	1	(F)OV	3M 3510 Monitor
tert-Butyl alcohol 75-65-0	2-Methyl-2-propanol, TBA, Trimethyl carbinol	8000	TWA=100	21.5	(F)OV	3M 3510 Monitor
Butylamine 109-73-9	1-Aminobutane, n-Butylamine	2000	C=5 -skin-	0.053	AM	AM not specifically approved, but longer service life than OV
Butylated hydroxytoluene 128-37-0	2,6-bis(1,1-Dimethylethyl)-4-methylphenol; 2,6-Di-tert-butyl-p-cresol; BHT; DBPD		TWA=2 mg/m^3 (inhalable fraction and vapor)		(F)OV/N95	
4-tert-Butylcatechol 98-29-3	4-(1,1-Dimethylethyl)-1,2-benzenediol; 4-tert-Butyl pyrocatechol; 4-tert-Butyl-1-1,2-dihydroxy benzene; p-tert-Butylcatechol		C= 2 mg/m^3 (AIHA) -skin-		(F)N95	
tert-Butyl chromate (as CrO_3) 1189-85-1	Chromic acid di-tert-butyl ester	30 mg/m^3	TWA=0.005 mg/m^3 (OSHA) C=0.1 mg/m^3 -skin-		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Butylene oxide 106-88-7	1,2-Butene oxide; 1,2-Butylene oxide; 1,2-Epoxybutane; 1-Butene oxide; BO; Epoxy-butane		TWA=2 (AIHA)	0.06	OV	Short service life
n-Butyl glycidyl ether 2426-08-6	1,2-Epoxy-3-butoxypropane, BGE	3500	TWA=3 -skin-		OV	3M 3510 Monitor
n-Butyl lactate 138-22-7	Lactic acid butylester	11500	TWA=5	7.06	OV	Irritation also provides warning
Butyl mercaptan 109-79-5	1-Mercaptobutane, n-Butanethiol	2500	TWA=0.5	0.001	OV	
o-sec-Butylphenol 89-72-5	2-sec-Butylphenol		TWA=5 -skin-		OV/P95	
p-tert-Butyltoluene 98-51-1	1-Methyl-4-tert-butylbenzene	1000	TWA=1	5.02	OV	3M 3510 Monitor
Butyraldehyde 123-72-8	Butal, Butaldehyde, Butalyde, Butanal, Butanaldehyde, Butylaldehyde, Butyral butyric aldehyde	19000	TWA=25 (AIHA)	0.009	(F)Form	Formaldehyde cartridge not specifically approved, but longer service life than OV

Cadmium and compounds (as Cd) 7440-43-9	Cadmium oxide fume	9 mg/m^3 (fume) 50 mg/m^3	TWA=0.002 mg/m^3 (respirable fraction) TWA=0.005 mg/m^3 (OSHA)	N100
Calcium arsenate (as As) 7778-44-1	Cucumber dust, Tricalcium arsenate, Tricalcium o-arsenate	100 mg/m^3	TWA=0.01 mg/m^3	N100
Calcium carbonate 1317-65-3	Limestone, Marble		TWA=15 mg/m^3 (OSHA) TWA= 5 mg/m^3 (OSHA, respirable fraction)	N95
Calcium chromate (as Cr) 13765-19-0	Calcium chrome yellow		TWA=0.001 mg/m^3	N95
Calcium cyanamide 156-62-7	Calcium carbimide, Lime nitrogen		TWA=0.5 mg/m^3	N95
Calcium fluoride (as F) 7789-75-5	Fluorite, Fluorospar		TWA= 2.5 mg/m^3	N95
Calcium hydroxide 1305-62-0	Calcium hydrate, Caustic lime, Hydrated lime		TWA=5 mg/m^3	N95

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Calcium oxide 1305-78-8	Pebble lime, Quicklime		TWA=2 mg/m^3		N95	
Calcium silicate (containing no asbestos and <1% crystaline silica) 1344-95-2	Calcium hydrosilicate, Tobermorite		TWA=10 mg/m^3		N95	
Calcium sulfate 7778-18-9	Gypsum, Plaster of Paris		TWA=10 mg/m^3 (inhalable fraction) TWA= 5 mg/m^3 (OSHA, respirable fraction)		N95	
Camphor 76-22-2	2-Camphonone, Gum camphor, Laurel camphor, Synthetic camphor	200 mg/m^3	TWA=2 STEL=3	0.051	(F)OV/N95	3M 3510 Monitor
Caprolactam 105-60-2	2-Oxohexamethylenimine, Aminocaproic lactam	14000	TWA=5 mg/m^3 (inhalable fraction and vapor)	0.064	OV/N95	
Captan 133-06-2	N-(Trichloromethylthio)-4-cyclohexene-1,2-dicarboximide		TWA=5 mg/m^3 (inhalable fraction)		N95	

Carbon black 1333-86-4	Acetylene black, Channel black, Furnace black, Lamp black, Thermal black		TWA=3 mg/m^3 (inhalable fraction)		N95	
Carbon dioxide 124-38-9	Carbonic acid gas, Dry ice	50000	TWA=5000 STEL=30000	74,000	SA	Ineffective sorbents
Carbon disulfide 75-15-0	Carbon bisulfide, Carbon bisulfur, Carbon bisulphide, Carbon disulphide, Carbon sulfide, Dithiocarbonic anhydride, Sulphocarbonic anhydride, Weevitox	500	TWA=1 C=30 (OSHA) -skin-	0.096	OV	Short service life
Carbon monoxide 630-08-0	Monoxide	1500	TWA=25	100,000	SA	Ineffective sorbents
Carbon tetrabromide 558-13-4	Tetrabromomethane		TWA=0.1 STEL=0.3		(F)OV	
Carbon tetrachloride 56-23-5	Tetrachloromethane	300	TWA=5 STEL=10 C=25 (OSHA) -skin-	40.7	(F)OV	3M 3510 Monitor
Carbonyl fluoride 353-50-4	Carbon oxyfluoride, Fluoroformyl fluoride		TWA=2 STEL=5		(F)MG	
Carbonyl sulfide 463-58-1	Carbon monoxide monosulfide, Carbon oxide sulfide, Carbon oxysulfide, Oxycarbon sulfide		TWA=5		SA	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Catechol 120-80-9	Pyrocatechol	14000	TWA=5 -skin-		OV/N95	
Cellulose 9004-34-6	Paper fiber		TWA=10 mg/m^3 TWA= 5 mg/m^3 (OSHA, respirable fraction)		N95	
Cesium fluoride (as F) 13400-13-0			TWA=2.5 mg/m^3		N95	
Cesium hydroxide 21351-79-1	Cesuim hydrate		TWA=2 mg/m^3		N95	
Chloramphenicol 56-75-7	[R-(R*,R*)]-2,2-dichloro-N-[2,hydroxy-1-(hydroxy methyl)-2-(4-nitrophenyl)ethyl] acetamide; Chloromycetin; Levomycetin		TWA=0.5 mg/m^3 (AIHA)		N95	
Chlorinated diphenyl oxide 31242-93-0	Hexachlorodiphenyl oxide		TWA=0.5 mg/m^3		OV/P95	
Chlorine 7782-50-5		30	TWA=0.5 STEL=1 C=1 (OSHA)	0.05	(F)AG	Irritation also provides warning

Chlorine dioxide 10049-04-4	Chlorine oxide, Chlorine peroxide	10	TWA=0.1 STEL=0.3	9.24	AG	
Chlorine trifluoride 7790-91-2	Chlorine fluoride	20	C=0.1		MG	
Chloroacetaldehyde 107-20-0	2-Chloroethanal, Chloroacetaldehyde (40% aqueous)	100	C=1	0.917	(F)OV	
Chloroacetone 78-95-5	Chloracetone, 1-Chloro-2- propanone, Monochloroacetone		C=1 -skin-		(F)OV	
Chloroacetyl chloride 79-04-9	Chloracetyl chloride		TWA=0.05 STEL=0.15 -skin-		(F)OV/AG	
Chlorobenzene 108-90-7	Chlorobenzol, MCB, Monochlorobenzene, Phenyl chloride	2400	TWA=10	0.741	OV	3M 3510 Monitor
Chlorobromomethane 74-97-5	Bromochloromethane, CBM, Halon™ 1011, Methylene chlorobromide	5000	TWA=200	399	OV	
1-Chloro-1,1- difluoroethane 75-68-3	a-Chloroethylidene fluoride, Chlorodifluoroethane, Dymel® 142b, Genetron™ 142b, HCFC-142b		TWA=1000 (AIHA)		SA	Short OV service life

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Chlorodifluoromethane 75-45-6	Freon® 22		TWA=1000		SA	Ineffective sorbents
Chlorodiphenyl (42% chlorine) 53469-21-9	PCB, Polychlorinated biphenyl	10 mg/m^3	TWA=1 mg/m^3 -skin-		(F)OV/P95	See comment D, page 8
Chlorodiphenyl (54% chlorine) 11097-69-1	PCB, Polychlorinated biphenyl	5 mg/m^3	TWA=0.5 mg/m^3 -skin-		(F)OV/P95	See comment D, page 8
Chloroform 67-66-3	Trichloromethane	1000	TWA=10 C=50 (OSHA)	11.7	OV	Short service life 3M 3510 Monitor
bis-(2-Chloroisopropyl) ether 39628-32-9	BCIPE; bis-(1-methyl-2-chloroethyl) ether; bis-2-chloro-1-methylethyl ether; Dichloroisopropyl ether		TWA=3 (AIHA)		(F)OV	
bis-Chloromethyl ether 542-88-1	BCME, Chloro (chloromethoxy) methane, Chloromethyl ether, Dichloromethylether		TWA=0.001		(F)OV	OSHA requires SA with hood for certain applications; see 29 CFR 1910.1003

Chloropenta-fluoroethane 76-15-3	FC-115, Monochloropentafluoroethane		TWA=1000		SA	Short OV service life
Chloropicrin 76-06-2	Nitrochloroform, Nitrotrichloromethane, Trichloronitromethane	4	TWA=0.1	1.08	(F)SA	Irritation also provides warning
b-Chloroprene 126-99-8	2-Chloro-1,3-butadiene, beta-Chloroprene, Chlorobutadiene	400	TWA=10 -skin-	14.9	(F)OV	Short service life
2-Chloropropane 75-29-6	2-CP, 2-Propyl chloride, Isoprid, Isopropyl chloride		TWA=50 (AIHA)		OV	Short service life
1-Chloro-2-propanol 127-00-4	1-Chloro-2-hydroxypropane, 1-Chloroisopropyl alcohol, sec-Propylene chlorohydrin		TWA=1 -skin-		OV	
2-Chloro-1-propanol 78-89-7	1-Hydroxy-2-chloropropane, 2-Chloropropanol, 2-Chloropropyl alcohol, Propylene chlorohydrin		TWA=1 -skin-		OV	
2-Chloropropionic acid 598-78-7	a-Chloropropionic acid		TWA=0.1 -skin-		OV/AG	
o-Chlorostyrene 2039-87-4	1-Chloro-2-ethenylbenzene, 2-Chlorostyrene		TWA=50 STEL=75		OV	3M 3510 Monitor

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Chlorosulfonic acid 7790-94-5	Chlorosulfuric acid, CSA		C=0.1 mg/m^3 (AIHA)		(F)AG/N95	HCl, SO_2 hydrolysis products
2-Chloro-1,1,1,2-tetrafluoroethane 2837-89-0	Chlorotetrafluoroethane, Fluorocarbon 124, HCFC124, HFA124		TWA=1000 (AIHA)		SA	Short OV service life
o-Chlorotoluene 95-49-8	2-Chloro-1-methylbenzene		TWA=50	0.219	OV	3M 3510 Monitor
Chlorotrifluoroethylene 79-38-9	CFE, CTFE, Trifluorochloroethylene, Trifluorovinylchloride		TWA=5 (AIHA)		SA	Short OV service life
Chromium II compounds (as Cr) 7440-47-3			TWA=0.5 mg/m^3 (OSHA)		N95	
Chromium metal and Cr III compounds (as Cr) 7440-47-3			TWA=0.5 mg/m^3		N95	
Chromium compounds, insoluble Cr VI compounds (as Cr) 7440-47-3			TWA=0.01 mg/m^3		N95	

Chromium compounds, water soluble Cr VI compounds (not otherwise classified) (as Cr) 7440-47-3	Chromic acid	30 mg/m^3	TWA=0.005 mg/m^3 (OSHA)		N95	
Chromyl chloride 14977-61-8	Chloro-chromic anhydride, Chromium oxychloride		TWA=0.025		AG	
Citral 5392-40-5	2,6-Octadienal-3,7-dimethyl; 3,7-Dimethyl-2,6-octadienal		TWA=5 (inhalable fraction and vapor) -skin-	0.03	OV/P95	
Coal dust, Anthracite			TWA=0.4 mg/m^3 (respirable fraction)		N95	May also contain crystaline silica (quartz)
Coal dust, Bituminous or Lignite			TWA=0.9 mg/m^3 (respirable fraction)		N95	May also contain crystaline silica (quartz)
Coal tar pitch volatiles (as Benzene solubles) 65996-93-2	Particulate polycyclic aromatic hydrocarbons, PPAH	700 mg/m^3	TWA=0.2 mg/m^3		R95 P95	Respirators with nuisance level organic vapor or acid gas relief specifically recommended. See Comment F, page 9.

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Cobalt, elemental and inorganic compounds (as Co) 7440-48-4		20 mg/m^3	TWA=0.02 mg/m^3		N95	
Cobalt carbonyl (as Co) 10210-68-1			TWA=0.1 mg/m^3		SA	Ineffective sorbents
Cobalt hydrocarbonyl (as Co) 16842-03-8			TWA=0.1 mg/m^3		SA	Ineffective sorbents
Coke oven emissions 65996-93-2			TWA=0.15 mg/m^3 (OSHA)		R95 P95	Respirators with nuisance level organic vapor or acid gas relief specifically recommended. See Comment F, page 9.
Copper dust and mist (as Cu) 7440-50-8			TWA=1 mg/m^3		N95	
Copper fume (as Cu) 7440-50-8			TWA=0.1 mg/m^3 (OSHA)		N95	

Cotton dust, raw			TWA=0.1 mg/m^3 (thoracic fraction)		N95	5X PEL maximum for disposables, per OSHA cotton dust standard. If oil aerosol present, use R or P95.
Cresol (all isomers) 1319-77-3	Cresylic acid	250	TWA=20 mg/m^3 (inhalable fraction and vapor) -skin-	0.00005-0.0079	OV/P95	
Crotonaldehyde 4170-30-3	b-Methylacrolein, Crotonic aldehyde, Propylene aldehyde	400	TWA=2 (OSHA) C=0.3	0.135	(F)OV	
Cryolite (as F) 15096-52-3	Greenland spar, Icetone	500 mg/m^3	TWA=2.5 mg/m^3		N95	
Cumene 98-82-8	2-Phenyl propane, Cumol, Isopropyl benzene	8000	TWA=50	0.024	OV	3M 3510 Monitor
Cumene hydroperoxide 80-15-9	a,a'-Dimethylbenzyl hydroperoxide, CHP, Cumyl hydroperoxide, Isopropyl benzene hydroperoxide		TWA=1 (AIHA) -skin-	0.005	(F)OV	
Cyanamide 420-04-2	Carbodiimide, Cyanogenamide		TWA=2 mg/m^3		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Cyanides (as CN)		50 mg/m^3	TWA=5 mg/m^3 (OSHA) -skin-		SA	
Cyanogen 460-19-5	Dicyan, Oxalonitrile	66000	TWA=10	231	MG	
Cyanogen chloride 506-77-4	CNCl		C=0.3	0.976	(F)SA	Short OV service life
Cyclohexane 110-82-7	Hexahydrobenzene, Hexamethylene	10000	TWA=100	83.8	(F)OV	Irritation also provides warning. 3M 3510 Monitor
Cyclohexanol 108-93-0	Anol, Cyclohexyl alcohol, Hexahydrophenol, Hexalin, Hydralin, Hydroxycyclohexane	3500	TWA=50 -skin-	0.068	OV	See comment E, page 9. 3M 3510 Monitor.
Cyclohexanone 108-94-1	Cyclohexyl ketone, Pimelic ketone	5000	TWA=20 STEL=50 -skin-	0.019	OV	3M 3510 Monitor
Cyclohexene 110-83-8	Benzene tetrahydride	10000	TWA=300	0.363	OV	3M 3510 Monitor

Cyclohexylamine 108-91-8	Aminocyclohexane, Hexahydroaniline	15000	TWA=10	2.66	(F)OV	
Cyclonite 121-82-4	Hexahydro-1,3,5-trinitro-sym-triazine, RDX, sym-Trimethylene trinitramine		TWA=0.5 mg/m^3 -skin-		N95	
Cyclopentadiene 542-92-7	1,3-Cylclopentadiene	2000	TWA=75	3.8	OV	Short service life
Cyclopentane 287-92-3	Pentamethylene	11000	TWA=600		SA	Short OV service life
Decaborane 17702-41-9		100 mg/m^3	TWA=0.05 STEL=0.15 -skin-	0.06	SA	Unknown sorbent effectiveness
Decabromodiphenyl oxide 1163-19-5	bis-(Pentabromophenyl) ether, DBDPO, Decabromodiphenyl ether		TWA=5 mg/m^3 (AIHA)		N95	
1-Decene 872-05-9	a-Decene, Decylene	5000	TWA=100 (AIHA)	7	OV	
Dehydrolinalool 29171-20-8			TWA=2 (AIHA)		OV	
Diacetone alcohol 123-42-2	2-Methyl-2-pentanol-4-one, 4-Hydroxy-4-methyl-2-pentanone, Diacetone	2100	TWA=50	0.891	(F)OV	3M 3510 Monitor

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Diacetyl 431-03-8	Biacetyl, 2,3-Butanedione, Dimethylglyoxal, Dimethyl diketone, 2,3-Diketobutane		TWA=0.01, STEL=0.02		OV/P95	
Diallylamine 124-02-7	Di-2-propenylamine, N-2-propenyl-2-propen-1-amine		TWA=1 (AIHA) -skin-	2-9	OV	
Diazomethane 334-88-3	Azimethylene, Diazirine	2	TWA=0.2		SA	Unknown sorbent effectiveness
Diborane 19287-45-7	Boroethane	40	TWA=0.1	1.8-3.5	SA	Unknown sorbent effectiveness
Dibromochloro-propane 96-12-8	1,2-Dibromo-3-chloropropane, 1-Chloro-2,3-dibromopropane, DBCP		TWA=0.001 (OSHA)		(F)SA	OSHA requires (F)SA; no change schedule allowed
Dibromoneopenytl Glycol 3296-90-0	Dibromopentaerythritol		TWA=0.2 mg/m^3 (AIHA)		(F)R95/P95	R95/P95 acceptable with appropriate eye/face protection
Dibutylamine 111-92-2	1-Butanamine, n-butyl; Di-n-butylamine; DNBA		C=5 (AIHA) -skin-	0.1	(F)OV	See comment E, page 9
2-N-Dibutylaminoethanol 102-81-8	Dibutylaminoethanol; N,N-Dibutyl-N-(2-hydroxyethyl) amine		TWA=0.5 -skin-		(F)OV	

Dibutyl phenyl phosphate 2528-36-1	DBPP		TWA=0.3 -skin-		R95 P95	OV/P95 may be preferable if heat involved
Dibutyl phosphate 107-66-4	Dibutyl acid-o-phosphate, Dibutyl phosphoric acid, Di-n-butyl hydrogen phosphate	125	TWA=5 mg/m^3 (inhalable fraction and vapor) -skin-		OV/P95	
Dibutyl phthalate 84-74-2	1,2-Benzene dicarboxylate, DBP, Dibutyl	9300 mg/m^3	TWA=5 mg/m^3		OV/P95	See comment D, page 8
Dichloroacetic acid 79-43-6	2-2-Dichloroacetic acid; Acetic acid, dichloro; Dichloroethanoic acid; Urmer's liquid		TWA=0.5 -skin-		(F)OV/AG	
Dichloroacetylene 7572-29-4	Dichloroethyne		C=0.1		(F)SA	Short OV service life
o-Dichlorobenzene 95-50-1	1,2-Dichlorobenzene, o-Dichlorobenzol	1000	TWA=25 STEL=50 C=50 (OSHA)	0.072	(F)OV	See comment E, page 9. 3M 3510 Monitor.
p-Dichlorobenzene 106-46-7	1,4-Dichlorobenzene, Dichloricide, PDCB	1000	TWA=10	0.048	(F)OV/N95	3M 3510 Monitor
1,4-Dichloro-2-butene 764-41-0	1,4-DCB, 2-Butylenedichloride, DCB, dichlorobutene		TWA=0.005 -skin-		(F)OV	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Dichlorodi-fluoromethane 75-71-8	Freon® 12, Refrigerant 12	50000	TWA=1000		SA	Short OV service life
1,3-Dichloro-5,5-dimethyl hydantoin 118-52-5	Dactin, Halane		TWA=0.2 mg/m^3 STEL=0.4 mg/m^3	0.01	OV/N95	
1,1-Dichloroethane 75-34-3	Ethylidene chloride	4000	TWA=100	255	OV	Short service life
1,2-Dichloroethylene 540-59-0 156-59-2 156-60-5	Acetylene dichloride, Dioform	4000	TWA=200	19.1	OV	Short service life
Dichloroethyl ether 111-44-4	2,2'-Dichlorodiethyl ether; bis-(2-Chloroethyl) ether	250	TWA=5 STEL=10 C=15 (OSHA) -skin-	0.049	(F)OV	
1,1-Dichloro-1-fluoroethane 1717-00-6	Fluorocarbon 141b, HCFC 141b, HFA 141b		TWA=500 (AIHA) STEL=3000 (AIHA 5 minute)		SA	Short OV service life

Dichlorofluoromethane 75-43-4	Dichloromonofluoromethane, Freon® 21, Refrigerant 21	50000	TWA=10		SA	Short OV service life
1,1-Dichloro-1-nitroethane 594-72-9		150	TWA=2 C=10 (OSHA)		OV	
2,4-Dichlorophenol 120-83-2	2,4-DCP, DCP		TWA=1 (AIHA) -skin-	0.21	OV	R or P95 may also be needed if material is molten
1,3-Dichloropropene 542-75-6	1,3-Dichloropropylene	53000	TWA=1 -skin-		(F)OV	
2,2-Dichloropropionic acid 75-99-0	Dalapon™		TWA=5 mg/m^3 (inhalable fraction)		(F)OV/N95	
Dichlorotetra-fluoroethane 76-14-2	FC-114, Freon® 114, Halon™ 242, Refrigerant 114	50000	TWA=1000		SA	Short OV service life
Dicyclopentadiene 77-73-6		8000	TWA=5	0.03	OV/N95	
Dicyclopentadienyl iron (as Fe) 102-54-5	bis-Cyclopentadienyl iron		TWA=10 mg/m^3 TWA=5 mg/m^3 (OSHA, respirable fraction)		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Diesel fuel (as total hydrocarbons) 68334-30-5 68476-30-2 68476-31-3 68476-34-6 77650-28-3	Astral oil, Coal oil, Fuel oil, Gas oil, Home heating oil, Marine diesel fuel		TWA=100 (inhalable fraction and vapor) -skin-		OV/P95	
Diethanolamine 111-42-2	2,2'-Dihydroxydiethylamine, Butadiene Dioxide, DEA, Diolamine, N,N-Diethanolamine, di-(2-Hydroxyethyl)amine, 2,2'-Iminobisethanol	16000	TWA=1 mg/m^3 (inhalable fraction and vapor) -skin-	0.025	OV/N95	See comment E, page 9
Diethylamine 109-89-7		2000	TWA=5 STEL=15 -skin-	0.186	(F)AM (F)OV	AM not specifically approved, but 3M recommended for longer service life
2-Diethylaminoethanol 100-37-8	2-Diethylaminoethyl alcohol, N,N-Diethylethanolamine	500	TWA=2 -skin-	0.034	OV	
Diethylbenzenes, mixed 25340-17-4	1,2-Diethylbenzene, 1,3-Diethylbenzene, 1,4-Diethylbenzene, DEB, Dowtherm™ J		TWA=5 (AIHA)	12	OV	

Diethylene glycol 111-46-6	2,2'-Dihydroxydiethyl ether, DEG, Digycol		TWA=10 mg/m^3 (AIHA)		R95 P95	See comments D and G, pages 8-9
Diethylene glycol monobutyl ether 112-34-5	Butoxy diethylene glycol, Butoxydiglycol, Butyl Carbitol®		TWA=10 (inhalable fraction and vapor)		(F)OV/P95	See comment D, page 8
Diethylene glycol monoethyl ether 111-90-0	2-(2-Ethoxyethoxy) ethanol, Carbitol®, DiEGEE, Diethylene glycol ethyl ether, Dioxitol, Ethyl Carbitol®, Glycol ether DE	12000	TWA=25 (AIHA)	0.708	OV	
Diethylene triamine 111-40-0		20000	TWA=1 -skin-	9.3	(F)OV	
N,N-Diethylhydroxylamine 3710-84-7	DEHA		TWA=2		OV	
Diethyl ketone 96-22-0	3-Pentanone, Ethyl propionyl, Metacetone, Propione	16000	TWA=200 STEL=300	0.316	OV	
Diethyl phthalate 84-66-2	DEP, Ethylphthalate	7000	TWA=5 mg/m^3		R95 P95	
Difluorodibromo-methane 75-61-6	DFBM, Dibromodifluoro-methane, Freon® 12B2	2500	TWA=100		OV	Short service life
1,1-Difluoroethane 75-37-6	Dymel® 152a, Ethylidene fluoride, Freon® 152a, Genetron™ 152a, HFC-152a		TWA=1000 (AIHA)		SA	Ineffective sorbents

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Difluoromethane 75-10-5	Hydrofluorocarbon 32, R32, Refrigerant 32		TWA=1000 (AIHA)		SA	Ineffective sorbents
Diglycidyl ether 2238-07-5	2-Epoxypropyl ether, bis-(2,3-Epoxypropyl)-ether, DGE, Di-(epoxypropyl) ether, Diallyl ether dioxide	25	TWA=0.01 C=0.5 (OSHA)	4.61	(F)OV	
Diisobutylene (mixed isomers) 25167-70-8	Diisobutene		TWA=75 (AIHA)		OV	
a-Diisobutylene 107-39-1	2,4,4-Trimethyl-1-pentene, a-Diisobutene		TWA=75 (AIHA)		OV	
b-Diisobutylene 107-40-4	2,4,4-Trimethyl-2-pentene, b-Diisobutene		TWA=75 (AIHA)		OV	
Diisobutyl ketone 108-83-8	2,6-Dimethyl-4-heptanone, Isovalerone, sym-Diisopropylacetone, Valerone	2000	TWA=25	0.339	(F)OV	See comment E, page 9. 3M 3510 Monitor.
Diisopropylamine 108-18-9		1000	TWA=5 -skin-	0.398	(F)OV	
Dimethyl acetamide 127-19-5	DMAC, N,N-Dimethyl acetamide	400	TWA=10 -skin-	47.9	OV	

Dimethylamine 124-40-3	Anhydrous dimethylamine	2000	TWA=5 STEL=15	0.081	AM	AM not specifically approved, but 3M recommended for longer service life
bis-(2-Dimethylaminoethyl) ether 3033-62-3	DMAEE; Ethylamine, 2,2”-Oxybis (N,N-dimethyl); Niax® Catalyst A-99		TWA=0.05 STEL=0.15 -skin-		(F)OV	
Dimethylaniline 121-69-7	N,N-Dimethylaniline	100	TWA=5 STEL=10 -skin-	0.219	OV	
Dimethyl carbamoyl chloride 79-44-7	Chloroformic acid dimethylamide, Dimethyl carbamic chloride, Dimethylcarbamyl chloride, DMCC		TWA=0.005 -skin-		(F)MG	
Dimethyldichlorosilane 75-78-5	Dichlorodimethylsilane		C=2 (AIHA)		OV/AG	
Dimethyl disulfide 624-92-0	2,3-Dithiabutane, Dimethyldisulfide, Dimethyldisulphide, DMDS		TWA=0.5 -skin-		OV/AG	
Dimethyl ether 115-10-6	Methyl ether, Wood ether	34000	TWA=1000 (AIHA)	0.3-9.0	SA	Short OV service life

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Dimethylethoxysilane 14857-34-2	Ethoxydimethyl silane		TWA=0.5 STEL=1.5		(F)SA	Unknown sorbent effectiveness
Dimethyl formamide 68-12-2	DMF, N,N-Dimethyl formamide	3500	TWA=10 -skin-	100	OV	
1,1-Dimethylhydrazine 57-14-7	UDMH, unsym-Dimethylhydrazine	50	TWA=0.01 -skin-	8.79	(F)AM	
Dimethylphthalate 131-11-3	DMP	9300 mg/m^3	TWA=5 mg/m^3		OV/P95	See comment D, page 8
Dimethyl sulfide 75-18-3	DMS; Methane, thiobis; Thiobis (methane)		TWA=10	0.003	OV/AG	AG recommended since H2S may also be present
Dimethyl sulfoxide 67-68-5	DMSO, Methylsulfoxide		TWA=250 (AIHA)		OV	
Dimethylsulfate 77-78-1	Methyl sulfate	10	TWA=0.1 -skin-		(F)OV	
Dimethyl terephthalate 120-61-6	1,4-Benzene dicarboxylic acid, dimethyl ester; Dimethyl para-phthalate; DMT		TWA=5 mg/m^3 (AIHA)		OV/N95	

N,N-Dimethyl-para-toluidine 99-97-8	4-Dimethylaminotoluene, DMPT, N,N,4-trimethylaniline, N,N,4-Trimethylbenzenamine		TWA=0.5 (AIHA)		OV	
Dinitrobenzene 528-29-0 99-65-0 100-25-4 25154-54-5	1,2-Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrobenzene, m-Dinitrobenzene, o-Dinitrobenzene, p-Dinitrobenzene	200 mg/m^3	TWA=0.15 -skin-		OV/N95	
3,5-Dinitro-o-toluamide 148-01-6	2-Methyl-3,5-dinitrobenzamide, Coccidin, Dinitolmide, Salcostat, Zoalene		TWA=1 mg/m^3		N95	
Dinitrotoluene 25321-14-6	DNT	200 mg/m^3	TWA=0.2 mg/m^3 -skin-		OV/N95	See comment D, page 8
Di-sec-octyl phthalate 117-81-7	bis(2-Ethylhexyl) phthalate, DEHP, Di-2-ethylhexyl phthalate, DOP	3000	TWA=5 mg/m^3		R95 P95	
1,3-Dioxalane 646-06-0	1,3-Dioxacyclopentane; 1,3-Dioxalan; 1,3-Dioxole, dihydroethylene glycol formal; Dioxalane; Formal glycol; Glycol methylene ether; Glycolformal		TWA=20		OV	
Dioxane 123-91-1	1,4-Dioxane, Diethylene dioxide, Diethylene ether, p-Dioxane	2000	TWA=20 -skin-	7.78	OV	3M 3510 Monitor

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Diphenylamine 122-39-4	DPA, N-Phenylaniline		TWA=10 mg/m^3	0.022	N95	OV/N95 may be preferable when odor is a problem
Dipropylene glycol methyl ether 34590-94-8	bis(2-Methoxypropyl) ether, Dipropylene glycol monomethyl ether, Dowanol™ 50B	11000	TWA=100 STEL=150 -skin-	1,000	OV	
Dipropyl ketone 123-19-3	4-Heptanone, Butyrane		TWA=50		OV	
Divinyl benzene 1321-74-0	DVB, Vinylstyrene	11000	TWA=10		(F)OV	
Dodecyl mercaptan 112-55-0	1-Dodecanethiol, 1-Mercaptododecane, n-Dodecyl mercaptan, n-Lauryl mercaptan		TWA=0.1		OV	R or P filter may be needed with oily aerosols
Dowtherm™ Q	1,1-Diphenylethane with ethylated benzenes		TWA=1 (AIHA)		OV/P95	
Emery 1302-74-5	Corundum		TWA=15 mg/m^3 (OSHA) TWA=1 mg/m^3 (respirable fraction)		N95	

Enflurane 13838-16-9	2-Chloro-1,1,2-trifluoroethyl difluoromethyl ether; Ethrane		TWA=75		SA	Short OV service life. 3M 3510 monitor
Epichlorohydrin 106-89-8	1-Chloro,2,3-epoxypropane, 2-Chloropropylene oxide, gamma-Chloropropylene oxide	250	TWA=0.5 -skin-	0.934	(F)OV	3M 3510 Monitor
Erythromycin 114-07-8	Dotycin, E-Mycin™, Ericynum, Erycin, Pentadecanoic acid		TWA=3 mg/m^3 (AIHA)		N95	
Ethane 74-84-0	Ethylhydride, Methyl methane					Simple asphyxiant, oxygen displacing gas.
Ethanolamine 141-43-5	2-Aminoethanol, 2-Hydroxyethylamine, b-Aminoethyl alcohol, Ethylolamine, Monoethanolamine	1000	TWA=3 STEL=6	2.59	OV	
2-Ethoxyethanol 110-80-5	Cellosolve® solvent, Ethylene glycol monoethyl ether, Glycol monoethyl ether	6000	TWA=5 -skin-	1.22	OV	3M 3510 Monitor
2-Ethoxyethyl acetate 111-15-9	Cellosolve® acetate, Ethylene glycol monoethyl ether acetate	2500	TWA=5 -skin-	0.182	OV	3M 3510 Monitor
Ethyl acetate 141-78-6	Acetic ester, Acetic ether, Ethyl ethanoate	10000	TWA=400	0.61	(F)OV	3M 3510 Monitor

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Ethyl acrylate 140-88-5	Acrylic acid ethyl ester	2000	TWA=5 STEL=15 -skin-	0.001	(F)OV	3M 3510 Monitor
Ethyl alcohol 64-17-5	Ethanol	15000	STEL=1000	0.136	OV	Short OV service life
Ethylamine 75-04-7	Aminoethane, Anhydrous ethylamine, Monoethylamine	4000	TWA=5 STEL=15 -skin-	0.324	(F)AM	AM not specifically approved, but 3M recommended for longer service life
Ethyl amyl ketone 541-85-5	5-Methyl-3-heptanone, EAK	3000	TWA=10	6	(F)OV	
Ethyl benzene 100-41-4	Ethylbenzol, Phenylethane	2000	TWA=20	2.3	OV	See comment E, page 9. 3M 3510 Monitor.
Ethyl bromide 74-96-4	Bromoethane	3500	TWA=5 -skin-	3.09	SA	Short OV service life
Ethyl butyl ketone 106-35-4	3-Heptanone	3000	TWA=50 STEL=75	0.1-10	OV	See comment E, page 9.
Ethyl chloride 75-00-3	Chloroethane, Hydrochloric ether, Monochloroethane	20000	TWA=100 -skin-	4.07	SA	Short OV service life

Ethyl cyanoacrylate 7085-85-0	2-Cyano-2-propenoic acid, ethyl ester; 2-Cyanoacrylic acid, ethyl ester; ECA; Ethyl 2-cyano-2-propenoate; Ethyl 2-cyanoacrylate; Ethyl alpha-cyanoacrylate		TWA=0.2		OV	
Ethyl tert-butyl ether 637-92-3	1,1-Dimethyl ethyl ether; 2-Ethoxy-2-methylpropane; ETBE; Ethyl 1,1-dimethylethyl ether; Ethyl tert-butyl oxide; tert-Butyl ethyl ether		TWA=25		OV	
Ethylene 74-85-1	Acetene, Bicarburretted hydrogen, Elayl, Ethene, Olefiant gas		TWA=200		(F)SA	
Ethylene chlorohydrin 107-07-3	2-Chloroethanol, 2-Chloroethyl alcohol	10	C=1 -skin-	0.402	OV	3M 3510 Monitor
Ethylenediamine 107-15-3	1,2-Diaminoethane, 1,2-Ethanediamine	2000	TWA=10	4.27	(F)OV	
Ethylene dibromide 106-93-4	1,2-Dibromoethane	400	TWA=20 (OSHA) C=30 (OSHA) -skin-	9.84	(F)OV	
Ethylene dichloride 107-06-2	1,2-Dichloroethane, Ethylene chloride	1000	TWA=10 C=100 (OSHA)	11.2	OV	3M 3510 Monitor

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Ethylene glycol aerosol 107-21-1	1,2-Ethanediol, Ethylene alcohol, Glycol	32000	C=100 mg/m^3 (aerosol only)	60.3 mg/m^3	OV/P95	See comments D and G, pages 8-9
Ethylene glycol dinitrate 628-96-6	Glycol dinitrate, Nitroglycol	500 mg/m^3	TWA=0.05 C=0.2 (OSHA) -skin-		OV	
Ethyleneimine 151-56-4	Aminoethylene, Azirane, Aziridine, Dihydroazirine, Dimethylenimine, Ethyleimine	100	TWA=0.05 STEL=0.1 -skin-	1.5	(F)MG	OSHA requires SA with hood for certain applications; see 29 CFR 1910.1003
Ethylene oxide 75-21-8	1,2-Epoxyethane, Dimethylene oxide, Oxirane	800	TWA=1 STEL=5 (OSHA)	851	(F)SA	OSHA requires (F)SA; no change schedule allowed. 3M 3550 Monitor.
Ethyl ether 60-29-7	Diethyl ether, Ether, Ethyl oxide	19000	TWA=400 STEL=500	2.29	OV	Short service life. 3M 3530 Monitor.
Ethyl formate 109-94-4	Ethyl methanoate, Formic acid ethyl ester	8000	STEL=100	18.6	(F)OV	Short service life

2-Ethylhexanoic acid 149-57-5	2-Butylbutanoic acid, 2-Ethylcaproic acid, 2-Ethylhexoic acid, Butylethylacetic acid, Ethylhexoic acid		TWA=5 mg/m^3 (inhalable fraction and vapor)		OV/N95	
Ethylidene norbornene 16219-75-3	ENB		C=5	0.074	(F)OV	
Ethyl mercaptan 75-08-1	Ethanethiol, Ethyl sulfhydrate	2500	TWA=0.5 C=10 (OSHA)	0.001	OV	Short service life
N-Ethylmorpholine 100-74-3	4-Ethylmorpholine	2000	TWA=5 -skin-	0.275	(F)OV	
Ethyl silicate 78-10-4	Ethyl orthosilicate, Tetraethoxy- silane, Tetraethyl silicate	1000	TWA=10	3.6	OV	
Ferrovanadium dust 12604-58-9			TWA=1 mg/m^3 STEL=3 mg/m^3		N95	
Flour dust			TWA=0.5 mg/m^3 (inhalable fraction)		N95	
Fluorides (as F)	(Synonyms vary depending upon specific compound.)	500 mg/m^3	TWA=2.5 mg/m^3		N95	
Fluorine 7782-41-4		25	TWA=0.1 (OSHA) STEL=2	0.126	(F)SA	Unknown reaction products with sorbent

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Formaldehyde 50-00-0	Formalin, Methylene oxide	30	TWA=0.75 (OSHA) STEL=2 (OSHA) C=0.3	0.871	(F)Form	Irritation also provides warning. 3M 3720 Monitor.
Formamide 75-12-7	Methanamide		TWA=10 -skin-	80	OV	
Formic acid 64-18-6	Hydrogencarboxylic acid, Methanoic acid	30	TWA=5 STEL=10	28.2	(F)OV	Low IDLH
Furfural 98-01-0	2-Furaldehyde, 2-Furancarboxaldehyde, Fural, Furfuraldehyde	250	TWA=2 -skin-	0.058	(F)OV	3M 3510 Monitor
Furfuryl alcohol 98-00-0	2-Hydroxymethylfuran, 2-Furylmethanol	250	TWA=10 STEL=15 -skin-	7.83	(F)OV	See comment E, page 9
Gallium arsenide 1303-00-0	Gallium monoarsenide		TWA=0.0003 mg/m^3 (respirable fraction)		N100	
Gasoline 86290-81-5	Petrol	14000	TWA=300 STEL=500	0.3	(F)OV	

Germanium tetrahydride 7782-65-2	Germane, Germanium hydride		TWA=0.2		(F)SA	Unknown sorbent effectiveness
Glutaraldehyde 111-30-8	1,5-Pentanedial		C=0.05	0.038	(F)OV	See comment E, page 9
Glycerin mist 56-81-5	Glycerol		TWA= 5 mg/m^3 (OSHA, respirable fraction)		R95 P95	
Glycidol 556-52-5	2,3-Epoxy-1-propanol; 2-Hydroxymethyloxiran; 3-Hydroxypropylene oxide; Epoxypropyl alcohol; Hydroxymethyl ethylene oxide	500	TWA=2		OV	
Glycidyl methacrylate 106-91-2	1-Propanol, 2-3, epoxy-, ethacrylate; 2,3-Epoxypropyl methacrylate; 2-Methyl-2-propenoic acid, oxiranylmethyl ester; GMA; Methacrylic acid, 2,3-Epoxypropyl ester		TWA=0.5 (AIHA) -skin-		OV	
Glyoxal 107-22-2	1,2-Ethanedione, Biformyl, Diformyl, Ethanedial, Glyoxalaldehyde, Oxalaldehyde		TWA=0.1 mg/m^3 (inhalable fraction and vapor)		(F)OV/N95	Short OV service life at 10X OEL

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Grain dust (oat, wheat, barley)			TWA=4 mg/m^3		N95	
Graphite (natural) 7782-42-5	Black lead, Corbo minerals, Plumbago, Potelot, Silver lead		TWA=2 mg/m^3 (respirable fraction)		N95	
Graphite (synthetic) 7440-44-0			TWA=15 mg/m^3 (OSHA) TWA=2 mg/m^3 (respirable fraction)		N95	
Hafnium and compounds (as Hf) 7440-58-6			TWA=0.5 mg/m^3		N95	
Halothane 151-67-7	2-Bromo-2-chloro-1,1,1-trifluoroethane		TWA=50	33	OV	Short service life 3M 3510 Monitor
Heptane (all isomers) 142-82-5 590-35-2 565-59-3 108-08-7 591-76-4 589-34-4	n-Heptane, normal Heptane	5000	TWA=400 STEL=500	9.77	OV	3M 3510 Monitor

Hexachlorobenzene 118-74-1	Perchlorobenzene		TWA=0.002 mg/m^3 -skin-	0.463 mg/m^3	N95	
Hexachlorobutadiene 87-68-3	Hexachloro-1,3-butadiene; Perchlorobutadiene		TWA=0.02 -skin-		(F)OV	
Hexachlorocyclo- pentadiene 77-47-4			TWA=0.01	0.03	(F)OV	
Hexachloroethane 67-72-1	Perchloroethane	300	TWA=1 -skin-	0.15	OV/N95	
Hexachloro- naphthalene 1335-87-1	Halowax™ 1014	2 mg/m^3	TWA=0.2 mg/m^3 -skin-		OV/N95	See comment D, page 8
1,4-Hexadiene 592-45-0	1-Allylpropene		TWA=10 (AIHA)		OV	
Hexafluoroacetone 684-16-2	1,1,1,3,3,3-Hexafluoro-2- propanone		TWA=0.1 -skin-		SA	Short OV service life
1,1,1,3,3,3- Hexafluoropropane 690-39-1	FC-236fa, FE-13, HFC-236fa, Hydrofluorocarbon 236fa		TWA=1000 (AIHA)		SA	Ineffective sorbents

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Hexafluoropropylene 116-15-4	1,1,2,3,3,3-Hexafluoro-1-propene; 1,1,2,3,3,3-Hexafluoropropylene; Fluorocarbon 1216; Hexafluoropropene; HFP; Perfluoro-1-propene; Perfluoropropene; Perfluoropropylene		TWA=0.1		SA	Short OV service life
Hexahydrophthalic anhydride (all isomers) 85-42-7 13149-00-3 14166-21-3	1,2-Cyclohexanedicarboxylic acid anhydride; 1,2-Cyclohexanedicarboxylic anhydride; 1,3-Isobenzofurandione, hexahydro; Cyclohexane-1,2-dicaboxylic anhydride, cis and trans mixture; Hexahydro-1,3-isobenzofurandione; Hexahydrophthalic acid anhydride; HHPA; HHPAA		C=0.005 mg/m^3 (inhalable fraction and vapor)		OV/N95	
Hexamethylene diisocyanate 822-06-0	HDI		TWA=0.005	0.01	OV/N95	

Hexane (n-hexane) 110-54-3	Hexyl hydride, Normal hexane	5000	TWA=50 -skin-	21.9	OV	3M 3510 Monitor
Hexane (other isomers)		12000	TWA=500 STEL=1000	65 - 248	OV	Short service life 3M 3510 Monitor
1,6-Hexanediamine 124-09-4	1,6-Diaminohexane, Hexamethylenediamine, HMD, HMDA		TWA=0.5		OV/N95	
Hexanediol diacrylate 13048-33-4	HDODA; Propenoic acid, 1,6-hexanediol ester		TWA=1 mg/m^3 (AIHA)		OV/P95	See comment D, page 8
1-Hexene 592-41-6	Butyl ethylene, Hex-1-ene, Hexene, Hexene-n-1, Hexylene		TWA=50		OV	Short service life
sec-Hexyl acetate 108-84-9	1,3-Dimethylbutyl acetate, Methylamyl acetate, Methylisoamyl acetate, Methylisobutyl carbinol	4000	TWA=50	0.219	(F)OV	See comment E, page 9
Hexylene glycol 107-41-5	4-Methyl-2,4-pentanediol	13000	C=25	49.9	(F)OV	Irritation also provides warning

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
HFE-7100 163702-08-7 163702-07-6	60% of mixture is:1-Methoxy-2-trifluoromethyl-1,1,2,3,3,3-hexafluoropropane; 1-Methoxyperfluoroisobutane 40% of mixture is 1-Methoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane; 1-Methoxyperfluorobutane		TWA=750 (AIHA)		OV	Short service life
Hydrazine 302-01-2	Anhydrous hydrazine	80	TWA=0.01 -skin-	3.6	(F)AM	
Hydrogenated terphenyls 61788-32-7			TWA=0.5		R95 P95	
Hydrogen bromide 10035-10-6	HBr, Hydrobromic acid	50	C=2	2	AG	Not specifically approved for HBr
Hydrogen chloride 7647-01-0	HCl, Hydrochloric acid, Muriatic acid	100	C=2	0.77	AG	Irritation also provides warning
Hydrogen cyanide 74-90-8	Hydrocyanic acid, Prussic acid	50	C=4.7 -skin-	0.603	(F)SA	Low IDLH

Hydrogen fluoride 7664-39-3	Anydrofluoric acid, Etching acid, Fluoric acid, Fluorohydric acid, HF	30	TWA=0.5 C=2 -skin-	0.042	(F)HF	
Hydrogen peroxide 7722-84-1	Hydrogen dioxide, Peroxide	75	TWA=1		(F)OV	See technical data bulletin 185
Hydrogen selenide (as Se) 7783-07-5	Selenium hydride	2	TWA=0.05	0.3	(F)MG	
Hydrogen sulfide 7783-06-4	H_2S, Hepatic gas, Hydrosulfuric acid, Sulfuretted hydrogen	300	TWA=1 STEL=5	0.001	AG	Poor warning (olfactory fatigue)
Hydroquinone 123-31-9	1,4-Benzenediol, Dihydroxybenzene, Quinol		TWA=1 mg/m^3		(F)OV/N95	See comment D, page 8
4-Hydroxybenzoic acid 99-96-7			TWA=5 mg/m^3 (AIHA)		(F)N95	
2-Hydroxypropyl acrylate 999-61-1	HPA	18000	TWA=0.5 -skin-		OV	
Indene 95-13-6	Indonaphthene		TWA=5	0.009	OV	
Indium and compounds (as In) 7440-74-6			TWA=0.1 mg/m^3		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Iodides			TWA=0.01 (inhalable fraction and vapor)		(F)MG/N95	See comment E, page 9
Iodine 7553-56-2		10	TWA=0.01 (inhalable fraction and vapor) STEL=0.1 vapor and aerosol		(F)MG/N95	See comment E, page 9
Iodoform 75-47-8	Triiodomethane		TWA=0.6	0.000019-1.1	(F)OV	
Iron oxide 1309-37-1	Burnt sienna, Burnt umber, Ferric oxide, Hematite, Jeweler's rouge, Rouge		TWA=5 mg/m^3 (respirable fraction)		N95	
Iron oxide fume 1309-37-1	Ferric oxide fume		TWA=10 mg/m^3 (OSHA) TWA= 5 mg/m^3 (respirable fraction)		N95	
Iron pentacarbonyl (as Fe) 13463-40-6	Iron carbonyl		TWA=0.1 STEL=0.2		SA	Unknown sorbent effectiveness

Iron salts, soluble (as Fe)	Ferric chloride; Ferric nitrate; Ferric sulfate; Ferric/Ferrous salts, soluble; Ferrous chloride; Ferrous sulfate		TWA=1 mg/m^3		N95	
Isoamyl alcohol 123-51-3	3-Methyl-1-butanol, Fusel oil, Isobutyl carbinol, Isopentyl alcohol	10000	TWA=100 STEL=125	0.045	(F)OV	See comment E, page 9
Isobutane 75-28-5	2-Methyl propane, Methylpropane	16000	STEL=1000		SA	Short OV service life
Isobutene 115-11-7	1,1-Dimethylethene, 1,1-Dimethylethylene, 2-Methylpropene, 2-Methylpropylene, Isobutylene		TWA=250		OV	Short service life
Isobutyl acetate 110-19-0	2-Methylpropyl acetate	7500	TWA=150	0.479	(F)OV	
Isobutyl alcohol 78-83-1	2-Methyl-1-propanol, IBA, Isobutanol, Isopropylcarbinol	8000	TWA=50	0.832	(F)OV	3M 3510 Monitor
Isobutyl nitrite 542-56-3	IBN; Nitrous acid, 2-methylpropyl ester; Nitrous acid, isobutyl ester		C=1 (inhalable fraction and vapor)		OV/N95	See comment E, page 9

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Isobutyraldehyde 78-84-2	2-Methyl-1-propanal, 2-Methylpropanal, 2-Methylpropionaldehyde, Isobutanal, Isobutyl aldehyde, Isobutyric aldehyde, Valine aldehyde		TWA=25 (AIHA)		OV	Short service life
Isocyanuric acid 108-80-5	Cyanuric acid; s-Triazine-2,4,6(1H,3H,5H)-triione; s-Triazinetriol		TWA=10 mg/m^3 (AIHA) TWA=5 mg/m^3 (AIHA, respirable fraction)		N95	AM/N95 may be preferable if wet
Isooctyl alcohol 26952-21-6	Isooctanol	9000	TWA=50 -skin-		OV	
Isophorone 78-59-1	3,5,5-Trimethyl-2-cyclohexene-1-one	800	C=5	0.631	OV	See comment E, page 9. 3M 3510 Monitor.
Isophorone diisocyanate 4098-71-9	IPDI		TWA=0.005		OV/N95	

Isophthalic acid 121-91-5	1,3-Benzenedicarboxylic acid, IA, IPA, m-Phthalic acid		TWA=10 mg/m^3 (AIHA) TWA=5 mg/m^3 (AIHA, respirable fraction)		N95	
Isoprene 78-79-5	2-Methyl-1,3-butadiene	15000	TWA=2 (AIHA)	1.8	OV	Short service life
Isopropoxyethanol 109-59-1	Ethylene glycol monoisopropyl ether, IPE, Isopropyl Cellosolve®, Isopropyl glycol		TWA=25 -skin-	0.738	OV	
Isopropyl acetate 108-21-4	Isopropyl ester of acetic acid, sec-Propyl acetate	16000	TWA=100 STEL=200	0.05-4.1	(F)OV	3M 3510 Monitor
Isopropylamine 75-31-0	2-Aminopropane, Monoisopropylamine	4000	TWA=5 STEL=10	0.6	(F)AM (F)OV	AM not specifically approved, but 3M recommended for longer service life
N-Isopropylaniline 768-52-5	o-Aminoisopropylbenzene, o-Isopropylaniline		TWA=2 -skin-		OV	
Isopropyl ether 108-20-3	Diisopropyl ether	10000	TWA=250 STEL=310	0.055	OV	
Isopropyl glycidyl ether 4016-14-2	1,2-Epoxy-3-isopropoxy-propane, IGE, Isopropoxymethyl-oxiran, Isopropyl epoxypropyl ether	1000	TWA=50 STEL=75	297	(F)OV	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Kaolin (particles with no asbestos and <1% crystalline silica) 1332-58-7	Aluminium silicate, China clay		TWA= 2 mg/m^3 (respirable fraction)		N95	
Kerosene (applications with negligible aerosol) 8008-20-6 64712-81-0	Deobase, Diesel No.1, Fuel oil No.1, JP-4, JP-5, JP-8, Kerosine, Hydrotreated kerosene	7000	TWA= 200 mg/m^3 (as total hydrocabon vapor) -skin-		OV/P95	When aerosols present, add a particulate prefilter
Ketene 463-51-4	Carbomethene, Ethenone		TWA=0.5 STEL=1.5		(F)SA	Ineffective sorbents
Lead arsenate (as As) 3687-31-8		100 mg/m^3	TWA=0.01 mg/m^3		N100	
Lead chromate (as Cr) 7758-97-6	Chromates of lead, Chrome orange, Red lead chromate	30 mg/m^3	TWA=0.012 mg/m^3		N100	
Lead, elemental and inorganic compounds (as Pb) 7439-92-1		700 mg/m^3	TWA=0.05 mg/m^3		N100	

d-Limonene 5989-27-5	1-Methyl-4(1-methylethenyl) cyclohexene, 4-Isopropyl-1-methlcyclohexene, Cajeputene, Cinene, p-Mentha-1,8-diene		TWA=30 (AIHA)	0.437	OV	
Lithium fluoride (as F) 7789-24-4			TWA=2.5 mg/m^3		N95	
Lithium hydride 7580-67-8		55 mg/m^3	TWA=0.025 mg/m^3		N95	
Lithium hydroxide 1310-65-2	Lithium hydroxide monohydrate		C=1 mg/m^3 (AIHA)		N95	
Lithium oxide 12057-24-8	Dilithium oxide, Lithium monoxide		C=1 mg/m^3 (AIHA)		N95	
LPG 68476-85-7	Bottled gas, Liquefied petroleum gas	19000	TWA=1000 (OSHA)		SA	Mixture with compounds with short OV service life
Magnesite 546-93-0	Magnesium carbonate		TWA=15 mg/m^3 (OSHA) TWA= 5 mg/m^3 (OSHA, respirable fraction)		N95	
Magnesium oxide fume 1309-48-4	Magnesia fume		TWA=10 mg/m^3 (inhalable fraction)		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Maleic anhydride 108-31-6	2,5-Furandione, cis-Butenedioic anhydride, Maleic acid anhydride	14000	TWA=0.01 (Inhalable fraction and vapor)	0.318	(F)OV/N95	
Manganese cyclopentadienyl tricarbonyl 12079-65-1	MCT		TWA=0.1 mg/m^3 -skin-		SA	Properties of vapor unknown
Manganese, elemental and inorganic compounds (as Mn) 7439-96-5			TWA=0.1 mg/m^3 (inhalable fraction) TWA=0.02 mg/m^3 (respirable fraction) C= 5 mg/m^3 (OSHA)		N95	
Melamine 108-78-1	1,3,5-Triazine-2,4,6-triamine; 2,4,6-Triamino-1,3,5-triazine; Cyanuramide		TWA=10 mg/m^3 (AIHA, inhalable fraction) TWA=5 mg/m^3 (AIHA, respirable fraction)		N95	
2-Mercaptobenzo-thiazole 149-30-4	2-Benzothiazolethiol, 2-Benzothiazolylmercaptan, Benzothiazole-2-thione, Mercaptobenzothiazole		TWA=5 mg/m^3 (AIHA) -skin-	12 mg/m^3	N95	

Mercaptoethanol 60-24-2	1-Hydroxy-2-mercaptoethane, 2-Hydroxy-1-ethanethiol, 2-Hydroxyethylmercaptan, 2ME, 2-Mercaptoethanol, 2-Thioethanol, Thioethyleneglycol, Thioglycol		TWA=0.2 (AIHA)	0.12-0.64	OV	
Mercury, alkyl compounds (as Hg)		10 mg/m^3	TWA=0.01 mg/m^3 -skin-		SA	
Mercury, aryl compounds (as Hg)		28 mg/m^3	TWA=0.1 mg/m^3 -skin-		N95	Dust with essentially no vapor pressure only
Mercury, inorganic compounds (as Hg)		28 mg/m^3	TWA=0.025 mg/m^3 -skin-		N95	Dust with essentially no vapor pressure only. Hg/N95 for volatile liquids.
Mercury, metallic mercury vapor 7439-97-6	Hg, Quicksilver	28 mg/m^3	TWA=0.025 mg/m^3 -skin-		Hg	
Mesityl oxide 141-79-7	Isobutenyl methyl ketone, Isopropylidene acetone, Methyl isobutenyl ketone	5000	TWA=15 STEL=25	0.056	(F)OV	3M 3510 Monitor
Methacrylic acid 79-41-4	a-Methacrylic acid		TWA=20		(F)OV	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Methane 74-82-8	Biogas, Fire damp, Marsh gas, Methyl hydride, R 50 (refrigerant)					Simple asphyxiant, oxygen displacing gas.
2-Methoxyethanol 109-86-4	Ethylene glycol monomethyl ether, Methyl Cellosolve®	2000	TWA=0.1 -skin-	0.11	OV	3M 3510 Monitor
2-Methoxyethyl acetate 110-49-6	Ethylene glycol methyl ether acetate, Ethylene glycol monomethyl ether acetate, Methyl Cellosolve® acetate	4000	TWA=0.1 -skin-	1.07	OV	3M 3510 Monitor
4-Methoxyphenol 150-76-5	Hydroquinone monomethyl ether, p-Methoxyphenol		TWA=5 mg/m^3		N95	
3-Methoxypropyl amine 5332-73-0	1-Propanimine, 3-methoxy		TWA=5 (AIHA) STEL=15 (AIHA)	2.7	(F)OV (F)AM	Irritation also provides warning. AM may be preferred, but not specifically approved
Methyl acetate 79-20-9	Acetic acid methyl ester, Methyl acetic ester, Methyl ethanoate	10000	TWA=200 STEL=250	6.17	OV	Short service life
Methyl acetylene 74-99-7	Allylene, Propyne	15000	TWA=1000		SA	Short OV service life

Methyl acetylene propadiene mixture 59355-75-8	MAPP gas, Methyl acetylene-allene mixture, Propyne-allene mixture	15000	TWA=1000 STEL=1250	100	SA	Short OV service life
Methyl acrylate 96-33-3	Methyl propenoate	1000	TWA=2 -skin-	0.263	(F)OV	3M 3510 Monitor
Methylacrylonitrile 126-98-7	2-Methyl-2-propenenitrile, Isoprene cyanide	20000	TWA=1 -skin-	6.8	SA	
Methylal 109-87-5	Dimethoxymethane, Dimethylacetal formaldehyde, Formal, Methyl formal	15000	TWA=1000		SA	
Methyl alcohol 67-56-1	Carbinol, Methanol, Wood alcohol	25000	TWA=200 STEL=250 -skin-	141	SA	Short OV service life
Methylamine 74-89-5	Monomethylamine	100	TWA=5 STEL=15	0.019	(F)AM	
Methyl amyl alcohol 108-11-2	Methyl isobutyl carbinol	2000	TWA=25 STEL=40 -skin-	1.1	OV	
Methyl n-amyl ketone 110-43-0	2-Heptanone, Amyl methyl ketone, Methyl amyl ketone, n-Amyl methyl ketone	4000	TWA=50	0.141	OV	See comment E, page 9
Methylaniline 100-61-8	MA, Monomethyl aniline, N-Methyl aniline	100	TWA=0.5 -skin-	1.74	OV	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Methyl bromide 74-83-9	Bromomethane	2000	TWA=1 C=20 (OSHA) -skin-		(F)SA	Short OV service life. Use of 60928 cartridge/ filter recommended by 3M, not specifically approved for methyl bromide.
Methyl tert-butyl ether 1634-04-4	2,2-MMOP, 2-Methoxy-2-methyl-propane, MTBE, tert-Butyl methyl ether	25000	TWA=50	0.053	OV	Short service life 3M 3510 Monitor
Methyl n-butyl ketone 591-78-6	2-Hexanone, MBK	5000	TWA=5 STEL=10 -skin-	0.166	OV	3M 3510 Monitor
Methyl chloride 74-87-3	Chloromethane	10000	TWA=50 STEL=100 -skin-	10.2	SA	Short OV service life
Methyl chloroform 71-55-6	1,1,1-Trichloroethane	1000	TWA=350 STEL=450	22.4	OV	3M 3510 Monitor
Methyl 2-cyanoacrylate 137-05-3	Mecrylate		TWA=0.2	2.16	(F)OV	

Methylcyclohexane 108-87-2	Cyclohexylmethane, Hexahydrotoluene	10000	TWA=400	500-630	OV	
Methylcyclohexanol 25639-42-3	Hexahydrocresols	10000	TWA=50	490	OV	
o-Methylcyclo-hexanone 583-60-8	2-Methylcyclohexanone	2500	TWA=50 STEL=75 -skin-		(F)OV	Irritation also provides warning
2-Methylcyclo-pentadienyl manganese tricarbonyl (as Mn) 12108-13-3			TWA=0.2 mg/m^3 -skin-		OV/N95	SA preferable if heat involved
Methylene bisphenyl isocyanate 101-68-8	4,4-Diphenylmethane diisocyanate, MDI, Methylene-bis-(4-phenyl isocyanate)	100 mg/m^3	TWA=0.005 C=0.02 (OSHA)	0.384	OV/N95	
Methylene chloride 75-09-2	Dichloromethane, Methylene dichloride	5000	TWA=25 (OSHA) STEL=125 (OSHA)	0.912	(F)SA	OSHA requires (F)SA; no change schedule allowed. Short OV service life. 3M 3530 Monitor.
4,4'-Methylene-bis-(2-chloroaniline) 101-14-4	4,4'-Methylene-bis-(2-chlorobenzamine), DACPM, MOCA		TWA=0.01 -skin-		OV	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Methylene-bis(4-cyclohexylisocyanate) 5124-30-1			TWA=0.005		OV/N95	
4,4'-Methylene dianiline 101-77-9	4,4'-Diaminodiphenylmethane, MDA		TWA=0.01 (OSHA) STEL=0.1 (OSHA) -skin-		N100	Use OV/N100 if heat is involved. See 29 CFR 1910.1050.
Methyl ethyl ketone 78-93-3	2-Butanone, MEK	3000	TWA=200 STEL=300	0.27	(F)OV	3M 3510 Monitor
Methyl ethyl ketone peroxide 1338-23-4	MEKP		C=0.2		(F)OV	
Methyl ethyl ketoxime 96-29-7	2-Butanone oxime, MEKO		TWA=10 (AIHA)		OV	
Methyl formate 107-31-3	Formic acid methyl ester, Methyl methanoate	5000	TWA=100 STEL=150	93.3	SA	Short OV service life
Methyl hydrazine 60-34-4	Monomethyl hydrazine	50	TWA=0.01 C=0.2 (OSHA) -skin-	1.71	(F)AM	

Methyl iodide 74-88-4	Iodomethane	800	TWA=2 -skin-		(F)SA	Short OV service life. Use of 60928 cartridge/filter recommended by 3M, not specifically approved for methyl iodide.
Methyl isoamyl ketone 110-12-3	2-Methyl-5-hexanone, 5-Methyl-2-hexanone, MIAK	10000	TWA=20 STEL=50	0.042	(F)OV	
Methyl isobutyl ketone 108-10-1	Hexone, MIBK	3000	TWA=20 STEL=75	0.121	(F)OV	3M 3510 Monitor
Methyl isocyanate 624-83-9	Isocyanic acid,methyl ester	20	TWA=0.02 -skin-	2.1	SA	Unknown sorbent effectiveness
Methyl isopropyl ketone 563-80-4	3-Methyl-2-butanone, MIPK		TWA=20	4.47	(F)OV	
Methyl mercaptan 74-93-1	Mercaptomethane, Methanethiol, Methyl sulfhydrate, Thiomethyl alcohol	400	TWA=0.5 C=10 (OSHA)	0.001	OV	Short service life
Methyl methacrylate 80-62-6	2-Methyl-2-propenoic acid methyl ester; Methacrylic acid,methyl ester; Methyl alpha-methyl-acrylate; Methyl-2-methyl-2-propenoate; Methyl-2-methylpropenoate; MMA	4000	TWA=50 STEL=100	0.085	OV	3M 3510 Monitor

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
1-Methylnaphthalene 90-12-0	a-Methyl naphthalene, a-Methylnaphthalene		TWA=0.5 -skin-		OV/R95 OV/P95	
2-Methylnaphthalene 91-57-6	b-Methyl naphthalene, b-Methylnaphthalene		TWA=0.5 -skin-		OV/R95 OV/P95	
Methyl propyl ketone 107-87-9	2-Pentanone, Ethyl acetone, MPK	5000	STEL=150	1.55	(F)OV	3M 3510 Monitor
n-Methyl-2-pyrrolidone 872-50-4	1-Methyl-2-pyrrolidone, m-Pyrol, n-Methyl Pyrrolidone, NMP		TWA=10 (AIHA) -skin-		OV	
Methyl silicate 681-84-5	Tetramethoxy silane		TWA=1		(F)OV	
a-Methyl styrene 98-83-9	1-Methyl-1-phenylethylene, AMS	5000	TWA=10	0.003	OV	See comment E, page 9
Methyltrichlorosilane 75-79-6	Trichloromethylsilane		C=1 (AIHA)		(F)AG/N95	Irritation also provides warning
Methyl vinyl ketone 78-94-4	3-Buten-2-one, 3-Butene-2-one, Acetyl ethylene, d(3)-2-Butenone, g-Oxo-a-Butylene, Methyl vinyl acetone, Methylene acetone	21000	C=0.2 -skin-	0.2	OV	

Mica (less than 1% quartz) 12001-26-2			TWA=3 mg/m^3 (respirable fraction)		N95	
Mineral oil (pure, highly and severely refined), excluding metal working fluids 8012-95-1	Liquid petrolatum, Parrafin oil, USP mineral oil, White mineral oil		TWA= 5 mg/m^3 (inhalable particulate matter)		R95 P95	
Molybdenum and insoluble compounds (as Mo) 7439-98-7			TWA=10 mg/m^3 (inhalable fraction) TWA=3 mg/m^3 (respirable fraction)		N95	
Molybdenum, soluble compounds (as Mo) 7439-98-7			TWA=0.5 mg/m^3 (respirable fraction)		N95	
Monochloroacetic acid 79-11-8	Chloroethanoic acid, MCAA		TWA=0.5 (inhalable fraction and vapor) -skin-		(F)OV/N95	
Morpholine 110-91-8	Diethylenimide oxide, Tetrahyrdo-1,4-oxazine	8000	TWA=20 -skin-	0.036	(F)OV	
Naphtha (coal tar) 8030-30-6	Crude solvent coal tar naphtha, High solvent naphtha, Naphtha, Rubber solvent	10000	TWA=100 (OSHA)		(F)OV	Odor variable. Irritation also provides warning.

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Naphthalene 91-20-3	Naphthalin, White tar	500	TWA=10 STEL=15 -skin-	0.015	OV	3M 3510 Monitor. See comment E, page 9.
Natural gas 8006-14-2						Simple asphyxiant, oxygen displacing gas.
Natural rubber latex 9006-04-6	Caoutchouc, India rubber, Natural latex, Natural rubber, NRL, Polyisoprene, Rubber		TWA=0.0001 mg/m^3 (inhalable fraction) -skin-		N95	
Nickel carbonyl (as Ni) 13463-39-3	Nickel tetracarbonyl	7	TWA=0.001 (OSHA)	0.5-3.0	(F)SA	Unknown sorbent effectiveness
Nickel, elemental/metal compounds (as Ni) 7440-02-0			TWA=1 mg/m^3 (OSHA) TWA=1.5 mg/m^3 (inhalable fraction)		N95	
Nickel, insoluble inorganic compounds (not otherwise specified) (as Ni)			TWA=1 mg/m^3 (OSHA) TWA=0.2 mg/m^3 (inhalable fraction)		N95	

Nickel, soluble inorganic compounds (not otherwise specified) (as Ni)			TWA=1 mg/m³ (OSHA) TWA=0.1 mg/m³ (inhalable fraction)		N95	
Nickel subsulfide (as Ni) 12035-72-2			TWA=0.1 mg/m³ (inhalable fraction)		N95	
Nicotine 54-11-5	3-(1-Methyl-2-pyrrolidyl) pyridine	35 mg/m³	TWA=0.5 mg/m³ -skin-		OV/P95	See comment D, page 8
Nitric acid 7697-37-2	Aqua fortis, Hydrogen nitrate, Red fuming nitric acid, RFNA, WFNA, White fuming nitric acid	100	TWA=2 STEL=4	0.267	(F)SA	Ineffective sorbents
Nitric oxide 10102-43-9	Nitrogen monoxide, NO	100	TWA=25		SA	Ineffective sorbents
p-Nitroaniline 100-01-6	1-Amino-4-nitrobenzene, 4-Nitroaniline, Azoic diazo component 37, Fast Red GG base, p-Aminonitro-benzene, PNA	300 mg/m³	TWA=3 mg/m³ -skin-		OV/N95	See comment D, page 8
Nitrobenzene 98-95-3	Nitrobenzol, Oil of mirbane	200	TWA=1 -skin-	0.044	OV	
p-Nitrochlorobenzene 100-00-5	1-Chloro-4-nitrobenzene, 4-Chloronitrobenzene, PCNB, PNCB, p-Nitrochlorobenzene	1000 mg/m³	TWA=0.1 -skin-		OV	

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Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Nitroethane 79-24-3		1000	TWA=100	2.11	(F)OV	
Nitrogen dioxide 10102-44-0	Nitrogen peroxide	50	TWA=0.2 C=5 (OSHA)	0.186	SA	Ineffective sorbents
Nitrogen trifluoride 7783-54-2	Nitrogen fluoride	2000	TWA=10		SA	Unknown sorbent effectiveness
Nitroglycerin (NG) 55-63-0	Glyceryl trinitrate, Trinitroglycerin	500 mg/m^3	TWA=0.05 C=0.2 (OSHA) -skin-		OV	
Nitromethane 75-52-5	Nitrocarbol	1000	TWA=20	3.5	OV	
1-Nitropropane 108-03-2		2300	TWA=25	7.09	OV	
2-Nitropropane 79-46-9	sec-Nitropropane	2300	TWA=10	4.85	OV	
Nitrotoluene 88-72-2 99-08-1 99-99-0	Nitrotoluol	200	TWA=2 -skin-	0.017	OV/N95	See comment D, page 8

5-Nitro-o-toluidine 99-55-8	2-Methyl-5-nitrobenzenamine, 5-Nitro-2-toluidine, Azoic Diazo Compound 12		TWA=1 mg/m^3 (inhalable fraction)		OV/R95 OV/P95	
Nitrous oxide 10024-97-2	Dinitrogen monoxide		TWA=50		SA	Ineffective sorbents
Nonane 111-84-2	n-Nonane	8000	TWA=200	1.26	OV	
Octachloro-naphthalene 2234-13-1	Halowax™ 1051		TWA=0.1 mg/m^3 STEL=0.3 mg/m^3 -skin-		OV/N95	See comment D, page 8
Octane, all isomers 111-65-9 540-84-1	n-Octane, Isooctane	5000	TWA=300	5.75	OV	3M 3510 Monitor
1-Octanol 111-87-5	1-Hydroxyoctane, Alcohol C-8, Capryl alcohol, Heptyl carbinol, n-Octanol, n-Octyl alcohol		TWA=50 (AIHA)	0.006	OV	
1-Octene 111-66-0	a-Octene, a-Octylene	8000	TWA=75 (AIHA)	2	OV	
Osmium tetroxide (as Os) 20816-12-0	Osmic acid	1 mg/m^3	TWA=0.0002 STEL=0.0006	0.002	(F)SA	Unknown sorbent effectiveness
Oxalic acid 144-62-7	Ethane dioic acid, Oxalic acid dihydrate	500 mg/m^3	TWA=1 mg/m^3 STEL=2 mg/m^3		OV/N95	See comment D, page 8

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
p,p-Oxybis (benzenesulfonyl hydrazide) 80-51-3	Benzenesulfonic acid, 4,4-Oxybis-dihydrazide; Celogen®; Diphenyl ether 4,4'-disulfohydrazide; OBSH		TWA=0.1 mg/m^3 (inhalable fraction)		N95	
Oxygen difluoride 7783-41-7	Difluorine monoxide, Fluorine monoxide	0.5	C=0.05	0.098	SA	Unknown sorbent effectiveness
Ozone 10028-15-6		10	TWA=0.1 (light work) TWA=0.08 (medium work) TWA=0.05 (heavy work)	0.051	OZ	Respirators with nuisance level organic vapor relief recommended by 3M up to 10X OEL. Not NIOSH approved for ozone.
Paraffin wax fume 8002-74-2			TWA=2 mg/m^3		N95	
Particulates Not Otherwise Regulated	Nuisance particulates		TWA=15 mg/m^3 (total dust, OSHA) TWA=10 mg/m^3 (inhalable fraction) TWA=3 mg/m^3 (respirable fraction)		N95	This category includes many materials. For oils, an R or P95 filter/respirator is recommended.

Pentaborane 19624-22-7	Pentaboron nonahydride, Stable pentaborane	3	TWA=0.005 STEL=0.015	0.97	SA	Unknown sorbent effectiveness
Pentachloro-naphthalene 1321-64-8	Halowax™ 1013		TWA=0.5 mg/m^3 -skin-		OV/N95	See comment D, page 8
Pentaerythritol 115-77-5	Tetramethylolmethane		TWA=10 mg/m^3 TWA= 5 mg/m^3 (OSHA, respirable fraction)		N95	
Pentaerythritol triacrylate 3524-68-3	2-Propenoic acid, 2-(hydroxymethyl)-2-[[(1-oxo-2-propenyl)oxy]methyl]-1,3-propanediyl-ester, PETA		TWA=1 mg/m^3 (AIHA)		OV/P95	See comment D, page 8
1,1,1,2,2-Pentafluoroethane 354-33-6	Fluorocarbon 125, HFC-125, Pentafluoroethane		TWA=1000 (AIHA)		SA	Ineffective sorbents
1,1,1,3,3-Pentafluoropropane 460-73-1	Genetron™ 245fa, HFC-245fa, R-245fa		TWA=300 (AIHA)		SA	
Pentane, all isomers 109-66-0 78-78-4 463-82-1	n-Pentane	15000	TWA=600	31.6	OV	Short service life

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
2,4-Pentanedione 123-54-6	Acetylacetone, Diacetylmethane		TWA=25 -skin-		OV	
Pentyl acetate, all isomers 628-63-7 626-38-0 620-11-1 625-16-1 123-92-2 624-41-9	2-Acetoxypentane, 3-Amyl acetate, n-Amyl acetate, sec-Amyl acetate, tert-Amyl acetate, Banana oil, 1,1-Dimethylpropyl acetate, Isoamyl acetate, Isopentyl acetate, 3-Methyl-1-butanol acetate, 1-Methylbutyl acetate, 2-Methylbutyl acetate, 3-Methylbutyl acetate, 2-Methylbutyl ethanoate, 1-Pentanol acetate, 2-Pentanol acetate, 1-Pentyl acetate, 2-Pentyl acetate, 3-Pentyl acetate, Pentyl acetate	3000-9000	TWA=50 STEL=100	0.004 for Isoamyl acetate	OV	See comment E, page 9. 3M 3510 Monitor.
Perchloroethylene 127-18-4	Perk, Tetrachloroethylene	500	TWA=25 STEL=100	6.17	(F)OV	
Perchloromethyl mercaptan 594-42-3	PMM, Trichloromethyl sulfur chloride	10	TWA=0.1	0.097	OV	

Perchloryl fluoride 7616-94-6	Chlorine oxyfluoride	385	TWA=3 STEL=6	11	SA	Unknown sorbent effectiveness
Perfluorobutyl ethylene 19430-93-4	1H,1H,2H-Perfluorohexene; 1-Hexane,3,3,4,4,5,5,6,6,6-nonafluoro; PFBE		TWA=100		OV	Short service life
Perfluoroisobutylene 382-21-8	Octafluoroisobutylene, Octafluoro-sec-butene, PFIB		C=0.01		SA	Short OV service life
Persulfates, Ammonium 7727-54-0			TWA=0.1 mg/m^3		N95	
Persulfates, Potassium 7727-21-1			TWA=0.1 mg/m^3		(F)N95	
Persulfates, Sodium 7775-27-1			TWA=0.1 mg/m^3		(F)N95	
Petroleum distillates 8002-05-9	Aliphatic petroleum naphtha, Petroleum ether (boiling range 95-115 degrees C), Petroleum naphtha	10000	TWA=500 (OSHA)		OV	Odor variable. See also Gasoline, Stoddard solvent.
Phenol 108-95-2	Carbolic acid, Monohydroxy benzene	250	TWA=5 -skin-	0.011	OV/N95	
m-Phenylenediamine 108-45-2	1,3-Benzenediamine, m-Diaminobenzene		TWA=0.1 mg/m^3		OV/N95	SA preferable if heat involved

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
o-Phenylenediamine 95-54-5	1,2-Benzenediamine, o-Diaminobenzene, Orthamine		TWA=0.1 mg/m^3		OV/N95	SA preferable if heat involved
p-Phenylenediamine 106-50-3	1,4-Diaminobenzene, p-Diaminobenzene		TWA=0.1 mg/m^3		OV/N95	SA preferable if heat involved
Phenyl ether, vapor 101-84-8	Diphenyl ether, Diphenyl oxide	7000	TWA=1 STEL=2	0.03	OV	See comment E, page 9. 3M 3510 Monitor.
Phenyl ether-biphenyl mixture vapor 8004-13-5	Diphenyl oxide-diphenyl mixture, Dowtherm™ A		TWA=1 (OSHA)	0.001-0.01	OV	See comment E, page 9
Phenyl glycidyl ether 122-60-1	1,2-Epoxy-3-phenoxy propane, Glycidyl phenyl ether, Oxirane, PGE, Phenoxymethyl, Phenoxypropenoxide, Phenyl epoxypropyl ether		TWA=0.1 -skin-		OV	
Phenylhydrazine 100-63-0	Hydrazinobenzene	295	TWA=0.1 -skin-		(F)OV	
Phenyl mercaptan 108-98-5	Benzenethiol, Thiophenol		TWA=0.1	0.001	OV	

Phenylphosphine 638-21-1			C=0.05		OV	
Phosgene 75-44-5	Carbon oxychloride, Carbonyl chloride, Chloroformyl chloride	2	TWA=0.1	0.55	SA	
Phosphine 7803-51-2	Hydrogen phosphide, Phosphorated hydrogen, Phosphorus hydride	200	TWA=0.3 STEL=1	0.14	SA	Hg recommended for certain applications. See technical data bulletin 212.
2-Phosphono-1,2,4-butanetricarboxylic acid 37971-36-1	PBTC		TWA=10 (AIHA)		N95	
Phosphoric acid 7664-38-2	m-Phosphoric acid, o-Phosphoric acid, White phosphoric acid	10000 mg/m^3	TWA=1 mg/m^3 STEL=3 mg/m^3		(F)N95	N95 acceptable with appropriate eye/face protection
Phosphorus (yellow) 12185-10-3	White phosphorus, WP		TWA=0.1 mg/m^3		SA	If no phosphorus vapor or phosphine gas present, N95
Phosphorus oxychloride 10025-87-3	Phosphoryl chloride		TWA=0.1		(F)AG	
Phosphorus pentachloride 10026-13-8	Phosphoric chloride	200 mg/m^3	TWA=0.1		AG	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Phosphorus pentasulfide 1314-80-3	Phosphoric sulfide	750 mg/m^3	TWA=1 mg/m^3 STEL=3 mg/m^3		N95	
Phosphorus trichloride 7719-12-2	Phosphorus chloride	50	TWA=0.2 STEL=0.5		(F)AG	
Phthalic anhydride 85-44-9	1,3-Isobenzofurandione, PAN	10000 mg/m^3	TWA=1	0.052	OV/N95	
m-Phthalodinitrile 626-17-5	IPN, Isophthalodinitrile, m-Dicyanobenzene		TWA=5 mg/m^3 (inhalable fraction and vapor)		OV/N95	See comment D, page 8
o-Phthalodinitrile 91-15-6	1,2-Benzenedicarbonitrile, 1,2-dicyanobenzene, 1,2-Benzodinitrile, o-Benzenedinitrile, Phtalic acid dinitrile		TWA=1 mg/m^3 (inhalable fraction and vapor)		OV/N95	See comment D, page 8
2-Picoline 109-06-8	2-Methyl-pyridine, a-Picoline		TWA=2 (AIHA) STEL=5 (AIHA) -skin-	0.003	OV	
3-Picoline 108-99-6	3-Methyl-pyridine, b-Picoline		TWA=2 (AIHA) STEL=5 (AIHA) -skin-		OV	

4-Picoline 108-99-4	4-Methyl-pyridine, g-Picoline		TWA=2 (AIHA) STEL=5 (AIHA) -skin-		OV	
Picric acid 88-89-1	2,4,6-Trinitrophenol, Lyddite, Melinite, Pertite, Shimose	100 mg/m^3	TWA=0.1 mg/m^3	0.0005 mg/m^3	N95	
Piperazine and salts 110-85-0	1,4-Piperazine, 1,4-Diazacyclohexane, Diethylenediamine, Hexahydropyrazine, Piperazidine		TWA=0.03 (inhalable fraction and vapor)		OV/N95	See comment D, page 8
Piperidine 110-89-4	Hexahydropyridine		TWA=1 (AIHA) -skin-	0.372	(F)OV	
Platinum metal (as Pt) 7440-06-4			TWA=1 mg/m^3		N95	
Platinum soluble salts (as Pt)			TWA=0.002 mg/m^3		(F)N95	
Polyethylene glycols 25322-68-3	PEG, PGE, Polyoxyethylene		TWA=10 mg/m^3 (AIHA)		R95 P95	See comment G, page 9
Polypropylene glycols 25322-69-4	PPG		TWA=10 mg/m^3 (AIHA)		R95 P95	See comment G, page 9

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Polyvinyl chloride 9002-86-2	Cloroethene polymer, Cloroethylene homopolymer, Cloroethylene polymer, Polychloroethylene, PVC, Vinyl chloride homoploymer, Vinyl chloride polymer		TWA=1 mg/m^3 (respirable fraction)		N95	
Portland cement (containing no asbestos and <1% crystaline silica) 65997-15-1	Cement, Hyraulic cement, Portland cement silicate		TWA=1 mg/m^3 (respirable fraction)		N95	
Potassium bromate 7758-01-2	Bromic acid potassium salt		TWA=0.1 mg/m^3 (AIHA)		N95	
Potassium hydroxide 1310-58-3	Caustic potash, Lye, Potassium hydrate		C=2 mg/m^3		N95	
Propane 74-98-6	Dimethyl methane, n-Propane	20000	TWA=1000 (OSHA)	2690	SA	Ineffective sorbents
2-Propanol 67-63-0	IPA, Isopropanol, Isopropyl alcohol, sec-Propyl alcohol	12000	TWA=200 STEL=400	0.44	(F)OV	Irritation also provides warning. 3M 3530 Monitor.
n-Propanol 71-23-8	1-Propanol, Ethyl carbinol, n-Propyl alcohol, Propan-1-ol	4000	TWA=100	2.6	(F)OV	See comment E, page 9

Propargyl alcohol 107-19-7	2-Propyn-1-ol		TWA=1 -skin-	0.015	OV	
Propargyl bromide 106-96-7	1-Bromo-2-propyne; 3-Bromopropyne; Bromopropyne; gama- Bromoallylene; Propyne,3-bromo		TWA=0.1 (AIHA) -skin-	<2	OV	
2-Propenoic acid, Isooctyl ester 29590-42-9	IOA, Isoctyl acrylate		TWA=5 (AIHA)	<1	OV	
b-Propiolactone 57-57-8	3-Hydroxy beta-lactone; 3-Hydroxypropionic acid; beta- Propiolactone; BPL; Hydroacrylic acid,beta-lactone; Propiolactone	29000	TWA=0.5		(F)OV	OSHA requires SA with hood for certain applications; see 29 CFR 1910.1003
Propionaldehyde 123-38-6	1-Propanal, Methylacetalaldhyde, Propylaldehyde		TWA=20	0.145	SA	Short OV service life
Propionic acid 79-09-4	Ethylformic acid, Methylacetic acid	29000	TWA=10	0.037	(F)OV	
n-Propyl acetate 109-60-4	Acetic acid n-propyl ester, Propyl acetate	8000	TWA=200 STEL=250	0.575	(F)OV	3M 3510 Monitor
Propylene 115-07-1	1-Propene, 1-Propylene, Methylethene, Methylethylene, Propene		TWA=500	17	SA	
Propylene dichloride 78-87-5	1,2-Dichloropropane	2000	TWA=10	0.851	OV	3M 3510 Monitor

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Propylene glycol (aerosol only) 57-55-6	1,2-Dihydroxy propane, 1,2-Propanediol, Methyl glycol		TWA=10 mg/m^3 (AIHA)		R95 P95	See comment G, page 9
Propylene glycol (vapor and aerosol) 57-55-6	1,2-Dihydroxy propane, 1,2-Propanediol, Methyl glycol	24000	TWA=10 mg/m^3 (AIHA)		OV/P95	See comment G, page 9
Propylene glycol dinitrate 6423-43-4	1,2-Propanediol dinitrate, 1,2-Propylene glycol dinitrate		TWA=0.05 -skin-	0.231	(F)OV	
Propylene glycol monomethyl ether	1-Methoxy-2-propanol	16000	TWA=50 STEL=100	0.003	OV	3M 3510 Monitor
Propylene glycol monomethyl ether acetate 108-65-6	1-Methoxy-2-acetoxypropane, 1-Methyoxy-2-propanol acetate, 2-Methoxy-1-methylethyl acetate, Glycol ether PM acetate, PGMEA	15000	TWA=50 (AIHA)		OV	3M 3510 Monitor
Propyleneimine 75-55-8	2-Methylaziridine	500	TWA=0.2 STEL=0.4 -skin-		(F)OV	

Propylene oxide 75-56-9	1,2-Epoxypropane,1,2-Propylene oxide,2,3-Epoxypropane, Methyloxirane, Propene oxide	2000	TWA=2	33.1	OV	3M 3550 Monitor, short service life
n-Propyl nitrate 627-13-4	Nitric acid n-propylester	2000	TWA=25 STEL=40	50	OV	
Pyridine 110-86-1	Azabenzene, Azine	3600	TWA=1	0.17	OV	
Quinoline 91-22-5	1-Azana-phthalene, 1-Benzazine, Chinoline, Lencol, Leukoline		TWA=0.001 (AIHA) -skin-	0.015	(F)OV	
Quinone 106-51-4	Benzoquinone, p-Benzoquinone	300 mg/m^3	TWA=0.1	0.012	(F)OV/N95	
Resorcinol 108-46-3	1,3-Benzenediol, m-Dihydroxybenzene	14000	TWA=10 STEL=20		N95	OV/N95 may be preferable if heat is involved
Rhodium, metal and insoluble compounds 7440-16-6			TWA=0.1 mg/m^3 (OSHA)		N95	
Rhodium, soluble compounds(as Rh)			TWA=0.001 mg/m^3 (OSHA)		N95	
Selenium & compounds, (as Se) 7782-49-2			TWA=0.2 mg/m^3		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Selenium hexafluoride 7783-79-1		5	TWA=0.05		SA	Unknown sorbent effectiveness
Silca, amorphous (diatomaceous earth) 61790-53-2	Diatomite, Silicon dioxide		TWA=0.8 mg/m^3 (OSHA)		N95	Assuming 100% SiO_2 (80 mg/m^3 divided by %SiO_2)
Silica, crystalline 14808-60-7 1317-95-9 14464-46-1	Crystallized silicon dioxide, Cristobalite, a-Quartz, Silica, Tripoli		TWA=0.025 mg/m^3 (respirable fraction)		N95	
Silica, crystalline-tridymite 15468-32-3			TWA=0.15 mg/m^3 (OSHA) TWA=0.05 mg/m^3 (OSHA, respirable dust)		N95	Assuming 100% SiO_2 (5 mg/m^3 divided by %SiO_2)
Silicon 7440-21-3			TWA=15 mg/m^3 (OSHA) TWA=5 mg/m^3 (OSHA, respirable fraction)		N95	

Silicon carbide (fibrous) 409-21-2		TWA= 0.1 f/cc (respirable fibers)	N95	
Silicon carbide (nonfibrous particles with no asbestos and <1% crystalline silica) 409-21-2		TWA= 10 mg/m^3 (inhalable fraction) TWA=3 mg/m^3 (respirable fraction)	N95	
Silicon tetrahydride 7803-62-5	Silane	TWA=5	SA	
Silver, metal and soluble compounds (as Ag) 7440-22-4		TWA=0.01 mg/m^3 (OSHA)	N95	
Soapstone (particles with no asbestos and <1% crystalline silica)	Massive talc, Soapstone silicate, Steatite	TWA=2 mg/m^3 (respirable fraction)	N95	
Sodium azide as hydrazoic acid vapor 26628-22-8	Hydrazoic acid vapor	C=0.11	SA	Unknown sorbent effectiveness
Sodium azide as sodium azide 26628-22-8	Hydrazoic acid (no vapor)	C=0.29 mg/m^3	N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Sodium bisulfite 7631-90-5	Sodium hydrogen sulfite		TWA=5 mg/m^3		AG/N95	N95 alone may be suitable if irritation eliminated
Sodium borate, anhydrous 1330-43-4	Borates,tetrasodium salts,anhydrous; Borax fused; Boric acid,disodium salt; Disodium tetraborate; Sodium tetraborate,anhydrous		TWA=2 mg/m^3 (inhalable fraction) STEL=6 mg/m^3 (inhalable fraction)		N95	
Sodium borate, decahydrate 1303-96-4	Borascu; Borates, tetrasodium salts,decahydrate; Borax; Borocin; Disodium diborate decahydrate; Disodium tetraborate decahydrate; Sodium pyroborate decahydrate; Sodium tetraborate,decahydrate		TWA=2 mg/m^3 (inhalable fraction) STEL=6 mg/m^3 (inhalable fraction)		N95	
Sodium borate, pentahydrate 12179-04-3	Borates,tetrasodium salts,pentahydrate; Boric acid,pentahydrate; Boron sodium oxide,pentahydrate; Mule team borascu; Sodium tetraborate pentahydrate		TWA=2 mg/m^3 (inhalable fraction) STEL=6 mg/m^3 (inhalable fraction)		N95	

Sodium chloroacetate 3926-62-3	Chloroacetic acid,sodium salt; Monoxone; Sodium monochloroacetate		TWA=2.5 mg/m^3 (AIHA)	N95	
Sodium fluoroacetate 62-74-8	1080, SFA, Sodium monofluoroacetate	5 mg/m^3	TWA=0.05 mg/m^3 -skin-	N95	
Sodium hydroxide 1310-73-2	Caustic soda, Lye, Soda lye	250 mg/m^3	C=2 mg/m^3	N95	
Sodium hypochlorite 7681-52-9	Hypochlorous acid, sodium salt; Sodium oxychloride		STEL= 2 mg/m^3 (AIHA)	N95	
Sodium metabisulfite 7681-57-4	Sodium pyrosulfite		TWA=5 mg/m^3	AG/N95	N95 alone may be suitable if irritation eliminated
Starch 9005-25-8	Corn starch		TWA=10 mg/m^3 TWA= 5 mg/m^3 (OSHA, respirable fraction)	N95	
Stearates 646-29-7	Aluminium stearate, Calcium stearate, Glyceryl stearate, Lithium stearate, Potassium stearate, Zinc stearate		TWA=10 mg/m^3	N95	
Stibine 7803-52-3	Antimony trihydride, Hydrogen antimonide	40	TWA=0.1	SA	Unknown sorbent effectiveness

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Stoddard solvent 8052-41-3	Dry cleaning safety solvent, Mineral spirits	29500 mg/m^3	TWA=100	1-30	OV	3M 3510 Monitor
Strontium chromate (as Cr) 7789-06-2	C.I. pigment yellow 32, Strontium yellow		TWA=0.0005 mg/m^3		N95	
Strychnine 57-24-9		3 mg/m^3	TWA=0.15 mg/m^3		N95	
Styrene 100-42-5	Cinnamene, Phenylethylene, Styrene monomer, Vinyl benzene	5000	TWA=20 STEL=40	3.44	OV	3M 3510 Monitor
Subtilisins 1395-21-7 9014-01-1	Proteolytic enzymes as 100% crystalline enzyme		C=0.00006 mg/m^3		SA	Difficult to measure 10X OEL. N95 acceptable with suitable air sampling data.
Sucrose 57-50-1	Saccharose, Table sugar		TWA=10 mg/m^3 TWA= 5 mg/m^3 (OSHA, respirable fraction)		N95	
Sulfur dioxide 7446-09-5	SO_2	100	STEL=0.25	0.708	AG	Irritation and taste also provides warning

Sulfur hexafluoride 2551-62-4	SF_6		TWA=1000		SA	Unknown sorbent effectiveness
Sulfuric acid 7664-93-9	Hydrogen sulfate, Matting acid, Oil of vitriol, Sulphuric acid, Vitriol brown oil	80 mg/m^3	TWA=0.2 mg/m^3 (thoracic fraction)		(F)N95	N95 acceptable with appropriate eye/face protection
Sulfur monochloride 10025-67-9	Sulfur chloride, Sulfur subchloride	10	C=1	0.001	(F)AG	
Sulfur pentafluoride 5714-22-7	Disulfur decafluoride	1	C=0.01		AG	
Sulfur tetrafluoride 7783-60-0			C=0.1		AG	
Sulfuryl fluoride 2699-79-8		1000	TWA=5 STEL=10		SA	Unknown sorbent effectiveness
Synthetic vitreous fibers - Continuous filament glass fibers	Fibrous glass, dust; Glass, fibrous or dust		TWA=5 mg/m^3 (inhalable fraction) TWA=1 f/cc (respirable fibers)		N95	
Synthetic vitreous fibers - glass wool fibers			TWA=1 f/cc (respirable fibers)		N95	
Synthetic vitreous fibers - refractory ceramic fibers			TWA=0.2 f/cc (respirable fibers)		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Synthetic vitreous fibers - rock wool fibers	Mineral (rock), wool fiber		TWA=1 f/cc (respirable fibers)		N95	
Synthetic vitreous fibers - slag wool fibers			TWA=1 f/cc (respirable fibers)		N95	
Synthetic vitreous fibers - special purpose glass fibers			TWA=1 f/cc (respirable fibers)		N95	
Talc (containing no asbestos and <1% cystalline silica) 14807-96-6	Hydrous magnesium silicate, Non-asbestiform talc, Non-fibrous talc, Steatite talc		TWA=2 mg/m^3 (respirable fraction)		N95	
Tantalum, metal and oxide dusts (as Ta) 7440-25-7			TWA=5 mg/m^3 (OSHA)		N95	
Tellurium and compounds (as Te, excluding hydrogen telluride) 13494-80-9			TWA=0.1 mg/m^3		N95	

Tellurium hexafluoride (as Te) 7783-80-4		1	TWA=0.02		SA	Unknown sorbent effectiveness
Terephthalic acid 100-21-0	1,4 Benzenediacarboxylic acids, Benzene-p-dicarboxylic acid, p-Phthalic acid, Tephthol, TPA		TWA=10 mg/m^3		N95	
Terphenyls 26140-60-3	Diphenyl benzenes, Mixed terphenyls, m-Terphenyl, o-Terphenyl, p-Terphenyl		C=5 mg/m^3		N95	OV/N95 may be preferable if heat is involved
1,1,2,2-Tetrabromoethane 79-27-6	Acetylene tetrabromide, Muthmann's liquid, Tetrabromoethane, Tetrabromoethylene	10	TWA=0.1 (inhalable fraction and vapor)	1	OV/N95	See comment E, page 9
1,1,1,2-Tetrachloro-2,2-difluoroethane 76-11-9	2,2-Difluoro-1,1,1,2-tetrachloroethane; Freon® 112a; Halocarbon 112a; Refrigerant 112a	15000	TWA=100		OV	
1,1,2,2-Tetrachloro-1,2-difluoroethane 76-12-0	Freon® 112, Halocarbon 112, Refrigerant 112	15000	TWA=50		OV	
1,1,2,2-Tetrachloroethane 79-34-5	Acetylene tetrachloride	150	TWA=1 -skin-	0.21	OV	3M 3510 Monitor

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Tetrachloro-naphthalene 1335-88-2	Halowax™, Nibren wax, Seekay wax		TWA=2 mg/m^3		OV/N95	See comment D, page 8
2,3,5,6-Tetrachloropyridine 2402-79-1	Pyridine 2,3,5,6-tetrachloro-		TWA=5 mg/m^3 (AIHA)		OV/N95	See comment D, page 8
Tetrachlorosilane 10026-04-7	Silicon chloride, Silicon tetrachloride		C=1 (AIHA)		AG/N95	Reacts rapidly with moisture yielding HCl and silica
Tetraethylene glycol diacrylate 17831-71-9	2-Propionic acid, oxybis (2, 1-ethane-diyoxy-2,1-ethanediol) ester; TTEGDA		TWA=1 mg/m^3 (AIHA) -skin-		OV/P95	See comment D, page 8
Tetraethylene pentamine 112-57-2	1,2-Ethanediamine, N-(2-aminoethyl)-N'-(2-((2-aminoethyl) amino)ethyl); DEH 26; TEPA; Tetraethyl pentamine; Tetren 1,4,7,10,13-Pentaazatridecane		TWA=5 mg/m^3 (AIHA) -skin-		(F)OV	
Tetraethyl lead (as Pb) 78-00-2	Lead tetraethyl, TEL	40 mg/m^3	TWA=0.075 mg/m^3 (OSHA) -skin-		OV	

1,1,1,2-Tetrafluoroethane 811-97-2	Fluorocarbon 134a, HFA 134a, HFC 134a, Tetrafluoroethane		TWA=1000 (AIHA)		SA	Ineffective sorbents
Tetrafluoroethylene 116-14-3	1,1,2,2-Tetrafluoroethylene; Fluoroplast 4; Perfluoroethene; Perfluoroethylene; Tetrafluoroethene; TFE		TWA=2		SA	
2,3,3,3-Tetrafluoropropene 754-12-1			TWA=500 (AIHA)		SA	
Tetrahydrofuran 109-99-9	Diethylene oxide, Tetramethylene oxide, THF	20000	TWA=50 STEL=100 -skin-	3.8	OV	3M 3510 Monitor
Tetrahydrofurfuryl alcohol 97-99-4	Tetrahydro-2-furancarbinol, Tetrahydro-2-furanmethanol, Tetrahydro-2-furylmethanol, THFA		TWA=0.5 (AIHA)		OV	
Tetrakis (hydroxymethyl) phosphonium chloride 124-64-1	Proban CC, Pyroset TKC, Retardol C, Tetrahydroxymethyl phosphonium chloride, THPC		TWA=2 mg/m^3		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Tetrakis (hydroxymethyl) phosphonium sulfate 55566-30-8	bis tetrakis-(hydroxymethyl) phosphonium sulfate, Octakis (hydroxymethyl) phosphonium sulfate, Pyroset TKO, Retardol S, THPS		TWA=2 mg/m^3		N95	
Tetramethyl lead (as Pb) 75-74-1	Lead tetramethyl, TML	40 mg/m^3	TWA=0.075 mg/m^3 (OSHA) -skin-		OV	
Tetramethyl succinonitrile, vapor 3333-52-6	TMSN	5	TWA=0.5 -skin-		OV	
Tetranitromethane 509-14-8	Tetan	5	TWA=0.005		OV	
Tetryl 479-45-8	2,4,6-Trinitrophenylmethylnitramine, Nitramine, N-Methyl-N-2,4,6-tetranitroaniline, Tetralite		TWA=1.5 mg/m^3		N95	
Thallium, elemental and soluble compounds (as Tl) 7440-28-0	Thallium acetate, Thallium carbonate, Thallium hydroxide	20 mg/m^3	TWA=0.02 mg/m^3 (inhalable fraction) -skin-		N95	

4,4'-Thiobis(6-tert-butyl-m-cresol) 96-69-5	4,4'-Thiobis(3-methyl-6-tert-butyl phenol)		TWA=15 mg/m^3 (OSHA) TWA=1 mg/m^3 (inhalable fraction) TWA=5 mg/m^3 (OSHA, respirable fraction)	N95	
Thioglycolic acid 68-11-1	Mercaptoacetic acid, Thioranic acid	59000	TWA=1 -skin-	(F)OV	
Thionyl chloride 7719-09-7	Sulfur oxychloride, Sulfurous oxychloride		C=0.2	(F)AG	
Thiram 137-26-8	Tetramethylthioram disulfide, TMT, TMTD, TMTDS	1500 mg/m^3	TWA=0.05 mg/m^3 (inhalable fraction and vapor)	OV/N95	
Tin, metal and inorganic compounds (except SnH_4) (as Sn) 7440-31-5		400 mg/m^3	TWA=2 mg/m^3	N95	
Tin, organic compounds (as Sn)			TWA=0.1 mg/m^3 STEL=0.2 mg/m^3 -skin-	OV/N95	See comment D, page 8
Titanium dioxide 13463-67-7	Anatase, Brookite, Rutile		TWA=10 mg/m^3	N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Titanium tetrachloride 7550-45-0	Titanium chloride		TWA=0.5 mg/m^3 (AIHA)		AG/N95	
Toluene 108-88-3	Aantisal 1a, Methacide, Methyl benzene, Methylbenzol, Monomethyl benzene, Phenyl methane, Tol, Toluol, Tolu-sol	2000	TWA=20 C=300 (OSHA)	0.16	OV	3M 3510 Monitor
Toluene diamine 25376-45-8 95-80-7	Diaminotoluene, TDA, Tolyenediamine		TWA=0.005 (AIHA) -skin-		N95	
Toluene-2,6-diisocyanate 91-08-7	2,6-TDI, 2,6-Toluene diisocyanate	10	TWA=0.005 STEL=0.02	0.17	OV/N95	
Toluene-2,4-diisocyanate 584-84-9	2,4-TDI, 2,4-Toluene diisocyanate		TWA=0.005 STEL=0.02	0.17	OV/N95	
p-Toluenesulfonyl chloride 98-59-9	4-Methyl-benzenesulfonyl chloride, Tosyl chloride		C=5 mg/m^3 (AIHA)		(F)OV/AG/N95	See comment D, page 8. HCl and p-toluene sulfuric acid produced by hydrolysis.

m-Toluidine 108-44-1	m-Aminotoluene		TWA=2 -skin-	0.46-5.9	(F)OV	
o-Toluidine 95-53-4	1-Methyl-1,2-aminobenzene; 2-Methylaniline; o-Aminotoluene; o-Methylaniline	100	TWA=2 -skin-	0.025-6.6	(F)OV	
p-Toluidine 106-49-0	p-Aminotoluene		TWA=2 -skin-	0.027-3.2	(F)OV	
Tributyl phosphate 126-73-8	TBP, Tri-n-butyl phosphate	125	TWA=5 mg/ m^3 (Inhalable fraction and vapor)		OV/P95	
Trichloroacetic acid 76-03-9	TCA		TWA=1	0.295	(F)OV/AG	Irritation also provides warning
1,2,4-Trichlorobenzene 120-82-1		25000	C=5	2.91	OV	
1,1,2-Trichloroethane 79-00-5	b-Trichloroethane, Vinyl trichloride	500	TWA=10 -skin-		(F)OV	3M 3510 Monitor
Trichloroethylene 79-01-6	1,1,2-TCE, 1-Chloro-2,2-dichloroethylene, Ethylene trichloride, TCE, Triclene™	1000	TWA=10 STEL=25 C=200 (OSHA)	1.36	OV	3M 3510 Monitor
Trichlorofluoromethane 75-69-4	CFC-11, Fluorotrichloromethane, Freon™ 11, Refrigerant 11, Trichloromonofluoromethane	10000	TWA=1000 (OSHA) C=1000	16.3	SA	Short OV service life

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Trichloronaphthalene 1321-65-9	Halowax™, Nibren wax, Seekay wax		TWA=5 mg/m^3 -skin-		OV/N95	See comment D, page 8
1,2,3-Trichloropropane 96-18-4	Allyl trichloride, Glycerin trichlorohydrin, Glycerol trichlorohydrin, Trichlorohydrin	1000	TWA=10 -skin-	100	(F)OV	
Trichlorosilane 10025-78-2	Silicochloroform		C=0.5 (AIHA)		(F)AG	
1,1,2-Trichloro-1,2,2-trifluoroethane 76-13-1	FC-113, Freon® 113, Halocarbon 113, Refrigerant 113, TTE	4500	TWA=1000 STEL=1250	487	SA	Short OV service life. 3M 3530 Monitor
Triethanolamine 102-71-6	2,2,2-Nitrilotriethanol, Daltogen, Sterolamide, TEA, Trihydroxytriethylamine		TWA=5 mg/m^3		OV/P95	See comment D, page 8
Triethoxysilane 998-30-1	Silane,triethoxy-		TWA=0.05 (AIHA)		(F)SA	Unknown sorbent effectiveness
Triethylamine 121-44-8	N,N-Diethylanamine, N-Triethylamine, TEA	1000	TWA=1 STEL=3	0.001	(F)OV	AM not specifically approved, but 3M recommended for longer service life

Triethylene glycol diacrylate 1680-21-3	2-Propenoic acid,2-ethanediylbis-(oxy-2,1-ethanediyl) ester; TREGDA		TWA=1 mg/m^3 (AIHA)		OV/P95	
Triethylenetetramine 112-24-3	1,4,7,10-Tetraazadecane; 1,8-Diamino-3,6-diazaoctane; 3,6-Diazaoctane-1,8-diamine; N, N'-bis(2-aminoethyl)-1,2,ethane diamine; TECZA; TETA, Trientine		TWA=1 (AIHA) -skin-		OV	See comment E, page 9. R or P filter, if filter required
Triethylphosphate 78-40-0	Phosphoric acid triethyl ester	17000	TWA=7.45 mg/m^3 (AIHA)		OV/P95	
Trifluorobromo-methane 75-63-8	Bromotrifluoromethane, Freon® 13B1, Halocarbon 13B1, Halon™ 1301, Refrigerant 13B1	50000	TWA=1000	16.3	SA	Short OV service life
1,1,1-Trifluoro-2,2-dichloroethane 306-83-2	FC-123, HCFC-123, Hydrofluorocarbon 123		TWA=50 (AIHA)		SA	Short OV service life
1,1,1-Trifluoroethane 420-46-2	FC-143a, HFC-143a, Hydrofluorocarbon 143a		TWA=1000 (AIHA)		SA	Ineffective sorbents
2,2,2-Trifluoroethanol 75-89-8	2,2,2-Trifluoroethyl alcohol; Ethanol, 2,2,2,-Trifluoro; TFE	55000	TWA=0.3 (AIHA)		SA	Ineffective sorbents
1,3,5-Triglycidyl-s-triazinetrione 2451-62-9	1,3,5-Triazine-2,4,6-(1H,3H,5H)-trione, Araldite PT-810, TEPIC		TWA=0.05 mg/m^3		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Trimellitic anhydride 552-30-7	Anhydrotrimellitic acid, TMA, TMAN, Trimellitic acid anhydride		TWA=0.0005 mg/m^3 (inhalable fraction and vapor) STEL=0.002 mg/m^3 (inhalable fraction and vapor)		OV/N95	Chemical manufacturer's recommendation. See comment D, page 8.
Trimethoxysilane 2487-90-3			TWA=0.05 (AIHA)		(F)OV	
Trimethylamine 75-50-3	N,N-Dimethyl methanamine, N-Trimethylamine, TMA	20000	TWA=1 (AIHA) STEL=15	0.001	(F)AM	AIHA WEEL is lower than TLV of 5 ppm. AM not specifically approved.
Trimethyl benzene 25551-13-7	Hemimellitene, Mesitylene, Pseudocumene	8000	TWA=25	2.4	OV	3M 3510 Monitor
Trimethylchlorosilane 75-77-4	Chlorotrimethylsilane, Monochlorotrimethylsilicon		C=5 (AIHA)		(F)OV/AG	
Trimethyl phosphite 121-45-9	Methyl phosphite, Phosphorus acid trimethylester		TWA=2	0.001	(F)OV	

Trimethylolpropane triacrylate 15625-89-5	2-Propenoic acid, 2-ethyl-2(((1-oxo-2-propenyl) oxy) methyl)-1,3-propanediyl ester		TWA=1 mg/m^3 (AIHA)	OV/P95	
Trimethylolpropane trimethacrylate 3290-92-4	Acrylic acid, triester w/2-ethyl 2 (hydroxymethyl) 1,3 propanediol		TWA=1 mg/m^3 (AIHA)	OV/P95	
2,4,6-Trinitrotoluene (TNT) 118-96-7	sym-Trinitrotoluene, TNT, Trinitrotoluene, Trinitrotoluol	1000 mg/m^3	TWA=0.1 mg/m^3 -skin-	OV/N95	See comment D, page 8
Triorthocresyl phosphate 78-30-8	o-Tritolyl phosphate, TCP, TOCP, Tricresylphosphate	40 mg/m^3	TWA=0.1 mg/m^3 -skin-	R95 P95	
Triphenyl phosphate 115-86-6	Phenyl phosphate, TPP		TWA=3 mg/m^3	N95	OV/N95 may be preferable if heat is involved
Trisodium phosphate 7601-54-9	Sodium o-phosphate, TSP		STEL=5 mg/m^3 (AIHA)	(F)N95	N95 acceptable with appropriate eye/face protection
Tungsten, metal and insoluble compounds (as W) 7440-33-7			TWA=5 mg/m^3 STEL=10 mg/m^3	N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Tungsten, soluble compounds (as W) 7440-33-7			TWA=1 mg/m^3 STEL=3 mg/m^3		N95	
Turpentine 8006-64-2	Gum spirits, Gum turpentine, Turps, Wood turpentine	1500	TWA=20	100-200	(F)OV	See comment E, page 9
Uranium, insoluble compounds (as U) 7440-61-1		30 mg/m^3	TWA=0.2 mg/m^3 STEL=0.6 mg/m^3		N95	See 10 CFR 20 subpart H
Uranium, soluble compounds (as U) 7440-61-1		20 mg/m^3	TWA=0.05 mg/m^3 (OSHA)		N95	AG/N95 if halides. See 10 CFR 20 subpart H
Urea 57-13-6	Carbamide, Carbonyldiamide, Carbonyldiamine, Isourea		TWA=10 mg/m^3 (AIHA)		N95	AM/N95 may be preferable if heat is involved
n-Valeraldehyde 110-62-3	Pentanal, Valeric aldehyde		TWA=50	0.006	(F)OV	
Vanadium pentoxide 1314-62-1	Vanadic anhydride, Vanadium oxide	70 mg/m^3	TWA= 0.05 mg/m^3 (inhalable fraction) C=0.5 mg/m^3 (OSHA, respirable fraction)		N95	

Vanadium pentoxide fume 1314-62-1		70 mg/m^3	TWA=0.05 mg/m^3 (inhalable fraction) C=0.1 mg/m^3 (OSHA)		N95	
Vanillin 121-33-5	Vanilla, Vanillaldehyde, Vanillic aldehyde		TWA=10 mg/m^3 (AIHA)		N95	
Vegetable oil			TWA=15 mg/m^3 (OSHA) TWA= 5 mg/m^3 (OSHA, respirable fraction)		R95 P95	
Vinyl acetate 108-05-4	1-Acetoxyethylene, Ethenyl acetate	26000	TWA=10 STEL=15	0.603	(F)OV	3M 3510 Monitor
Vinyl bromide 593-60-2	Bromoethylene		TWA=0.5		(F)SA	Short OV service life
Vinyl Chloride 75-01-4	Chloroethene, Chloroethylene, Monochloroethylene, VC, VCM, Vinyl chloride monomer	36000	TWA=1 (OSHA) STEL=5 (OSHA)	0.253	SA	OSHA allows OV for very short use periods. See 29 CFR 1910.1017.
4-Vinylcyclohexene 100-40-3	1-Vinylcyclohexene-3; 4-vinylcyclohex-1-ene; 4-Ethenyl-1-1-cyclohexene; 4-Vinyl-1-cyclohexene; 4-Vinylcyclohexene-1-butadiene dimer; VCH		TWA=0.1		OV	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Vinyl cyclohexene dioxide 106-87-6	Vinylcyclohexane dioxide		TWA=0.1 -skin-		(F)OV	
Vinyl fluoride 75-02-5	Fluoroethene, Fluoroethylene, Monofluoroethylene	26000	TWA=1		SA	Short OV service life
Vinylidene chloride 75-35-4	1,1-Dichloroethylene, VDC	65000	TWA=5	35.5	OV	Short service life
Vinylidene fluoride 75-38-7	1,1-Difluoroethene; 1,1-Difluoroethylene; Ethene, 1,1-difluoro; Ethylene,1,1-difluoro; Halocarbon 1132A; VDF; Vinylidene difluoride	55000	TWA=500		SA	Ineffective sorbents
N-Vinyl-2-pyrrolidone 88-12-0	1-Ethenyl-2-pyrrolidinone, 1-Vinylpyrrolidinone, N-Vinylpyrrolidinone, Vinylbutyrlactam, Vinylpyrrolidinone, Vinylpyrrolidone		TWA=0.05		OV	
Vinyl toluene 25013-15-4	Methyl styrene, Tolyethylene	5000	TWA=50 STEL=100	10	(F)OV	See comment E, page 9. 3M 3510 Monitor.

Vinyltrichlorosilane 75-94-5	Silane trichloroethenyl, Silane trichlorovinyl, Trichlorovinyl silicane, Trichlorovinylsilane, Trichlorovinylsilicon, Vinylsilicon trichloride		C=1 (AIHA)		OV/AG	
Wood dust (All varieties except western red cedar)			TWA=1 mg/m^3 (inhalable fraction)		N95	
Wood dust (Western red cedar)			TWA=0.5 mg/m^3 (inhalable fraction)		N95	
Xylene (o-, m-, p- isomers) 1330-20-7 95-47-6 108-38-3 106-42-3	Dimethylbenzene (o-, m-, p-isomers), 1,2-Dimethylbenzene, 1,3-Dimethylbenzene, 1,4-Dimethylbenzene	1000	TWA=100 STEL=150	0.3-0.8	OV	3M 3510 Monitor
m-Xylene a,a'-diamine 1477-55-0	MXDA		C=0.1 mg/m^3 -skin-		OV/N95	See comment D, page 8
Xylidine 1300-73-8	Aminodimethyl benzene, Aminoxylene dimethyl aniline, Dimethylaminobenzene	150	TWA=0.5 (inhalable fraction and vapor) -skin-	0.005-0.06	OV/N95	See comment E, page 9
Yttrium, metal and compounds (as Y) 7440-65-5			TWA=1 mg/m^3		N95	

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

Chemical Name CAS #	Synonym	IDLH (ppm)	OEL (ppm)	Odor Threshold (ppm)	Respirator (to 10x OEL)	Comments
Zinc chloride fume 7646-85-7		4800 mg/m^3	TWA=1 mg/m^3 STEL=2 mg/m^3		N95	
Zinc chromate (as Cr) 13530-65-9 11103-86-9 37300-23-5	Basic zinc chromate, Chromates of zinc, Zinc potassium chromate, Zinc yellow		TWA=0.01 mg/m^3		N95	
Zinc oxide 1314-13-2	Zinc white, Zincite	2500 mg/m^3	TWA=15 mg/m^3 (OSHA) TWA=2 mg/m^3 (respirable fraction) STEL=10 mg/m^3 (respirable fraction)		N95	
Zinc stearate 557-05-1	Dermarone, Synpro stearate, Zinc distearate		TWA=10 mg/m^3 TWA= 5 mg/m^3 (OSHA, respirable fraction)		N95	
Zirconium and compounds (as Zr) 7440-67-7		500 mg/m^3	TWA=5 mg/m^3 STEL=10 mg/m^3		N95	

Respirator Codes and Descriptions

(F)	Full Facepiece (with appropriate cartridges and filters)
AG	Acid Gas Respirator
AM	Ammonia/Methylamine Respirator
FORM	Formaldehyde Respirator
HF	Hydrogen Fluoride Respirator
Hg	Mercury Vapor/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
SA(F)	Supplied air respirator with full facepiece, helmet, hood or loose fitting facepiece

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 June 2013.

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

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