NIOSH Pocket Guide to Chemical Hazards

APPENDICES

APPENDIX A
NIOSH POTENTIAL OCCUPATIONAL CARCINOGENS

New Policy

For the past 20 plus years, NIOSH has subscribed to a carcinogen policy that was published in 1976 by Edward J. Fairchild, II, Associate Director for Cincinnati Operations, which called for "no detectable exposure levels for proven carcinogenic substances" (Annals of the New York Academy of Sciences, 271:200-207, 1976). This was in response to a generic OSHA rulemaking on carcinogens. Because of advances in science and in approaches to risk assessment and risk management, NIOSH has adopted a more inclusive policy. NIOSH recommended exposure limits (RELs) will be based on risk evaluations using human or animal health effects data, and on an assessment of what levels can be feasibly achieved by engineering controls and measured by analytical techniques. To the extent feasible, NIOSH will project not only a no-effect exposure, but also exposure levels at which there may be residual risks. This policy applies to all workplace hazards, including carcinogens, and is responsive to Section 20(a)(3) of the Occupational Safety and Health Act of 1970, which charges NIOSH to ". . .describe exposure levels that are safe for various periods of employment, including but not limited to the exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience."

The effect of this new policy will be the development, whenever possible, of quantitative RELs that are based on human and/or animal data, as well as on the consideration of technological feasibility for controlling workplace exposures to the REL. Under the old policy, RELs for most carcinogens were non-quantitative values labeled "lowest feasible concentration (LFC)." [Note: There are a few exceptions to LFC RELs for carcinogens (e.g., RELs for asbestos, formaldehyde, benzene, and ethylene oxide are quantitative values based primarily on analytical limits of detection or technological feasibility). Also, in 1989, NIOSH adopted several quantitative RELs for carcinogens from OSHA's permissible exposure limit (PEL) update.]

Under the new policy, NIOSH will also recommend the complete range of respirators (as determined by the NIOSH Respirator Decision Logic) for carcinogens with quantitative RELs. In this way, respirators will be consistently recommended regardless of whether a substance is a carcinogen or a non-carcinogen.

Old Policy

In the past, NIOSH identified numerous substances that should be treated as potential occupational carcinogens even though OSHA might not have identified them as such. In determining their carcinogenicity, NIOSH used the OSHA classification outlined in 29 CFR 1990.103, which states in part:

Potential occupational carcinogen means any substance, or combination or mixture of substances, which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance which is metabolized into one or more potential occupational carcinogens by mammals.

When thresholds for carcinogens that would protect 100% of the population had not been identified, NIOSH usually recommended that occupational exposures to carcinogens be limited to the lowest feasible concentration. To ensure maximum protection from carcinogens through the use of respiratory protection, NIOSH also recommended that only the most reliable and protective respirators be used. These respirators include (1) a self-contained breathing apparatus (SCBA) that has a full facepiece and is operated in a positive-pressure mode, or (2) a supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in a pressure-demand or other positive-pressure mode.

Recommendations to be Revised

The RELs and respirator recommendations for carcinogens listed in this edition of the *Pocket Guide* still reflect the old policy. Changes in the RELs and respirator recommendations that reflect the new policy will be included in future editions.

APPENDIX B
THIRTEEN OSHA-REGULATED CARCINOGENS

Without establishing PELs, OSHA promulgated standards in 1974 to regulate the industrial use of 13 chemicals identified as potential occupational carcinogens.

- 2-acetylaminofluorene
- 4-aminodiphenyl
- benzidine
- bis-chloromethyl ether
- 3,3'-dichlorobenzidine
- 4-dimethylaminoazobenzene
- ethyleneimine
- methyl chloromethyl ether
- alpha-naphthylamine
- beta-naphthylamine
- 4-nitrobiphenyl
- N-nitrosodimethylamine
- beta-propiolactone

Exposures of workers to these 13 chemicals are to be controlled through the required use of engineering controls, work practices, and personal protective equipment, including respirators. See 29 CFR 1910.1003-1910.1016 for specific details of these requirements.

Respirator selections in the Pocket Guide are based on NIOSH policy, which considers the 13 chemicals to be potential occupational carcinogens.

APPENDIX C
SUPPLEMENTARY EXPOSURE LIMITS

Aldehydes (Low-Molecular-Weight)

Exposure to acetaldehyde has produced nasal tumors in rats and laryngeal tumors in hamsters, and exposure to malonaldehyde has produced thyroid gland and pancreatic islet cell tumors in rats. NIOSH therefore recommends that acetaldehyde and malonaldehyde be considered potential occupational carcinogens in conformance with the OSHA carcinogen policy.

Testing has not been completed to determine the carcinogenicity of acrolein, butyraldehyde (CAS#: 123-72-8), crotonaldehyde, glutaraldehyde, glyoxal (CAS#: 107-22-2), paraformaldehyde (CAS#: 30525-89-4), propiolaldehyde (CAS#: 624-67-9), propionaldehyde (CAS#: 123-38-6), and n-valeraldehyde, nine related low-molecular-weight-aldehydes.

However, the limited studies to date indicate that these substances have chemical reactivity and mutagenicity similar to acetaldehyde and malonaldehyde. Therefore, NIOSH recommends that careful consideration should be given to reducing exposures to these nine related aldehydes.

Further information can be found in the "NIOSH Current Intelligence Bulletin 55: Carcinogenicity of Acetaldehyde and Malonaldehyde, and Mutagenicity of Related Low-Molecular-Weight Aldehydes" [DHHS (NIOSH) Publication No. 91-112.]

Asbestos

NIOSH considers asbestos to be a potential occupational carcinogen and recommends that exposures be reduced to the lowest feasible concentration. For asbestos fibers >5 micrometers in length, NIOSH recommends a REL of 100,000 fibers per cubic meter of air (100,000 fibers/m^3), which is equal to 0.1 fiber per cubic centimeter of air (0.1 fiber/cm^3), as determined by a 400-liter air sample collected over 100 minutes in accordance with NIOSH Analytical Method #7400. Airborne asbestos fibers are defined as those particles having (1) an aspect ratio of 3 to 1 or greater and (2) the mineralogic characteristics (that is, the crystal structure and elemental composition) of the asbestos minerals and their nonasbestiform analogs. The asbestos minerals are defined as chrysotile, crocidolite, amosite (cummingtonite-grunerite), anthophyllite, tremolite, and actinolite. In addition, airborne cleavage fragments from the nonasbestiform habits of the serpentine minerals antigorite and lizardite, and the

amphibole minerals contained in the series cummingtonite-grunerite, tremolite-ferroactinolite, and glaucophane-riebeckite should also be counted as fibers provided they meet the criteria for a fiber when viewed microscopically.

As found in 29 CFR 1910.1001, the OSHA PEL for asbestos fibers (i.e., actinolite asbestos, amosite, anthophyllite asbestos, chrysotile, crocidolite, and tremolite asbestos) is an 8-hour TWA airborne concentration of 0.1 fiber (longer than 5 micrometers and having a length-to-diameter ratio of at least 3 to 1) per cubic centimeter of air (0.1 fiber/cm^3), as determined by the membrane filter method at approximately 400X magnification with phase contrast illumination. No worker should be exposed in excess of 1 fiber/cm^3 (excursion limit)as averaged over a sampling period of 30 minutes.

Benzidine-, o-Tolidine, and o-Dianisidine-based Dyes

In December 1980, OSHA and NIOSH jointly published the Health Hazard Alert: Benzidine-, o-Tolidine-, and o-Dianisidine-based Dyes.

In this Alert, OSHA and NIOSH concluded that benzidine and benzidine-based dyes were potential occupational carcinogens and recommended that worker exposure be reduced to the lowest feasible level.

OSHA and NIOSH further concluded that o-tolidine and o-dianisidine (and dyes based on them) may present a cancer risk to workers and should be handled with caution and exposure minimized.

Carbon Black

NIOSH considers "Carbon Black" to be the material consisting of more than 80% elemental carbon in the form of near-spherical colloidal particles and coalesced particle aggregates of colloidal size that is obtained by the partial combustion or thermal decomposition of hydrocarbons.

The NIOSH REL (10-hour TWA) for carbon black is 3.5 mg/m^3. Polycyclic aromatic hydrocarbons (PAHs), particulate polycyclic organic material (PPOM), and polynuclear aromatic hydrocarbons (PNAs) are terms frequently used to describe various petroleum-based substances that NIOSH considers to be potential occupational carcinogens.

Since some of these aromatic hydrocarbons may be formed during the manufacture of carbon black (and become adsorbed on the carbon black), the NIOSH REL (10-hour TWA) for carbon black in the presence of PAHs is also 0.1 mg PAHs/m^3 (measured as the cyclohexane-extractable fraction).

The OSHA PEL (8-hour TWA) for carbon black is 3.5 mg/m^3.

Chloroethanes

NIOSH considers ethylene dichloride; hexachloroethane; 1,1,2,2-tetrachloroethane; and 1,1,2-trichloroethane; to be potential occupational carcinogens.

Additionally, NIOSH recommends that the other five chloroethane compounds:

- 1,1-dichloroethane
- ethyl chloride
- methyl chloroform
- pentachloroethane
- 1,1,1,2-tetrachloroethane

be treated in the workplace with caution because of their structural similarity to the four chloroethanes shown to be carcinogenic in animals.

Chromic Acid and Chromates (as CrO_3), Chromium(II) and Chromium(III) Compounds (as Cr), and Chromium Metal (as Cr)

The NIOSH REL (10-hour TWA) is 0.001 mg Cr(VI)/m^3 for all hexavalent chromium [Cr(VI)] compounds. NIOSH considers all Cr(VI) compounds (including chromic acid, tert-butyl chromate, zinc chromate, and chromyl chloride) to be potential occupational carcinogens.

The NIOSH REL (8-hour TWA) is 0.5 mg Cr/m^3 for chromium metal and chromium(II) and chromium(III) compounds.

The OSHA PEL is 0.1 mg CrO_3/m^3 (ceiling) for chromic acid and chromates (including tert-butyl chromate with a "skin" designation and zinc chromate); 0.5 mg Cr/m^3 (8-hour TWA) for chromium(II) and chromium(III) compounds; and 1 mg Cr/m^3 (8-hour TWA) for chromium metal and insoluble salts.

Coal Tar Pitch Volatiles

NIOSH considers coal tar products (i.e., coal tar, coal tar pitch, or creosote) to be potential occupational carcinogens; the NIOSH REL (10-hour TWA) for coal tar products is 0.1 mg/m^3 (cyclohexane-extractable fraction).

The OSHA PEL (8-hour TWA) for coal tar pitch volatiles is 0.2 mg/m^3 (benzene-soluble fraction). OSHA defines "coal tar pitch volatiles" in 29 CFR 1910.1002 as the fused polycyclic hydrocarbons that volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter and includes substances such as anthracene, benzo(a)pyrene (BaP), phenanthrene, acridine, chrysene, pyrene, etc.

Coke Oven Emissions

The production of coke by the carbonization of bituminous coal leads to the release of chemically-complex emissions from coke ovens that include both gases and particulate matter of varying chemical composition.

The emissions include coal tar pitch volatiles (e.g., particulate polycyclic organic matter [PPOM], polycyclic aromatic hydrocarbons [PAHs], and polynuclear aromatic hydrocarbons [PNAs]), aromatic compounds (e.g., benzene and beta-naphthylamine), trace metals (e.g., arsenic, beryllium, cadmium, chromium, lead, and nickel), and gases (e.g., nitric oxides and sulfur dioxide).

Cotton Dust (raw)

NIOSH recommends reducing exposures to cotton dust to the lowest feasible concentration to reduce the prevalence and severity of byssinosis; the REL is <0.200 mg/m^3 (as lint-free cotton dust).

As found in OSHA Table Z-1 (29 CFR 1910.1000), the PEL for cotton dust (raw) is 1 mg/m^3 for the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and garnetting.

PELs for other sectors (as found in 29 CFR 1910.1043) are 0.200 mg/m^3 for yarn manufacturing and cotton washing operations, 0.500 mg/m^3 for textile mill waste house operations or for dust from "lower grade washed cotton" used during yarn manufacturing, and 0.750 mg/m^3 for textile slashing and weaving operations.

The OSHA standard in 29 CFR 1910.1043 does not apply to cotton harvesting, ginning, or the handling and processing of woven or knitted materials and washed cotton.

All PELs for cotton dust are mean concentrations of lint-free, respirable cotton dust collected by the vertical elutriator or an equivalent method and averaged over an 8-hour period.

Lead

NIOSH considers "Lead" to mean metallic lead, lead oxides, and lead salts (including organic salts such as lead soaps but excluding lead arsenate).

The NIOSH REL for lead (8-hour TWA) is 0.050 mg/m^3; air concentrations should be maintained so that worker blood lead remains less than 0.060 mg Pb/100 g of whole blood.

OSHA considers "Lead" to mean metallic lead, all inorganic lead compounds (lead oxides and lead salts), and a class of organic compounds called soaps; all other lead compounds are excluded from this definition.

The OSHA PEL (8-hour TWA) is 0.050 mg/m^3; other OSHA requirements can be found in 29 CFR 1910.1025. The OSHA PEL (8-hour TWA) for lead in "non-ferrous foundries with less than 20 employees" is 0.075 mg/m^3.

Mineral Dusts

These OSHA PELs for "mineral dusts" listed below are from Table Z-3 of 29 CFR 1910.1000.

The OSHA PEL (8-hour TWA) for crystalline silica (as respirable quartz) is either 250 mppcf divided by the value "%SiO_2 + 5" or 10 mg/m^3 divided by the value "%SiO_2 + 2".

The OSHA PEL (8-hour TWA) for crystalline silica (as total quartz) is 30 mg/m^3 divided by the value "%SiO_2 + 2".

The OSHA PELs (8-hour TWAs) for cristobalite and tridymite are the values calculated above using the count or mass formulae for quartz.

The OSHA PEL (8-hour TWA) for amorphous silica (including diatomaceous earth) is either 80 mg/m^3 divided by the value "%SiO_2", or 20 mppcf.

The OSHA PELs (8-hour TWAs) for mica, soapstone, and talc (not containing asbestos) are 20 mppcf.

The OSHA PEL (8-hour TWA) for Portland cement is 50 mppcf. The OSHA PEL (8-hour TWA) for graphite (natural) is 15 mppcf.

The OSHA PEL (8-hour TWA) for coal dust (as the respirable fraction) containing less than 5% SiO_2 is 2.4 mg/m^3.

The OSHA PEL (8-hour TWA) for coal dust (as the respirable fraction) containing greater than 5% SiO_2 is 10 mg/m^3 divided by the value "%SiO_2 + 2".

NIAX® Catalyst ESN

In May 1978, OSHA and NIOSH jointly published the Current Intelligence Bulletin (CIB) 26: NIAX® Catalyst ESN.

In this CIB, OSHA and NIOSH recommended that occupational exposure to NIAX® Catalyst ESN, its components, dimethylaminopropionitrile and bis(2-(dimethylamino)ethyl)ether, as well as formulations containing either component, be minimized.

Exposures should be limited to as few workers as possible, while minimizing workplace exposure concentrations with effective work practices and engineering controls.

Exposed workers should be carefully monitored for potential disorders of the nervous and genitourinary system. Although substitution is a possible control measure, alternatives to NIAX® Catalyst ESN or its components should be carefully evaluated with regard to possible adverse health effects.

Trichloroethylene

NIOSH considers trichloroethylene (TCE) to be a potential occupational carcinogen and recommends a REL of 2 ppm (as a 60-minute ceiling) during the usage of TCE as an anesthetic agent and 25 ppm (as a 10-hour TWA) during all other exposures.

Tungsten Carbide (Cemented)

"Cemented tungsten carbide" or "hard metal" refers to a mixture of tungsten carbide, cobalt, and sometimes metal oxides or carbides and other metals (including nickel).

When the cobalt (Co) content exceeds 2%, its contribution to the potential hazard is judged to exceed that of tungsten carbide.

Therefore, the NIOSH REL (10-hour TWA) for cemented tungsten carbide containing >2% Co is 0.05 mg Co/m^3; the applicable OSHA PEL is 0.1 mg Co/m^3 (8-hour TWA). Nickel (Ni) may sometimes be used as a binder rather than cobalt.

NIOSH considers cemented tungsten carbide containing nickel to be a potential occupational carcinogen and recommends a REL of 0.015 mg Ni/m^3 (10-hour TWA).

The OSHA PEL for Insoluble Nickel (i.e., a 1 mg Ni/m^3 8-hour TWA) applies to mixtures of tungsten carbide and nickel.

APPENDIX D
SUBSTANCES WITH NO ESTABLISHED RELs

After reviewing available published literature, NIOSH provided comments to OSHA on August 1, 1988, regarding the "Proposed Rule on Air Contaminants" (29 CFR 1910, Docket No. H-020).

In these comments, NIOSH questioned whether the PELs proposed (and listed below) for the following substances included in the Pocket Guide were adequate to protect workers from recognized health hazards:

- acetylene tetrabromide [TWA 1 ppm]
- chlorobenzene [TWA 75 ppm]
- coal dust (<5%SiO_2) [2 mg/m^3 (as the respirable dust fraction)], coal dust (>/= 5% SiO_2) [0.1 mg/m^3 (as the respirable quartz fraction)]
- ethyl bromide [TWA 200 ppm; STEL 250 ppm]
- ethylene glycol [Ceiling 50 ppm]
- ethyl ether [TWA 400 ppm; STEL 500 ppm]
- fenthion [TWA 0.2 mg/m^3 (skin)]
- furfural [TWA 2 ppm (skin)]
- 2-isopropoxyethanol [TWA 25 ppm]
- isopropyl acetate [TWA 250 ppm; STEL 310 ppm]
- isopropylamine [TWA 5 ppm; STEL 10 ppm]
- manganese tetroxide (as Mn) [TWA 1 mg/m^3]
- molybdenum (soluble compounds as Mo) [TWA 5 mg/m^3]
- nitromethane [TWA 100 ppm]
- m-toluidine [TWA 2 ppm (skin)]
- triethylamine [TWA 10 ppm; STEL 15 ppm]

At that time, NIOSH also conducted a limited evaluation of the literature and concluded that the documentation cited by OSHA was inadequate to support the proposed PEL (as an 8-hour TWA) of 10 mg/m^3 for alpha-alumina, benomyl, emery, glycerine (mist), graphite (synthetic), magnesium oxide fume, molybdenum (insoluble compounds as Mo), particulates not otherwise regulated, picloram, and rouge.

APPENDIX E
RESPIRATOR RECOMMENDATIONS FOR SELECTED CHEMICALS

Mercury compounds [except (organo) alkyls]

Mercury vapor: NIOSH	
Up to 0.5 mg/m^3:	(APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern[†]/ (APF = 10) Any supplied air respirator
Up to 1.25 mg/m^3:	(APF = 25) Any supplied-air respirator operated in a continuous-flow mode/ (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern[†]
Up to 2.5 mg/m^3:	(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern[†]/ (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern[†]/ (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/ (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern[†]/ (APF = 50) Any self-contained breathing apparatus that has a full facepiece/ (APF = 50) Any supplied-air respirator with a full facepiece
Up to 10 mg/m^3:	(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode
Emergency or planned entry into unknown concentrations or IDLH conditions:	(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/ (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode
Escape:	(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compund of concern[†]/ Any appropriate escape-type, self-contained breathing apparatus

† End of service life indicator (ESLI) required

Other non (organo) alkyl mercury compounds: NIOSH/OSHA	
Up to 1 mg/m^3:	(APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern[†]/ (APF = 10) Any supplied air respirator
Up to 2.5 mg/m^3:	(APF = 25) Any supplied-air respirator operated in a continuous-flow mode/ (APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern[†]
Up to 5 mg/m^3:	(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern[†]/ (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern[†]/ (APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/ (APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern[†]/ (APF = 50) Any self-contained breathing apparatus that has a full facepiece/ (APF = 50) Any supplied-air respirator with a full facepiece
Up to 10 mg/m^3:	(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode
Emergency or planned entry into unknown concentrations or IDLH conditions:	(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/ (APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode
Escape:	(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compund of concern[†]/ Any appropriate escape-type, self-contained breathing apparatus

† End of service life indicator (ESLI) required

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APPENDIX F
MISCELLANEOUS NOTES

Benzene: The final OSHA Benzene standard in 1910.1028 applies to all occupational exposures to benzene except some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sales of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply (i.e., an 8-hour TWA of 10 ppm, an acceptable ceiling of 25 ppm, and 50 ppm for a maximum duration of 10 minutes as an acceptable maximum peak above the acceptable ceiling).

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APPENDIX G
1989 AIR CONTAMINANTS UPDATE PROJECT: EXPOSURE LIMITS NOT IN EFFECT

Acetaldehyde	TWA 100 ppm (180 mg/m^3) ST 150 ppm (270 mg/m^3)
Acetic anhydride	C 5 ppm (20 mg/m^3)
Acetone	TWA 750 ppm (1800 mg/m^3) ST 1000 ppm (2400 mg/m^3)
Acetonitrile	TWA 40 ppm (70 mg/m^3) ST 60 ppm (105 mg/m^3)
Acetylsalicyclic acid	TWA 5 mg/m^3
Acrolein	TWA 0.1 ppm (0.25 mg/m^3) ST 0.3 ppm (0.8 mg/m^3)
Acrylamide	TWA 0.03 mg/m^3 [skin]
Acrylic acid	TWA 10 ppm (30 mg/m^3) [skin]
Allyl alcohol	TWA 2 ppm (5 mg/m^3) ST 4 ppm (10 mg/m^3) [skin]
Allyl chloride	TWA 1 ppm (3 mg/m^3) ST 2 ppm (6 mg/m^3)
Allyl glycidyl ether	TWA 5 ppm (22 mg/m^3) ST 10 ppm (44 mg/m^3)
Allyl propyl disulfide	TWA 2 ppm (12 mg/m^3) ST 3 ppm (18 mg/m^3)
alpha-Alumina	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Aluminum (pyro powders & welding fumes, as Al)	TWA 5 mg/m^3
Aluminum (soluble salts & alkyls, as Al)	TWA 2 mg/m^3
Amitrole	TWA 0.2 mg/m^3
Ammonia	ST 35 ppm (27 mg/m^3)
Ammonium chloride fume	TWA 10 mg/m^3 ST 20 mg/m^3
Ammonium sulfamate	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Aniline (and homologs)	TWA 2 ppm (8 mg/m^3) [skin]
Atrazine	TWA 5 mg/m^3
Barium sulfate	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Benomyl	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Benzenethiol	TWA 0.5 ppm (2 mg/m^3)
Bismuth telluride (doped with selenium sulfide, as Bi2Te3)	TWA 5 mg/m^3
Borates, tetra, sodium salts (Anhydrous)	TWA 10 mg/m^3

Borates, tetra, sodium salts (Decahydrate)	TWA 10 mg/m^3
Borates, tetra, sodium salts (Pentahydrate)	TWA 10 mg/m^3
Boron oxide	TWA 10 mg/m^3
Boron tribromide	C 1 ppm (10 mg/m^3)
Bromacil	TWA 1 ppm (10 mg/m^3)
Bromine	TWA 0.1 ppm (0.7 mg/m^3) ST 0.3 ppm (2 mg/m^3)
Bromine pentafluoride	TWA 0.1 ppm (0.7 mg/m^3)
n-Butane	TWA 800 ppm (1900 mg/m^3)
2-Butanone	TWA 200 ppm (590 mg/m^3) ST 300 ppm (885 mg/m^3)
2-Butoxyethanol	TWA 25 ppm (120 mg/m^3) [skin]
n-Butyl acetate	TWA 150 ppm (710 mg/m^3) ST 200 ppm (950 mg/m^3)
Butyl acrylate	TWA 10 ppm (55 mg/m^3)
n-Butyl alcohol	C 50 ppm (150 mg/m^3) [skin]
sec-Butyl alcohol	TWA 100 ppm (305 mg/m^3)
tert-Butyl alcohol	TWA 100 ppm (300 mg/m^3) ST 150 ppm (450 mg/m^3)
n-Butyl glycidyl ether	TWA 25 ppm (135 mg/m^3)
n-Butyl lactate	TWA 5 ppm (25 mg/m^3)
n-Butyl mercaptan	TWA 0.5 ppm (1.5 mg/m^3)
o-sec-Butylphenol	TWA 5 ppm (30 mg/m^3) [skin]
p-tert-Butyltoluene	TWA 10 ppm (60 mg/m^3) ST 20 ppm (120 mg/m^3)
Calcium cyanamide	TWA 0.5 mg/m^3
Caprolactam	Dust: TWA 1 mg/m^3 ST 3 mg/m^3 Vapor: TWA 5 ppm (20 mg/m^3) ST 10 ppm (40 mg/m^3)
Captafol	TWA 0.1 mg/m^3
Captan	TWA 5 mg/m^3
Carbofuran	TWA 0.1 mg/m^3
Carbon dioxide	TWA 10,000 ppm (18,000 mg/m^3) ST 30,000 ppm (54,000 mg/m^3)
Carbon disulfide	TWA 4 ppm (12 mg/m^3) ST 12 ppm (36 mg/m^3) [skin]
Carbon monoxide	TWA 35 ppm (40 mg/m^3) C 200 ppm (229 mg/m^3)
Carbon tetrabromide	TWA 0.1 ppm (1.4 mg/m^3) ST 0.3 ppm (4 mg/m^3)
Carbon tetrachloride	TWA 2 ppm (12.6 mg/m^3)
Carbonyl fluoride	TWA 2 ppm (5 mg/m^3) ST 5 ppm (15 mg/m^3)
Catechol	TWA 5 ppm (20 mg/m^3) [skin]
Cesium hydroxide	TWA 2 mg/m^3
Chlorinated camphene	TWA 0.5 mg/m^3 ST 1 mg/m^3 [skin]

Chlorine	TWA 0.5 ppm (1.5 mg/m^3) ST 1 ppm (3 mg/m^3)
Chlorine dioxide	TWA 0.1 ppm (0.3 mg/m^3) ST 0.3 ppm (0.9 mg/m^3)
Chloroacetyl chloride	TWA 0.05 ppm (0.2 mg/m^3)
o-Chlorobenzylidene malononitrile	C 0.05 ppm (0.4 mg/m^3) [skin]
Chlorodifluoromethane	TWA 1000 ppm (3500 mg/m^3)
Chloroform	TWA 2 ppm (9.78 mg/m^3)
1-Chloro-1-nitropropane	TWA 2 ppm (10 mg/m^3)
Chloropentafluoroethane	TWA 1000 ppm (6320 mg/m^3)
beta-Chloroprene	TWA 10 ppm (35 mg/m^3) [skin]
o-Chlorostyrene	TWA 50 ppm (285 mg/m^3) ST 75 ppm (428 mg/m^3)
o-Chlorotoluene	TWA 50 ppm (250 mg/m^3)
Chlorpyrifos	TWA 0.2 mg/m^3 [skin]
Coal dust	TWA 2 mg/m^3 ($_2$)(resp dust) TWA 0.1 mg/m^3 (>/= 5% SiO_2) (resp quartz)
Cobalt metal dust & fume, as Co)	TWA 0.05 mg/m^3
Cobalt carbonyl (as Co)	TWA 0.1 mg/m^3
Cobalt hydrocarbonyl (as Co)	TWA 0.1 mg/m^3
Crag® herbicide	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Crufomate	TWA 5 mg/m^3
Cyanamide	TWA 2 mg/m^3
Cyanogen	TWA 10 ppm (20 mg/m^3)
Cyanogen chloride	C 0.3 ppm (0.6 mg/m^3)
Cyclohexanol	TWA 50 ppm (200 mg/m^3) [skin]
Cyclohexanone	TWA 25 ppm (100 mg/m^3) [skin]
Cyclohexylamine	TWA 10 ppm (40 mg/m^3)
Cyclonite	TWA 1.5 mg/m^3 [skin]
Cyclopentane	TWA 600 ppm (1720 mg/m^3)
Cyhexatin	TWA 5 mg/m^3
Decaborane	TWA 0.3 mg/m^3 (0.05 ppm) ST 0.9 mg/m^3 (0.15 ppm) [skin]
Diazinon	TWA 0.1 mg/m^3 [skin]
2-N-Dibutylaminoethanol	TWA 2 ppm (14 mg/m^3)
Dibutyl phosphate	TWA 1 ppm (5 mg/m^3) ST 2 ppm (10 mg/m^3)
Dichloroacetylene	C 0.1 ppm (0.4 mg/m^3)
p-Dichlorobenzene	TWA 75 ppm (450 mg/m^3) ST 110 ppm (675 mg/m^3)
1,3-Dichloro-5,5-dimethylhydantoin	TWA 0.2 mg/m^3 ST 0.4 mg/m^3
Dichloroethyl ether	TWA 5 ppm (30 mg/m^3) ST 10 ppm (60 mg/m^3) [skin]
Dichloromonofluoromethane	TWA 10 ppm (40 mg/m^3)
1,1-Dichloro-1-nitroethane	TWA 2 ppm (10 mg/m^3)
1,3-Dichloropropene	TWA 1 ppm (5 mg/m^3) [skin]
2,2-Dichloropropionic acid	TWA 1 ppm (6 mg/m^3)

Dicrotophos	TWA 0.25 mg/m^3 [skin]
Dicyclopentadiene	TWA 5 ppm (30 mg/m^3)
Dicyclopentadienyl iron	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Diethanolamine	TWA 3 ppm (15 mg/m^3)
Diethylamine	TWA 10 ppm (30 mg/m^3) ST 25 ppm (75 mg/m^3)
Diethylenetriamine	TWA 1 ppm (4 mg/m^3)
Diethyl ketone	TWA 200 ppm (705 mg/m^3)
Diethyl phthalate	TWA 5 mg/m^3
Diglycidyl ether	TWA 0.1 ppm (0.5 mg/m^3)
Diisobutyl ketone	TWA 25 ppm (150 mg/m^3)
N,N-Dimethylaniline	TWA 5 ppm (25 mg/m^3) ST 10 ppm (50 mg/m^3) [skin]
Dimethyl-1,2-dibromo-2,2-dichlorethyl phosphate	TWA 3 mg/m^3 [skin]
Dimethyl sulfate	TWA 0.1 ppm (0.5 mg/m^3) [skin]
Dinitolmide	TWA 5 mg/m^3
Di-sec octyl phthalate	TWA 5 mg/m^3 ST 10 mg/m^3
Dioxane	TWA 25 ppm (90 mg/m^3) [skin]
Dioxathion	TWA 0.2 mg/m^3 [skin]
Diphenylamine	TWA 10 mg/m^3
Dipropylene glycol methyl ether	TWA 100 ppm (600 mg/m^3) ST 150 ppm (900 mg/m^3) [skin]
Dipropyl ketone	TWA 50 ppm (235 mg/m^3)
Diquat (Diquat dibromide)	TWA 0.5 mg/m^3
Disulfiram	TWA 2 mg/m^3
Disulfoton	TWA 0.1 mg/m^3 [skin]
2,6-Di-tert-butyl-p-cresol	TWA 10 mg/m^3
Diuron	TWA 10 mg/m^3
Divinyl benzene	TWA 10 ppm (50 mg/m^3)
Emery	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Endosulfan	TWA 0.1 mg/m^3 [skin]
Epichlorohydrin	TWA 2 ppm (8 mg/m^3) [skin]
Ethanolamine	TWA 3 ppm (8 mg/m^3) ST 6 ppm (15 mg/m^3)
Ethion	0.4 mg/m^3 [skin]
Ethyl acrylate	TWA 5 ppm (20 mg/m^3) ST 25 ppm (100 mg/m^3) [skin]
Ethyl benzene	TWA 100 ppm (435 mg/m^3) ST 125 ppm (545 mg/m^3)
Ethyl bromide	TWA 200 ppm (890 mg/m^3) ST 250 ppm (1110 mg/m^3)
Ethylene chlorohydrin	C 1 ppm (3 mg/m^3) [skin]
Ethylene dichloride	TWA 1 ppm (4 mg/m^3) ST 2 ppm (8 mg/m^3)
Ethylene glycol	C 50 ppm (125 mg/m^3)
Ethylene glycol dinitrate	ST 0.1 mg/m^3 [skin]
Ethyl ether	TWA 400 ppm (1200 mg/m^3)

	ST 500 ppm (1500 mg/m^3)
Ethylidene norbornene	C 5 ppm (25 mg/m^3)
Ethyl mercaptan	TWA 0.5 ppm (1 mg/m^3)
N-Ethylmorpholine	TWA 5 ppm (23 mg/m^3) [skin]
Ethyl silicate	TWA 10 ppm (85 mg/m^3)
Fenamiphos	TWA 0.1 mg/m^3 [skin]
Fensulfothion	TWA 0.1 mg/m^3
Fenthion	TWA 0.2 mg/m^3 [skin]
Ferbam	TWA 10 mg/m^3
Ferrovanadium dust	TWA 1 mg/m^3 ST 3 mg/m^3
Fluorotrichloromethane	C 1000 ppm (5600 mg/m^3)
Fonofos	TWA 0.1 mg/m^3 [skin]
Formamide	TWA 20 ppm (30 mg/m^3) ST 30 ppm (45 mg/m^3)
Furfural	TWA 2 ppm (8 mg/m^3) [skin]
Furfuryl alcohol	TWA 10 ppm (40 mg/m^3) ST 15 ppm (60 mg/m^3) [skin]
Gasoline	TWA 300 ppm (900 mg/m^3) ST 500 ppm (1500 mg/m^3)
Germanium tetrahydride	TWA 0.2 ppm (0.6 mg/m^3)
Glutaraldehyde	C 0.2 ppm (0.8 mg/m^3)
Glycerin (mist)	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Glycidol	TWA 25 ppm (75 mg/m^3)
Graphite (natural)	TWA 2.5 mg/m^3 (resp)
Graphite (synthetic)	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
n-Heptane	TWA 400 ppm (1600 mg/m^3) ST 500 ppm (2000 mg/m^3)
Hexachlorobutadiene	TWA 0.02 ppm (0.24 mg/m^3)
Hexachlorocyclopentadiene	TWA 0.01 ppm (0.1 mg/m^3)
Hexafluoroacetone	TWA 0.1 ppm (0.7 mg/m^3) [skin]
n-Hexane	TWA 50 ppm (180 mg/m^3)
Hexane isomers (except n-Hexane)	TWA 500 ppm (1800 mg/m^3) ST 1000 ppm (3600 mg/m^3)
2-Hexanone	TWA 5 ppm (20 mg/m^3)
Hexone	TWA 50 ppm (205 mg/m^3) ST 75 ppm (300 mg/m^3)
Hexylene glycol	C 25 ppm (125 mg/m^3)
Hydrazine	TWA 0.1 ppm (0.1 mg/m^3) [skin]
Hydrogenated terphenyls	TWA 0.5 ppm (5 mg/m^3)
Hydrogen bromide	C 3 ppm (10 mg/m^3)
Hydrogen cyanide	ST 4.7 ppm (5 mg/m^3) [skin]
Hydrogen fluoride (as F)	TWA 3 ppm ST 6 ppm
Hydrogen sulfide	TWA 10 ppm (14 mg/m^3) ST 15 ppm (21 mg/m^3)
2-Hydroxypropyl acrylate	TWA 0.5 ppm (3 mg/m^3) [skin]
Indene	TWA 10 ppm (45 mg/m^3)

Indium	TWA 0.1 mg/m^3
Iodoform	TWA 0.6 ppm (10 mg/m^3)
Iron pentacarbonyl (as Fe)	TWA 0.1 ppm (0.8 mg/m^3) ST 0.2 ppm (1.6 mg/m^3)
Iron salts (soluble, as Fe)	TWA 1 mg/m^3
Isoamyl alcohol (primary & secondary)	TWA 100 ppm (360 mg/m^3) ST 125 ppm (450 mg/m^3)
Isobutane	TWA 800 ppm (1900 mg/m^3)
Isobutyl alcohol	TWA 50 ppm (150 mg/m^3)
Isooctyl alcohol	TWA 50 ppm (270 mg/m^3) [skin]
Isophorone	TWA 4 ppm (23 mg/m^3)
Isophorone diisocyanate	TWA 0.005 ppm ST 0.02 ppm [skin]
2-Isopropoxyethanol	TWA 25 ppm (105 mg/m^3)
Isopropyl acetate	TWA 250 ppm (950 mg/m^3) ST 310 ppm (1185 mg/m^3)
Isopropyl alcohol	TWA 400 ppm (980 mg/m^3) ST 500 ppm (1225 mg/m^3)
Isopropylamine	TWA 5 ppm (12 mg/m^3) ST 10 ppm (24 mg/m^3)
N-Isopropylaniline	TWA 2 ppm (10 mg/m^3) [skin]
Isopropyl glycidyl ether	TWA 50 ppm (240 mg/m^3) ST 75 ppm (360 mg/m^3)
Kaolin	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Ketene	TWA 0.5 ppm (0.9 mg/m^3) ST 1.5 ppm (3 mg/m^3)
Magnesium oxide fume	TWA 10 mg/m^3
Malathion	TWA 10 mg/m^3 [skin]
Manganese compounds and fume (as Mn)	Compounds: C 5 mg/m^3 Fume: TWA 1 mg/m^3 ST 3 mg/m^3
Manganese cyclopentadienyl tricarbonyl (as Mn)	TWA 0.1 mg/m^3 [skin]
Manganese tetroxide (as Mn)	TWA 1 mg/m^3
Mercury compounds, as Hg [except(organo) alkyls]	
Hg Vapor	TWA 0.05 mg/m^3 [skin]
Non-alkyl compounds	C 0.1 mg/m^3 [skin]
Mercury (organo) alkyl compounds (as Hg)	TWA 0.01 mg/m^3 ST 0.03 mg/m^3 [skin]
Mesityl oxide	TWA 15 ppm (60 mg/m^3) ST 25 ppm (100 mg/m^3)
Methacrylic acid	TWA 20 ppm (70 mg/m^3) [skin]
Methomyl	TWA 2.5 mg/m^3
Methoxychlor	TWA 10 mg/m^3
4-Methoxyphenol	TWA 5 mg/m^3
Methyl acetate	TWA 200 ppm (610 mg/m^3) ST 250 ppm (760 mg/m^3)
Methyl acetylene-propadiene mixture	TWA 1000 ppm (1800 mg/m^3) ST 1250 ppm (2250 mg/m^3)

Methylacrylonitrile	TWA 1 ppm (3 mg/m^3) [skin]
Methyl alcohol	TWA 200 ppm (260 mg/m^3) ST 250 ppm (325 mg/m^3) [skin]
Methyl bromide	TWA 5 ppm (20 mg/m^3) [skin]
Methyl chloride	TWA 50 ppm (105 mg/m^3) ST 100 ppm (210 mg/m^3)
Methyl chloroform	TWA 350 ppm (1900 mg/m^3) ST 450 ppm (2450 mg/m^3)
Methyl-2-cyanoacrylate	TWA 2 ppm (8 mg/m^3) ST 4 ppm (16 mg/m^3)
Methylcyclohexane	TWA 400 ppm (1600 mg/m^3)
Methylcyclohexanol	TWA 50 ppm (235 mg/m^3)
o-Methylcyclohexanone	TWA 50 ppm (230 mg/m^3) ST 75 ppm (345 mg/m^3) [skin]
Methyl cyclopentadienyl manganese tricarbonyl (as Mn)	TWA 0.2 mg/m^3 [skin]
Methyl demeton	TWA 0.5 mg/m^3 [skin]
4,4'-Methylenebis(2-chloroaniline)	TWA 0.02 ppm (0.22 mg/m^3) [skin]
Methylene bis(4-cyclo-hexylisocyanate)	C 0.01 ppm (0.11 mg/m^3) [skin]
Methyl ethyl ketone peroxide	C 0.7 ppm (5 mg/m^3)
Methyl formate	TWA 100 ppm (250 mg/m^3) ST 150 ppm (375 mg/m^3)
Methyl iodide	TWA 2 ppm (10 mg/m^3) [skin]
Methyl isoamyl ketone	TWA 50 ppm (240 mg/m^3)
Methyl isobutyl carbinol	TWA 25 ppm (100 mg/m^3) ST 40 ppm (165 mg/m^3) [skin]
Methyl isopropyl ketone	TWA 200 ppm (705 mg/m^3)
Methyl mercaptan	TWA 0.5 ppm (1 mg/m^3)
Methyl parathion	TWA 0.2 mg/m^3 [skin]
Methyl silicate	TWA 1 ppm (6 mg/m^3)
alpha-Methyl styrene	TWA 50 ppm (240 mg/m^3) ST 100 ppm (485 mg/m^3)
Metribuzin	TWA 5 mg/m^3
Mica	TWA 3 mg/m^3 (resp)
Molybdenum (insoluble compounds, as Mo)	TWA 10 mg/m^3
Monocrotophos	TWA 0.25 mg/m^3
Monomethyl aniline	TWA 0.5 ppm (2 mg/m^3) [skin]
Morpholine	TWA 20 ppm (70 mg/m^3) ST 30 ppm (105 mg/m^3) [skin]
Naphthalene	TWA 10 ppm (50 mg/m^3) ST 15 ppm (75 mg/m^3)
Nickel metal & other compounds (as Ni)	
Metal & insoluble compounds	TWA 1 mg/m^3
Soluble compounds	TWA 0.1 mg/m^3
Nitric acid	TWA 2 ppm (5 mg/m^3) ST 4 ppm (10 mg/m^3)
p-Nitroaniline	TWA 3 mg/m^3 [skin]
Nitrogen dioxide	ST 1 ppm (1.8 mg/m^3)
Nitroglycerine	ST 0.1 mg/m^3) [skin]
2-Nitropropane	TWA 10 ppm (35 mg/m^3)
Nitrotoluene (o-, m-, p-isomers)	TWA 2 ppm (11 mg/m^3) [skin]

Nonane	TWA 200 ppm (1050 mg/m^3)
Octachloronaphthalene	TWA 0.1 mg/m^3 ST 0.3 mg/m^3 [skin]
Octane	TWA 300 ppm (1450 mg/m^3) ST 375 ppm (1800 mg/m^3)
Osmium tetroxide (as Os)	TWA 0.002 mg/m^3 (0.0002 ppm) ST 0.006 mg/m^3 (0.0006 ppm)
Oxalic acid	TWA 1 mg/m^3 ST 2 mg/m^3
Oxygen difluoride	C 0.05 ppm (0.1 mg/m^3)
Ozone	TWA 0.1 ppm (0.2 mg/m^3) ST 0.3 ppm (0.6 mg/m^3)
Paraffin wax fume	TWA 2 mg/m^3
Paraquat	TWA 0.1 mg/m^3 (resp) [skin]
Pentaborane	TWA 0.005 ppm (0.01 mg/m^3) ST 0.015 ppm (0.03 mg/m^3)
Pentaerythritol	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
n-Pentane	TWA 600 ppm (1800 mg/m^3) ST 750 ppm (2250 mg/m^3)
2-Pentanone	TWA 200 ppm (700 mg/m^3) ST 250 ppm (875 mg/m^3)
Perchloryl fluoride	TWA 3 ppm (14 mg/m^3) ST 6 ppm (28 mg/m^3)
Petroleum distillates (naphtha)	TWA 400 ppm (1600 mg/m^3)
Phenothiazine	TWA 5 mg/m^3 [skin]
Phenyl glycidyl ether	TWA 1 ppm (6 mg/m^3)
Phenylhydrazine	TWA 5 ppm (20 mg/m^3) ST 10 ppm (45 mg/m^3) [skin]
Phenylphosphine	C 0.05 ppm (0.25 mg/m^3)
Phorate	TWA 0.05 mg/m^3 ST 0.2 mg/m^3 [skin]
Phosdrin	TWA 0.01 ppm (0.1 mg/m^3) ST 0.03 ppm (0.3 mg/m^3) [skin]
Phosphine	TWA 0.3 ppm (0.4 mg/m^3) ST 1 ppm (1 mg/m^3)
Phosphoric acid	TWA 1 mg/m^3 ST 3 mg/m^3
Phosphorus oxychloride	TWA 0.1 ppm (0.6 mg/m^3)
Phosphorus pentasulfide	TWA 1 mg/m^3 ST 3 mg/m^3
Phosphorus trichloride	TWA 0.2 ppm (1.5 mg/m^3) ST 0.5 ppm (3 mg/m^3)
Phthalic anhydride	TWA 6 mg/m^3 (1 ppm)
m-Phthalodinitrile	TWA 5 mg/m^3
Picloram	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Piperazine dihydrochloride	TWA 5 mg/m^3
Platinum metal (as Pt)	TWA 1 mg/m^3
Portland cement	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Potassium hydroxide	TWA 2 mg/m^3

Propargyl alcohol	TWA 1 ppm (2 mg/m^3) [skin]
Propionic acid	TWA 10 ppm (30 mg/m^3)
Propoxur	TWA 0.5 mg/m^3
n-Propyl acetate	TWA 200 ppm (840 mg/m^3) ST 250 ppm (1050 mg/m^3)
n-Propyl alcohol	TWA 200 ppm (500 mg/m^3) ST 250 ppm (625 mg/m^3)
Propylene dichloride	TWA 75 ppm (350 mg/m^3) ST 110 ppm (510 mg/m^3)
Propylene glycol dinitrate	TWA 0.05 ppm (0.3 mg/m^3)
Propylene glycol monomethyl ether	TWA 100 ppm (360 mg/m^3) ST 150 ppm (540 mg/m^3)
Propylene oxide	TWA 20 ppm (50 mg/m^3)
n-Propyl nitrate	TWA 25 ppm (105 mg/m^3) ST 40 ppm (170 mg/m^3)
Resorcinol	TWA 10 ppm (45 mg/m^3) ST 20 ppm (90 mg/m^3)
Ronnel	TWA 10 mg/m^3
Rosin core solder, pyrolysis products (as formaldehyde)	TWA 0.1 mg/m^3
Rouge	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Silica, amorphous	TWA 6 mg/m^3 TWA 0.1 mg/m^3 (fused)
Silica, crystalline (as respirable dust)	TWA 0.05 mg/m^3 (cristobalite) TWA 0.05 mg/m^3 (tridymite) TWA 0.1 mg/m^3 (quartz) TWA 0.1 mg/m^3 (tripoli)
Silicon	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Silicon carbide	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Silicon tetrahydride	TWA 5 ppm (7 mg/m^3)
Soapstone	TWA 6 mg/m^3 (total) TWA 3 mg/m^3 (resp)
Sodium azide	C 0.1 ppm (as HN_3) [skin] C 0.3 mg/m^3 (as NaN_3) [skin]
Sodium bisulfite	TWA 5 mg/m^3
Sodium fluoroacetate	TWA 0.05 mg/m^3 ST 0.15 mg/m^3 [skin]
Sodium hydroxide	C 2 mg/m^3
Sodium metabisulfite	TWA 5 mg/m^3
Stoddard solvent	TWA 525 mg/m^3 (100 ppm)
Styrene	TWA 50 ppm (215 mg/m^3) ST 100 ppm (425 mg/m^3)
Subtilisins	ST 0.00006 mg/m^3 [60-minute]
Sulfur dioxide	TWA 2 ppm (5 mg/m^3) ST 5 ppm (13 mg/m^3)
Sulfur monochloride	C 1 ppm (6 mg/m^3)
Sulfur pentafluoride	C 0.01 ppm (0.1 mg/m^3)
Sulfur tetrafluoride	C 0.1 ppm (0.4 mg/m^3)
Sulfuryl fluoride	TWA 5 ppm (20 mg/m^3) ST 10 ppm (40 mg/m^3)

Sulprofos	TWA 1 mg/m^3
Talc	TWA 2 mg/m^3 (resp)
Temephos	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Terphenyl (o-, m-, p-isomers)	C 5 mg/m^3 (0.5 ppm)
1,1,2,2-Tetrachloroethane	TWA 1 ppm (7 mg/m^3) [skin]
Tetrachloroethylene	TWA 25 ppm (170 mg/m^3)
Tetrahydrofuran	TWA 200 ppm (590 mg/m^3) ST 250 ppm (735 mg/m^3)
Tetrasodium pyrophosphate	TWA 5 mg/m^3
4,4'-Thiobis(6-tert-butyl-m-cresol)	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Thioglycolic acid	TWA 1 ppm (4 mg/m^3) [skin]
Thionyl chloride	C 1 ppm (5 mg/m^3)
Tin (organic compounds, as Sn)	TWA 0.1 mg/m^3 [skin]
Tin(II) oxide (as Sn)	TWA 2 mg/m^3
Tin(IV) oxide (as Sn)	TWA 2 mg/m^3
Titanium dioxide	TWA 10 mg/m^3
Toluene	TWA 100 ppm (375 mg/m^3) ST 150 ppm (560 mg/m^3)
Toluene-2,4-diisocyanate	TWA 0.005 ppm (0.04 mg/m^3) ST 0.02 ppm (0.15 mg/m^3)
m-Toluidine	TWA 2 ppm (9 mg/m^3) [skin]
p-Toluidine	TWA 2 ppm (9 mg/m^3) [skin]
Tributyl phosphate	TWA 0.2 ppm (2.5 mg/m^3)
Trichloroacetic acid	TWA 1 ppm (7 mg/m^3)
1,2,4-Trichlorobenzene	C 5 ppm (40 mg/m^3)
Trichloroethylene	TWA 50 ppm (270 mg/m^3) ST 200 ppm (1080 mg/m^3)
1,2,3-Trichloropropane	TWA 10 ppm (60 mg/m^3)
1,1,2-Trichloro-1,2,2-trifluoroethane	TWA 1000 ppm (7600 mg/m^3) ST 1250 ppm (9500 mg/m^3)
Triethylamine	TWA 10 ppm (40 mg/m^3) ST 15 ppm (60 mg/m^3)
Trimellitic anhydride	TWA 0.005 ppm (0.04 mg/m^3)
Trimethylamine	TWA 10 ppm (24 mg/m^3) ST 15 ppm (36 mg/m^3)
1,2,3-Trimethylbenzene	TWA 25 ppm (125 mg/m^3)
1,2,4-Trimethylbenzene	TWA 25 ppm (125 mg/m^3)
1,3,5-Trimethylbenzene	TWA 25 ppm (125 mg/m^3)
Trimethyl phosphite	TWA 2 ppm (10 mg/m^3)
2,4,6-Trinitrotoluene	TWA 0.5 mg/m^3 [skin]
Triorthocresyl phosphate	TWA 0.1 mg/m^3 [skin]
Triphenylamine	TWA 5 mg/m^3
Tungsten (insoluble compounds, as W)	TWA 5 mg/m^3 ST 10 mg/m^3
Tungsten (soluble compounds, as W)	TWA 1 mg/m^3 ST 3 mg/m^3
Tungsten carbide (cemented)	TWA 5 mg/m^3 (as W) ST 10 mg/m^3 (as W)

	TWA 0.05 mg/m^3 (as Co) TWA 1 mg/m^3 (as Ni)
Uranium (insoluble compounds, as U)	TWA 0.2 mg/m^3 ST 0.6 mg/m^3
n-Valeraldehyde	TWA 50 ppm (175 mg/m^3)
Vanadium dust	TWA 0.05 mg V_2O_5/m^3 (resp)
Vanadium fume	C 0.05 mg V_2O_5/m^3
Vinyl acetate	TWA 10 ppm (30 mg/m^3) ST 20 ppm (60 mg/m^3)
Vinyl bromide	TWA 5 ppm (20 mg/m^3)
Vinyl cyclohexene dioxide	TWA 10 ppm (60 mg/m^3) [skin]
Vinylidene chloride	TWA 1 ppm (4 mg/m^3)
VM & P Naphtha	TWA 1350 mg/m^3 (300 ppm) ST 1800 mg/m^3 (400 ppm)
Welding fumes	TWA 5 mg/m^3
Wood dust (all wood dusts except Western red cedar)	TWA 5 mg/m^3 ST 10 mg/m^3
Wood dust (Western red cedar)	TWA 2.5 mg/m^3
Xylene (o-, m-, p-isomers)	TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3)
m-Xylene alpha, alpha'-diamine	C 0.1 mg/m^3 [skin]
Xylidine	TWA 2 ppm (10 mg/m^3) [skin]
Zinc chloride fume	TWA 1 mg/m^3 ST 2 mg/m^3
Zinc oxide	TWA 5 mg/m^3 (fume) ST 10 mg/m^3 (fume) TWA 10 mg/m^3 (total dust) TWA 5 mg/m^3 (resp dust)
Zinc stearate	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)
Zirconium compounds (as Zr)	TWA 5 mg/m^3 ST 10 mg/m^3

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