Resources

Helpful Tools

Mixtures of Airborne substances R-3

Notes

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

This tool will assist you in determining if a mixture of airborne substances is a respiratory hazard. Use this tool when the concentration of each substance in the mixture is below the PEL for that substance.

- Use the following formula to determine if a respiratory hazard is present when an employee is exposed to a mixture of two or more airborne substances that are potential respiratory hazards, and the substances have additive health effects:

$$E_m = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \ldots + \frac{C_n}{L_n}$$

The symbol	Is the
E	Equivalent exposure for the mixture. When the value of E is greater than 1 a respiratory hazard is present.
C	Concentration of a substance.
L	TWA, STEL, or ceiling for that contaminant, from Table 3.

Step 1 : Identify the health effects of the substances

- Look up the health effects in Table HT-1, which contains the health effects that were used as the basis for the PEL of each substance.

  OR

- Look up the health effects for the substances in the TLV booklet published by ACGIH.

  OR

- Use other available source, such as MSDS, RTECS, etc., to identify health effects for the substances

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(Continued)

Step 2 : Compare the health effects

- If the same health effect is listed for each substance, the substances have additive health effects.
- You may use resources such as the documentation for the TLVs, OSHA preambles, and published articles to determine that the same listed health effects are not additive. Examples of when the effects would not be additive are:

  1. The toxic effects of the substances on the target organ are different.
  2. The substances affect different target organs.
  3. The mixture inhibits the toxic effect of one or more substance.
  4. The mixture increases the toxic effect of one or more substance (synergism). Synergism is a serious hazard that would be evaluated separately.

Step 3 : Look up the PELs in Table HT-1

- Use the TWA_8, STEL, or ceiling PEL value for the substances. Any PEL (TWA_8, STEL, or ceiling) will work in the formula but you must use the same time duration for all substances. For example, you cannot use an 8-hour sample and a 15-minute sample together.
- Multiple calculations may be needed to address all possible combinations, for example:

Substance A	Substance B
TWA_8	TWA_8
STEL	STEL
STEL	ceiling
ceiling	STEL
ceiling	ceiling

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Mixtures of Airborne Substances

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(Continued)

Step 4 : Determine the employee exposure concentrations

- Use air monitoring results for the time period covered by the PEL for each substance.

Step 5 : Plug the PEL and exposure concentration values into the formula and calculate the result

Example values:

Substance	TWA_8 Results (PEL)	STEL Results (PEL)	Health Effects
n-Hexane	20 ppm (50)	40 ppm (75)	Irritation, CNS, Neuropathy
sec-Butyl acetate	20 ppm (200)	150 ppm (250)	Irritation
Methyl ethyl ketone	90 ppm (200)	120 ppm (300)	Irritation, CNS

$$E_m = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \ldots + \frac{C_n}{L_n}$$

Calculation for irritation TWA_8:

E_m = n-Hexane + sec-Butyl acetate + Methyl ethyl ketone

E_m = 20/50 + 20/200 + 90/200

E_m = 0.4 + 0.1 + 0.45

E_m = 0.95

The sum is less than 1, so the mixture is NOT a respiratory hazard.

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Mixtures of Airborne Substances

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(Continued)

Calculation for irritation STEL:

$E_m = 40/75 + 150/250 + 120/300$

$E_m = 0.53 + 0.75 + 0.4$

$E_m = 1.68$

The sum is greater than 1, so the mixture is a respiratory hazard.

Calculation for CNS TWA_8:

$E_m = 20/50 + 90/200$

$E_m = 0.4 + 0.45$

$E_m = 0.85$

The sum is less than 1, so the mixture is NOT a respiratory hazard.

Calculation for CNS STEL:

$E_m = 40/75 + 120/300$

$E_m = 0.53 + 0.4$

$E_m = 0.93$

The sum is less than 1, so the mixture is NOT a respiratory hazard.

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Table HT-1 Health Effects of Substances	
SUBSTANCE	**PEL BASIS (Health Effects)**
Abate (Temephos) Total particulate Respirable fraction	Cholinergic
Acetaldehyde	Irritation
Acetic acid	Irritation
Acetic anhydride	Irritation
Acetone	Irritation
Acetonitrile	Lung
2-Acetylaminofluorene (see WAC 296-62-073)	Cancer
Acetylene	
Acetylene dichloride (1,2-Dichloroethylene)	Liver
Acetylene tetrabromide	Irritation; liver
Acetylsalicylic acid (Aspirin)	Blood
Acrolein	Irritation; pulmonary edema
Acrylamide	CNS; dermatitis
Acrylic acid	Irritation; reproductive
Acrylonitrile (see WAC 296-62-07336)	Cancer
Aldrin	Liver
Allyl alcohol	Irritation
Allyl Chloride	Liver
Allyl glycidyl ether (AGE)	Irritation; dermatitis; sensitization
Allyl propyl disulfide	Irritation
alpha-Alumina (Aluminum oxide) Total particulate Respirable fraction	Lung; irritation
Aluminum (as Al) Total particulate Respirable fraction Pyro powders Welding fumes[d] Soluble salts Alkyls (NOC)	Lung; irritation

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Aluminum oxide (Alundum, Corundum) Total particulate Respirable fraction	
4-Aminodiphenyl (see WAC 296-62-073)	Cancer (bladder)
2-Aminoethanol (Ethanolamine)	Irritation
2-Aminopyridine	CNS
Amitrole	Reproductive; thyroid
Ammonia	Irritation
Ammonium chloride, fume	Irritation
Ammonium sulfamate (Ammate) Total particulate Respirable fraction	Irritation
n-Amyl acetate	Irritation
sec-Amyl acetate	Irritation
Aniline and homologues	Anoxia
Anisidine (o, p-isomers)	Anoxia
Antimony and Compounds (as Sb)	Irritation, lung, CVS
ANTU (alpha Naphthyl thiourea)	Lung; irritation
Argon	
Arsenic, Organic compounds (as As)	Cancer (lung, skin); lung
Arsenic, Inorganic compounds (as As) (when use is covered by WAC 296-62-07347)	Cancer (lung, skin); lung
Arsenic, Inorganic compounds (as As) (when use is not covered by WAC 296-62-07347)	Cancer (lung, skin); lung
Arsine	Blood; kidney
Asbestos (see WAC 296-62-077)	Asbestosis, cancer
Asphalt (Petroleum fumes)	Irritation
Atrazine	Irritation
Azinphos methyl (Guthion)	Cholinergic
Barium, soluble compounds (as Ba)	Irritation; GI; muscles
Barium Sulfate Total particulate Respirable fraction	Pneumoconiosis (baritosis)

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Benomyl Total particulate Respirable fraction	Dermatitis; irritation; reproductive
Benzene (see WAC 296-62-07523	Cancer
Benzidine (see WAC 296-62-073)	Cancer (bladder)
p-Benzoquinone (Quinone)	Irritation; eyes
Benzo(a) pyrene (Coal tar pitch volatiles)	Cancer
Benzoyl peroxide	Irritation
Benzyl chloride	Irritation; lung
Beryllium and beryllium compounds (as Be)	Cancer (lung); berylliosis
Biphenyl (Diphenyl)	Lung
Bismuth telluride, Undoped	Irritation
Total particulate	Irritation
Respirable fraction	Irritation, lung
Bismuth telluride, Se-doped	Irritation, lung
Borates, tetra, sodium salts	Irritation
Anhydrous	Irritation
Decahydrate	Irritation
Pentahydrate	Irritation
Boron oxide	Irritation
Total particulate	
Boron tribromide	Irritation; burns
Boron trifluoride	Irritation
Bromacil	Irritation
Bromine	Irritation
Bromine pentafluoride	Irritation
Bromochloromethane (Chlorobromethane)	CNS; liver
Bromoform	Irritation, liver
Butadiene (1,3-butadiene)	Cancer
Butane	Narcosis
Butanethiol (Butyl mercaptan)	Irritation; CNS; reproductive

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
2-Butanone (Methyl ethyl ketone)	Irritation; CNS
2-Butoxy ethanol (Butyl Cellosolve)	Irritation
n-Butyl acetate	Irritation
sec-Butyl acetate	Irritation
tert-Butyl acetate	Irritation
Butyl acrylate	Irritation; reproductive
n-Butyl alcohol	Irritation
sec-Butyl alcohol	Irritation; narcosis
tert-Butyl alcohol	Narcosis; irritation
Butylamine	Irritation
Tert-Butyl chromate (Chromic acid)	Irritation; lung
n-Butyl glycidyl ether (BGE)	Irritation, sensitization
n-Butyl lactate	Irritation; headache
Butyl mercaptan	Irritation; CNS; reproductive
o-sec-Butylphenol	Irritation
p-tert-Butyl-toluene	Irritation; CNS; CVS
Cadmium oxide fume (as Cd) (see WAC 296-62-074)	Cancer
Cadmium dust and salts (as Cd) (see WAC 296-62-074)	Cancer; Kidney
Total particulate	
Respirable fraction	
Calcium arsenate (see WAC 296-62-07347)	Cancer
Calcium carbonate	Irritation
Total particulate	
Respirable fraction	
Calcium cyanamide	Irritation; dermatitis
Calcium hydroxide	Irritation
Calcium oxide	Irritation
Calcium silicate	Irritation
Total particulate	
Respirable fraction	

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Calcium sulfate	Irritation
Total particulate	
Respirable fraction	
Camphor (synthetic)	Irritation; anosmia
Caprolactam	Irritation
Dust	
Vapor	
Captafol (Difolatan)	Dermatitis; sensitization
Captan	Irritation
Carbaryl (Sevin)	Cholinergic; reproductive
Carbofuran (Furadon)	Cholinergic
Carbon black	Lung
Carbon dioxide	N/A
Carbon disulfide	CVS; CNS
Carbon monoxide	Anoxia; CVS; CNS; reproductive
Carbon tetrabromide	Irritation; liver
Carbon tetrachloride (Tetrachloromethane)	Liver; cancer
Carbonyl chloride (Phosgene)	Irritation; CNS; GI
Carbonyl fluoride	Irritation; bone; fluorosis
Catechol (Pyrocatechol)	Irritation; CNS; lung
Cellulose (paper fiber)	Irritation
Total particulate	
Respirable fraction	
Cesium hydroxide	Irritation
Chlordane	Seizures; liver
Chlorinated camphene (Toxaphen)	Seizures; liver
Chlorinated diphenyl oxide	Chloracne, liver
Chlorine	Irritation
Chlorine dioxide	Irritation; bronchitis
Chlorine trifluoride	Irritation; lung
Chloroacetaldehyde	Irritation

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
a-Chloroacetophenone (Phenacyl chloride)	
Chloroacetyl chloride	Irritation; lung
Chlorobenzene (Monochlorobenzene)	Liver
O-Chlorobenzylidene malononitrile (OCBM)	Irritation
Chlorobromomethane	CNS; liver
2-Chloro-1, 3-butadiene (beta-Chloroprene)	Irritation; liver; reproductive
Chlorodifluoromethane	CVS
Chlorodiphenyl (42% Chlorine) (PCB) (Polychlorobiphenyls)	Irritation; chloracne; liver
Chlorodiphenyl (54% Chlorine) (PCB) (Polychlorobiphenyls)	Irritation; chloracne; liver
1-Chloro-2, 3-epoxypropane (Epichlorhydrin)	Irritation; liver; kidney
2-Chloroethanol (Ethylene chlorohydrin)	Irritation; liver; kidney; GI; CVS; CNS
Chloroethylene (vinyl chloride)	Cancer, liver
Chloroform (Trichloromethane)	Liver; reproductive
1-Chloro-1-nitropropane	Irritation; liver; lung
bis-Chloromethyl ether (see WAC 296-62-073)	Cancer (lung)
Chloromethyl methyl ether (Methyl carbomethyl ether)	Cancer (lung); irritation
Chloropentafluoroethane	CVS
Chloropicrin (Nitrotrichloromethan)	Irritation; lung
beta-Chloroprene (2-Chloro-1, 3-butadiene)	Irritation; liver; reproductive
o-Chlorostyrene	Kidney; CNS; neurotoxic; liver
o-Chlorotoluene	Irritation
2-Chloro-6-trichloromethyl pyridine (see Nitrapyrin)	Liver
Total particulate	
Respirable fraction	
Chlorpyrifos	Cholinergic
Chromic acid and chromates (as CrO3)	Cancer; liver, kidney
Chromium, sol, chromic chromous salts (as Cr)	Irritation; dermatitis
Chromium (VI) compounds (as Cr)	Cancer; liver, kidney
Chromium Metal and insoluble salts	Cancer; irritation
Chromyl chloride	Kidney; liver; respiratory

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Chrysene (Coal tar pitch volatiles)	Cancer
Clopidol	Irritation
Total particulate	Irritation
Respirable fraction	Irritation
Coal dust (less than 5% SiO2) Respirable fraction	Pulmonary fibrosis, pneumoconiosis; pulmonary function
Coal dust (greater than or equal to 5% SiO2) Respirable fraction	Pulmonary fibrosis, pneumoconiosis; pulmonary function
Coal tar pitch volatiles (benzene soluble fraction anthracene, BaP, phenanthrene, acridine, chrysene, pyrene, Benzo(a) pyrene, (Particulate polycyclic aromatic hydrocarbons)	Cancer
Cobalt, metal fume & dust (as Co)	Asthma; lung; CVS
Cobalt carbonyl (as Co)	Lung edema
Cobalt hydrocarbonyl (as Co)	Lung edema
Coke oven emissions (see WAC 296-62-200)	Cancer (lung)
Copper fume (as Cu)	Irritation; GI; metal fume fever
Dusts and mists (as Cu)	Irritation; GI; metal fume fever
Cotton dust (raw) see WAC 296-62-14533	Lung, byssinosis
Corundum (Aluminum oxide)	Lung; irritation
Crag herbicide (Sesone, Sodium-2, 4-dichloro-phenoxyethyl sulfate)	Irritation
Total particulate	
Respirable fraction	
Cresol (all isomers)	Dermatitis, irritation, CNS
Crotonaldehyde	Irritation
Crufomate	Cholinergic
Cumene	Irritation; CNS
Cyanamide	Irritation
Cyanide (as CN)	CNS, irritation, anoxia, lung, thyroid
Cyanogen	Irritation
Cyanogen chloride	Irritation; lung function
Cyclohexane	CNS

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Cyclohexanol	Irritation; CNS
Cyclohexanone	Irritation; liver
Cyclohexene	Irritation
Cyclohexylamine	Irritation
Cyclonite (RDX)	Irritation; CNS; liver; blood
Cyclopentadiene	Irritation
Cyclopentane	Irritation; narcosis
Cyhexatin (Tricyclohexyltin hydroxide)	Irritation
2,4-D (Dichlorophenoxy- acetic acid)	Irritation
DDT (Dichlorodiphenyltri- chloroethane)	Seizures; liver
DDVP, Dichlorvos	Cholinergic
Decaborane	CNS; lung function
Demeton	Cholinergic
Diacetone alcohol (4-hydroxy-4-methyl- 2-pentanone)	Irritation
1,2-Diaminoethane (Ethylenediamine)	Irritation; asthma; sensitization
Diazinon	Cholinergic
Diazomethane	Irritation; cancer (lung)
Diborane	CNS; lung function
Dibrom (see Naled)	Cholinergic; dermatitis
1,2-Dibromo-3-chloropropane (DBCP) (see WAC 296-62-07342)	Cancer
2-N-Dibutylamino ethanol	Irritation; cholinergic
Dibutyl phosphate	Irritation
Dibutyl phthalate	Reproductive; irritation
Dichloroacetylene	GI; neurotoxicity; irritation
o-Dichlorobenzene	Irritation; liver
p-Dichlorobenzene	Irritation; kidney
3,3'-Dichlorobenzidine (see WAC 296-62-073)	Cancer; Irritation; dermatitis
Dichlorodiphenyltri- chloroethane (DDT)	Seizures; liver
Dichlorodifluoromethane	CVS
1,3-Dichloro-5,5-dimethyl hydantoin	Irritation
1,1-Dichloroethane	Liver; kidney; irritation

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
1,2-Dichloreothane (Ethylene dichloride)	Liver; narcosis
1,2-Dichloroethylene (Acetylene dichloride)	Liver
1,1-Dichloroethylene (Vinylidene chloride)	CNS; liver; kidney
Dichloroethyl ether	Irritation; lung
Dichlorofluoromethane	Liver
Dichloromethane (Methylene chloride)	CNS; anoxia
1,1-Dichloro-1-nitroethane	Irritation
1,2-Dichloropropane (Propylene dichloride)	Irritation; CNS; liver; kidney
Dichloropropene	Irritation
2,2-Dichloropropionic acid	Irritation
Dichlorotetrafluoroethane	CVS; narcosis; asphyxiation
Dichlorvos (DDVP)	Cholinergic
Dicrotophos	Cholinergic
Dicyclopentadiene	Irritation
Dicyclopentadienyl iron	Blood; liver
Total particulate	
Respirable fraction	
Dieldrin	Liver; CNS
Diethanolamine	Liver; kidney; blood
Diethylamine	Irritation
2-Diethylaminoethanol	Irritation; CNS
Diethylene triamine	Irritation; sensitization
Diethyl ether (Ethyl ether)	Irritation; narcosis
Diethyl ketone	Irritation; narcosis
Diethyl phthalate	Irritation
Difluorodibromomethane	Irritation; liver; CNS
Diglycidyl ether (DGE)	Irritation; reproductive; blood
Dihydroxybenzene (Hydroquinone)	CNS; dermatitis; ocular
Diisobutyl ketone (2, 6-Dimethylheptanone)	Irritation
Diisopropylamine	Vision; irritation
Dimethoxymethane (Methylal)	Irritation; CNS

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Dimethyl acetamide	Reproductive; liver
Dimethylamine	Irritation
4-Dimethylaminoazo benzene (see WAC 296-62-073)	Cancer
Dimethylaminobenzene (Xylidene)	Cancer; genotoxic
Dimethylaniline (N,N-Dimethylaniline)	Anoxia; neurotoxicity
Dimethylbenzene (Xylene)	Cancer; genotoxic
Dimethyl-1, 2-dibromo-2, 2-dichloroethyl phosphate (Naled)	Cholinergic; dermatitis
Dimethylformamide	Liver
2, 6-Dimethylheptanone (Diisobutyl ketone)	Irritation
1, 1-Dimethylhydrazine	Irritation; neoplasia
Dimethyl phthalate	Irritation
Dimethyl sulfate	Irritation
Dinitolmide (3, 5-Dinitro-o-toluamide)	Irritation; liver
Dinitrobenzene (all isomers) - (alpha), (meta), and (para)	Anoxia
Dinitro-o-cresol	Metabolic disorders
Dinitrotoluene	CVS; reproductive
Dioxane (Diethylene dioxide)	Irritation; liver; kidney
Dioxathion	Cholinergic
Diphenyl (Biphenyl)	Lung
Diphenylamine	Liver; kidney; blood
Diphenylmethane diisocyanate (Methylene bisphenyl isocyanate (MDI))	Irritation; lung edema; sensitization
Dipropylene glycol methyl ether	Irritation; CNS
Dipropyl ketone	Irritation; liver; kidney; neurotoxicity
Diquat	Irritation, ocular
Di-sec, Octyl phthalate (Di-2-ethylhexylphthalate)	Irritation
Disulfram	GI; CVS
Disulfoton	Cholinergic
2, 6-Di-tert-butyl-p-cresol	Irritation

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Diuron	Irritation; blood
Divinyl benzene	Irritation
Emery	Irritation
Total particulate	Irritation
Respirable fraction	Irritation
Endosulfan (Thiodan)	Liver; CNS
Endrin	CNS; liver
Epichlorhydrin (1-Chloro-2, 3-epoxypropane)	Irritation; liver; kidney
EPN	Cholinergic
1, 2-Epoxypropane (Propylene oxide)	Irritation; cancer (nasal)
2, 3-Epoxy-1-propanol (Glycidol)	Irritation; neoplasia
Ethane	
Ethanethiol (Ethyl mercaptan)	Irritation
Ethanolamine (2-Aminoethanol)	Irritation
Ethion	Cholinergic
2-Ethoxyethanol (Glycol monoethyl ether)	Reproductive
2-Ethoxyethyl acetate (Cellosolve acetate)	Reproductive
Ethyl acetate	Irritation
Ethyl acrylate	Irritation; cancer; sensitization
Ethyl alcohol (ethanol)	Irritation
Ethylamine	irritation
Ethyl amyl ketone (5-Methyl-3-hepatone)	Irritation
Ethyl benzene	Irritation; CNS
Ethyl bromide	Liver; kidney; CVS
Ethyl butyl ketone (3-Heptanone)	Irritation; narcosis
Ethyl chloride	Liver; CNS
Ethylene	N/A
Ethylene chlorohydrin (2-Chloroethanol)	Irritation; liver; kidney; GI; CVS; CNS
Ethylenediamine (1,2-Diaminoethane)	Irritation; asthma; sensitization
Ethylene dibromide	Irritation; liver; kidney
Ethylene dichloride (1,2-Dichloroethane0	Liver; narcosis
Ethylene glycol	Irritation

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Ethylene glycol dinitrate	CVS
Ethylene glycol monomethyl ether acetate (Methyl cellosolve acetate)	Blood, reproductive, CNS
Ethyleneimine (see WAC 296-62-073)	Irritation; bronchitis
Ethylene oxide (see WAC 296-62-07359)	Cancer; reproductive
Ethyl ether (Diethyl ether)	Irritation; narcosis
Ethyl formate	Irritation
Ethylidine chloride (1, 1-Dichloroethane)	Liver; narcosis
Ethylidene norbornene	Irritation
Ethyl mercaptan (Ethanethiol)	Irritation
n-Ethylmorpholine	Irritation; ocular
Ethyl sec-amyl ketone (5-methyl-3-heptanone)	Irritation
Ethyl silicate	Irritation; kidney
Fenamiphos	Cholinergic
Fensulfothion (Dasanit)	Cholinergic
Fenthion	Cholinergic
Ferbam Total particulate	Irritation
Ferrovanadium dust	Irritation
Fluorides (as F)	Irritation, bone, fluorosis
Fluorine	Irritation
Fluorotrichloromethane (see Trichlorofluoro methane)	CVS; CNS
Fonofos	Cholinergic
Formaldehyde (see WAC 296-62-07540)	Irritation; cancer (nasal)
Formamide	Irritation; liver
Formic acid	Irritation
Furfural	Irritation
Furfuryl alcohol	Irritation
Gasoline	Irritation; CNS
Germanium tetrahydride	Blood
Glass, fibrous or dust	Irritation
Gluteraldehyde	Irritation; sensitization

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Glycerin mist	Irritation
Total particulate	
Respirable fraction	
Glycidol (2, 3-Epoxy-1- propanol)	Irritation; neoplasia
Glycol monoethyl ether (2-Ethoxyethanol)	Reproductive
Grain dust (oat, wheat, barley)	Irritation; bronchitis; pulmonary function
Graphite, natural Respirable dust	Pneumoconiosis
Graphite, Synthetic	Pneumoconiosis
Total particulate	
Respirable fraction	
Guthion (Azinphosmethyl)	Cholinergic
Gypsum	Irritation
Total particulate	
Respirable fraction	
Hafnium	Liver; irritation
Helium	
Heptachlor	CNS, liver, blood
Heptane (n-heptane)	Irritation; narcosis
2-Heptanone (Methyl n-amyl ketone)	Irritation
3-Heptanone (Ethyl butyl ketone)	Irritation; narcosis
Hexachlorobutadiene	Irritation; kidney
Hexachlorocyclopentadiene	Irritation; pulmonary edema
Hexachloroethane	Irritation; liver; kidney
Hexachloronaphthalene	Liver; chloracne
Hexafluoroacetone	Reproductive; kidney
Hexane	CNS, irritation
n-hexane	Neuropathy; CNS; irritation
other Isomers	Neuropathy; CNS; irritation
2-Hexanone (Methyl-n-butyl ketone)	Neuropathy
Hexone (Methyl isobutyl ketone)	Irritation; kidney
sec-Hexyl acetate	Irritation

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Hexylene Glycol	Irritation
Hydrazine	Irritation; liver
Hydrogen	N/A
Hydrogenated terphenyls	Irritation, liver
Hydrogen bromide	Irritation
Hydrogen chloride	Irritation; corrosion
Hydrogen cyanide	CNS, irritation, anoxia, lung, thyroid
Hydrogen fluoride	Irritation; bone; teeth; fluorosis
Hydrogen peroxide	Irritation; pulmonary edema; CNS
Hydrogen selenide (as Se)	Irritation; GI
Hydrogen Sulfide	Irritation; CNS
Hydroquinone (Dihydroxybenzene)	CNS; dermatitis; ocular
4-Hydroxy-4-methyl-2- pentanone (Diacetone alcohol)	Irritation
2-Hydroxypropyl acrylate	irritation
Indene	Irritation; liver; kidney
Indium and compounds (as In)	Pulmonary edema; bone; GI
Iodine	Irritation
Iodoform	CNS; liver; kidney; CVS
Iron oxide dust and fume (as Fe)	Pneumoconiosis (siderosis)
Total particulate	
Iron pentacarbonyl (as Fe)	Pulmonary edema; CNS
Iron salts, soluble (as Fe)	Irritation
Isoamyl acetate	Irritation
Isoamyl alcohol (primary and secondary)	Irritation
Isobutyl acetate	Irritation
Isobutyl alcohol	Irritation, ocular
Isooctyl alcohol	Irritation
Isophorone	Irritation; narcosis
Isophorone diisocyanate	Dermatitis; asthma; sensitization
Isopropoxyethanol	Blood

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Isopropyl acetate	Irritation
Isopropyl alcohol	Irritation
Isopropylamine	Irritation
N-Isopropylaniline	Blood
Isopropyl ether	Irritation
Isopropyl glycidyl ether (IGE)	Irritation; dermatitis
Kaolin Total particulate Respirable fraction	 Pneumoconiosis
Ketene	Lung irritation; lung edema
Lead inorganic (as Pb) (see WAC 296-62-07521)	CNS; blood; kidney; reproductive
Lead arsenate (see WAC 296-62-07347)	CNS; anemia; kidney; reproductive
Lead chromate	Cancer; CVS; reproductive
Limestone Total particulate Respirable fraction	 Irritation
Lindane	CNS; liver
Lithium hydride	Irritation
L.P.G. (liquified petroleum gas)	N/A
Magnesite Total particulate Respirable fraction	 Irritation; pneumoconiosis
Magnesium oxide fume	Irritation; metal fume fever
Total particulate	
Malathion Total particulate	 Cholinergic; CNS; neuropathy; vision
Maleic anhydride	Irritation; asthma
Manganese and compound (as Mn)	CNS (manganism); lung; reproductive
Manganese tetroxide and fume (as Mn)	CNS (manganism); lung; reproductive
Manganese cyclopentadienyl tricarbonyl (as Mn)	CNS; pulmonary edema
Manganese tetroxide (as Mn)	CNS (manganism); lung; reproductive
Marble Total particulate Respirable fraction	 Irritation

Mixtures of Airborne Substances

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Mercury (aryl and inorganic) (as Hg)	CNS; neuropathy; vision; kidney; reproductive; GI
Mercury (organo-alkyl compounds) (as Hg)	CNS
Mercury (vapor) (as Hg)	CNS
Mesityl oxide	Irritation; narcosis; liver; kidney
Methacrylic acid	Irritation
Methane	N/A
Methanethiol (Methyl mercaptan)	Irritation; CNS
Methomyl (lannate)	Cholinergic
Methoxychlor	CNS; liver
Total particulate	CNS; liver
2-Methoxyethanol (Methyl cellosolve)	Blood; reproductive; CNS
4-Methoxyphenol	Eye; depigmentation
Methyl acetate	Irritation; narcosis
Methyl acetylene (propyne)	Anesthesia
Methyl acetylene-propadiene mixture (MAPP)	Anesthesia
Methyl acrylate	Irritation
Methylacrylonitrile	Irritation; CNS
Methylal (Dimethoxy-methane)	Irritation; CNS
Methyl alcohol (methanol)	Neuropathy; vision; CNS
Methylamine	Irritation
Methyl amyl alcohol (Methyl isobutyl carbinol)	Irritation; anesthesia
Methyl n-amyl ketone (2-Heptanone)	Irritation
N-Methyl aniline (see Monomethyl aniline)	Anoxia; blood
Methyl bromide	Irritation
Methyl butyl ketone (see 2-Hexanone)	Neuropathy
Methyl cellosolve (see 2-Methoxyethanol)	Blood; reproductive; CNS
Methyl cellosolve acetate (2-Methoxyethyl acetate)	Blood; reproductive; CNS
Methyl chloride	Kidney; CNS; reproductive
Methyl chloroform (1,1,1-trichlorethane)	Anesthesia; CNS
Methyl chloromethyl ether (see WAC 296-62-073)	Cancer (lung); irritation
Methyl 2-cyanoacrylate	Irritation; dermatitis

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Methylcyclohexane	Narcosis; irritation
Methylcyclohexanol	Irritation; narcosis; liver; kidney
Methylcyclohexanone	Irritation; narcosis
Methylcyclopentadienyl manganese tricarbonyl (as Mn)	CNS, liver, kidney
Methyl demeton	Irritation; cholinergic
Methylene bisphenyl isocyanate (MDI) (Diphenylmethane diisocyanate)	Irritation; lung edema; sensitization
4, 4'-Methylene bis (2-chloro- aniline) (MBOCA) (see WAC 296-62-073)	Cancer
Methylene bis (4-cyclohexylisocyanate)	Irritation; sensitization
Methylene chloride (see WAC 296-62-07470) Dichloromethane)	CNS; anoxia
4, 4-Methylene dianiline	Liver
Methyl ethyl ketone (MEK) (2-Butanone)	Irritation; CNS
Methyl ethyl ketone peroxide (MEKP)	Irritation; liver; kidney
Methyl formate	Irritation; narcosis.; lung edema
5-Methyl-3-heptanone (Ethyl amyl ketone)	Irritatiion
Methyl hydrazine (Monomethyl hydrazine)	Irritation; liver
Methyl iodide	CNS; irritation
Methyl isoamyl ketone	Irritation; narcosis; liver; kidney
Methyl isobutyl carbinol (Methyl amyl alcohol)	Irritation; anesthesia
Methyl isobutyl ketone (Hexone)	Irritation; kidney
Methyl isocyanate	Irritation; lung edema; sensitization
Methyl isopropyl ketone	Irritation
Methyl mercaptan (Methanethiol)	Irritation; CNS
Methyl methacrylate	Irritation; dermatitis
Methyl parathion	Cholinergic
Methyl propyl ketone (2-Pentanone)	Irritation; narcosis
Methyl silicate	Ocular (severe), lung
alpha-Methyl styrene	Irritation; dermatitis; CNS
Mevinphos (Phosdrin)	Cholinergic
Metribuzin	Blood; liver

Mixtures of Airborne Substances

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Mica (Silicates)	Pneumoconiosis
Molybdenum (as Mo)	
Soluble compounds	Irritation, metabolic disorder
Insoluble compounds (Total particulate)	Irritation
Monocrotophos (Azodrin)	Cholinergic
Monomethyl aniline (N-Methyl aniline)	Anoxia; blood
Monomethyl hydrazine	Irritation, liver
Morpholine	Irritation; vision
Naled (Dibrom)	Cholinergic; dermatitis
Naphtha (Coal tar)	Irritation; CNS
Naphthalene	Irritation; ocular; blood
alpha-Naphthylamine (see WAC 296-62-073)	Cancer
beta-Naphthylamine (see WAC 296-62-073)	Cancer (bladder)
Neon	N/A
Nickel carbonyl (as Ni)	Irritation; CNS
Nickel (as Ni)	Dermatitis; pneumoconiosis
Metal and insoluble compounds	Cancer (lung), irritation, dermatitis
Soluble compounds	CNS, irritation, dermatitis
Nicotine	CVS; GI; CNS
Nitrapyrin (2-Chloro-6 trichloromethyl pyridine)	Liver
Total particulate	
Respirable fraction	
Nitric acid	Irritation; corrosion; pulmonary edema
Nitric oxide	Anoxia; irritation; cyanosis
p-Nitroaniline	Anoxia; anemia; liver
Nitrobenzene	Anoxia
4-Nitrobiphenyl (see WAC 296-62-073)	Cancer (bladder)
p-Nitrochlorobenzene	Anoxia; blood; liver
4-Nitrodiphenyl (see WAC 296-62-073)	Cancer
Nitroethane	Irritation; narcosis; liver
Nitrogen	N/A

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Nitrogen dioxide	Irritation; pulmonary edema
Nitrogen trifluoride	Anoxia; blood; liver; kidney
Nitroglycerin	CVS
Nitromethane	Thyroid
1-Nitropropane	Irritation; liver
2-Nitropropane	Liver; cancer
N-Nitrosodimethylamine (see WAC 296-62-073)	Cancer,; liver
Nitrotoluene	Anoxia; cyanosis
o-isomer	
m-isomer	
p-isomer	
Nitrotrichloromethane (Chloropicrin)	Irritation; lung
Nitrous Oxide (Nitrogen oxide)	Reproductive; blood; CNS
Nonane	CNS; skin; irritation
Octachloronaphthalene	Liver; dermatitis
Octane	Irritation
Oil mist mineral (particulate)	Lung
Osmium tetroxide (as Os)	Irritation; vision
Oxalic acid	Irritation; burns
Oxygen difluoride	Irritation; kidney
Ozone	Lung function; irritation
Paraffin wax fume	Irritation
Paraquat (Respirable fraction)	Pulmonary edema, kidney, liver, pulmonary fibrosis
Parathion	Cholinergic
Particulate polycyclic aromatic hydrocarbons (coal tar pitch volatiles)	Cancer
Particulates not otherwise regulated	Lung
Total particulate	
Respirable fraction	
Pentaborane	CNS
Pentachloronaphthalene	Chloracne; liver
Pentachlorophenol	CVS; CNS

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Pentaerythritol	Irritation
Total particulate	
Respirable fraction	
Pentane	Irritation; narcrosis
2-Pentanone (methyl propyl ketone)	Irritation; narcosis
Perchloroethylene (tetrachloroethylene)	Irritation; CNS
Perchloromethyl mercaptan	Irritation; pulmonary edema
Perchloryl fluoride	Irritation; blood
Perlite	Irritation
Total particulate	
Respirable fraction	
Petroleum distillates (Naptha, Rubber Solvent)	Irritation; CNS
Phenol	Irritation; CNS; blood
Phenothiazine	Irritation; ocular; liver; kidney
p-Phenylene diamine	Sensitization; skin; eye
Phenyl ether (vapor)	Irritation; nausea
Phenyl ether-diphenyl mixture (vapor)	Irritation; nausea
Phenylethylene (Styrene)	Neurotoxicity; irritation; CNS
Phenyl glycidyl ether (PGE)	Irritation; dermatitis; sensitization
Phenylhydrazine	Dermatitis; anemia
Phenyl mercaptan	Irritation; dermatitis
Phenylphosphine	Irritation; dermatitis; blood; reproductive
Phorate	Cholinergic
Phosdrin (Mevinphos)	Cholinergic
Phosgene (carbonyl chloride)	Irritation; anoxia; lung edema
Phosphine	Irritation; CNS; GI
Phosphoric acid	Irritation
Phosphorus (yellow)	Irritation; liver; kidney; CVS; GI
Phosphorous oxychloride	Irritation; kidney
Phosphorus pentachloride	Irritation
Phosphorus pentasulfide	Irritation

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Phosphorus trichloride	Irritation
Phthalic anhydride	Irritation; sensitization
m-Phthalodinitrile	Irritation
Picloram	Liver; kidney
Total particulate	
Respirable fraction	
Picric acid (2, 4, 6-Trinitrophenol)	Dermatitis; irritation; ocular; sensitization
Pindone (2-Pivalyl-1, 3-indandione, Pival	Liver; kidney; bleeding; dermatitis
Piperazine dihydrochloride	Irritation; burns; asthma; sensitization
Pival (Pindone)	Liver; kidney; bleeding; dermatitis
Plaster of Paris	Irritation
Total particulate	
Respirable fraction	
Platinum (as Pt)	
Metal	Irritation
Soluble salts	Asthma, irritation, sensitization
Polychlorobiphenyls (Chlorodiphenyls)	Irritation; chloracne; liver
Portland cement	Irritation; Dermatitis
Total particulate	
Respirable fraction	
Potassium hydroxide	Irritation; corrosion
Propane	N/A
Propargyl alcohol	Irritation; liver; kidney
beta-Propiolactone (see WAC 296-62-073)	Irritation
Propionic acid	Irritation
Propoxur (Baygon)	Cholinergic
n-Propyl acetate	Irritation
n-Propyl alcohol	Irritation; narcosis
n-Propyl nitrate	Blood; cyanosis; anoxia
Propylene	
Propylene dichloride (1,2-Dichloropropane)	Irritation; CNS; liver; kidney

Mixtures of Airborne Substances

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Propylene glycol dinitrate	CVS; headache; CNS, anoxia
Propylene glycol monomethyl ether	Irritation; anesthesia
Propylene imine	Irritation; CNS
Propylene oxide (1, 2-Epoxypropane)	Irritation; cancer (nasal)
Propyne (see Methyl acetylene)	Anesthesia
Pyrethrum	Dermatitis; CNS; liver; sensitization
Pyridine	Irritation; CNS; liver; kidney; blood
Quinone (p-Benzoquinone)	Irritation; eyes
RDX (Cyclonite)	Irritation; CNS; liver; blood
Resorcinol	Irritation; dermatitis; blood
Rhodium (as Rh) Insoluble compounds,	Irritation
Metal fumes and dusts	
Soluble compounds, salts	
Ronnel	Cholinergic
Rosin core solder, pyrolysis products (as formaldehyde)	Cholinergic
Rotenone	Irritation; CNS
Rouge	Lung, siderosis, irritation
Total particulate	
Respirable fraction	
Rubber solvent (naphtha)	Irritation, CNS
Selenium compounds (as Se)	Irritation
Selenium hexafluoride (as Se)	Pulmonary edema
Sesone (Crag herbicide)	Irritation
Silane (see Silicon tetrahydride)	Irritation
Silica, amorphous, precipitated and gel	Irritation
Silica, amorphous, diatomaceous earth, containing less than1% crystalline silica	Irritation; pneumoconiosis
Total particulate	
Respirable fraction	
Silica, crystalline cristobalite, respirable fraction	Lung fibrosis; silicosis
Silica, crystalline quartz, respirable fraction	Silicosis; lung function; lung fibrosis; cancer

Mixtures of Airborne Substances

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Silica, crystalline tripoli (as quartz), respirable fraction	Lung fibrosis
Silica, crystalline tridymite, respirable fraction	Lung fibrosis; silicosis
Silica, fused, respirable fraction	Lung fibrosis
Silicates (less than 1% crystalline silica)	
Mica (Respirable particulate)	Pneumoconiosis
Soapstone, Total particulate	Pneumoconiosis
Soapstone, Respirable fraction	Pneumoconiosis
Talc (containing asbestos) use asbestos limit (see WAC 296-62-07705)	Lung, asbestosis
Talc (containing no asbestos) Respirable fraction	Lung
Tremolite (see WAC 296-62-07705)	Lung, asbestosis
Silicon	Lung
Total particulate	
Respirable fraction	
Silicon Carbide	Lung
Total particulate	
Respirable fraction	
Silicon tetrahydride (Silane)	Irritation
Silver, metal dust and soluble compounds (as Ag)	Argyria (skin, eyes, mucosa)
Soapstone,	Pneumoconiosis
Total particulate	
Respirable fraction	
Sodium azide	CNS; CVS; lung
(as HN3)	Irritation
(as NaN3)	Irritation
Sodium bisulfite	Irritation
Sodium-2, 4-dichloro- phenoxyethyl sulfate (Crag herbicide)	Irritation
Sodium fluoroacetate	CNS; CVS
Sodium hydroxide	Irritation

Mixtures of Airborne Substances

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Sodium metabisulfitte	Irritation
Starch	Dermatitis; lung
Total particulate	
Respirable fraction	
Stibine	Irritation; blood
Stoddard solvent	Irritation; narcosis; kidney
Strychnine	CNS
Styrene (Phenylethylene, Vinyl benzene)	Neurotoxicity; irritation; CNS
Subtilisins	Irritation, lung, sensitization
Sucrose	Lung
Total particulate	
Respirable fraction	
Sulfotep (TEDP)	Cholinergic
Sulfur dioxide	Irritation
Sulfur hexafluoride	N/A
Sulfuric acid	Irritation; cancer (larnyx)
Sulfur monochloride	Irritation
Sulfur pentafluoride	Irritation
Sulfur tetrafluoride	Irritation
Sulfuryl fluoride	Irritation; CNS
Sulprofos	Cholinergic
Systox (Demeton)	Cholinergic
2, 4, 5-T	Irritation
Talc (Silicates)	Lung
Tantalum Metal and oxide dusts	Irritation; lung
TEDP (Sulfotep)	Cholinergic
Tellurium and compounds (as Te)	CNS; cyanosis; liver
Tellurium hexafluoride (as Te)	Irritation
Temephos (Abate)	Cholinergic
Total particulate	
Respirable fraction	

Mixtures of Airborne Substances

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
TEPP	Cholinergic
Terphenyls	Irritation
1, 1, 1, 2-Tetrachloro- 2, 2-difluoroethane	Liver, blood
1, 1, 2, 2-Tetrachloro- 1, 2-difluoroethane	CNS; pulmonary edema
1, 1, 2, 2-Tetrachloroethane	Liver; CNS; GI
Tetrachloroethylene (Perchloroethylene)	Irritation; CNS
Tetrachloromethane (Carbon tetrachloride)	Liver; cancer
Tetrachloronaphhalene	Liver
Tetraethyl lead (as Pb)	CNS
Tetrahydrofuan	Irritation; narcosis
Tetramethyl lead (as Pb)	CNS
Tetramethyl succinonitrile	CNS
Tetranitromethane	Irritation
Tetrasodium pyrophosphate	Irritation
Tetryl (2, 4, 6-trinitrophenyl- methylnitramine)	Liver; dermatitis; sensitization
Thallium (soluble compounds) (as Tl)	Irritation; CNS; CVS
4, 4-Thiobis (6-tert-butyl-m-cresol)	Liver; kidney
Total particulate	Liver; kidney
Respirable fraction	Liver; kidney
Thioglycolic acid	Irritation
Thionyl chloride	Irritation
Thiram (see WAC 296-62-07519)	Cancer; irritation
Tin (as Sn) Inorganic compounds (except oxides)	Stanosis
Tin, Organic compounds (as Sn)	CNS, immuniotoxicity, irritation
Tin Oxide (as Sn)	Stanosis
Titanium dioxide	Lung
Total particulate	
Toluene	CNS
Toluene-2, 4-diisocyanate (TDI)	Irritation; sensitization
m-Toluidine	Anoxia; kidney
o-Toluidine	Anoxia; kidney

Mixtures of Airborne Substances

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
p-Toluidine	Anoxia; kidney
Toxaphene (Chlorinated camphene)	Seizures; liver
Tremolite (see WAC 296-62-07705)	Lung, asbestosis
Tributyl phosphate	Irritation; cholinergic
Trichloroacetic acid	Irritation
1, 2, 4-Trichlorobenzene	Irritation
1, 1, 1-Trichloroethane (Methyl chloroform)	Anesthesia; CNS
1, 1, 2-Trichloroethane	CNS; liver
Trichloroethylene	CNS; headache; liver
Trichlorofluoromethane	CVS; CNS
Trichloromethane (Chloroform)	Liver; reproductive
Trichloronaphthalene	Liver
1, 2, 3-Trichloropropane	Liver; kidney
1, 1, 2-Trichloro- 1, 2, 2-trifluoroethane	Narcosis; CVS; asphyxiation
Tricyclohexyltin hydroxide (Cyhexatin)	Irritation
Triethylamine	Irritation; vision
Trifluorobromomethane	CNS; CVS
Trimellitic anhydride	Bleeding (lung); immunotoxicity; sensitization
Trimethylamine	Irritation
Trimethyl benzene	Irritation; CNS; blood
Trimethyl phosphite	Irritation
2, 4, 6-Trinitrophenol (Picric acid)	Dermatitis; irritation; ocular; sensitization
2, 4, 6-Trinitrophenyl- methylnitramine (Tetryl)	Liver; dermatitis; sensitization
2, 4, 6-Trinitrotoluene (TNT)	Irritation; liver; blood; eye
Triorthocresyl phosphate	CNS; cholingeric
Triphenyl amine	Irritation
Triphenyl phosphate	Irritation; dermatitis
Tungsten (as W)	
Soluble compounds	CNS, irritation
Insoluble compounds	Irritation
Turpentine	Irritation

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Uranium (as U)	Kideny; blood; cancer
Soluble compounds	
Insoluble compounds	
n-Valeraldehyde	Irritation
Vanadium (as V2O5) Respirable fraction	Irritation; lung
Vegetable oil mist	Lung
Total particulate	
Respirable fraction	
Vinyl acetate	Irritation
Vinyl benzene (Styrene)	Neurotoxicity; irritation; CNS
Vinyl bromide	Liver; CNS; cancer
Vinyl chloride (see WAC 296-62-07329) (Chloroethylene)	Cancer (liver)
Vinyl cyanide (See WAC WAC 296-62-07336,Acrylonitrile)	Cancer
Vinyl cyclohexene dioxide	Irritation; dermatitis; reproductive
Vinyl toluene	Irritation
Vinylidene chloride (1, 1-Dichloroethylene)	CNS; liver; kidney
VM & P Naphtha	Irritation; CNS
Warfarin	Blood; bleeding
Welding fumes[d] (total particulate)	Metal fume fever, irritation
Wood dust	
Nonallergenic (All woods except allergenics)	Irritation, dermatitis, lung
Allergenics (e.g. cedar, mahogany and teak)	Cancer, irritation, mucostasis
Xylenes (Xylol) (o-, m-, p-isomers) (Dimethylbenzene)	Irritation
m-Xylene alpha, alpha-diamine	Irritation; blood
Xylidine (Dimethylaminobenzene)	Cancer; genotoxic
Yttrium	Fibrosis
Zinc chloride fume	Irritation; lung edema
Zinc chromate (as Cr03)	Cancer (lung)
Zinc oxide	Lung
Total particulate	
Respirable fraction	

Mixtures of Airborne Substances

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Table HT-1 Health Effects of Substances (Continued)	
SUBSTANCE	**PEL BASIS (Health Effects)**
Zinc oxide fume	Lung, metal fume fever
Zinc stearate	Lung
Total particulate	
Respirable fraction	
Zirconium compounds (as Zr)	Lung