

SELECT CARCINOGENS

The Occupational Safety and Health Administration (OSHA) defines a “select carcinogen” as a substance that meets one of the following criteria:

1. Is regulated by OSHA as a carcinogen;
2. Is listed under the category “known to be a carcinogen” or “reasonably anticipated to be a carcinogen” in the Annual Report on Carcinogens published by the National Toxicology Program (NTP); or
3. Is listed under Group 1 (“carcinogenic to humans”) or under Group 2A (“probably carcinogenic to humans”) or 2B (“possibly carcinogenic to humans”) by the International Agency for Research on Cancer (IARC).

This list includes byproducts of industrial or manufacturing processes, which are typically not present in laboratories at Indiana University, but may be used or generated during experimental procedures.

SUBSTANCE	OSHA	IARC	NTP
A- α -C (2-amino-9 <i>h</i> -pyrido [2,3- <i>b</i>] indole)		x	
Acetaldehyde		x	x
Acetamide		x	
2-Acetylaminofluorene	x		x
Acrylamide		x	x
Acrylonitrile	x	x	x
Actinolite	x		
Adriamycin		x	x
AF-2 [2-(2-furyl)-3-(5-nitro-2-furyl) acrylamide]		x	
Aflatoxins (naturally occurring)		x	x
Aflotoxins M1		x	
2-Aminoanthraquinone			x
<i>p</i> -Aminoazobenzene		x	
<i>o</i> -Aminoazotoluene		x	x
4-Aminobiphenyl	x	x	x
1-Amino-2,4-dibromoanthraquinone			x
1-Amino-2-methylanthraquinone			x
2-Amino-3,4-dimethylimidazo[4,5- <i>f</i>]quinoline (MEIQ)			x
2-Amino-3,8-dimethylimidazo[4,5- <i>f</i>]quinoxaline (MEIQx)			x
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole		x	
2-Amino-3-methylimidazo [4,5- <i>f</i>]quinoline (IQ)			x
2-Amino-1-methyl-6-phenylimidazo[4,5- <i>b</i>]pyridine (PhIP)		x	x
Amitrole			x
Amsacrine		x	
Androgenic (anabolic) steroids		x	
<i>o</i> -Anisidine		x	
<i>o</i> -Anisidine hydrochloride			x
Antimony trioxide		x	
Aramite [®]		x	
Arisolochic acids (naturally occurring mixtures of)		x	

APPENDIX C

SUBSTANCE	OSHA	IARC	NTP
Arsenic and certain arsenic compounds	x	x	x
Asbestos	x	x	x
Atrazine		x	
Auramine		x	
Azacitidine		x	x
Azaserine		x	
Azathioprine		x	x
Anziridine (dimethyleneimine)		x	
Benzene	x	x	x
Benzidine, benzidine based dyes, and dyes metabolized to benzidine	x	x	x
Benzo[<i>a</i>]anthracene		x	x
Benzo[<i>b</i>]fluoranthene		x	x
Benzo[<i>j</i>]fluoranthene		x	x
Benzo[<i>k</i>]fluoranthene		x	x
Benzofuran		x	
Benzo[<i>a</i>]pyrene		x	x
Benzotrichloride			x
Benzyl violet 4B		x	
Beryllium and certain beryllium compounds		x	x
<i>N,N</i> -Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)		x	
Bischloroethyl nitrosourea		x	x
Bleomycins		x	
Bracken fern		x	
Bromodichloromethane		x	x
2,2-bis-(Bromoethyl)-1,3-propanediol		x	x
1,3-Butadiene		x	x
1,4-Butanediol dimethyl-sulfonate (Myleran) x			x
Butylated hydroxyanisole (BHA)		x	x
β-Butyrolactone		x	
Cadmium and certain cadmium compounds	x	x	x
Caffeic acid		x	
Captafol		x	
Carbon black		x	
Carbon tetrachloride		x	x
Ceramic fibers (respirable size)		x	x
Chlorambucil		x	x
Chloramphenicol		x	x
Chlordane		x	
Chlordecone (Kepone)		x	
Chlorendic acid		x	x
Chlorinated paraffins (C ₁₂ , 60% Chlorine)			x
α-Chlorinated toluenes (benzyl chloride, benzalchloride, benzotrichloride)		x	x
<i>p</i> -Chloroaniline		x	
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)		x	x

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SUBSTANCE	OSHA	IARC	NTP
2-Chloroethyl -3- (4 methylcyclohexyl) -1-nitrosoarea (MECCNU)		X	X
bis-Chloroethyl nitrosoarea			X
Chloroform		X	X
bis-Chloromethyl ether (Dimethyl-1,1'-dichloro ether)	X	X	X
Chloromethyl methyl ether (Methyl chloromethyl ether)	X		X
1-Chloro-2-methylpropene		X	
3-Chloro-2-methylpropene			X
Chlorophenoxy herbicides		X	
4-Chloro- <i>o</i> -phenylenediamine		X	X
Cloroprene		X	X
p-Chloro- <i>o</i> -toluidine and p-chloro- <i>o</i> -toluidine hydrochloride			X
Chlorothalonil		X	
Chlorozotocin		X	X
Chromium [VI] and certain chromium [VI] compounds		X	X
CI Acid Red 114 (see 3,3 dimethylbenzidine)		X	X
CI Direct Black 38 (see benzidine)			X
CI Basic Red 9 monohydrochloride		X	
CI Direct Blue 6 (see benzidine)			X
CI Direct Blue 15 (see 3,3 dimethoxybenzidine)		X	X
CI Direct brown 95 (see benzidine)			X
Ciclosporin		X	
Cisplatin		X	X
Citrus red no. 2		X	
<i>Clonorchis sinensis</i> (infection with)		X	
Coal tars and coal tar pitches		X	X
Coke oven emissions	X		X
Cobalt and cobalt compounds		X	
Cobalt sulfate			X
<i>p</i> -Cresidine		X	X
Cupferron			X
Cycasin		X	
Cyclophosphamide		X	X
Cyclosporin A (ciclosporin)			X
Dacarbazine		X	X
Danthron (chrysazin 1,8-dihydroxyanthraquinone)		X	X
Daunomycin		X	
N,N'-Diacetylbenzidine		X	
2,4-Diaminoanisole		X	
2,4-Diaminoanisole sulfate			X
4,4'-Diaminodiphenyl ether		X	
2,4-Diaminotoluene		X	X
Dibenz[<i>a,h</i>]acridine		X	X
Dibenz[<i>a,j</i>]acridine		X	X
Dibenz[<i>a,h</i>]anthracene		X	X
7 <i>h</i> -Dibenzo[<i>c,g</i>]carbazole		X	X
Dibenzo[<i>a,e</i>]pryrene		X	X

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SUBSTANCE	OSHA	IARC	NTP
Dibenzo[<i>a,h</i>]pyrene		X	X
Dibenzo[<i>a,i</i>]pyrene		X	X
Dibenzo[<i>a,l</i>]pyrene		X	X
Diazoaminobenzene (DAAB)			X
1,2-Dibromo-3-chloropropane	X	X	X
1,2-Dibromoethane (Ethylene dibromide)			X
2,3-Dibromo-1-propanol		X	X
tris (2,3-Dibromopropyl) phosphate			X
1,4-Dichlorobenzene			X
<i>p</i> -Dichlorobenzene	X	X	
3,3'-Dichlorobenzidine	X	X	X
3,3'-Dichlorobenzidine dihydrochloride			X
3,3'-Dichloro-4,4'-diaminodiphenyl ether		X	
Dichlorodiphenyltrichloroethane (DDT)		X	X
1,2-Dichloroethane (Ethylene dichloride)		X	X
Dichloromethane (Methylene chloride)	X	X	X
1,3-Dichloropropene		X	X
Dichlorvos		X	
Diepoxybutane			X
1,2 Diethylhydrazine		X	
Diesel exhaust particulates			X
Diethylstilbestrol		X	X
Diethyl sulfate		X	X
Diisopropyl sulfate		X	
Diglycidyl resorcinol ether		X	X
Dihydrosafrole		X	
3,3'-Dimethoxybenzidine (<i>o</i> -dianisidine) & dyes metabolized to 3,3 dimethoxybenzidine		X	X
3,3'-Dimethylbenzidine (<i>o</i> -tolidine) & dyes metabolized to 3,3'-dimethylbenzidine		X	X
4-Dimethylaminoazobenzene	X		X
<i>p</i> -Dimethylaminoazobenzene		X	
<i>trans</i> -2-[(Dimethylamino)methylamino] -5- 2-(5-nitro-2-furyl)-vinyl]-1,3,4-oxadiazole		X	
2,6-Dimethylaniline (2,6-Xylidine)		X	
Dimethylcarbamoyl chloride		X	X
1,1-Dimethylhydrazine		X	X
1,2-Dimethylhydrazine		X	
Dimethyl sulfate		X	X
Dimethylvinyl chloride			X
3,7-Dinitrofluoranthene		X	
3,9-Dinitrofluoranthene		X	
1,6-Dinitropyrene		X	X
1,8-Dinitropyrene		X	X
2,4-Dinitrotoluene		X	
2,6-Dinitrotoluene		X	

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SUBSTANCE	OSHA	IARC	NTP
1,4-Dioxane		X	X
Disperse Blue 1		X	X
Epichlorohydrin		X	X
1,2 Epoxybutane		X	
Epstien-Barr virus		X	
Erionite		X	X
Estrogens, nonsteroidal		X	
Estrogens, steroidal		X	X
Ethyl acrylate		X	
Ethylbenzene		X	
Ethylene dibromide		X	
Ethyleneimine	X		
N-ethyl-N-nitrosourea		X	
Ethylene oxide	X	X	X
Ethylene thiourea			X
di(2-Ethylhexyl) phthalate			X
Ethyl methanesulfonate		X	X
Etoposide with cisplatin & bleomycin		X	
Formaldehyde (gas)	X	X	X
2-(2-Formylhydrazino)-4-(5-nitro-2-furly) thiazole		X	
Fumonisin B1		X	
Furan		X	X
Gamma radiation and X-radiation		X	X
Glass wool (respirable size)			X
Glu-P-2 (2-aminodipyrido[1,2-a:3',2'-d]imidazole		X	
Glu-P-1 (2-amino-6-methyldipyrido-1,2-a:3',2'-d]imidazole)		X	
Glycidaldehyde		X	
Glycidol		X	X
Griseofulvin		X	
HC Blue No. 1		X	
<i>Helicobacter pylori</i> (infection with)		X	
Hepatitis B virus		X	X
Hepatitis C virus		X	X
Heptachlor		X	
Hexachlorobenzene		X	X
Hexachlorocyclohexanes		X	
Hexachloroethane		X	X
Hexamethyl-phosphoramide		X	X
Human papillomavirus (types 16, 18, 31, 33, 35, 39, 45, 51, 52, 58, 59)		X	X
Hydrazine and hydrazine sulfate		X	X
Hydrazobenzene			X
1-Hydroxyanthraquinone		X	
Indeno [1,2,3- <i>cd</i>] pyrene		X	X
Iron dextran complex		X	X
IQ (2-amino-3-methylimidazo[4,5- <i>f</i>]quinoline		X	
Isoprene		X	X

APPENDIX C

SUBSTANCE	OSHA	IARC	NTP
Kepone (Chlordecone)			X
Lasiocarpine		X	
Lead and lead compounds, inorganic		X	X
Lindane and other hexachlorocyclohexane isomers			X
Magenta (containing CI Basic red 9)		X	
Magnetic Fields (extremely low frequency)		X	
MeA-alpha-c (2-amino-3-methyl-9 <i>h</i> -pyrido-[2,3- <i>b</i>] indole		X	
Medroxyprogesterone acetate		X	
MeIQ (2-amino-3,4-dimethylimidazo [4,5- <i>f</i>] Quinoline)		X	
MeIQx (2-amino-3,8-dimethylimidazo[4,5- <i>f</i>] quinoxaline)		X	
Melphalan		X	X
Methoxsalen with ultraviolet A therapy (PUVA)		X	X
2-Methylaziridine (Propylenimine)		X	X
5-Methoxypsoralen (methoxsalen)		X	
8-Methoxypsoralen (methoxsalen)		X	
2- Methylaziridine (propyleneimine)		X	X
Methylazoxymethanol acetate		X	
5-Methylchrysene		X	X
4,4'-Methylenebis (2-chloroaniline) (MOCA)		X	X
4,4'-Methylenebis (<i>N,N</i> -dimethylbenzenamine)		X	X
4,4'-Methylenebis (2-methylaniline)		X	
Methylene chloride (dichloromethane)	X	X	X
Methylenedianiline	X		
4,4'-Methylenedianiline and its dihydrochloride salt		X	X
Methyleugenol			X
Methyl chloromethyl ether (Chloromethyl methyl ether)	X	X	X
Methylmercury compounds		X	
Methyl methanesulfonate		X	X
2-Methyl-1-nitroanthraquinone		X	
<i>N</i> -Methyl- <i>N'</i> -nitro- <i>N</i> -nitrosoguanidine (MNNG)		X	X
<i>N</i> -Methyl- <i>N</i> -nitrosourea		X	
<i>N</i> -methyl- <i>N'</i> -nitrosourethane		X	
Methylthiouracil		X	
Metronidazole		X	X
Michler's ketone (4,4'-(Dimethylamino)benzophenone)			X
Mineral Oils (untreated and mildly treated)		X	X
Mirex		X	X
Mitomycin C		X	
Mitoxantrone		X	
Monocrotaline		X	
MOPP and other combined chemotherapy including alkylating agents		X	
5-Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino-] 2-oxazolidinone		X	

APPENDIX C

SUBSTANCE	OSHA	IARC	NTP
Mustard gas		X	X
Nafenopin		X	
Napthalene		X	X
α -Naphthylamine	X		
β -Naphthylamine	X		
2-Naphthylamine		X	X
Neutrons		X	
Nickel and certain nickel compounds		X	X
Niridazole		X	
Nitrilotriacetic acid		X	X
5-Nitroacenaphthene		X	
2-Nitroanisole		X	
<i>o</i> -Nitroanisole			X
Nitrobenzene		X	X
4-Nitrobiphenyl	X		
6- Nitrochrysene		X	X
Nitrofen (2,4-Dichlorophenyl- <i>p</i> -nitrophenyl ether)		X	X
2-Nitrofluorene		X	
1-[(5-Nitrofurfurylidene)amino]-2-imidazolidinone		X	
N-[4-(5-Nitro-2-furyl)-2-thiazolyl] acetamide		X	
Nitrogen mustard		X	
Nitrogen mustard hydrochloride			X
Nitrogen mustard N-oxide		X	
Nitromethane		X	X
2-Nitropropane		X	X
1-Nitropyrene		X	X
4-Nitropyrene		X	X
<i>N</i> -Nitrosodi- <i>n</i> -butylamine		X	X
<i>N</i> -Nitrosodiethanolamine		X	X
<i>N</i> -Nitrosodiethylamine		X	X
<i>N</i> -Nitrosodimethylamine	X	X	X
<i>N</i> -Nitrosodi- <i>n</i> -propylamine		X	X
<i>N</i> -Nitroso- <i>N</i> -ethylurea			X
3-(<i>N</i> -Nitrosomethylamino) propionitrile		X	
4-(<i>N</i> -Nitrosomethyl-amino)-1(3-pyridyl)-1-butanone (NNK)		X	X
<i>N</i> -Nitrosomethylethylamine		X	
<i>N</i> -Nitroso- <i>N</i> -methylurea			X
<i>N</i> -Nitrosomethylvinylamine		X	X
<i>N</i> -Nitrosomorpholine		X	X
<i>N</i> -Nitrosornicotine		X	X
<i>N</i> -Nitrosopiperdine		X	X
<i>N</i> -Nitrosopyrrolidine		X	X
<i>N</i> -Nitrososarcosine		X	X
Norethisterone			X
Ochratoxin A		X	X
Oestrogens nonsteriodal		X	
Oestrogens, steroidal		X	

APPENDIX C

SUBSTANCE	OSHA	IARC	NTP
Oil orange SS		X	
<i>Opisthorchis viverini</i> (infection with)		X	
Oral contraceptives, combined		X	
Oral contraceptives, sequential		X	
Oxazepam		X	
4,4'-Oxydianiline			X
Oxymetholone			X
Palygorskite (attapulgit)		X	
Panfuran S (containing dihydroxymethyl-Furatrizine)		X	
Phenacetin and analgesic mixtures containing phenacetin		X	X
Phenazopyridine hydrochloride		X	X
Phenobarbital		X	
Phenolphthalein		X	X
Phenoxybenzamine hydrochloride		X	X
Phenyl glycidyl ether		X	
Phenytoin		X	X
Phosphorus-32		X	
Plutonium-239		X	
Polybrominated biphenyls (PBBs)		X	X
Polychlorinated biphenyls (PCBs)		X	X
Polychlorophenols and their sodium salts		X	
Ponceau MX		X	
Ponceau 3R		X	
Potassium bromate		X	
Procarbazine hydrochloride		X	X
Progesterone			X
Progestins		X	
1,3-Propane sultone		X	X
β -Propiolactone	X	X	X
Propylene oxide		X	X
Propylthiouracil		X	X
Radionuclides (alpha & beta emitting)		X	
Radium-224, 226, 228		X	
Radon-222		X	
Riddelliine		X	
Reserpine			X
Safrole		X	X
Selenium sulfide			X
<i>Schistosoma haematobium</i> (infection with)		X	
<i>Schistosoma japonicum</i> (infection with)		X	
Silca, crystalline (respirable size)		X	X
Sodium- <i>o</i> -phenylphenate		X	
Solar radiation (and Sunlamps)		X	
Soots			X
Sterigmatocystin		X	
Streptozotocin		X	X
Strong inorganic acid mists containing sulfuric acid			X

APPENDIX C

SUBSTANCE	OSHA	IARC	NTP
Styrene		X	
Styrene-7,8-oxide		X	X
Sulfallate		X	X
Talc containing asbestiform fibers		X	
Tamoxifen		X	X
Teniposide		X	
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)		X	X
Tetrachloroethylene (Perchloroethylene)		X	X
Tetrafluoroethylene		X	X
Tetranitromethane		X	X
Thioacetamide		X	X
4,4'-Thiodianiline		X	X
Thiotepa		X	X
Thiouracil		X	
Thiourea			X
Thorium-232 & decay products		X	
Thorium dioxide		X	
Tobacco smoke, environmental tobacco smoke, & smokeless tobacco		X	X
Toluene diisocyanate		X	X
<i>o</i> -Toluidine and <i>o</i> -toluidine hydrochloride		X	X
Toxaphene			X
Tresulfan		X	
Trichloroethylene		X	X
Trichloromethine (trimustine hydrochloride)		X	
2,4,6-Trichlorophenol			X
1,2,3-Trichloropropane		X	X
tris (1-aziridinyl)phosphine sulfide (thiotepa)		X	X
tris (2,3-dibromopropyl) phosphate		X	X
TRP-P-1 (3-amino-1,4-dimethyl-5 <i>h</i> -pyrido [4,3- <i>b</i>] indole)		X	
TRP-P-2 (3-amino-1-methyl-5 <i>h</i> -pyrido [4,3- <i>b</i>] indole)		X	
Trypan blue		X	
Ultraviolet radiation (broad spectrum)			X
Ultraviolet radiation A		X	X
Ultraviolet radiation B		X	X
Ultraviolet radiation C		X	X
Uracil mustard		X	
Urethane		X	X
Vinyl acetate		X	
Vinyl bromide		X	X
Vinyl chloride (Chloroethylene)	X	X	X
4-Vinylcyclohexene		X	
4-Vinylcyclohexene diepoxide		X	
4-Vinyl-1-cyclohexene diepoxide			X
Vinyl fluoride		X	X
Wood Dust		X	X
Zalcitabine		X	
Zidovudine		X	

APPENDIX C

SUBSTANCE	OSHA	IARC	NTP
Mixtures:			
Analgesic mixtures containing phenacetin		X	
Bitumens		X	
Carrageenan, degraded		X	
Chlorinated paraffins of average carbon chain length C ₁₂ and approximately 60% chlorination		X	
Coal-tars		X	
Creosotes		X	
Diesel fuel, marine		X	
Diesel engine exhaust		X	
Engine exhaust, gasoline		X	
Fuel oils, residual (heavy)		X	
Gasoline		X	
Hot mate		X	
Mineral oils, untreated and mildly treated		X	
Non-arsenical insecticides (spraying and application)		X	
Polybrominated biphenyls (PBBs)		X	
Polychlorinated biphenyls (PCBs)		X	
Shale-oils		X	
Soots		X	
Toxaphene (chlorinated camphenes)		X	
Toxins derived from <i>fusarium moniliforme</i>		X	
Welding fumes		X	

REPRODUCTIVE TOXINS¹

EXAMPLES

Drugs and Environmental Chemicals:

Acetaldehyde
 Acetonitrile
 Acrolein
 Aminopterin
 Androgenic hormones
 Arsenic (elemental/organic)
 Benzene
 Benzo(a)pyrene
 Boric acid
 Busulfan
 tert-Butyl alcohol
 Cadmium
 Calcium arsenate
 Carbon Disulfide
 Chlorobiphenyls
 Chloroform
 Coumarin anticoagulants
 Cyclophosphamide
 DDT
 Dibenzofuran
 Diethylstilbestrol
 Dimethyl mercury
 Dinitrogen pentoxide
 Diphenylhydantoin
 Ethylene glycol
 Ethylene oxide
 Ethylene dibromide
 Ethyl methane sulfonate
 Etretinate
 5-Fluorouracil
 Glycol ether
 Hydrazine
 Isocyanate, Methyl-
 Lead compounds
 Lithium
 Methotrexate
 Methylaminopterin
 Methylene chloride
 Methylmercury
 Mercury, organic

Penicillamine
 Perchloroethylene
 Phthalate, dibutyl-
 Polychlorinated biphenyls
 13-cis-Retinoic acid (Isotretinoin and Accutane)
 Tetracyclines
 Thalidomide
 Toluene
 Trimethadone
 Valproic acid
 Vinyl chloride
 Xylene, *o*-, *m*-, *p*-
 Zinc sulfate

Infectious Agents:

Cytomegalovirus (CVM)
 Parvovirus B-19
 Rubella virus
 Syphilis
 Toxoplasmosis
 Varicella virus
 Venezuelan equine encephalitis virus

Radiation:

Ionizing radiation

¹ References: Shepard, T.H. *Catalog of Teratogenic Agents*, 8th eds. Baltimore: Johns Hopkins University Press, 1995.

Jankovic, J. and Drake, F. A screening method for occupational reproductive health risk. *American Industrial Hygiene Association Journal*. 57:641-649, 1996.

ACUTELY TOXIC CHEMICALS

<u>EXAMPLES</u>	<u>IDLH</u> ¹
Acrolein	2 ppm
Arsine	3 ppm
Chlorine	10 ppm
Diazomethane	2 ppm
Diborane (gas)	15 ppm
Hydrogen cyanide	50 ppm
Hydrogen fluoride	30 ppm
Methyl fluorosulfonate	5 ppm
Methyl isocyanate	3 ppm
Nickel carbonyl	2 ppm
Nitrogen dioxide	20 ppm
Osmium tetroxide	1 mg/m ³
Ozone	5 ppm
Phosgene	2 ppm
Sodium azide	20 ppm
Sodium cyanide (as CN)	25 mg/m ³

¹ IDLH - Immediately Dangerous to Life and Health (IDLH), values based on Lethal Concentrations or Dose (LC₅₀ or LD₅₀), National Institute of Occupational Safety and Health (NIOSH), *Pocket Guide to Chemical Hazards*, 2004.

CHEMICALS THAT CAN FORM PEROXIDES UPON AGING¹

Class I: Unsaturated materials, especially those of low molecular weight, may polymerize violently and hazariously due to peroxide initiation:

Acrylic acid	Tetrafluoroethylene
Acrylonitrile	Vinyl acetate
Butadiene	Vinyl acetylene
Chlorobutadiene (Chloroprene)	Vinyl chloride
Chlorotrifluoroethylene	Vinyl pyridine
Methyl methacrylate	Vinylidene chloride
Styrene	

Class II: The following chemicals are a peroxide hazard upon concentration (distillation/evaporation). Test for peroxides if concentration is suspected or intended.

Acetal	Dioxane (<i>p</i> -dioxane)
Cumene	Ethylene glycol dimethyl ether (glyme)
Cyclohexene	Furan
Cyclooctene	Methyl acetylene
Cyclopentene	Methyl cyclopentane
Diacetylene	Methyl- <i>i</i> -butyl ketone
Dicyclopentadiene	Tetrahydrofuran
Diethylene glycol dimethyl ether (diglyme)	Tetrahydronaphthalene (Tetraline)
Diethyl ether (Ethyl ether)	Vinyl ethers

Class III: Peroxides derived from the following compounds may explode without concentration.

Organic:	Inorganic
Divinyl ether	Potassium metal
Divinyl acetylene	Potassium amide
Isopropyl ether	Sodium amide (sodamide)
Vinylidene chloride	

¹ Reference: National Research Council, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*, Table 3.13, p. 56, 1995

CHEMICAL INCOMPATIBILITIES PARTIAL LIST

Chemical	Incompatible Chemicals
Acetic acid	Chromic acid, nitric acid, peroxides, permanganates, hydroxyl compounds, ethylene glycol, perchloric acid
Acetic anhydride	Hydroxyl-containing compounds (i.e. ethylene glycol, perchloric acid)
Acetone	Concentrated nitric and sulfuric acid mixtures, hydrogen peroxide
Acetylene	Chlorine, bromine, copper, silver, fluorine, mercury
Alkali and alkaline earth such as sodium, magnesium, calcium, powdered aluminum	Water, carbon dioxide, carbon tetrachloride, other metals, chlorinated hydrocarbons, halogens, potassium, lithium, chemical extinguishers (water, foam, and dry)
Ammonia (anhydrous)	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate nitrites,	Acids, metal powders, flammable liquids, chlorates, sulfur, finely divided organics, combustibles
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), sodium carbide, turpentine, benzene, hydrogen, finely divided metals
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organics, combustibles
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, turpentine, alcohol, other flammable liquids
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), sodium, carbide, turpentine, benzene, hydrogen, finely divided metals
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, perchloric acid, sodium peroxide, halogens
Fluorine	Isolate from everything
Hydrazine	Hydrogen peroxide, nitric acid, other oxidants
Hydrocarbons (benzene, propane, gasoline, etc.)	Fluorine, chlorine, bromine, chromic acid, butane, peroxides

CHEMICAL INCOMPATIBILITIES
PARTIAL LIST
 (continued)

Chemical	Incompatible Chemicals
Hydrocyanic acid	Nitric acid, alkalis
Hydrofluoric acid	Ammonia (aqueous or anhydrous)
Hydrogen Peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible material
Hydrogen Sulfide	Fuming nitric acid, oxidizing gases
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric Acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, greases, hydrogen, flammable liquids, solids, or gases
Perchloric acid	Acetic anhydride, acetic acid, bismuth and its alloys, alcohol, paper, wood, greases, oils, flammables
Peroxide, organic	Acids (also avoid friction, store cold)
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerine, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals such as sodium and lithium)

**SUMMARY OF THE MAXIMUM ALLOWABLE QUANTITY
OF HAZARDOUS MATERIALS IN STORAGE PER FIRE CONTROL AREA^a
POSING A PHYSICAL OR HEALTH HAZARD**

Hazardous Material ^e	Class ^e	IBC Hazard Group ^f when Quantity is Exceeded	Maximum Quantity in Storage ^b for Occupancies Constructed Prior to May 17, 2003 in Accordance with the Uniform Fire Code ^c (UFC)			Maximum Quantity in Storage ^b for Occupancies Constructed after May 17, 2003 in Accordance with the International Fire Code ^d (IFC)		
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet)
Combustible liquid	II IIIA IIIB	H-2 or H-3 H-2 or H-3		120 ^h 330 ^h 13,200 ^{h,i}			120 ^{g,h} 330 ^{g,h} 13,200 ^{h,i}	
Combustible fiber	Loose Baled	H-3	(100) (1,000)			(100) (1,000)		
Consumer Fireworks (Class C, Common)	1.4G	H-3				125 ^{g,h,q}		
Cryogenics, flammable		H-2		45			45 ^g	
Cryogenics, Oxidizing		H-3		45			45 ^g	
Explosives		H-1	1 ^h	(1) ^h		1 ^{h,j}	(1) ^{h,j}	
Flammable gas	Gaseous	H-2			750 ^{g,h}			1,000 ^{g,h}
	Liquefied			15 ^{g,h}			30 ^{g,h}	
Flammable liquid	1A 1B 1C	H-2 or H-3		30 ^h 60 ^h 90 ^h			30 ^{g,h} 60 ^{g,h} 90 ^{g,h}	
Combination Flammable Liquid (1A,1B,1C)		H-2 or H-3		120 ^h			120 ^{g,h,k}	
Flammable solid		H-3	125 ^{g,h}			125 ^{g,h}		
Organic peroxide	UD	H-1	1 ^{h,j}	(1) ^{h,j}		1 ^{h,i}	(1) ^{h,j}	
	I	H-2	5 ^{g,h}	(5) ^{g,h}		5 ^{g,h}	(5) ^{g,h}	
	II	H-3	50 ^{g,h}	(50) ^{g,h}		50 ^{g,h}	(50) ^{g,h}	
	III	H-3	125 ^{g,h}	(125) ^{g,h}		125 ^{g,h}	(125) ^{g,h}	
	IV			500 ^{g,h}	(500) ^{g,h}		NL	NL
	V		NL	NL		NL	NL	
Oxidizer	4	H-1	1 ^{h,j}	(1) ^{h,j}		1 ^{h,j}	(1) ^{h,j}	
	3 ^j	H-2	10 ^{g,h}	(10) ^{g,h}		10 ^{g,h}	(10) ^{g,h}	
	2	H-3	250 ^{g,h}	(250) ^{g,h}		250 ^{g,h}	(250) ^{g,h}	
	1	H-3	4,000 ^{g,h}	(4,000) ^{g,h}		4,000 ^{g,h}	(4,000) ^{g,h}	
Oxidizing gas	Gaseous	H-3			1500 ^{g,h}			1500 ^{g,h}
	Liquefied			15 ^{g,h}			15 ^{g,h}	
Pyrophoric material		H-2	4 ^{h,j}	(4) ^{h,j}	50 ^{h,j}	4 ^{h,j}	(4) ^{h,j}	50 ^{h,j}
Unstable (reactive)	4	H-1	1 ^{h,j}	(1) ^{h,j}	10 ^{h,j}	1 ^{h,j}	(1) ^{h,j}	10 ^{g,j}
	3	H-1 or H-2	5 ^{g,h}	(5) ^{g,h}	50 ^{g,h}	5 ^{g,h}	(5) ^{g,h}	50 ^{g,h}
	2	H-3	50 ^{g,h}	(50) ^{g,h}	250 ^{g,h}	50 ^{g,h}	(50) ^{g,h}	250 ^{g,h}
	1		NL	NL	750 ^{g,h}	NL	NL	NL
Water reactive	3	H-2	5 ^{g,h}	(5) ^{g,h}		5 ^{g,h}	(5) ^{g,h}	
	2	H-3	50 ^{g,h}	(50) ^{g,h}		50 ^{g,h}	(50) ^{g,h}	
	1		125 ^{h,i}	(125) ^{h,j}		NL	NL	
Corrosive			5000 ^{g,h}	500 ^{g,h}	810 ^{g,h}	5000 ^{g,h}	500 ^{g,h}	810 ^{g,o}
Highly Toxic			10 ^{g,h}	(10) ^{g,h}	20 ^{g,p}	10 ^{g,h}	(10) ^{g,h}	20 ^{g,p}
Toxic			500 ^{g,h}	(500) ^{g,h}	810 ^{g,h}	500 ^{g,h}	(500) ^{g,h}	810 ^{g,h}
Irritants			NL	NL	810 ^{g,h,i}			
Sensitizers			NL	NL	810 ^{g,h,i}			
Other Health Hazards			NL	NL	810 ^{g,h,i}			

NL = Not Limited SI equivalents: 1 cubic foot = 0.023 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L

APPENDIX C

- Notes:**
- A control area is a space within a building bounded by exterior walls, fire walls, fire barriers, and roofs, or a combination thereof, where hazardous materials are stored, dispensed, or handled in amounts not exceeding the maximum allowable quantities.
 - The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
 - Uniform Fire Code*, 1997, Article 80, Hazardous Materials, Section 8001, Tables 8001.15-C & 8001.15-D.
 - International Fire Code*, 2000, Chapter 27, Hazardous Materials – General Provisions, Tables 2703.1.1(1) & 2703.1.1(2).
 - See definitions below.
 - Hazard groups are defined in the International Building Code, 2000, [F] Section 307, and require specific design criteria.
 - Maximum quantities shall be increased 100% for buildings equipped throughout with an automatic sprinkler system. Where note h applies, the increase for both shall be applied accumulatively.
 - Quantities shall be increased 100% when stored in approved cabinets, gas cabinets, exhausted enclosures, or safety cans as specified by the *International Fire Code*. Where note g applies, the increase for both shall be applied accumulatively.
 - The permitted quantities shall not be limited in buildings equipped throughout with an automatic sprinkler system and provided with exhaust ventilation.
 - Permitted only in building equipped throughout with an automatic sprinkler system.
 - Containing not more than the maximum allowable quantity per control area of Class 1A, 1B, or 1C flammable liquids.
 - Quantities in parentheses indicate quantity units in parentheses at the head of each column.
 - A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes.
 - Net weight of the pyrotechnic composition. Where net weight is unknown, 25% of the gross weight including packaging shall be used.
 - A single cylinder per control area containing 150 pounds of anhydrous ammonia shall be considered the maximum in and un-sprinklered building or two cylinders containing 150 pounds each in a building equipped throughout with an automatic sprinkler system.
 - Allowed only when stored in approved exhausted gas cabinets or exhausted enclosures.
 - Net weight of the pyrotechnic composition. Where the net weight is unknown 25% of the gross weight shall be used including packaging.

Definitions:

- Combustible Liquids: Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).
Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).
Class IIIB. Liquids having a closed cup flash point at or above 200°F (93°C).
- Flammable Liquids: Class IA. Liquids having a flash point below 73°F (23°C) and having a boiling point below 100°F (38°C).
Class IB. Liquids having a flash point below 73°F (23°C) and having a boiling point above 100°F (38°C).
Class IC. Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C).
- Highly Toxic: 1. A chemical that has a lethal dose (LD₅₀) 50 mg/kg or less orally in rats.
2. A chemical that has a lethal dose (LD₅₀) 200 mg/kg or less by contact in rabbits.
3. A chemical that has a lethal concentration (LC₅₀) in air of 200 ppm (gas or vapor) or 2 mg/l (mist, fume, or dust) or less by inhalation in rats.
- Organic Peroxides: UD. Unclassified detonable. Organic peroxides that are capable of detonation. Extremely high explosion hazard through rapid explosive decomposition.
I. Formulations capable of deflagration but not detonation.
II. Formulations that burn very rapidly and pose a moderate reactivity hazard.
III. Formulations that burn rapidly and pose a moderate reactivity hazard.
iV. Formulations that burn in the same manner as ordinary combustibles and pose minimal reactivity hazards.
V. Formulations that burn with less intensity than ordinary combustibles or do not sustain combustion and pose no reactivity hazard.
- Oxidizers: Class 1. An oxidizer whose primary hazard is that it slightly increases the burning rate but does not cause spontaneous ignition when it comes in contact with combustible materials.
Class 2. An oxidizer that will cause a moderate increase in the burning rate or that causes spontaneous ignition when it comes in contact with combustible materials.
Class 3. An oxidizer that will cause a severe increase in the burning rate of combustibles with which it comes into contact or that will undergo vigorous self-sustained decomposition due to contamination or exposure to heat.
Class 4. An oxidizer that will undergo an explosive reaction due to contamination or exposure to thermal or physical shock and will enhance the burning rate and cause spontaneous ignition of combustibles.
- Toxic: 1. A chemical that has a lethal dose (LD₅₀) 50 mg/kg but not more than 500 mg/kg orally in rats.
2. A chemical that has a lethal dose (LD₅₀) 200 mg/kg but not more than 1000 mg/kg by contact in rabbits.
3. A chemical that has a lethal concentration (LC₅₀) in air of more than 200 ppm (gas or vapor) or 2 mg/l (mist, fume, or dust) but not more than 2000 ppm (or 20 mg/l) by inhalation in rats.
- Unstable (reactive): Class 1. Materials that are normally stable but can become unstable at elevated temperatures and pressures.
Class 2. Materials that are normally unstable and readily undergo violent chemical change but do not detonate and includes materials that can undergo chemical change with the rapid release of energy at normal temperatures and pressures and that undergo violent chemical change at elevated temperatures and pressures.
Class 3. Materials capable of detonation or explosive decomposition or explosive reaction but require a strong initiating source or must be heated under confinement before initiation and includes materials sensitive to mechanical or localized thermal shock at elevated temperatures and pressures.
Class 4. Materials readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures and includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.
- Water reactive: Class 1. Materials that react with water with some release of energy but not violently.
Class 2. Materials that may form potentially explosive mixtures with water.
Class 3. Materials that react explosively with water without requiring heat or confinement.

EXAMPLES OF LIQUID AND SOLID OXIDIZER CLASSIFICATIONS¹

Class 1: Oxidizers that **do not moderately increase**¹ or cause a slight increase² in the burning rate of the combustible materials with which they come into contact:

All inorganic nitrites	Potassium persulfate
Ammonium persulfate	Sodium carbonate peroxide
Barium peroxide	Sodium dichloro- <i>s</i> -triazinetrione dihydrate
Calcium peroxide	Sodium dichromate
Hydrogen peroxide solutions (8-27.5%)	Sodium perborate (anhydrous)
Lead dioxide	Sodium perborate monohydrate
Lithium hypochlorite (<39% avail. chlorine)	Sodium perborate tetrahydrate
Lithium peroxide	Sodium percarbonate
Magnesium peroxide	Sodium persulfate
Manganese dioxide	Strontium peroxide
Nitric acid ($\leq 40\%$ conc.)	Trichloro- <i>s</i> -triazinetrione
Perchloric acid solutions (<50% by weight)	(trichloroisocyanuric) (acid all forms)
Potassium dichromate	Zinc peroxide
Potassium percarbonate	

Class 2: Oxidizers that **do moderately increase** the burning rate of the combustible materials with which they come into contact:

Barium bromate	Magnesium perchlorate
Barium chlorate	Mercurous chlorate
Barium hypochlorite	Nitric acid (40-86% conc.)
Barium perchlorate	Nitrogen tetroxide
Barium permanganate	Perchloric acid solutions (50-60% conc.)
1-Bromo-3-chloro-5,5-dimethylhydantoin (BCDMH)	Potassium perchlorate
Calcium chlorate	Potassium permanganate
Calcium chlorite	Potassium peroxide
Calcium hypochlorite ($\leq 50\%$ by weight)	Potassium superoxide
Calcium perchlorate	Silver peroxide
Calcium permanganate	Sodium chlorite ($\leq 40\%$ by weight)
Chromium trioxide	Sodium perchlorate
Copper chlorate	Sodium perchlorate monohydrate
Halane (1,3-dichloro-5,5-dimethylhydantoin)	Sodium permanganate
Hydrogen peroxide (27.5-52%)	Sodium peroxide
Lead perchlorate	Strontium chlorate
Lithium chlorate	Strontium perchlorate
Lithium hypochlorite (>39% avail. chlorine)	Thallium chlorate
Lithium perchlorate	Urea hydrogen peroxide
Magnesium bromate	Zinc bromate
Magnesium chlorate	Zinc chlorate
	Zinc permanganate

EXAMPLES OF LIQUID AND SOLID OXIDIZER CLASSIFICATIONS¹

(continued)

Class 3: Oxidizers that **will cause a severe increase** in the burning rate of the combustible materials with which they come into contact **or** that **will undergo vigorous self-sustained decomposition** due to contamination or exposure to heat:

Ammonium dichromate	Potassium bromate
Ammonium nitrate ²	Potassium chlorate
Calcium hypochlorite (>50% by weight)	Potassium dichloro- <i>s</i> -triazinetriene
Chloric acid (10% max. conc.)	(potassium dichloroisocyanurate)
Hydrogen peroxide solutions (52-91%)	Sodium bromate
Mono-(trichloro)-tetra-(monopotassium	Sodium chlorate
dichloro)-penta- <i>s</i> -triazinetriene	Sodium chlorite (>40% by weight)
Nitric acid, fuming (>86% conc.)	Sodium dichloro- <i>s</i> -triazinetriene (sodium
Perchloric acid solutions (60-72% by	dichloroisocyanurate)
weight)	

Class 4: Oxidizers that **will cause a severe increase** in the burning rate of the combustible materials with which they come into contact **and** will **undergo an explosive reaction** due to contamination or exposure to thermal or physical shock:

Ammonium perchlorate (> 15 micron particle	Guanidine nitrate
size, <15 microns is classified explosive)	Hydrogen peroxide solutions (>91%)
Ammonium permanganate	Tetranitromethane

¹ National Fire Protection Association, *Code for Storage of Liquid and Solid Oxidizers*, NFPA 430, 2000.

² International Code Council, *International Building Code*, Section 307, High-Hazard Group H, 2000.

CENTER FOR DISEASE CONTROL (CDC) SELECT AGENTS¹

Viruses

1. Crimean-Congo hemorrhagic fever virus
2. Ebola hemorrhagic fever viruses
3. Cercopithecine herpes virus 1 (Herpes B virus)
4. Lassa hemorrhagic fever virus
5. Marburg hemorrhagic fever virus
6. Monkeypox virus
7. South American hemorrhagic fever viruses (Junin, Machupo, Sabia, Flexal, Guanarito)
8. Tick-borne encephalitis complex (flavi) viruses (Central European, Far Eastern [Russian Spring and Summer, Kyasanur Forest, Omsk Hemmoraghic Fever])
9. Variola major (Smallpox) and Variola minor (Alastrim) viruses
10. Eastern Equine encephalitis virus
11. Nipah and Hendra Complex viruses
12. Rift Valley hemorrhagic fever virus
13. Venezuelan Equine encephalitis virus

Bacteria

1. Rickettsia prowazekii (Typhus)
2. Rickettsia rickettsii (Spotted Fever)
3. Yersinia pestis (Plague)
4. Bacillus anthracis (Anthrax)
5. Brucella abortus (Brucellosis)
6. Brucella melitensis
7. Brucella suis
8. Burkholderia (Pseudomonas) mallei (Glanders)
9. Burkholderia (Pseudomonas) pseudomallei (Melioidosis)
10. Clostridium botulinum (Botulism)
11. Coxiella burnetti (Q Fever)
12. Francisella tularensis (Tularemia)

Fungi

1. Coccidioides posadasii
2. Coccidioides immitis (Coccidioidomycosis)

Toxins

1. Abrin
2. Conotoxins
3. Diacetoxyscirpenol
4. Ricin
5. Saxitoxin
6. Tetrodotoxin
7. Shiga-like ribosome inactivating proteins
8. Botulinum neurotoxins
9. Clostridium perfringens epsilon toxin
10. Shigatoxin
11. Staphylococcal
12. T-2 toxin

Genetic Elements, Recombinant Nucleic Acids, and Recombinant Organisms

1. Viral nucleic acids that can encode infectious and/or replication competent forms of any of the select agent viruses.
2. Nucleic acids that encode for the functional forms of any of the select agent toxins.
3. Viruses, bacteria, fungi and toxins that have been genetically modified.

Exclusions

1. Select agents in their naturally occurring environment
2. Non-viable organisms or non-functional toxins
3. Vaccine strain of Junin virus (Candid #1)
4. Abrin (<100 mg)
5. Conotoxins (<100 mg)
6. Diacetoxyscirpenol (<1000 mg)
7. Ricin (<100 mg)
8. Saxitoxin (<100 mg)
9. Shiga-like ribosome inactivating proteins (<100 mg)
10. Tetrodotoxin (<100 mg)

¹ Reference: Title 42, Code of Federal Regulations, Part 73, December 13, 2002

U.S. DEPARTMENT OF AGRICULTURE (USDA) BIOLOGICAL AND ANIMAL AGENTS¹

Biological Agents and Toxins

1. Bacillus anthracis (Anthrax)
2. Botulinum neurotoxins
3. Botulinum neurotoxin producing species of Clostridium
4. Brucella abortus (Brucellosis)
5. Brucella melitensis
6. Brucella suis
7. Burkholderia mallei
8. Burkholderia pseudomallei
9. Clostridium botulinum
10. Clostridium perfringens epsilon toxin
11. Coccidioides immitis
12. Coxiella burnetti
13. Eastern Equine encephalitis virus
14. Francisella tularensis (Tularemia)
15. Hendra virus
16. Nipah virus
17. Rift Valley fever virus
18. Shigatoxin
19. Staphylococcal enterotoxins
20. T-2 toxin
21. Venezuelan equine encephalitis virus

Animal Agents and Toxins

1. African horse sickness virus
2. African swine fever virus
3. Akabane virus
4. Avian influenza virus (highly pathogenic)
5. Blue tongue virus (exotic)
6. Bovine spongiform encephalopathy agent
7. Camel pox virus
8. Classical swine fever virus
9. Cowdria ruminantium (heartwater)
10. Foot and mouth disease virus
11. Goat pox virus
12. Japanese encephalitis virus
13. Lumpy skin disease virus
14. Malignant catarrhal fever virus (exotic)
15. Menangle virus
16. Micoplasma capricolum/M. F38/M. mycoides capri (contagious caprine pleuropneumonia)
17. Micoplasma mycoides mycoides (contagious bovine pleuropneumonia)
18. Newcastle Disease Virus (VVND)
19. Peste de petits ruminants virus
20. Rinderpest virus
21. Sheep pox virus
22. Swine vesicular disease virus
23. Vesicular stomatitis virus (exotic)

Genetic Elements, Recombinant Nucleic Acids, and Recombinant Organisms

1. Viral nucleic acids that can encode infectious and/or replication competent forms of any of the select agent viruses.
2. Nucleic acids that encode for the functional forms of any of the select agent toxins.
3. Viruses, bacteria, fungi and toxins that have been genetically modified.

Exclusions

1. Agents in their naturally occurring environment
2. Non-viable organisms or non-functional toxins
3. Attenuated strains (upon approval of the USDA)

¹References: Title 7, Code of Federal Regulations, Part 331, December 13, 2002
Title 9, Code of Federal Regulations, Part 121, December 13, 2002

Chemicals Requiring Skin Protection

The following chemicals have been identified by the Occupational Safety and Health Administration (OSHA)¹ and/or the American Conference of Governmental Industrial Hygienists (ACGIH)² as chemicals that require skin protection or the use of other methods to prevent or reduce skin exposure. **Many chemicals not listed here also require the use of gloves** because of other hazardous characteristics but these chemicals present a significant degree of toxicity by skin contact.

Always refer to the glove manufacturers glove selection guides when choosing gloves for use with any chemical. Chemicals that are not listed may not have been tested. Some chemicals may not have an acceptable glove material based on the permeation and degradation tests. In this case, engineering controls, work practice controls or other methods must be used to prevent or reduce skin exposure to these chemicals.

Manufacturer's glove selection guides are available in the Chemistry and Biology Stockrooms and also on the internet directly from the manufacturer's websites or through the EH&S website (www.ehs.indiana.edu). Additional references³ are also available that provide guidance for selecting glove materials or contact EH&S at 855-6311 for more information.

Chemical	CAS Number	Reference	
		OSHA ¹	ACGIH ²
Acetone cyanohydrin	75-86-5		X
Acetonitrile	75-05-8		X
Acrolein	107-02-8		X
Acrylamide	79-06-1	X	X
Acrylic acid	79-10-7		X
Acrylonitrile	107-13-1		X
Adiponitrile	111-69-3		X
Aldrin	309-00-2	X	X
Allyl alcohol	107-18-6	X	X
4-Aminodiphenyl	92-67-1		X
Ammonium perfluorooctanoate	3825-26-1		X
Aniline	62-53-3	X	X
(<i>o</i> - & <i>p</i> -) Anisidine	90-04-0/104-94-9	X	X
Azinphos-methyl	86-50-0	X	X
Benzene	71-43-2		X
Benzidine	92-87-5		X
Benzotrithloride	98-07-7		X
Bromoform	75-25-2	X	X
2-Butoxyethanol (EGBE)	111-76-2	X	
<i>n</i> - Butylamine	109-73-9	X	X
<i>tert</i> -Butyl chromate (as CrO ₃)	1189-85-1	X	X
<i>o</i> -sec-Butylphenol	89-72-5		X
Captafol	2425-06-1		X
Carbon disulfide	75-15-0		X
Carbon tetrachloride	56-23-5		X
Catechol	120-80-9		X
Chlordane	57-74-9	X	X
Chlorinated camphene	8001-35-2	X	X
Chloroacetone	78-95-5		X
Chloroacetyl chloride	79-04-9		X
<i>o</i> -Chlorobenzylidene malononitrile	2698-41-1		X
Chlorodiphenyl	53469-21-9/11097-69-1		X
β -Chloroprene	126-99-8	X	
1-Chloro-2-propanol	127-00-4		X
2-Chloro-1-propanol	78-89-7		X
2-Chloropropionic acid	598-78-7		X
Chloropyrifos	2921-88-2		X
<i>o</i> , <i>m</i> , & <i>p</i> Cresol	1319-77-3; 95-48-7; 108-39-4; 106-44-5	X	X
Crotonaldehyde	4170-30-3		X
Cumene	98-82-8	X	
Cyanide salts	592-01-8; 151-50-8; 143-33-9		X
Cyclohexanol	108-93-0		X

Chemicals Requiring Skin Protection (continued)

Chemical	CAS Number	Reference	
		OSHA ⁴	ACGIH ⁵
Cyclohexanone	108-94-1		X
Cyclonite	121-82-4		X
Decaborane	11702-41-9	X	X
Demeton	8065-48-3		X
Demeton-S-methyl (Systox)	919-86-8	X	X
Diazinon	333-41-5		X
2-N-Dibutylaminoethanol	102-81-8		X
Dibutyl phenyl phosphate	2528-36-1		X
3,3'-Dichlorobenzidine	91-94-1		X
1,4-Dichloro-2-butene	764-41-0		X
Dichlorodiphenyltri-chloroethane (DDT)	50-29-3	X	
Dichloroethyl ether	111-44-4	X	X
1,3-Dichloropropene	542-75-6		X
Dichlorvos (DDVP)	62-73-7	X	X
Dicrotophos	141-66-2		X
Dieldrin	60-57-1	X	X
Diesel fuel	68334-30-5; 68476-30-2; 68476-31-3; 68476-34-6; 77650-28-3		X
Diethanolamine	111-42-2		X
Diethylamine	109-89-7		X
2-Diethylaminoethanol	100-37-8	X	X
Diethylene triamine	111-40-0		X
Diisopropylamine	108-18-9	X	X
Dimethyl acetamide	127-19-5	X	X
bis (2-Dimethylaminoethyl) ether	3033-62-3		X
Dimethylaniline	121-69-7	X	X
Dimethylformamide	68-12-2	X	X
1,1-Dimethylhydrazine	57-14-7	X	X
Dimethyl sulfate	77-78-1	X	X
(<i>o</i> -, <i>m</i> -, & <i>p</i> -) Dinitrobenzene	528-29-0; 99-65-0; 100-25-4	X	X
Dinitro- <i>o</i> -cresol	534-52-1	X	X
Dinitrotoluene	25321-14-6	X	X
1,4-Dioxane	123-91-1	X	X
Dioxathion	78-34-2		X
Dipropylene glycol methyl ether	34590-94-8	X	
Diquat	2764-72-9		X
Disulfoton	298-04-4		X
Endosulfan	115-29-7	X	X
Endrin	72-20-8	X	X
Epichlorohydrin	106-89-8	X	X
EPN	2104-64-5	X	X
Ethion	563-12-2		X
2-Ethoxyethanol (Cellosolve)	110-80-5	X	X
2-Ethoxyethyl acetate (Cellosolve acetate)	111-15-9	X	X
Ethyl acrylate	140-88-5	X	
Ethylamine	75-04-7		X
Ethyl bromide	74-96-4		X
Ethyl chloride	75-00-3		X
Ethylene chlorohydrin	107-07-3	X	X
Ethylenediamine	107-15-3		X
Ethylene dibromide	106-93-4		X
Ethylene glycol dinitrate	628-96-6	X	X
Ethylenimine	151-56-4		X
N-Ethylmorpholine	100-74-3	X	X
Fenamiphos	22224-92-6		X
Fenthion	55-38-9		X
Fonofos	944-22-9		X
Formaldehyde	50-00-0	X	
Formamide	75-12-7		X
Furfural	98-01-1	X	X
Furfuryl alcohol	98-00-0		X
Heptachlor & heptachlor epoxide	76-44-8; 1024-57-3	X	X
Hexachlorobenzene	118-74-1		X
Hexachlorobutadiene	87-68-3		X

Chemicals Requiring Skin Protection (continued)

Chemical	CAS Number	Reference	
		OSHA ⁴	ACGIH ⁵
Hexachloroethane	67-72-1	X	X
Hexachloronaphthalene	1335-87-1	X	X
Hexafluoroacetone	684-16-2		X
Hexamethylphosphoramide	680-31-9		X
<i>n</i> -Hexane	110-54-3		X
Hydrazine	302-01-2		X
Hydrogen cyanide	74-90-8	X	X
2-Hydroxypropyl acrylate	999-61-1		X
Isooctyl alcohol	26952-21-6		X
2-Isopropoxyethanol	109-59-1		X
<i>N</i> -Isopropylaniline	768-52-5		X
Latex, natural rubber latex as total proteins	9006-04-6		X
Lindane	58-89-9	X	X
Malathion	121-75-5	X	X
Manganese cyclopentadienyl tricarbonyl	12079-65-1		X
Mercury (Inorganic)	7439-97-6		X
Mercury (Organic):	7439-97-6		X
Methanol	67-56-1		X
2-Methoxyethanol; (Methyl cellosolve)	109-86-4	X	X
2-Methoxyethyl acetate (Methyl cellosolve acetate)	110-49-6	X	X
bis-(2-Methoxypropyl) ether (DPGME)	34590-94-8		X
Methyl acrylate	96-33-3	X	X
Methylacrylonitrile	126-98-7		X
<i>N</i> -Methyl aniline	100-61-8		X
Methyl bromide	74-83-9	X	X
Methyl <i>n</i> -butyl ketone	591-78-6		X
Methyl chloride	74-87-3		X
<i>o</i> -Methylcyclohexanone	583-60-8	X	X
2-Methylcyclopentadienyl manganese tricarbonyl	12108-13-3		X
Methyl demeton	8022-00-2		X
4,4'-Methylene bis(2-chloroaniline)	101-14-4		X
4-4'-Methylene dianiline	1071-77-9		X
Methyl hydrazine	60-34-4	X	X
Methyl iodide	74-88-4	X	X
Methyl isobutyl carbinol	108-11-2	X	X
Methyl isocyanate	624-83-9	X	X
Methyl parathion	298-00-0		X
Methyl vinyl ketone	78-94-4		X
Mevinphos (Phosdrin)	7786-34-7		X
Monocrotophos	6923-22-4		X
Monomethyl aniline	100-61-8	X	
Morpholine	110-91-8	X	X
Naled	300-76-5		X
Naphthalene	91-20-3		X
Nicotine	54-11-5	X	X
<i>p</i> -Nitroaniline	100-01-6	X	X
Nitrobenzene	98-95-3	X	X
<i>p</i> -Nitrochlorobenzene	100-00-5	X	X
4-Nitrodiphenyl	92-93-3		X
Nitroglycerin	55-63-0	X	X
<i>N</i> -Nitrosodimethylamine	62-75-9		X
(<i>o</i> -, <i>m</i> -, & <i>p</i> -) Nitrotoluene	88-72-2; 99-08-1; 99-99-0	X	X
Octachloronaphthalene	2234-13-1	X	X
Paraquat	4685-14-7	X	
Parathion	56-38-2	X	X
Pentachloronaphthalene	1321-64-8	X	X
Pentachlorophenol	87-86-5	X	X
Phenol	108-95-2	X	X
Phenothiazine	92-84-2		X
Phenyl glycidyl ether	122-60-1		X
<i>p</i> -Phenylene diamine	106-50-3	X	
Phenyldiazine	100-63-0	X	X
Phenyl mercaptan	108-98-5		X
Phorate	298-02-2		X

Chemicals Requiring Skin Protection (continued)

Chemical	CAS Number	Reference	
		OSHA ⁴	ACGIH ⁵
Phosdrin (Mevinphos)	7786-34-7	X	
Picric acid (2,4,6-trinitrophenol)	88-89-1	X	
<i>n</i> -Propanol (<i>n</i> -propyl alcohol)	71-23-8		X
Propargyl alcohol	107-19-7		X
Propylene glycol dinitrate	6423-43-4		X
Propylenimine	75-55-8	X	X
Sodium azide	26628-22-8		
Sodium fluoroacetate	62-74-8	X	X
Sulfotep (TEDP)	3689-24-5	X	X
Terbufos	13071-79-9		X
1,1,2,2-Tetrachloroethane	79-34-5	X	X
Tetrachloronaphthalene	1335-88-2	X	
Tetraethyl lead	78-00-2	X	X
Tetraethyl pyrophosphate (TEPP)	107-49-3	X	X
Tetramethyl lead	75-74-1	X	X
Tetramethyl succinonitrile	3333-52-6	X	X
Tetryl (2,4,6-Trinitrophenylmethylnitramine)	479-45-8	X	
Thallium	7440-28-0	X	X
Thioglycolic acid	68-11-1		X
Tin (organic compounds)	7440-31-5		X
<i>o</i> -Tolidine	119-93-7	X	X
Toluene	108-88-3		X
(<i>o</i> -, <i>m</i> -, & <i>p</i> -) Toluidine	95-53-4; 108-44-1; 106-49-0		X
1,1,2-Trichloroethane	79-00-5	X	X
Trichloronaphthalene	1321-65-9	X	X
1,2,3 Trichloropropane	96-18-4		X
Triethylamine	121-44-8		X
2,4,6-Trinitrotoluene (TNT)	118-96-7	X	X
Triorthocresyl phosphate	78-30-8		X
Vinyl cyclohexene dioxide	106-87-6		X
<i>m</i> -Xylene α,α' -diamine	1477-55-0		X
Xylidine	1300-73-8	X	

Notes: 1. Title 29, Code of Federal Regulations, Part 1910.1000 (29 CFR Part 1910.1000), Air Contaminants, Table Z-1, Limits for Air Contaminants.

2. American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, 2004.

3. Refer to manufacturer's permeation and degradation charts for glove selection. Glove thicknesses vary and will provide different levels of protection. Not all chemicals have been tested for glove type. Contact EH&S if glove type is not listed for a particular chemical. The following references provide additional information regarding glove materials and chemical resistance.

a. McConville, Francis X., The Pilot Plant Real Book, 2002, pg. 9-13, Glove Selection Guide.

b. Furr, A. Kieth, CRC Handbook of Laboratory Safety, 5th Ed., 2000, Table 6.2, Resistant Properties of Selected Materials by Class, pg 742-743.

4. Skin Designation (OSHA): Skin exposure to substances listed by OSHA with "Skin Designation" must be reduced or prevented by the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls, or work practices.

5. Skin Notation (ACGIH): The ACGIH "Skin Notation" refers to the potential for significant contribution to the overall exposure by the cutaneous route, including mucous membranes and the eyes, either by contact with vapors or, of probable greater significance, by direct skin contact with the substance. Vehicles present in mixtures can also significantly enhance potential skin absorption. It should be noted that while some materials are capable of causing irritation, dermatitis, and sensitization in workers, these properties are not considered relevant when assigning the ACGIH skin notation. The development of a dermatological condition, however, can significantly affect the potential for dermal absorption. Use of the skin designation is intended to alert the reader that air sampling alone is insufficient to accurately quantify exposure and that measures to prevent significant cutaneous absorption may be required.