Appendix D: Particularly Hazardous Substances

The U.S. Occupational Safety and Health Administration's (OSHA) standard for Occupational Expoisures to Hazardous Chemicals in Laboratories (see Appendix B for more details) requires that your laboratory's Chemical Hygiene Plan include provisions for additional employee protection for work with particularly hazardous substances. Particularly hazardous substances include select carcinogens, reproductive toxins and substances that have a high degree of acute toxicity. These substances are described more fully in this appendix.

SELECT CARCINOGENS

Substances regulated as select carcinogens by OSHA include:

- compounds regulated by Title 29, Code of Federal Regulations, Part 1910, Subpart Z - Toxic and Hazardous Substances[1]
- compounds considered to be "Known Carcinogens" by the National Toxicology Program,(NTP)[2]
- Compounds designated as carcinogens and suspect carcinogens by the International Agency for Research on Cancer, (IARC).[3]

Those compounds included in the IARC lists are shown with their IARC Group; those from Subpart Z and the NTP lists are shown with the appropriate footnote. This list does not include industrial processes that have been identified to cause cancer.

Substance	**IARC Group**[4]
A-a-C(2-Amino-9*H*-pyrido[2,3,*b*]indole)	2B
Acetaldehyde	2B
Acetamide	2B
2-Acetylaminofluorene[1]	--
Acrylamide	2B
Acrylonitrile[1]	2A
Adriamycin	2A
AF-2[2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide]	2B
Aflatoxins	1
para-Aminoazobenzene	2B
ortho-Aminoazotoluene	2B
4-Aminobiphenyl[1,2]	1
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole	2B
Amitrole	2B
Analgesic mixtures containing phenacetin[2]	1
Androgenic steroids	2A
ortho-Anisidine	2B
Aramite™	2B
Arsenic and arsenic compounds[1,2]	1

Substance	IARC Group[4]
Asbestos[1,2]	1
Auramine, technical-grade	2B
Azaserine	2B
Azathioprine[2]	1
Benzene[1,2]	1
Benzidine[1,2]	1
Benzidine-based dyes	2A
Benzo[*a*]pyrene	2A
Benzo[*b*]fluoranthene	2B
Benzo[*f*]fluoranthene	2B
Benzo[*k*]fluoranthene	2B
Benzyl violet 4B	2B
Beryllium compounds	2A
Betel quid with tobacco	1
Bis(chloroethylnaphthyl)amine	1
Bis(chloroethyl) nitrosourea (BCNU)	2A
Bis(chloromethyl) ether[1,2]	1
Bitumens, extracts of steam-refined & air-refined	2B
Bleomycins Bracken fern: Toxic Component is shikimic acid	2B
1,3-Butadiene	2B
1,4-Butanediol dimethanesulfonate ("Myleran")	1
Butylated hydroxyanisole (BHA)	2B
β-Butyrolactone	2B
Cadmium compounds	2A
Carbon-black extracts	2B
Carbon tetrachloride	2B
Carrageenan, degraded	2B
Chlorambucil[2]	1
Chloramphenicol	2B
Chlordecone ("Kepone")	2B
a-Chlorinated toluenes	2B
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)	2A
1-(2-Chloroethyl)-3-(methylcyclohexyl)-1-nitrosourea (Methyl-CCNU)	1
Chloroform	2B
Chlorophenols	2B
Chlorophenoxy herbicides	2B
4-Chloro-*ortho*-phenylenediamine	2B
para-Chloro-*ortho*-toluidine	2B
Chromium (VI) compounds[2]	1
Cisplatin	2A
Citrus Red No. 2	2B
Coal tar pitches[1]	1
Coal tars[1]	1
Cotton dusts[1]	-

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Substance	IARC Group[4]
Creosotes	2A
para-Cresidine	2B
Cycasin	2B
Cyclophosphamide[2]	1
Dacarbazine	2B
Daunomycin	2B
DDT	2B
N,N'-Diacetylbenzidine	2B
2,4-Diaminoanisole	2B
4,4'-Diaminodiphenyl ether	2B
2,4-Diaminotoluene	2B
Dibenz[*a,h*]acridine	2B
Dibenz[*a,f*]acridine	2B
7H-Dibenzo[*c,g*]carbazole	2B
Dibenz[*a,h*]anthracene	2A
Dibenzo[*a,e*]pyrene	2B
Dibenzo[*a,h*]pyrene	2B
Dibenzo[*a,i*]pyrene	2B
Dibenzo[*a,l*]pyrene	2B
1,2-Dibromo-3-chloropropane[1]	2B
para-Dichlorobenzene	2B
3,3[1]-Dichlorobenzidine[1]	2B
3,3'-Dichloro-4,4'-diaminodiphenyl ether	2B
1,2-Dichloroethane	2B
Dichloromethane	2B
1,3-Dichloropropene (technical-grade)	2B
Diepoxybutane	2B
Di(2-ethylhexyl)phthalate	2B
1,2-Diethylhydrazine	2B
Diethylstilbestrol[2]	1
Diethyl sulphate	2A
Diglycidyl resorcinol ether	2B
Dihydrosafrole	2B
3,3'-Dimethoxybenzidine (*ortho*-Dianisidine)	2B
para-Dimethylaminoazobenzene[1]	2B
trans-2[(Dimethylamino)methylimino]-5-(2-(5-nitro-2-furyl)vinyl-1,3,4-oxadiazole	2B
3,3'-Dimethylbenzidine (*ortho*-Tolidine)	2B
1,1-Dimethylhydrazine	2B
1,2-Dimethylhydrazine	2B
Dimethylcarbamoyl chloride	2A
Dimethyl sulphate	2A
1,4-Dioxane	2B
Epichlorohydrin	2A
Erionite	1
Ethyl acrylate	2B

Substance	IARC Group[4]
Ethylene dibromide	2A
Ethyleneimine[1](aziridine)	--
Ethylene oxide[1]	2A
Ethylene thiourea	2B
Ethyl methanesulphonate	2B
N-Ethyl-*N*-nitrosourea	2A
Formaldehyde[1]	2A
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	2B
Glu-P-1 (2-Amino-6-methyldipyrido[1,2-α:3',2'-*d*]imidazole	2B
Glu-P-2 (2-Aminodipyrido[1,2-α:3',2'-*d*]imidazole)	2B
Glycidaldehyde	2B
Griseofulvin	2B
Hexachlorobenzene	2B
Hexachlorocyclohexanes	2B
Hexamethylphosphoramide	2B
Hydrazine	2B
Indeno[1,2,3-*cd*]pyrene	2B
IQ (2-Amino-3-methylimidazo[4,5-*f*]quinoline)	2B
Iron-dextran complex	2B
Iron and steel founding	1
Isopropyl alcohol manufacture, strong-acid process	1
Lasiocarpine	2B
Lead compounds (inorganic)[1]	2B
Magenta, manufacture of	1
MeA- α -C(2-Amino-3-methyl-9H-pyrido[2,3-*b*]indole)	2B
Methoxyprogesterone acetate	2B
Melphalan[2]	1
Merphalan	2B
5-Methoxypsoralen	2A
8-Methoxypsoralen & UV light[2]	1
2-Methylaziridine	2B
Methylazoxymethanol and its acetate	2B
Methyl chloromethyl ether[1]	1
5-Methylchrysene	2B
4,4'-Methylene bis(2-chloroaniline) (MOCA)	2A
4,4'-Methylene bis(2-methylaniline)	2B
4,4'-Methylenedianiline	2B
Methyl methanesulphonate	2B
2-Methyl-1-nitroanthraquinone	2B
N-Methyl-*N*-nitrosourethane	2B
N-Methyl-*N'*-nitro-*N*-nitrosoguanidine (MNNG)	2A
N-Methyl-*N*-nitrosourea	2A
Methylthiouracil	2B
Metronidazole	2B
Mineral oils	1

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Substance	IARC Group[4]
Mirex	2B
Mitomycin C	2B
Monocrotaline	2B
5-(Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino]-2-oxazolinone	2B
Mustard gas[2]	1
Nafenopin	2B
1-Naphthylamine[1]	3
2-Naphthylamine[1,2]	1
Nickel compounds	1
Niridazole	2b
5-Nitroacenaphthene	2B
4-Nitrobiphenyl[1]	3
Nitrofen (technical-grade)	2B
1-[(5-Nitrofurfurylidene)amino]-2-imidazolidonone	2B
N-[4-(5-Nitro-2-furyl)-2-thiazolyl]acetamide	2B
Nitrogen mustard	2A
Nitrogen mustard *N*-oxide	2B
2-Nitropropane	2B
N-Nitrosodiethylamine	2A
N-Nitrosodimethylamine[1]	2A
N-Nitrosodi-*n*-butylamine	2B
N-Nitrosodi-ethanolamine	2B
N-Nitrosodi-*n*-propylamine	2B
3-(*N*-Nitrosomethylamino)propionitrile	2B
4-(*N*-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	2B
N-Nitrosomethylethylamine	2B
N-Nitrosomethylvinylamine	2B
N-Nitrosomorpholine	2B
N-Nitrosonornicotine	2B
N-Nitrosopiperidine	2B
N-Nitrosopyrrolidine	2B
N-Nitrososarcosine	2B
Oestrogens, non-steroidal	1
Oestrogens, steroidal	1
Oil Orange SS	2B
Oral contraceptives, combined	1
Oral contraceptives, sequential	1
Panfuran S (containing dihydroxymethylfuratrizine)	2B
Phenacetin & analgesics	2A
Phenazopyridine hydrochloride	2B
Phenobarbital	2B
Phenoxybenzamine hydrochloride	2B
Phenytoin	2B
Polybrominated biphenyls	2B
Polychlorinated biphenyls	2A

Substance	IARC Group[4]
Ponceau MX	2B
Ponceau 3R	2B
Potassium bromate	2B
Procarbazine hydrochloride	2A
Progestins	2B
1,3-Propane sultone	2B
β-Propiolactone[1]	2B
Propylene oxide	2A
Propylthiouracil	2B
Saccharin	2B
Safrole	2B
Shale oils	1
Silica, crystalline	2A
Sodium *ortho*-phenylphenate	2B
Soots	1
Sterigmatocystin	2B
Streptozotocin	2B
Styrene	2B
Styrene oxide	2A
Sulfallate	2B
Talc containing asbestiform fibers	1
2,3,7,8-Tetrachlorodibenzo-*para*-dioxin (TCDD)	2B
Tetrachloroethylene	2B
Thioacetamide	2B
4,4'-Thiodianiline	2B
Thiourea	2B
Thorium dioxide[2]	--
Tobacco products, smokeless	1
Tobacco smoke	1
Toluene diisocyanates	2B
ortho-Toluidine	2B
Toxaphene (polychlorinated camphenes)	2B
Treosulphan	1
Tris(1-aziridinyl)phosphine sulphide (Thiotepa)	2A
Tris(2,3-dibromopropyl) phosphate	2A
Trp-P-1 (3-Amino-1,4-dimethyl-5H-pyrido[4,3-*b*]indole)	2B
Trp-P-2 (3-Amino-1-methyl-5H-pyrido[4,3-*b*]indole)	2B
Trypan blue	2B
Uracil mustard	2B
Urethane	2B
Vinyl bromide	2A
Vinyl chloride[1,2]	1

References

[1] Occupational Safety and Health Administration Standards, Title 29, Code of Federal Regulations, Part 1910, Subpart Z - Toxic and Hazardous Substances as of 19 January 1989.

[2] *Fifth Annual Report on Carcinogens*, Substances "Known to be Carcinogenic," National Toxicology Program, Report NTP 89-239, 1989. (latest edition)

[3] *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Overall Evaluations of Carcinogenicity, Supplement 7,* International Agency for Research on Cancer (IARC), Lyons, France, 1987.

[4] IARC Carcinogen Groups: 1 = known carcinogenicity; 2A = probable; 2B = possible; 3 = not classifiable due to insufficient or conflicting data.

REPRODUCTIVE TOXINS

No recognized list of known human reproductive toxins exists. OSHA only specifically regulates four agents based on their reproductive toxicity: dibromochloropropane (DBCP), lead, ionizing radiation and ethylene oxide. The following list of other potential reproductive hazards is a combination of lists from the National Institute of Occupational Safety and Health, the State of California, and the U.S. Air Force. This list is by no means comprehensive, so handle all chemicals with caution.

Metals	Pesticides	Solvents
Lead	Carbaryl	Benzene
Cadmium	Chlordane	Chloroform
Mercury	Kepone (Chlordecone)	Hexane
Arsenic	Lindane	Trichloroethylene
Lithium	DDT	Toluene
Antimony	Methoxychlor	Xylene
Boron	Aldrin	Carbon Disulfide
Manganese	Dieldrin	Glycidyl Ethers
Selenium	Mirex	Methylene Chloride
	Hexachlorobenzene	Perchloroethylene

Glycol Ethers

Ethylene Glycol Monomethyl Ether (also called Methyl Cellosolve or Methoxyethanol)
Ethylene Glycol Monoethyl Ether (also called Ethyl Cellosolve or Ethoxyethanol)
Other Glycol Ethers (many varieties)

Other Organic Chemicals

Chloroprene
DBCP (Dibromochloropropane)
Epichlorohydrin
Ethylene Dibromide
Ethylene Oxide
PCB's (Polychlorinated Biphenyls)
Vinyl Chloride
1,3-Butadiene
Dinitrotoluene
Ethylene Thiourea
Dimethyl Formamide
Aminopterin
Chlorcyclizine Hydrochloride
Chlorambucil
Cycloheximide
Cyclophosphamide
Cyhexatin
Cytarabine
Diethylstilbestrol
Dinoseb
Diphenylhydantoin
Etretinate
Fluorouracil
Isoretinoin
Mechlorethamine
Methotrexate
Methyl Mercury
Thalidomide
Valproate
Warfarin
Tobacco Smoke
Ethyl alcohol in alcoholic beverages

SUBSTANCES WITH A HIGH DEGREE OF ACUTE TOXICITY

The OSHA Laboratory Standard does not list or define substances with a high degree of acute toxicity. The rule's preamble (55 FR 3320) describes substances with a high degree of acute toxicity as those substances that are "fatal or cause damage to target organs as a result of a single exposure or exposures of short duration." Hydrogen cyanide, hydrogen sulfide and nitrogen dioxide are given as examples.

To determine if you use a substance with a high degree of acute toxicity that may require additional employee protection under the OSHA Laboratory Standard, consult your Material Safety Data Sheets, the *Registry of Toxic Effects of Chemical Substances* (RTECS), the Safety Department or the UW Hospital and Clinics Poison Control Center. Part B of the *Guide* discusses the criteria for classifying acutely toxic chemicals.