Standard Operating Procedures

Waste Handling & Disposal

Handling and disposal of waste generated during laboratory experiments must be conducted in accordance with University policies. For a full description of waste handling and disposal procedures, see the University Chemical Hygiene Plan on the Risk Management website.

Chemical Hygiene Plan: http://riskmanagement.nd.edu/assets/13200/chp2010.pdf

An excerpt regarding Waste Handling & Disposal, including classification of various wastes and the appropriate "trash" or "sink" wastes vs. those needing special containers, is provided here.

CHEMICAL WASTE DISPOSAL

1.0 HAZARDOUS WASTE DISPOSAL AT THE UNIVERSITY OF NOTRE DAME

You can help ease the problem of chemical waste disposal. Please:

a. Order Only What You Need

Don't buy a kilogram of material when you plan to use only a few grams. The savings made by an economy size purchase, may be used up and exceeded in the disposal costs of the excess. Be sure to check your current stock before ordering chemicals. It may also be possible to borrow small amounts of chemicals from other labs. Please take the time to check.

b. Substitute Non-Hazardous Or Less Hazardous Materials For Hazardous Ones

For example, there are many nonhazardous substitutes for chromic acids. Also, dichloromethane is less toxic than carbon tetrachloride or chloroform and can be substituted satisfactorily in most cases.

c. Dispose of Nonhazardous Materials Yourself

Chemicals that can safely be disposed of in the normal trash or in the sanitary sewer system should not be given to RM&S or mixed with hazardous chemicals.

d.. Use Recycled Chemicals Whenever Possible

We have an ongoing program of redistributing your usable but unwanted chemicals. The RM&S Department has established criteria for deciding which chemicals are suitable for recycling. All recycled chemicals are in their original container and may still have their factory seals.

Periodically, RM&S distributes a list of recyclable chemicals in the Department newsletter, FlashPoint.

f. Treat Chemicals In Your Laboratory

When you order a chemical, you have the responsibility for its disposal. Don't give RM&S a chemical you can treat in your lab. Acids and bases should be neutralized and put into the sewer system. Procedures are given in this guide. Other treatments that you can carry out in you lab are metal precipitations and safe reductions of strong oxidizers. Please call RM&S for procedures for carrying out these and other chemical treatments.

g. Date Opening

Many chemicals have limited shelf life. After which they decompose, give off fumes, absorb water or CO2, or form peroxides. Watching the storage time can minimize disposal of "reactive" materials by disposing of them when they are stable. See below for a chart of chemicals not designed for long term storage.

1.1 What is Hazardous?

This section will help you identify hazardous chemicals. The Indiana Department of Environmental Management (IDEM) and the U.S. Environmental Protection Agency (EPA) considers chemical waste hazardous if it:

- exhibits certain hazardous characteristics (See 1.2.1, below), or

- is a listed hazardous chemical (Section 1.2.2, below).

Some chemicals are included in both Sections 1.2.1 and 1.2.2, because they fit the criteria of each section. Chemicals that you can dispose of in the normal trash or the sewer system, are listed in Sections 1.3 and 1.4. If a chemical isn't in these sections or you'd like more information, call RM&S.

1.1.1 Hazardous Characteristics

Chemicals which have the following four characteristics are considered to be

hazardous by the EPA:

a. IGNITABILITY

A liquid which has a flash point of less than 60 deg C is considered ignitable by the EPA. This includes almost all organic solvents. Some examples are:

Ethyl ether, Methanol, Ethanol, Acetone, Toluene, Benzene, Pentane, Hexane, Skelly B, Xylene, Formaldehyde, Heptane, Ethyl Acetate, Petroleum Ether

Instructions for the disposal of organic solvents are given in Section 1.6.

b. CORROSIVITY

An aqueous solution having a pH of less than or equal to 2, or greater than or equal to 12.5 is considered corrosive by the EPA. Instructions for the disposal of concentrated solutions of acids or bases are given in Section 1.5. Corrosive materials also include thionyl chloride, solid, sodium hydroxide and other nonaqueous acids or bases.

c. REACTIVITY

Chemicals that react violently with air or water are considered reactive by the EPA. An example is sodium metal. Reactive materials also include strong oxidizers, such as perchloric acids, and chemicals capable of detonation when subjected to an initiating source, such as old picric acid and phosphorous.

Solutions of cyanide or sulfide that could generate toxic gases are also classified as a reactive by EPA.

d. TCLP TOXICITY

TCLP is a laboratory test to determine leaching. Chemicals characterized as toxic by the EPA may leach into the groundwater if improperly managed. EP toxic wastes include concentrated toxic metal solutions and the following list of pesticides:

Endrin Lindane 2,4-D

Methoxychlor Toxaphene 2,4,5-TP Silvex

Any chemical with an LD50 less than 500 mg/kg or is a carcinogen, mutagen or, teratogen eg. Furadan Oral LD50 (human) 11 mg/kg or Osium tetraoxide Oral LD50 (rat) 14 mg/kg.

1.1.2 Other Hazardous Wastes

Aqueous Solutions of Toxic Metals

Special Precautions for Lead, Mercury and Silver

Lead, mercury and silver require special precautions for disposal. If you discharge any of these metals, their compounds or aqueous solutions of their compounds into the sewer system, make sure you meet these concentrations.

Lead 2.0 mg/l

Mercury 0.02 mg/l

Silver 0.4 mg/l

Lead, mercury and silver are especially important pollutants. Filtering and precipitation for some other type of collection must be routine procedure for your lab if you use them. Even when silver recovery units are being employed, we've found several instances of high discharges resulting from poor maintenance. For treatment procedures, testing or more information, please call us. RM&S will collect solutions and/or filtrated solids for disposal.

2. Solutions of Nonmetallic Pesticides

You should put solutions of nonmetallic pesticides in plastic or glass bottles for pickup by RM&S.

3. Free-Flowing Metallic Mercury

Package free-flowing mercury (broken thermometers, mercury from manometers, etc in tightly sealed containers. Label with a chemical discard tag and call RM&S for pickup.

4. Solutions of Cyanide or Sulfide

Solutions containing cyanide or sulfide compounds release toxic gases under acidic conditions. For safety, you should package these solutions separately from acids and give them to us.

1.2 Hazardous Chemicals

This section presents a list of chemicals which the EPAconsidered hazardous because of their carcinogenicity, mutagenicity, teratogenicity, or other toxicity. The list, which will be updated to keep up with current scientific information, is not meant to be complete and generally does not include substances which have hazardous characteristics, as defined previously. The omission of a chemical from this list does not mean it is not toxic or otherwise hazardous. Call RM&S if you want additional hazard information.

Disposal instructions for these chemicals are given in Sections depending on their date, classification, and physical form.

EPA HAZARDOUS CHEMICALS LIST

*Not Otherwise Specified; includes related species

Auramine

Azaserine (L-Serine, diazoacetate (ester))

Aziridine

Azirinopyrrola indole-4,7-dione

Barium and compunds, N.O.S.* Flammable solid & oxidizer ORMB

Barium Cyanide - Poison B

Benz(c) acridine (3,4-Benzacridine)

Benzenamine, 4-chloro-2-methylBenz(a) anthracene (1,2-Benzanthracene)

Benzene (Cyclohexatriene) (Benzol)

Benzenearsonic acid (Arsonic acid, phenyl-)

Benzene, dichloromethyl-(Benzal chloride)

Benzene, hexahydro- Flammable liquid

Benzene, (1-methylethyl) - Flammable liquid

Benzenesulfonic acid chloride (Benzenesulfonyl chloride)

Benzenethiol (Thiophenol)

Benzidine ((1,1'-Biphenyl)-4,4'diamine) -Poison B

Benzo (b) fluoranthene (2,3-Benzofluoranthene)

Benzo (j) fluoranthene (7,8-Benzofluoranthene)

Benzo (a) pyrene (3,4-Benzpyrene)

p-Benzoquinone (1,4-Cyclohexadienedione)

Benzotrichloride (Benzene, trichloromethyl-)

Benzyl chloride (Benzene, (chloromethyl-) Corrosive material

Beryllium and compounds, N.O.S* .-Poison B

Beryllium Dust

2,2'-Bioxirane (1,2:3,4-Diepoxybutane)

Bis (2-chloroethyl) ether (Ethane, 1,1'-oxybis (2-chloro)) bis (2-chloro-))

Bis (2-chloroethyl) ether (Ethane, 1,1'-oxybis (2-chloro-))

Bis (2-chloroisopropyl) ether (Propane, 2,2'-oxybis (2-chloro-))

Bis (chloromethyl) ether (Methane, oxybis (chloro-))

Bis (2-ethylhexyl) phthalate (1,2-Benzenedicarboxylic acid,

bis (2-ethyl-hexyl) ester)

Bromoacetone (2-Propanone, 1-bromo-)-Poison A

Bromomethane (Methyl bromide)-Toxic

4-Bromophenyl phenyl ether (Benzene, 1-bromo-4-phenoxy-)

Brucine (Strychnidin-10-one, 2,3-dimethoxy-)-Poison B

1-Butanol (n-Butyl alcohol)

2-Butanone peroxide (Methyl ethyl ketone peroxide)-Toxic

Butyl benzyl phthalate (1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester)

2-sec-Butyl-4,5-dinitrophenol (DNBP) (Phenol, 2,4-dinitro-6-(1-methylpropyl)-)

DDE (Ethylene, 1,1-dichloro-2,2-bis (4-chlorophenyl)-)

DDT (Dichlorodipehnyltrichloroethane)-ORMA

Diallate (S-2,3-Dichloroally)diisopropylthiocarbamate)

Dibenz (a,H) acridine (1,2,5,6-Dibenzacridine)

Dibenz (a,j) acridine (1,2,7,8-Dibenzanthracene)

7H-Dibenzo (c,g) carbazole (3,4,5,6-Dibenzcarbazole)

Dibenzo (a,e) pyrene (1,2,4,5-Dibenzpyrene)

Dibenzo (a,h) pyrene (1,2,5,6-Dibenzpyrene)

Dibenzo (a,i) pyrene (1,2,7,8-Dibenzpyrene)

1,2-Dibromo-3-chloropropane

1,2-Dibromoethane (Ethylene dibromide)

Dibromomethane (Methylene bromide)

Di-n-butyl phthalate (1,2-Benzenedicarboxylic acid, dibutyl ester)

o-Dichlorobenzene (Benzene, 1,2-dichloro-)

m-Dichlorobenzene (Benzene, 1,3-dichloro-)

p-Dichlorobenzene (Benzene, 1,4-dichloro-) ORM-A

Dichlorobenzene, N.O.S.* ORM-A

3,3'-Dichlorobenzidine

1,4-Dichloro-2-butene Flammable liquid, corrosive material

Dichlorodifluoromethane

1,1-Dichloroethane (Ethylidene dichloride) Toxic

1,2-Dichloroethane (Ethylene dichloride) Toxic

trans-1,2-Dichloroethene (1,2-Dichloroethylene)

Dichloroethylene, N.O.S.* (Ethene, dichloro-, N.O.S.*)

1,1-Dichloroethylene (Ethene, 1,1-dichloro-)

Dichloroethyl ether

Dichloromethane (Methylene chloride)-ORM A

2,4-Dichlorophenol

2,6-Dichlorophenol

2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters

Dichlorophenylarsine (Phenyl dichloroarsine)

Dichloropropane, N.O.S.*

1,2-Dichloropropane (propylene dichloride)

Dichloropropanol, N.O.S.*

Dichloropropene, N.O.S.*

1,3-Dichloropropene

Dieldrin - ORM A

Diethylarsine

N,N-Diethylhydrazine (Hyrazine,1,2-diethyl)

O,O-Diethyl S-methyl ester of phophorodithioic acid

O,O-Diethylphosphoric acid, O-p-nitrophenyl ester (Phosporic acid, diethyl

p-nitrophenyl ester)

Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)

O,O-Diethyl-O-2-pyrazinyl phosphorothioate

(phosphororthioic acid, O,O- diethyl-O-pyrazinyl ester)

Diethylstilbesterol

Dihydrosafrole (Benzene, 1,2-methylenedioxy-4-propyl-)

Diisoproplyfluorphosphate (DFP)

Dimethoate

3,3'-Dimethoxybenzidine

Dimethylamine (N-Methylmethanamine)

N,N-Dimethylaniline

7,12-Dimethylbenz(a)anthracene (1,2-Benzanthracene,. 7,12-dimethyl-)

3,3'-Dimethylbenzidine (o-Tolidine)Date:

alpha, alpha-Dimethylbenzylhydroperoxide

Dimethylcarbamoyl chloride

1,1-Dimethylhydrazine

1,2-Dimethylhydrazine

alpha, alpha-Dimethylphenethylamine (Ethanamine, 1,1-dimethyl-2-phenyl)

2,4-Dimethylphenol

Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)

Dimethyl sulfate (Sulfuric acid, dimethyl ester)

Dinitrobenzene, N.O.S.*

4,6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)

2,4-Dinitrophenol

2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)

2,6-Dinitrotoluene (Benzene, 1-methyl-2,6-dinitro-)

Di-n-octyl phthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)

1,4-Dioxane (1,4-Diethylene oxide)

Diphenylamine (Benzenamine, N-phenyl-)

1,2-Diphenylhydrazine

Dipropylamine

Di-n-propylnitrosamine (N-Nitroso-di-n-propylamine)

Disulfoton

2,4-Dithiobiuret (Thiomidodicarbonic diamide)

Endosulfan

Endothall

Endrin nd metabolites

Epineprine

Ethane, 1,1'-oxybis- (Ethyl Ether)

Ethidium Bromide

Ethyl acetate

Ethyl acrylate

Ethyl carbamate (Urethan) (Carbamic acid, ethyl ester)

Ethyl cyanide (Propanenitrile)

Ethylenebisdithiocarbamic acid, salts and esters

Ethyleneimine (Azirdine)

Ethylene oxide (Oxirane)

Ethylenethiourea (2-Imidazolidinethione)

Ethyl methacrylate (2-Propenoic acid, 2-methyl-, ethyl ester)

Ethyl methanesulfonate (Methanesulfonic acid, ethyl ester)

Famphur (Famophos)

Fluoranthene (Benzo (j,k) fluorene)

Flourine

2-Flouroacetamide

Flouroacetic acid, sodium salt

Formaldehyde (Methylene oxide)

Formic acid (Methanoic acid)

Furan (Furfuran)

2-Furancarboxaldehyde (Furfural)Date:

Furan, tetrahydroGlycidylaldehyde (1-Propanol,2,3,-epoxy)

Hamolethane, N.O.S.*

Heptachlor

Heptachlor epoxide (alpha, beta, and gamma isomers)

Hexachlorobenzene

Hexachlorobutadiene (1,3-Butadiene, 1,1,2,3,4,4-Hexachloro-)

Hexachlorocyclopentadiene (1,3-cyclopentadiene, 1,2,3,4,5,5-hexachloro-)

Hexachloroethane (Ethane, 1,1,1,2,2,2-hexachloro-)

Hexachlorophene (2,2'-Methylene (3,4,6-trichlorophenol))

Hexachloropropene (1-Propene, 1,1,2,3,3,3-hexachloro-)

Hexaethyl tetraphosphate (Tetraphophoric acid, hexaethyl ester)

Hydrazine (Diamine)

Hydrofluoric acid (Hydrogen fluoride)

Hydrogen cyanide (Hyrdocyanic acid)

Hydrogen sulfide (Sulfur hydride)

Hydroperoxide, 1-methyl-1-pheylethyl

Hydroxydimethylarsine oxide (Cacodylic acid)

Ineno (1,2,3-cd) pyrene (1,10- (1,2-phenylene) pyrene)

Indomethacin

Iodomethane (Methyl iodid)

Iron Dextran (Ferric dextran)

Isocyanic acid, methyl ester (Methyl isocyante)

Isobutyl alcohol (1-Propanol, 2-methyl-)

Isosafrole Benzene, 1,2-methylenedioxy-4-allyl-)

Keptone (Chlordecone)

Lasiocarpine

Lead and compounds, N.O.S.*

Lead acetate (Acetic acid, lead salt)

Lead subacetate (Lead, bis (acetato-O) tetrahydroxyti-)

Lindane (all isomers)

Maleic anhydride (2,5-Furandione)

Maleic hydrazide (1,2-Dihydro-3,6-pyridazinedione)

Malononitrile (Propanedinitrile)

Melphalan (Alanine, 3-(p-bis(2-chloroethyl) amino) phenyl-, L)

Mercury fulminate (Fulminic acid, mercury salt)

Mercury and compounds, N.O.S.*

Methacrylonitrile (2-Propenenitrile, 2-methyl-)

Methanamine, N-methyl

Methanethiol (Thiomethanol)

Methanol

Methapyrilene (Pyridien, 2-((2-dimethylamino)ethyl)-2-thenylamino-)

Metholmyl

Methoxychlor (Ethane, 1,1,1-trichloro-2,2-bis(p-methoxyphenyl)-)

2-Methylaziridine (1,2-Propylenimine)

1-Methylbutadiene

Methyl chlorocarbonate (Carbonochloridic acid, methyl ester)

3-Methylcholanthrene (Benz(j)aceanthrylene, 1,2-dihydro-3-methyl-)

4,4'-Methylenebis(2-chloroaniline) (Benzeneamine, 4,4'-methylenebis- (2-chloro-)

Methylethylketone (MEK) (2-Butanone)

Methyl hydrazine

2-Methyllactonitrile (Propanenitrile, 2-hydroxy-2-methyl-)

Methyl isobutyl ketone

Methyl methacrylate (2-Propenoic acid, 2-methyl-,methyl ester)

Methyl methanesulfonate (Methanesulfonic acid, methyl ester)

2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl)oxime (Propanal,

2-methyl-2-(methylthio-,o-((methylaminocarbonyl)oxime)

N-Methyl-N'-nitro-N'-nitrosoguanidine

Methyl parathion

4-Methyl-2-pentanone

Methylulthiouracil

Mitomycin-C

Mustard gas (Sulfide, bis(2-chloroethyl)-)

Naphthalene

1,4-Naphthoquinone (1,4-Napthalenedione)

1-Naphthylamine (alpha-Naphthylamine)

2-Naphthylamine (beta-Naphthylamine)

1-(1-Naphthyl)-2-thiourea (Thiourea, 1-naphthalenyl-)

Nickel and compounds, N.O.S.*

Nickel carbonyl (Nickel tetracarbonyl)

Nickel cyanide (Nickel (II) cyanide)

Nicotine and salts

Nitric oxide (Nitrogen (II) oxide)

p-Nitroaniline (Benzenamine, 4-nitro-)

Nitrogen dioxide (Nitrogen (IV) oxide)

Nitrogen mustard and hydrochloride salt (Ethanamine, 2-chloro-,N-(2-chloroethyl)-N-methyl-, and

hydrochloride salt)

Nitrogen mustard N-Oxide and hydrochloride salt (Ethanamine, 2-chloro-,

N-(2 chloroethyl)-N-methyl-, and hydrochloride salt)

Nitroglycerine (1,2,3-Propanetriol, trinitrate)

p-Nitrophenol (4-Nitrophenol) (Phenol, 4-nitro-) Nitrobenzene

2-Nitropropane

4-Nitroquinoline-1-oxide (quinoline, 4-nitro-1-oxide-)

Nitrosamine, N.O.S.*

N-Nitrosodi-n-butylamine (1-Buranamine, N-butyl-N-nitroso-)

N-Nitrosodiethyanolamine (Ethanol, 2,2'-(nitrosoimino)bis-)

N-Nitrosodiethylamine (Ethanamine, N-ethyl-n-nitroso-)

N-Nitrosodimethylamine (Dimethylnitrosamine)

N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)

N-Nitrosomethylethylamine (Ethanamine, N-methyl-N-nitroso-)

N-Nitroso-N-methylurea (Carbamide, N-methyl-N-nitroso-)

N-Nitroso-N-methylurethane (Carbamic acid, methylnitroso-, ethyl ester)

N-Nitrosomethylvinvylamine (ethenamine, N-methyl-N-nitroso-)

N-Nitrosomorpholine (Morpholine, N-nitroso-)

N-Nitrosonornicotine (Nornicotine, N-nitroso-)

N-Nitrosopiperidine (Pyridien, hexahydro-, N-nitroso-)

Nitrosopyrrolidine (Pyrrole, tetrahydro-, N-nitroso-)

N-Nitrososarcosine

5-Nitro-o-toluidine (Benzenamine, 2-methyl-5-nitro-)

Octamethylpyrophosphoramide (Diphosphoramide, octamethyl-)

Osmium tetraoxide

Paraldehyde

Parathion

Pentachlorobenzene

Pentachloroethane

Pentachloronitrobenzene (PCNB)

Pentachlorophenol

1,3-Pentadiene

Phenacetine (Acetamide, N-(4-ethoxyphenyl-)

Phenol, (Carbolic acid)

Phenol, 2,4-dinitroPhenol, 2,4,6,-trinitro-, ammonium salt

Phenylenediamine (Benenediamine)

Phenylmercury acetate (Mercury, (acetato)phenyl-)

N-Phenylthiourea

Phorate

Phosgene (Carbonyl chloride)

Phosphine (Hydrogen phosphine)

Phosphorouse sulfide

Phthalic acid esters, N.O.S.* (Benzene, 1,2-dicarboxylic acid, esters, N.O.S.*)

Phthalic achydride (1,2-Benzenedicarboxylic acid anhydride)

2-Picoline (Pyridien, 2-methyl-)

Polychlorinated biphenyl, N.O.S*

Potassium cyanide

Potassium silver cyanide (Argentate (1-), potassium dicyano-)

Pronamide (3.5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide)

Propane, 2-nitro-

1,3-Propane sultone (1,2-Oxathiolane, 2,2-dioxide)

2-Propenoic acid, ethyl ester

n-Propylamine (1-Propanamine)

Propyltiouracil

2-Propyn-1-ol (Propargyl alcohol)

Pyridine and salts

Reserpine

Resorcinol (1,2-Benzenediol)

Saccharin and salts

Safrole (Benzene, 4-allyl-1,2-methylenedioxy)

Selenious acid (Selenium dioxide)

Selenium and compounds

Selenium sulfide (Sulfur selenide)

Selenourea (Caramimidoselenoic acid)

Silver cyanide

Sodium azide

Sodium cyanide

Streptozotocin (D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)

Strontium sulfide

Strychnine and salts (strychnidin-10-one, and salts)

Sulfur phosphide

1,2,4,5-Tetrachlorobenzene

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Tetrachloroethane, N.O.S.*

1,1,1,2- Tetrachlorethane

1,1,2,2-Tetrachlotoethane

Tetrachloroethylene (Ethene, 1,1,2,2-tetrachloro-)

Tetrachloromethane (Carbon tetrachloride)

2,3,4,6-Tetrachlorophenol

Tetraehtyldithiopyrophosphate (Dithiopyrophosphoric acid, tetraethylester)

Tetraethyl lead (Plumbane, tetraethyl-)

Tetraethylpyrophosphate (pytophosphoric acid, tetraethyl ester)

Tetrahydrofuran

Tetranitromethane

Thallium and compounds, N.O.S.*

Thallic oxide (Thallium (III) oxide)

Thallium (I) acetate (Acetic acid, thallium (I) salt)

Thallium (I) carbonate (Carbonic acid dithallium (I) salt)

Thallium (I) chloride

Thallium (I) nitrate (Nitric acid, Thallium (I) salt)

Thallium selenite

Thallium (I) sulfate (Sulfuric acid, thallium (I) salt)

Thioacetamide (Ethanethioamide)

Thiofanox

Thiosemicarbazide (Hydrazinecarbothioamide)

Thiourea (Carbamide, thio-)

Thiram (Bis(dimethylthiocarbamoyl)disulfide)

Toluene (Benzene, methyl-)

o-Toluidine hydrochloride (Benzenamine, 2-methyl-,hydrochloride)

Tolylene diisocyanate (Benzene, 1,3-diisocyanatomethyl-)

Toxaphene (Camphen, octachloro-)

Tribromomethane (Bromoform)

1,2,4-Trichlorobenzene

1,1,1-Trichloroethane (Methyl chloroform)

1,1,2-Trichloroethane

Trichloroethene (Trichloroethylene)

Trichloromethanethiol

Trichloromonofluoromethane (Freon)

2,4,5-Trichlorophenol

2,4,6-Trichlorophenol

2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)

2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)

Trichloropropane, N.O.S.*

1,2,3-Trichloropropane

O,O,O-Triethyl phosphorothioate (Phosphorothioic acid, O,O,O-triethyl ester)

sym-Trinitrobenzene (Benzne, 1,3,5-trinitro-)

Tris(1-azidinyl)phosphine sulfide

Tris(2,3-dibromopropyl) phosphate(1-Propanol, 2,3-dibromo-,phosphate)

Trypan blue

Uracil mustard (Uracil 5-(bis(2-chloroethyl)amino)-)

Vanadic acid, ammonium salt (Ammonium vanadate)

Vanadium pentoxide (Vanadium (V) oxide)

Vinyl chloride (Ethene, chloro-)

Warfarin

Xylene (Benzene, dimethyl)

Zinc Chloride

Zinc phosphide

1.3 Chemicals For the Normal Trash

You can safely dispose of many solid chemicals in the normal trash if the containers are tightly capped and of good integrity. Examples are given on the following list. These chemicals were selected because they:

a. are sold by Chemistry Stores

b. have oral rat LD50 toxicity values higher than 500 mg/kg and

c. have no positive determination for carcinogenicity according to the National Institute of Occupational Safety and Health (NIOSH) 1979 Registry of Toxic Effects of Chemical Substances.

If you intend to dispose of more than five pounds of any one of these chemicals, call RM&S for further evaluation.

CHEMICAL FOR NORMAL TRASH

Acid, Ascorbic Acid Benzoic

Acid, Boric Acid Casamind

Acid, Citric Acid, Lactic

Acid, Oleic Acid, Phosphotungstic

Acid, Phthalic Acid, Salicylic

Acid, Silicic Acid, Stearic

Acid, Succinic Agar

Acid, Tartaric Aluminum Chloride

Albumen Aluminum Metal

Aluminum Hydroxide Ammonium Chloride

Ammonium Bicarbonate Ammonium Sulfate

Ammonium Phosphate Base, Blood Agar

Ammonium Sulphamate Brain Heart Infusin

Beef Extract Broth Nutrient

Brom Phenol Blue Calcium Carbonate

Buffer Solution Calcium Lactate

Calcium Chloride Calcium Sulphate

Calcium Phosphate Charcoal, Animal

Cerelose, Dextrose Dextdrose

Crystal Violet Extract Malt

Drierite Ferric Chloride

Extract Yeast Ferric Sulphate

Ferric Nitrate Galactose

Ferrous Ammonium Sulphate Graphite

Gelatin Gum, Guaic

Gum, Arabic Kaolin

Hematoxylin Lithium Carbonate

Lactose Lithium Sulphate

Lithium Chloride Magnesium Carbonate

Litmus Mild Magnesium Nitrate

Magnesium Chloride Magnesium Sulphate

Magnesium Oxide Magnesium Acetate

Maltose Manganese Dioxide

Manganese Chloride Methyl Red

Manganese Sulphate Methylene Blue

Methyl Salicylate Naphthol Beta

Naphthalene Pepsin

Paraffin Petroleum Jelly

Peptone Potassium Bicarbonate

Potassium Acetate Potassium Bitartrate

Potassium Bisulphate Potassium Bromide

Potassium Bromate Potassium Citrate

Potassium Carbonate Potassium Phosphate

Potassium Iodide Potassium Sulphate

Potassium Nitrate Potassium Sulphocyanate

Potassium Sodium Tartrate SDS (Sodium Dodexyl Sulfate)

Potassium Sulphite Sodium Ammonium

Pumice Phosphate

Sodium Acetate Sodium Bicarbonate

Sodium Benzoate Sodium Bisulphite

Sodium Bisulphate Sodium Bromide

Sodium Borate Sodium Citrate

Sodium Carbonate Sodium Iodide

Sodium Chloride Sodium Nitrate

Sodium Formate Sodium Phosphate

Sodium Lactate Sodium Silicate

Sodium Salicylate Sodium Tartrate

Sodium Succinate Sodium Thiosulphate

Sodium Thioglycollate Stannous Chloride

Sucrose Thymol

Talcum Powder Trypticase

Tin Metal TryptoneWax, Bee'sDate: 05/11/2010 REV: 5 Page: 55

University of Notre Dame

Chemical Hygiene Plan

1.3 Chemicals For the Sanitary Sewer System

You can safely dispose of many chemicals into the sanitary sewer system if they are water soluble, degradable in the sanitary sewer and properly diluted. Examples are given in the following list. Chemicals in solid form should be followed by twenty (20) parts of water. If you intend to dispose of more than one pound of any one of these chemicals, call RM&S for further evaluation.

1. AQUEOUS SOLUTIONS OF CHEMICALS LISTED UNDER "CHEMICALS FOR THE NORMAL TRASH" (Section 1.3).

2. VERY DILUTE AQUEOUS SOLUTIONS OF WATER SOLUBLE ORGANIC SOLVENTS. (i.e., <10% solutions). Examples are:

Allyl Alcohol Propanol

Glycerine Propylene Glycol

3. CONCENTRATED SOLUTIONS OF ACIDS OR BASES

This section explains the disposal of concentrated solutions of acids, such as hydrochloric, sulfuric, and nitric and bases such as ammonium hydroxide. These solutions should be neutralized in the laboratory as described in Section 1.5 below.

You should take special care when neutralizing strongly oxidizing acids such as perchloric acid and fresh chromic acid, so call RMS for additional instructions.

1.3.1 General Neutralization Procedures

CAUTION: FUMES AND HEAT ARE GENERATED

1. Do your neutralizations in a well-ventilated hood and behind a safety shield.

2. Keep containers cool while neutralizing.

3. You should be wearing an apron, goggles, and gloves.

4. Perform all steps SLOWLY.

5. Neutralize concentrated solutions of acids and bases to within a pH range of greater than 2 and lower than 12.5 and then flush them into the sanitary sewer with at least twenty (20) parts of water.

1.3.2 Acid Neutralization

While stirring, add acids to large amounts of an ice-water solution of base such as sodium carbonate (soda ash), calcium hydroxide (slaked lime), or 8M sodium hydroxide (for concentrated acids). When a pH above 2 is achieved, dispose of the solution into the sewer system followed by twenty (20) parts of water.

1.3.3 Base Neutralization

Neutralize by first adding the base to a large vessel containing water. Slowly add a 1M solution of HCL. When a pH of 12.5 is achieved, dispose of into the sewer system followed by twenty parts of water.

1.3.4 Chromic Acid

1. Alternatives to Chromic Acid Cleaning Solutions

Chromic acid is a powerful oxidizing agent. It is both toxic and corrosive and can explode on contact with organic materials. Users of chromic acid cleaning solutions on campus have suffered burns to both skin and clothing. We urge you to consider the alternatives listed on the next page that clean satisfactorily and are less toxic.

2. Disposal

You should neutralize spent chromic acid solution to pH 2by SLOWLY pouring it into a stirred 8M NaOH-ice solution in a large container. CAUTION: fumes and heat are green Cr (III) by the addition of a saturated sodium bisulfite solution. (Hexavalent chromium is highly oxidizing and toxic and is strictly regulated in waste). Put the neutralized, reduced solution into the sewer system, followed by twenty (20) parts of water.

SUGGESTED ALTERNATIVES TO CHROMIC ACID CLEANING SOLUTION

Product Manufacturer

No Chromi Godax Laboratories

RBS 35 Concentrate Pierce Chemical Co.

RBS Solid Pierce Chemical Co.

S/P Laboratory Detergen t American Scientific Products

S/P Contrad 70 American Scientific Products

Alconox American Scientific Products

Fisherband Sparkleen Fisher Scientific Co.

FL-70 Concentrate Fisher Scientific Co.

Liquinox Liquid Detergent Fisher Scientific Co.

Isoclean Lab Safety Supply

Count-Off New England Nuclear Co.

Lift Away Concentrated Decontaminant Research Products International Corp.

1.4 Organic Solvents

Place your organic solvents in glass bottles or carboys the solvents originally came in or in ones provided by RM&S. Don’t put them in the sewer. Halogenated solvents (e.g., chloroform, carbon tetrachloride and dichloromethane) and their mixtures should be kept separate as they are more difficult to dispose of. Be sure to deface or remove original label and attach Chemical Discard tag to bottle.

Call RM&S and we’ll pick up your spent organic solvents and their associated organic solutes. When we pick up the solvents, the contents will then be commingled in 55 gallon drums and

shipped off campus for incineration. We have to pump the contents, so they must be fluid and not contain any solids, precipitates or residues.

1. Substances That Should Not Be Put Into Solvent Waste Containers

The following substances are inappropriate for incineration. Don't put them into your organic waste containers. They should be collected in separate containers.

Solutions of acids or bases

Aqueous solutions of toxic organic chemicals

Metals (e.g., Sb, As, Ba, Cd, Cr, Pb, Hg, Ni, Se, Ag)

Vacuum pump oil

Sulfides or inorganic cyanides

Strong oxidizers or reducers

Water reactive substances

Unknowns

Large amounts of water

2. Waste Analysis

To comply with EPA regulations, you must complete our Chemical Discard tag when giving us waste. You'll need to complete a form for each container. You must list the major components of your waste on the form and particularly note all of the following:

Halogenated compounds (e.g., CHCl3 , CH2CL2, CCl4, and solutes)

Metals (e.g., Pb, Hb, Ag, Cr)

Sulfur compounds (e.g., CS2, DMSO, and solutes)

Hazardous Chemicals listed in Section 1.2

Solvents

Please be sure that you values reflect a reasonable, defendable estimate. We're required to routinely analyze waste to see if there are discrepancies between waste content and information reported on your form.

3. Waste Solvent

To avoid fumes, you may wish to initially collect waste solvents in another vessel such as a beaker with a watch glass on top or a metal can with spring loaded cover (available from Scientific Products or Fisher, called safety can or liquid disposal can). This may be stored conveniently in a fume hood.

1.5 Liquids Other Than Acids, Bases, and Organic Solvents

This section deals with six other types of liquid chemicals. For liquids not covered by these sections, use Section 1.2, “What is Hazardous?” to determine whether the liquid is hazardous.

Package hazardous liquids according to Section 1.13 and give to RM&S. Dispose of nonhazardous, water-soluble liquids into the sewer system.

1. Aqueous Solutions of Toxic Organic Chemicals

For highly toxic chemicals, the decision as to whether an aqueous solution should be incinerated, treated in some way, or put into the sewer system depends on the toxicity and concentration of the solute. This decision is made by RM&S staff after consultation with its desk references as well as the appropriate disposal facility.

If you think that the sewer system is not an appropriate route of disposal for an aqueous solution (because the organic solute is highly toxic), package it according to Section L and give to RM&S. We will evaluate the solution for its appropriate route of disposal.

In general, aqueous solutions of organic chemicals should be put into the sewer system if they are neutral, nonreactive, nonignitable and the organic solute is not highly toxic. Call RM&S if you have any questions.

1.6 Solids

Package tightly capped containers of hazardous solid chemicals according to the instructions given in 1.13. To determine whether or not a chemical is hazardous, see Section 1.2.

Section 1.3 lists chemicals that may be disposed of in the normal trash.

You can dissolve small amounts of hazardous organic solids in an organic solvent and place them into solvent waste containers.

1.7 Potentially Explosive and Other Reactive Chemicals

1.7.1 Potentially Explosive Chemicals

You should package each container of potentially explosive chemicals separately from other chemicals. Follow the packaging instructions in Section 1.13 and label the box and form clearly as to hazardous characteristics and special handling precautions. In addition, when calling for a

pickup, please inform RM&S that have potentially explosive materials. Potentially explosive chemicals include:

Ammonium nitrate Diazo compounds

Hydrazine compounds Nitrocellulose

Peroxide-forming agents Picric Acid

A. Peroxide Forming Agents

Peroxides are low power explosives and very sensitive to shock and heat. A variety of organic compounds react with oxygen from the air to form unstable peroxides. Well-known peroxide forming compounds include:

Diethyl Ether

Tetrahydrofuran

Isopropyl Ether

Other ethers

Other peroxide forming agents include:

Aldehydes

Compounds with benzylic hydrogens

Compounds with allyl groups

Vinyls

B. Peroxide Formation and Safety Tips

1. Exposure of any of the peroxide-forming agents to light or air increase the rate of peroxide information. Therefore, store these agents in full, light-tight containers.

2. Refrigeration does not prevent peroxide formation

3. Order small amounts frequently to decrease storage time.

4. Date new containers when opened.

5. Be particularly cautious with materials of unknown vintage. Do not attempt to remove caps from containers that may cause sparks. Call RM&S for advice or assistance when such containers are found.

6. Never distill peroxide-forming solvents unless they are known to be free of peroxides. Peroxides concentrated in the residue can pose a serious explosion hazard.

C. Peroxide Testing and Disposal

1. Before beginning work with a peroxide-forming agent, determine its peroxide content. Dispose of agents containing greater than 80 ppm peroxide. Easy-to-use quantitative peroxide test strips are available from Scientific Products or Aldrich.

2. Materials found to contain peroxides (greater than 80 ppm) should be treated prior to disposal. Methods for removal of peroxides involve the addition of reducing agent such as ferrous sulfate (for diethyl ether peroxides) or sodium metabisulfite (for isopropyl peroxides).

3. The treated solvent should be placed in a waste container and the empty container rinsed with water. Most peroxides are water soluble and the rinsate can be put in the sewer system.

1.7.2 Strong Oxidizers and Reducers

The best way to dispose of oxidizers and reducers is to chemically neutralize them. You should treat the chemicals listed below in your laboratory. For information on treatment techniques, please call us. If you choose not to neutralize these chemicals, contact RM&S for pickup and disposal.

STRONG OXIDIZERS

Chromic acid (fresh)

Metallic chlorates

Metallic nitrates

Metallic perchlorates

Metallic permanganates

Perchloric acid

STRONG REDUCERS

n-Butyl lithium Calcium hydride

Metallic sulfides Sodium hydride

Stannous chloride

1.7.3 Other Reactives (Including Water Reactives)

Listed below are a variety of reactive materials that you should give to RM&S for disposal. Package any liquids separately from solids and please note special hazards and/or handling precautions on each box. See 1.13 for additional packaging and labeling instructions.

Acetyl chloride

Bezoyl peroxide

Bromine

Calcium metal

Lithium metal

Phosphorous (yellow)

Potassium metal

Sodium metal

Thionyl chloride

1.9 Precipitates, Semisolids, Residues, Gels, etc.

Since they can't be pumped, don't put precipitates, semisolids, residues or gels of any kind into solvent waste containers. If separable, the liquid phase should first be removed by decantation, filtration, evaporation or absorption. Use Section 1.2 to determine whether the material is hazardous or call us for assistance. If the material is hazardous, package it in leak-proof containers according to 1.13 and contact RM&S for pick-up.

1.10 Labware Contaminated with Toxic Chemicals

Contaminated labware disposal can be a problem if the contaminant(s) is/are highly toxic. Labware pertains to disposable lab items, such as gloves, bench top coverings, pipets, test tubes, aprons, etc. The decision as to whether contaminated labware should be place in a secure landfill, treated in some way, or put into the normal trash depends upon the toxicity and concentration of the contaminant. If you feel that the normal trash is not an appropriate route of disposal for your contaminated labware (because the contaminant has a high toxicity), package it according to 1.13 and let RM&S pick it up. We will evaluate the labware for its appropriate route of disposal. All PCB contaminated labware 50 ppm or greater must be given to RM&S for disposal.

In general, labware contaminated with chemicals should be put into the normal trash if it is nonreactive, nonignitable and the contaminant is not highly toxic. Call RM&S if you have any questions. Procedures for decontaminating non disposable items are also available.

1.11 Unknown Chemicals

You must make every effort to provide an accurate description of all chemicals you give us. Unknown chemicals present serious problems for the University. Without a description, we can't handle or dispose of a chemical in a safe manner. Disposal companies will not accept chemical waste without an analysis, and an analysis of one sample could easily cost $1,000.

1. Investigation of Unknown Chemicals

We offer assistance in investigating the identity of unknown chemicals. Any information you can provide about an unknown chemical you wish to dispose of greatly aids identification. For example, even knowing whether or not a chemical is organic or inorganic is helpful.

2. Procedure

Call RM&S if you have an unknown chemical. Don't move it from its location if possible. An RM&S staff m ember will come to your lab to investigate.

3. Reducing the Problem

You can reduce the occurrence of unknown chemicals by being thorough in maintaining labels on chemical containers. Periodic review of chemical stock and careful record keeping lessens the chance of discovering containers with missing labels.

1.12 Packaging and Labeling

Good packaging increases safety when we handle and transport your all material we receive from labs. Please follow these rules when giving material to RM&S:

1. Label each container you package with its identity. Attach a properly, completed Chemical Discard Tag on each waste container.

2. Consider chemical compatibility when packaging a variety of items.

3. Put chemicals into closed containers that will not leak.

4. Pack liquids separately from solids.

5. If you have multiple containers of the same chemical, pack your chemicals in a strong cardboard box. Do not seal box as RM&S staff will check each container for proper identification.

6. Call RM&S (1-5037) and let them know you have waste for pickup. Routine pickups are scheduled Galvin, Stepan, Nieuwland, Fitzpatrick Cushing, Stinson-Remick, Raclin-Carmichael and Jordan Halls. If you are not located in one of these buildings, every effort will be made to pick up the waste within 72 hours of the call.