Chapter 1 Overview of Waste Laws and Regulations

Federal, state, and local laws and regulations governing waste disposal are in place to protect human health and the environment at the University of Illinois at Urbana-Champaign. Violating these laws can result in a citation to the U of I or to the individual responsible for the violation and create a situation that may cause harm to a person or the environment. Each person using chemicals in the workplace is responsible for being aware of the regulations. The Division of Research Safety (DRS) can provide campus personnel with the information and resources they need to understand the regulations as they apply to individual situations.

The following laws that govern the disposal of chemical wastes:

Resource Conservation and Recovery Act (RCRA)

This 1976 law gave power to the Environmental Protection Agency (EPA) to establish regulations that govern the disposal of solid and hazardous waste. In Illinois, the Illinois EPA (IEPA) is authorized to enforce the regulations.

RCRA regulations that apply in Illinois can be found in the Illinois Administrative Code (IAC), Title 35, on the Illinois Pollution Control Board's website.

Comprehensive Environmental Responsibility, Compensation and Liability Act (CERCLA)

This 1980 law, also known as Superfund, gave power to the EPA to establish a liability system in which the ***generator of the waste is responsible for that material forever***. This means that if a waste is disposed of at a particular site and clean-up of that site is needed in the future, the waste generator may be asked to cover part of the clean-up costs. This "cradle to grave" responsibility motivates waste generators to select a waste disposal company that:

- Provides the best technology for destroying the material (e.g., disposal technology that completely recycles or destroys the material is preferred to landfill);
- Has a good history of compliance (no outstanding EPA or Occupational Safety and Health Administration (OSHA) violations that would indicate a problem with handling the waste or the safety of the employees);
- Has adequate insurance and financial stability to cover costs if a clean-up is necessary.

Hazardous and Solid Wastes Amendments (HSWA)

These amendments were made to the original RCRA law. They prohibit the land disposal (landfill) of untreated wastes and set standards by which all hazardous waste must be treated before disposing via wastewaters or via land disposal. To comply with HSWA and determine if the regulations will be met, generators should know how their waste will be treated and disposed by their disposal company.

How the U of I Complies With These Laws

The DRS Chemical Waste Section has a chemical waste disposal program that reduces the burden of complying with the regulations for campus waste generators.

If campus waste generators use the chemical waste disposal program described in Chapter 8, they will have to be concerned only with the following points to be sure that they are complying with the regulations:

- Clearly label all chemical waste containers as to their contents using complete chemical names. Abbreviations and chemical formulas are not permitted. Labeling should be done the first time waste is placed in a container (see Chapter 6 for details on the Illinois EPA labeling requirements).
- Keep all chemical waste containers closed at all times except when waste is being actively added to the container.
- Dispose of all chemical wastes through the chemical waste disposal program unless the chemical is a liquid and is identified in Chapter 4 as a non-hazardous chemical that may be poured down the sanitary sewer (sink drain).
- Use the appropriate chemical waste pickup request (ChemTrak) forms to request a chemical waste pickup, and provide complete information about the wastes on the forms.
- Avoid excessive accumulations of waste. Have waste removed by DRS on a regular basis and **do not store more than 55 gallons of hazardous waste**.

Chapter 2 Waste Minimization

Waste minimization is any action that reduces the amount and/or toxicity of a chemical material that must be shipped off-site for disposal as hazardous waste. There are three primary ways of waste minimization. The EPA has ranked them as follows:

1. Source reduction,
2. Recycling,
3. Treatment

Source Reduction

Source reduction is the most desirable and effective method of waste minimization. This is any activity that reduces or eliminates the generation of chemical waste at the source. Laboratories can accomplish this by good material management, substitution of less hazardous materials, and good laboratory procedures. Good material management means purchasing only the amount of chemical needed for a procedure.

Buy only what you need. Use all of what you buy.

It is also good laboratory procedure to prepare only the amount of solutions needed for the work anticipated; to consider the types and amounts of wastes to be generated as a factor in choosing techniques and procedures; and to handle and store chemicals with spill prevention in mind.

Recycling

Recycling, which is reusing a waste material for another purpose, treating and reusing it in the same process, or reclaiming it for another process, is the second most desirable approach to waste minimization. The U of I's *ChemCycle* program (chemical redistribution) is an example. Solvent redistillation is another method for recycling laboratory material.

Treatment

The third waste minimization method is *treatment.* From a regulatory point of view, this is best done in the laboratory because almost all treatment activities at the DRS waste storage facility require a permit from the IEPA, but if treatment is conducted in the laboratory as part of an experimental or analytical procedure, a special permit is not required. The most common treatment is elementary neutralization. Other kinds of treatment may involve chemical, physical, or biological methods.

Labeling Containers

Inadequate labelling can complicate waste disposal procedures and increase associated costs. **Label all containers of chemicals clearly (abbreviations and chemical formulas are not permitted).**

Chapter 3 Restrictions and Waste Definitions

The DRS chemical waste disposal program is designed to make it easier for campus personnel to understand and comply with the restrictions on the disposal of chemical waste. Anyone who generates chemical waste is responsible for disposing of it through the DRS chemical waste disposal program. The *only* chemical waste that does not have to go through DRS for disposal is any chemical identified as *liquid, non-hazardous waste* in Chapter 4, which can be poured down the sanitary sewer (sink).

Chemical waste should never be sent off campus for disposal without notifying DRS in advance. The Campus Administrative Manual (CAM) states, "Campus personnel shall not initiate off-site shipments of chemical waste without first consulting with the Chemical Waste Section in order to ensure the waste is being transported and disposed of legally, and that the amount of waste disposed of is properly recorded on the University's annual Illinois Environmental Protection Agency report (see policy number V-B-4.1)."

The disposal of *toxic waste* and *hazardous waste* in the trash or down the sanitary sewer (sink drain) is illegal. The definitions of toxic waste and hazardous waste are provided below.

All chemical waste, whether toxic, hazardous, or non-hazardous, is potentially regulated as *Illinois Special Waste* if placed in the trash and therefore should not be disposed of in the trash until a waste determination and non-special waste certification is made by DRS personnel. Illinois Special Waste is defined later in this chapter.

In addition to the *toxic* and *hazardous waste* disposal restrictions and the *Illinois special waste* disposal restrictions, the Urbana-Champaign Sanitary District (UCSD) places restrictions on sanitary sewer disposal, which are explained at the end of this chapter.

Instructions for completing a request for collection of chemical waste through the DRS chemical waste disposal program are found in Chapter 8.

Definition of Toxic (Chemical) Waste

Toxic (chemical) waste must be disposed of through the DRS chemical waste disposal program.

For the purposes of this manual, a toxic waste is defined as:

- Waste that has an oral-rat LD50 toxicity value lower than 500 mg/kg, or
- Waste that is a carcinogen, mutagen, teratogen, or is identified as a possible carcinogen, mutagen or teratogen (check MSDS for information).

If the waste is a mixture and there is uncertainty as to whether the mixture would meet these criteria, it is recommended that the waste be disposed of through the DRS chemical waste disposal program.

Definition of Hazardous (Chemical) Waste

Hazardous (chemical) waste must be disposed of through the DRS chemical waste disposal program.

The EPA has defined a hazardous waste as a "solid waste," or combination of solid wastes that may, because of its quantity, concentration, or chemical or infectious characteristic:

- Cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness;
- Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

NOTE: The EPA defines "solid waste" as any solid, liquid, or gas that is disposed of, abandoned, or discarded.

How to Determine If a Chemical Waste is a Hazardous Waste

A waste is classified as a hazardous (chemical) waste if it has one or more hazardous characteristics or if it is specifically listed in the EPA regulations. There are five hazardous characteristics: ignitability, corrosivity, reactivity, and toxicity. Each of these are defined below:

Ignitability (D001):

Waste that exhibits any of the following properties:

- A liquid (other than an aqueous solution containing less than 24% alcohol by volume) with a flashpoint less than 140°F (60°C),
- A non-liquid capable of spontaneous combustion under normal conditions,
- An ignitable compressed gas per Department of Transportation (DOT) regulations,
- An oxidizer per DOT regulations.

Corrosivity (D002):

Waste that exhibits either of the following properties:

- An aqueous waste with a pH ≤2 or ≥12.5,
- A liquid that corrodes steel at a rate ≥¼ inch per year at a temperature of 130° F (55°C).

Reactivity (D003):

Waste that exhibits any of the following properties:

- Normally unstable and readily undergoes violent change without detonating
- Reacts violently with water;
- Forms potentially explosive mixtures with water;
- Generates toxic gases, vapors or fumes when mixed with water in a quantity sufficient to present a danger to human health or the environment;
- A cyanide- or sulfide-bearing waste that, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment;
- Is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement;
- Is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure;
- Is a forbidden explosive, Class A explosive, or Class B explosive per DOT regulations.

Toxicity (D004-D043):

The toxicity characteristic is determined by a testing the material using an EPA-specified protocol called the toxicity characteristic leaching procedure (TCLP). If the test shows excessive levels of toxic chemicals can be leached from the waste, it meets the definition of hazardous waste. A list of the specific limits for the

hazardous constituents in the TCPL procedure is shown in an appendix:

Web developer: link to TCLP limits.pdf

➔ TCLP Test Limits

Listed Wastes

A waste is also **hazardous** if it is named on one of the EPA lists for non-specific source wastes, acute discarded wastes, or toxic discarded wastes. Each of these lists are detailed below:

Non-Specific Source Wastes

The non-specific source waste classifications apply to specific used solvents.

Non-Specific Source Waste Description	EPA Code
The following spent halogenated solvents used in degreasing: **Tetrachloroethylene**, **trichloroethylene**, **methylene chloride**, **1,1,1-trichloroethane**, **carbon tetrachloride**, and chlorinated **fluorocarbons**; all spent solvent used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in solvent mixtures F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent mixtures/blends.	F001
The following spent halogenated solvents: **Tetrachloroethylene**, **methylene chloride**, **trichloroethylene**, **1,1,1,- trichloroethane**, **chlorobenzene**, **1,1,2-trichloro-1,2,2- trifluoroethane**, **ortho-dichlorobenzene**, **trichlorofluoromethane**, and **1,1,2-trichloroethane**; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	F002
The following spent non-halogenated solvents: **Xylene**, **acetone**, **ethyl acetate**, **ethyl benzene**, **ethyl ether**, **methyl isobutyl ketone**, **n-butyl alcohol**, **cyclohexanone**, and **methanol**; all spent solvent mixtures/blends containing, before use, only the or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	F003
The following spent non-halogenated solvents: **Cresols** and **cresylic acid**, and **nitro-benzene**; all spent solvent mixtures/blends containing before use a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	F004

The following spent non-halogenated solvents: **Toluene**, **methyl ethyl ketone**, **carbon disulfide**, **isobutanol**, **pyridine**, **benzene**, **2-ethyoxyethanol**, and **2-nitropropane**; all spent solvent mixtures/blends containing before use a total of ten percent or more (by volume) of one or more of the above non- halogenated solvents or those solvents listed in F001, F002 or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	F005

Acute and Toxic Discarded Waste Lists

The acute and toxic waste classifications apply only to chemicals that have not been used (unspent). Specific chemicals in these categories are listed in the following links. Due to the length of the lists, they are provided as separate Excel files. The lists incorporate CAS numbers and alternative names for the chemicals for searching convenience.
Web developer: link to P List Waste.pdf and U List Waste.pdf, respectively.

- ➔ Acute Discarded Waste List
- ➔ Toxic Discarded Waste List

Any container to be disposed of containing a chemical from either list in its original form (i.e., as purchased) is regulated as a hazardous waste. Empty containers of these chemicals are also regulated as hazardous waste and cannot go in the regular trash ***unless*** the container has been triple-rinsed. See Chapter 9 for further information on the decontamination of empty chemical containers. The rinse from a container of a chemical from the Acute Discarded Waste List must be saved and disposed of through the campus chemical waste disposal program (see Chapter 8 for instructions on requesting a chemical collection).

Materials contaminated with these chemicals (original product only) from a spill (e.g., paper towels, gloves, soil) are also regulated as hazardous waste.

Illinois Special Waste

Illinois special waste includes hazardous waste, potentially infectious medical waste (PIMW), industrial process waste, and pollution control waste.

The IEPA has included university and college research, as well as maintenance activities, as an industrial process. This means that all chemicals (hazardous or non-hazardous) to be disposed of from the U of I that cannot be disposed of down the sanitary sewer qualify as industrial process waste and are classified as Illinois Special Waste until a non-special waste certification is made. DRS is responsible for making the non-special waste certification. Therefore, IEPA requires all labs to send all chemicals, hazardous or non-hazardous, to DRS for proper disposal according to IEPA regulations.

Urbana-Champaign Sanitary District (UCSD) Restrictions for Sewer Disposal

Disposal of chemical wastes in the sanitary sewer is regulated by an ordinance adopted by the Urbana-Champaign Sanitary district. Specific disposal requirements are as follows:

- Waste solution to be poured down the sanitary sewer (sink drain) must have a pH

between 6 and 10;

- Noxious or malodorous gases or substances capable of creating a public nuisance cannot be poured down the sanitary sewer (sink drain);
- Limits for metals and other constituents in the waste solution (prior to any dilution) before pouring it down the sanitary sewer (sink drain) are:

Constituent	**Concentration (mg/L)**
Arsenic	0.1
Barium	100
Cadmium	0.04
Chromium (+6)	0.3
Chromium (Total)	2.3
Copper	1.5
Cyanide	1.2
Lead	0.8
Mercury	0.0005
Nickel	2.7
Selenium	0.04
Silver	0.1
Zinc	3.1

Chapter 4 Liquid Non-Hazardous (Chemical) Waste Disposal

Specific liquid non-hazardous (chemical) wastes may be flushed to the sanitary sewer (down the sink) *if* the solution has a pH between 6 and 9. An aqueous (water-based) solution of any of the compounds in the list below is considered a **liquid non-hazardous chemical waste** and can be poured down the sanitary sewer (sink drain) with copious amounts of water (20-30 times the amount of the original solution). However, if you have more than five gallons of liquid non-hazardous chemical waste to dispose of, email the DRS Chemical Waste Section (cws@illinois.edu) or call 333-2755 to determine whether the waste should be collected through the DRS chemical waste disposal program or if it may be poured down the drain.

Solid non-hazardous chemical wastes must be disposed of through the DRS chemical waste disposal program. All solid chemical wastes, whether hazardous or non-hazardous, are regulated in Illinois as special waste if placed in the regular trash, so it is illegal to dispose any solid chemical waste in the regular trash on campus. DRS Chemical Waste Section can put in place certifications for disposing of these solid chemical wastes in a legal manner that is no cost to the U of I. See Chapter 3 for additional information on Illinois special waste.

Other liquid chemicals might be eligible for sink disposal if they meet all of the following conditions:

- The dissolve in water or are water-based.
- They are not a toxic waste (see Chapter 3).
- They are not a hazardous (chemical) waste (see Chapter 3).
- They do not contain any chemicals or metals regulated by the IEPA or the UCSD (see Chapter 3).
- They are not flammable.
- They are not corrosive.
- They are not reactive.

If a chemical waste meets all the criteria listed above, but it is not listed below, contact DRS to determine if the waste can be poured down the drain.

Liquid Non-Hazardous (Chemical) Waste			
Compound	**CAS #**	**Compound**	**CAS #**
Acacia Gum	9000015	Lysine, L-	56871
Acetate Buffer (Acetate Kinase)	9027423	Lysozyme	12650883
Acid Ascorbic	50817	Magnesium Acetate	142723
Alanine, , Dl-	302727	Magnesium Chloride	7786303
Alanine, L-	56417	Magnesium Phosphate Tribase	7757860
Alanine -D	338692	Magnesium Sulfate	7487889
Aluminum Sodium Sulfate	10102713	Magnesium Sulfate Heptahydrate	10034998

Aluminum Sulfate Anhydrous, Solid	10043013
Amino Acids	29022115
Aminoacetic Acid	56406
Ammonium Phosphate Monobasic	7722761
Ammonium Phosphate, Dibasic	7783280
Ammonium Salicylate	528949
Ammonium Sulfate	7783202
Ammonium Valerate	42739388
Aquacide I, Calbiochem	9004324
Aquacide II, Calbiochem	9004324
Arabinose, L-(+)-	87729
Arabinose,D -	28697532
Arginine Hydrochloride	1119342
Arginine, L-	74793
Ascorbic Acid, L-	50817
Asparaginase, L-	9015683
Asparagine Hydrate, (L)-	5794138
Asparagine,L -	70473
Aspartic Acid, D-	1783966
Aspartic Acid, Dl-	617458
Aspartic Acid,L -	56848
Azapropazone	22304309
B- Lactoglobulin	50863928
Borax, Anhydrous	1330434
Calcium Acetate	62544
Calcium Chloride	10043524
Calcium Chloride Dihydrate	10035048
Calcium Disodium Edta	62339
Calcium Disodium Versenate	62339
Calcium Gluconate	299285
Calcium Iodide	10102688
Calcium Lactate	814802
Calcium Pantothenate	137086
Calcium Phosphate, Dibasic	7789777
Calcium Phosphate, Monobasic	7758238

Malt Extract	8002480
Maltodextrin	9050366
Maltose Monohydrate, D-	6363537
Mannitol, D-	69658
Methionine, Dl-	59518
Methionine, L-	63683
Methionine,D -	348674
Methyl Cysteine -S	7728985
Methyl Histidine, L-1-	15507763
Methyl-L- Histidine	368161
Methylmannoside, Alpha	617049
Mucic Acid	526998
Mutarotase	9031769
Myoglobin	9008451
Niacin	59676
Niacinamide	98920
Nicotinamide	98920
Nicotinamide Adenine Dinucleotide Phosphate	53598
Nicotinic Acid	59676
Ofloxacin	82419361
Olibanum Gum	8050075
Pancreatin	8049476
Pepsin Powder	9001756
Phenylalanine, D-	673063
Phenylalanine, L-	63912
Phosphalase, Acid	9001778
Phosphatidyl Choline, L-Alpha-	8002435
Phosphodiesterase 3-5-Cyclic Nucleotide	9040599
Piperazine Citrate	144296
Pirenzepine Hcl Hydrate	29868971
Plasmin	9001905
Poly (3-Hydroxy Butyric Acid)	26063003
Poly-Beta- Hydroxybutyric Acid	26063003
Potassium Acetate	127082
Potassium Bicarbonate	298146

Calcium Phosphate, Tribasic	7758874
Calcofluor - White	133664
Carnitine Hydrochloride	461052
Casein, Sodium Complex	9005463
Catechu Gum	69599333
Chlorhexidine	55561
Chlorohexidine Diacetate	56951
Chlorophyll	1406651
Choline	62497
Choline Chloride	67481
Citric Acid	77929
Citric Acid Monohydrate	5949291
Citric Acid Trisodium Salt Dihydrate	68042
Creatinine	60275
Cyanocobalamin	68199
Cyclodextrin Hydrate, Alpha-	10016203
Cyclohexaamylose	10016203
Cystine	923320
Cystine, Dl-	923320
Cystine, L-	56893
Cytidine 5'-Diphosphoglucose	1.03E+08
Cytidine-3'-Monophosphate	84526
Cytidylic Acid, 3'-	84526
Cytosine	71307
Dansylglycine Free Acid	1091856
Dextran Sulfate	9011181
Dextran T 70	9004540
Dextrin	9004539
Dextrose	492626
Diatase (Of Malt)	900024
Diatrizoate Sodium	737315
Dihydroxyphenyl)-L-Alanine], [3-(3,4-	59927
Dimethyl Thiourea	534134

Potassium Bisulfite	1310618
Potassium Bitartrate	868144
Potassium Carbonate	584087
Potassium Chloride	7447407
Potassium Citrate	866842
Potassium Gibberellate	125677
Potassium Gluconate	299274
Potassium Hydrogen Sulfite	1310618
Potassium Hydrogen Tartrate	868144
Potassium Iodide	7681110
Potassium Phosphate Dibasic Trihydrate	16788571
Potassium Phosphate Monobasic, Anhydrous	7778770
Potassium Phosphate, Dibasic, Anhydrous	7758114
Potassium Phosphate, Tribasic	7778532
Potassium Pyrophosphate, Tetra-	7320345
Potassium Sodium Tartrate	304596
Potassium Sulfate	7778805
Potassium Tetraborate Tetrahydrate	12045782
Povidone	9003398
Procion Brilliant Red	17804498
Protoporphyrin Ix, Sodium Salt	50865015
Pyridoxal Phosphate	54477
Rennin	9001983
Retinyl Acetate	127479
Riboflavin	83885
Riboflavin-5-Phosphate	146178
Ribose	24259594
Ribose Nucleic Acid	9014259
Ribose, D-	50691
Rongalite	149440
Saccharose	57501
Salicylic Acid	69727
Senna Gum	51434185

Dimethyl Urea 1,3	96311
Dimethylaniline Hcl	51786539
Dimethylglycine Hcl, N,N-	2491067
Diphospho-D-Glyceric Acid,2,3-	62868795
Dipotassium Phosphate	7758114
Disodium Phosphate	7758794
Disodium Pytophosphate	7758169
Disodium Sulfate	7757826
Dl-Alpha-Glycerophosphate	3325006
Epsom Salt	10034998
Ethyl(2)- Hexyl Acetate	103093
Ferric Citrate	2338058
Ferritin	9007732
Ferrous Gluconate	299296
Fluorescein	2321075
Fructose 1,6-Diphosphate Disodium Salt	26177855
Fructose, D-	57487
Fructose-6-Phosphate	643130
Fucose, L-	6696417
Galactose, D-(+)-	59234
Galactric Acid	526998
Gluconic Acid	527071
Gluconic Acid, D-Sodium Salt	527071
Gluconic Acid, Potassium Salt	299274
Glucose 6-Phosphate, D-	56735
Glucose Pentaacetate, Alpha-D-	604682
Glucose Pentaacetate, Beta-D-	604693
Glucose Reagent	50997
Glucose, Alpha-D	492626
Glucose, D-(+)-	50997
Glucose-1-Phosphate Dipotassium, Alpha, D-	5996145
Glutamic Acid, L-	56860

Serine, Dl-	302841
Serine, L-	56451
Shellac Gum	9000593
Sodium Acetate	127093
Sodium Acetate Trihydrate	6131904
Sodium Ascorbate	134032
Sodium Bicarbonate	144558
Sodium Borate, Anhydrous	1330434
Sodium Carbonate	497198
Sodium Carbonate Monohydrate	5968116
Sodium Carbonate, Decahydrate	6132021
Sodium Cellulose Phosphate	9038419
Sodium Chloride	7647145
Sodium Cholate	361091
Sodium Citrate	68042
Sodium Glucuronate	7182776
Sodium Glutamate	142472
Sodium Hyaluronate	9067327
Sodium Iodide	7681825
Sodium L- Aspartate	5598538
Sodium Lactate	72173
Sodium Metaphosphate	10361032
Sodium Monofluorophosphate	10163152
Sodium Nitrobenzene Sulfonate	27215710
Sodium Nucleinate	9014259
Sodium Oleate	143191
Sodium Phosphate Dibasic Dodecahydrate	10039324
Sodium Phosphate Monobasic Monohydrate	10049215
Sodium Phosphate Tribasic Dodecahydrate	10101890
Sodium Phosphate, Dibasic	10039324
Sodium Phosphate, Dibasic, Anhydrous	7558794
Sodium Phosphate,	7782856

Glutamine, L-	56859
Glutaric Acid	110941
Glutathione Reduced Form	70188
Glutathione S- Transferase	50812378
Glyceryl Guaiacolate	93141
Glycine	56406
Glycogen	9005792
Guanine	73405
Guar Gum	9000300
Gum Arabic	9000015
Gum Benzoin	9000059
Gum Elemi	9000753
Gum Ghatti	9000286
Gum Guaic	9000297
Gum Tragacanth	9000651
Hemoglobin	9008020
Heparin	9005496
Histamine	51456
Histamine Dihydrochloride	56928
Histidine Monohydrochloride Mononydrate, D-	6341248
Hydroxy-L-Proline, Cis-4-	618279
Hydroxy-L-Proline, Trans-4-	51354
Hydroxylapatite	1306065
Hypaque	737315
Iminodipropionatrile (-3,3)	111944
Indican	2642377
Inositol	87898
Isocitric Acid, Trisodium Salt Hydrate, Dl-	1637736
Isocitric Dehydrogenase	9028482
Isoleucine, L-	73325
Karaya Gum	9000366
Klucel	9004642
L- Glutamic Acid,	142472

Dibasic, Heptahydrate	
Sodium Phosphate, Monobasic, Anhydrous	7558807
Sodium Polymethacrylate	54193361
Sodium Potassium Phosphate	7782696
Sodium Potassium Tartrate	304596
Sodium Pyrophosphate	7722885
Sodium Sulfate	7767826
Sodium Sulfate, Anhydrous	7757826
Sodium Tartrate	868188
Sodium Tetraborate, Anhydrous	1330434
Sodium Tetraphosphate	14986846
Sodium Tripolyphosphate	13573187
Sodium Tripolyphosphate	7758294
Sorbitol, D-	50704
Sorbose, L-(-)-	87796
Steapsin	9001621
Sucrose	57501
Sulfadoxine	2447576
Tartaric Acid, L(+)-	87694
Terrasodium Pyrophosphate	7772885
Thiamine Hydrochloride	67038
Thienyl-Dl-A-Alanine-Z	139866
Threonine, D-	632202
Threonine, Dl-	80682
Threonine, L-	72195
Thyodene	9005849
Tragacanth Powder	9000651
Tricalcium Phosphate	7758874
Trifluorothymine	54206
Trigonelline	535831
Triphosphopyridine Nucleotide, Sodium Salt	53598
Trisodium Phosphate, Activator	7601549
Trypsin	9002077
Trypsin Inhibitor	9087701

Monosodium Salt	
Lactalbumin Enzymatic Hydrolysate	9073603
Lactobionic Acid	3847298
Lactose Monohydrate	63423
Lactose, Beta-D-	63423
Lactulose	4618182
Lecithin	8002435
Lente Iletin	8049625
Leucine, D-	328381
Leucine, Dl-	328392
Leucine, L-	61905
Leupeptin	1.03E+08
Levulose	57487
Litmus Blue	1393926
Litmus, Indicator	1393926
Lysine Monohydrochloride, L-	657272
Lysine Monohydrochloride,Dl -	70531

Tyrosine, D-	556025
Tyrosine, Dl-	556036
Tyrosine, L-	60184
Urease	9002135
Urecholine	590636
Uricase	9002124
Uridine	58968
Valine, L-	72184
Vitamin B12	68199
Vitamin B2	83885
Vitamin E	59029
Vitamin E	7695912
Vitamin K-5	83705
Xanthine	69896
Xylan	9014635
Yeast Extract	8013012
Zirconium Oxychloride	7699436

Chapter 5 Unknown Chemical Disposal

The IEPA prohibits DRS from collecting unlabeled chemical containers. If you have unlabeled chemical containers in your workplace for disposal, ask the person who generated the substance to identify it or perform the following screening procedures for each unlabeled chemical container.

Important Pre-Screening Notices

Over time, peroxidizable compounds such as ethers, dioxanes, and tetrahydrofuran absorb and react with oxygen to form potentially explosive compounds. Exposure to air and light accelerates this process. Therefore, if an unlabeled *liquid* is partially or fully evaporated and crystals are present (or the liquid has become cloudy), label the container as "POSSIBLE PEROXIDE." DO NOT attempt to screen this container; request assistance from the DRS Chemical Waste Section by sending an email to cws@illinois.edu or calling 333-2755.

Some unlabeled chemicals contain radioactive materials. If possible, use a radiation detection instrument to check the container to determine if the material is radioactive. If radioactivity is found, DO NOT attempt to screen the container; request assistance from the DRS Radiation Safety Section by sending an email to rss@illinois.edu or calling 333-2755.

Unlabeled chemicals may contain biological materials. If you suspect a biohazard, DO NOT attempt to screen the container; request assistance from the DRS Biological Safety Section by sending an email to bss@illinois.edu or calling 333-2755.

Safety Considerations

Use chemical resistant gloves, goggles, a face shield, and/or a poly work shield. Perform all screening work in an empty chemical fume hood. Because the procedure tests items for flammability, have a functioning fire extinguisher available in case of unexpected violent reactions. Locate the nearest fire alarm pull station in advance. If you are uncomfortable performing these procedures, ask your supervisor to find someone else to do them.

Screening Procedures for Unlabeled Containers

Each unlabeled material is screened for air reactivity, water reactivity, corrosivity, and flammability. Because of the small quantities involved for each unlabeled chemical container, a rigorous sampling method is not required. One test container (aluminum dish, evaporating dish, watch glass) can sometimes be used for all four steps of the screening procedures. Residues from the screening procedures may be poured down the sink drain. When labeling the chemical container, do not cover the original label or any markings with the new label.

1. Air reactivity

Pour a small amount (a few drops or crystals) of the unlabeled material into a test container inside the chemical fume hood. If the material is air-reactive, a reaction will be visible within 30 seconds, and it should be labeled "UI#7078—Characterized Waste—Air-Reactive." If not air-reactive, proceed to step two.

2. Water reactivity

Pour a small amount (a few drops or crystals) of the material into a test container inside the chemical fume hood. Using a wash bottle filled with water, add a few

drops of water to the compound. If the material is water-reactive, a reaction will be visible within a few seconds. If reactive, label the container "UI#7079—Characterized Waste—Water-Reactive." If not water-reactive, proceed to step three.

Note: Steps 3 and 4 should both be performed if classification is not determined in steps 1 or 2.

3. Corrosivity
Obtain the pH of the sample using pH paper or a pH meter. Record the pH to the nearest whole number on the container label.

4. Flammability (Perform only on liquids)
Pour a few drops (maximum of three to four drops) of the material into a test container inside the chemical fume hood. Before proceeding, seal the original container of unlabeled material, and remove it from the chemical fume hood. Light a match and hold it approximately one to two inches above the screening sample. If the material immediately starts burning, it is considered to be flammable. If the material has not started burning after a few seconds, it is considered to be not flammable.

Labeling Containers

a. If steps 1 or 2 are positive, label the container as instructed above.

b. If steps 1 and 2 are negative, label the container as follows:

- If flammable and pH = 3-11: "UI#7080—Characterized Waste—Flammable"
- If flammable and pH = 2 or less: "UI#7083—Characterized Waste—Flammable, Acid"
- If flammable and pH = 12 or more: "UI#7084—Characterized Waste—Flammable, Base"
- If not flammable (or solid) and pH = 2 or less: "UI#7081—Characterized Waste—Acid"
- If not flammable (or solid) and pH = 12 or more: "UI#7082—Characterized Waste—Base"
- If not flammable (or solid) and pH = 3-11: "UI#7085—Characterized Waste—Other"

c. Any other information about the contents of the container should also be indicated on the container.

Pickup of Screened Containers

After containers have been labeled according to the preceding guidelines, use ChemTrak form CWM-TRK-01: Request for Pickup of Chemical Waste, to request that they be picked up. The UI# required on the form is listed above. ChemTrak labels will be returned to be placed on the containers. Do not cover the original label or any markings with this new label.

If you have questions or need assistance, contact the DRS Chemical Waste Section by sending an email to cws@illinois.edu or calling 333-2755.

Chapter 6 Chemical Waste Collection and Storage in the Lab or Work Area

Different chemical waste streams are managed in very different ways, so the proper collection and storage procedures will depends on the ultimate disposition of the waste. Therefore, you should determine the ultimate disposal method before creating the chemical waste. This will allow you to obtain the necessary equipment (containers, labels) before the waste is created. This chapter explains how to determine the final disposition of waste, select the appropriate waste container, and store waste in the lab or work area.

Determining How to Dispose of a Chemical Waste

The final disposition of a chemical waste is determined by the answers to a series of questions:

Step 1. Is the waste contaminated debris (glassware, paper towels, clean-up materials) or is it a chemical or chemical solution?
If it is contaminated debris: Go to Step 5.
If it is a chemical or chemical solution: Go to Step 2.

Step 2. Is the chemical a DEA controlled substance? (A list of DEA controlled substances can be found in the UIUC DEA Controlled Substances Guidance Document available on the DRS website.)
Yes: Refer to the end of this chapter for instructions how to dispose DEA controlled substances.
No: Go to Step 3.

Step 3. Is the chemical a solid (not liquid or gas)?
Yes: Collect and store the waste as described below and dispose of it through the DRS chemical waste disposal program. (No solid chemical waste, hazardous or non-hazardous, can be placed in the regular trash.)
No: Go to Step 4.

Step 4. Is the chemical a liquid non-hazardous waste as listed in Chapter 4?
Yes: The chemical can be poured down the sanitary sewer (sink drain) with copious amounts of water.
No: Collect and store the waste as described below, and dispose of it through the DRS chemical waste disposal program.

Step 5. Is the debris contaminated with a substance listed in Chapter 4 as a non-hazardous (chemical) waste?
Yes: The contaminated debris can be disposed in the regular trash. Seal broken glassware in a box prior to placing it in the trash.
No: Go to Step 6.

Step 6. Is the contaminated debris unbroken glassware that can be decontaminated by washing with water or detergent?
Yes: Decontaminate and dispose of the glassware as directed in Chapter 9.
No: All other debris should be collected and disposed of as described in the Contaminated Debris section of this chapter.

Guidelines for Choosing Chemical Waste Containers

- Reuse chemical containers only if they are in good condition (no cracks or major

dents) and have a threaded cap that can seal tightly. The DRS will not accept broken or leaking chemical waste containers.

- Use the chemical's original container if appropriately sized.
- Use Nalgene® jerricans or poly carboys for common solvents, photo developing solutions, and acid mixtures (not including hydrofluoric, nitric, or perchloric acids). See the section on jerricans for additional information on what wastes can be put in them.
- All containers must be compatible with the specific chemical waste stored in them. Example: hydrofluoric acid and solutions of sodium hydroxide must not be placed in glass bottles because they will etch through the bottle.
- Use a separate container for each waste chemical item or mixture. Refer to the section on Chemical Waste Segregation for additional details.
- Use a container size appropriate for the amount of waste generated. Do not use containers larger than 10 liters.
- DRS may refuse to pick up waste containers (other than drums) that are too heavy (>35lbs).
- Do not overfill waste containers; leave some space at the top of the container. Overfilled containers (including drums) will be refused. Jerricans are marked for the 6- or 10-liter level; do not fill past this line.

Except in high volume situations, 55-gallon drums SHOULD NOT be used for accumulating waste chemicals of any kind. If drums are used, no more than one 55-gallon drum of waste should be stored in a given area. If you need to use a drum to accumulate waste chemicals, first contact the DRS Chemical Waste Section by email at cws@illinois.edu or by phone at 333-2755. EPA regulations require that if wastes at a site are greater than 55 gallons, the excess shall be removed within 72 hours. DRS can provide instructions on how to meet this regulatory requirement.

Drums for chemical collection should not be smaller than 55 gallons. If you do not generate enough waste to fill a 55-gallon drum, then use 10 liter jerricans and request frequent chemical waste pickups.

Using Jerricans

Jerricans should be used to collect liquid high-volume (at least 10 L or more a year) waste streams that are not reactive, extremely toxic, or malodorous. Solids must be filtered out before adding the waste to a jerrican. Wastes that should be collected in jerricans include:

- Organic solvents (halogenated and non-halogenated);
- Acids or acid mixtures [EXCEPT hydrofluoric acid (HF) or oxidizing acids such as nitric acid (HNO3) and perchloric acid (HClO4)];
- Photographic fixing/developing solutions;
- Formaldehyde solutions.

There are other waste streams that may be accepted in jerricans; check with the DRS Chemical Waste Section (cws@illinois.edu or 333-2755) before using a jerrican to be sure that the waste is one that DRS can bulk. Otherwise, the DRS may be unable to return the jerrican because it will have to be directly packed for shipment to the off-site waste treatment and disposal facility where it will be destroyed.

What Wastes Not to Place in a Jerrican

The chart below lists items that SHOULD NOT be placed in a jerrican because they are reactive when bulked with other chemicals, create odor problems, or are too toxic to bulk. DRS will be unable to return the jerrican if its contents react when tested or if it contains any of the chemical listed below. Chemicals known to react with solvents or that are otherwise extremely toxic should never be added to a jerrican.

Do NOT Dispose of the Following Chemicals in Jerricans:		
Acetaldehyde	Hypochlorite esters	Phosphite esters
Acyl halides	Iron petnacarbonyl	Phosphite esters
Alkaline and alkaline earth hydrides and alkyls in solutions	Isocyanates	Polymer solutions
Alkyl silyl halides	Isocyanides	Poly-nitro compounds
Alkynes	Lithium aluminum hydride	Propargyl bromides
Allyl Alcohol	Mercaptans/ Thiols	Pyrocarbonate esters
Aluminum and gallium trialkyls	Mercury compounds	Pyrrole
Amines > 5% by vol.	Metal halides and oxyhalides	Silicon and germanium hydroalkyls
Anhydrides	Monomers (polymerizable)	Sodium or calcium hydride
Arsines	Nitrate esters	Sulfate esters
Aziridines	Nitric acid > 40% conc.	Sulfite esters
Boranes	Nitriles	Sulfonate esters
Bromine	Nitrite esters	Sulfones
Carbon disulfide	Nitro esters	Sulfonyl halides
Carbonyls	Nitroso esters	Sulfuric acid (conc.)
Chloroformates	Nitrosoureas	Thallium ethoxide
Chloromethylsilanes	Nitrosourethanes	Thio ketones or esters
Chloropicrin	Paint	Thiocarbonyls
Chromate esters	PCBs	Vinyls
Cyanohydrins	Perfluoroaliphatic acids	Zinc and cadmium alkyls
Dienes	Peroxides	
Ethyl Ether > 5% by vol.	Phosphate esters	
Hydrazines	Phosphines	

Chemical Waste Segregation

The advantages of chemical waste segregation include:

- Prevention of unwanted or potentially dangerous reactions,
- Protection of personnel (including DRS) from potentially unsafe working environments,

- Ease in handling and disposing of wastes,
- Reduction of disposal costs,
- Minimization of chemical waste.

Use the following segregation guidelines to generate manageable waste streams:

- Collect halogenated and non-halogenated organic solvents in separate containers.
- Separate organic wastes from metal-containing and/or inorganic wastes.
- Do not mix solids and liquids unless the waste is a result of a process combining them. Liquids should be strained of all solids (e.g., towels, filters, centrifuge tubes, gloves, pipet tips). These filterable items should be handled as contaminated debris.
- Separate mercury solutions and mercury compounds from other wastes as much as possible. Do not combine mercury wastes of different concentrations.
- Vacuum pump oil and other machine oil must be separated from organic solvents and other chemicals. Used oil cannot be recycled if solvents are present. When segregating oils, "flushing oil" is considered to be free of solvents. If solvents are present, make sure to choose the correct description from the Master Chemical List (Appendix A).
- Labware and equipment obviously contaminated with acutely hazardous or toxic chemicals should be handled as contaminated debris. Such items include disposables such as gloves, bench top coverings, and aprons. See Chapter 9 for decontamination procedures for glassware (not broken).
- Separate radioactive waste from chemical waste**.**
- Separate non-hazardous chemical wastes from hazardous chemical waste.
- Keep highly toxic wastes (such as cyanides) separate from all other wastes.

Suggested Hazard Class Groupings for Chemical Storage

Store chemicals in the following compatibility groups separate from each other:

- Air reactive,
- Water reactive,
- Cyanides and sulfides,
- Acids,
- Bases,
- Oxidizers,
- Flammables,
- Miscellaneous.

NOTE: Additional categories are possible. If the above groups do not allow for suitable segregation of incompatible chemicals in your laboratory, or you do not know how to categorize certain chemicals, contact the DRS Laboratory Safety Section (lss@illinois.edu or 333-2755) for assistance in developing an appropriate classification scheme.

Illinois EPA Chemical Waste Storage Requirements

- Keep all chemical waste containers closed at all times except when adding waste to the container.
- All containers must be identified and labeled with the name of the contents and with the word "Waste." Examples: "Waste Acetone" or "Waste

Hydrochloric Acid, Chromium, and Lead." A generic label such as "Waste Halogenated Solvents" may be used, but a list of the contents must be kept nearby.

- Chemical waste containers must be labeled with the complete chemical names. Abbreviations and chemical formulas are not permitted.
- Label chemical waste containers before using them or at the time the first drop of waste is added to the container.
- Unused or outdated chemicals in their original containers with labels identifying the contents do not need the word "Waste" written on the labels. If the label is faded or illegible, affix a new label to the bottle. Re-attach labels that are coming loose.
- Store incompatible wastes in separate areas (see suggestion in the section above).
- Avoid storing glass containers on the floor where they can be broken easily, or on the edge of counters/shelves where they can be knocked over. If glass containers must be stored on the floor, place them in secondary containment, i.e., a plastic tub.

Waste-Contaminated Debris

This includes gloves, paper, plastic, glass, and other inert debris contaminated with chemicals.

- Collect the debris if it contains any amount of a chemical listed in Chapter 3 or significant concentrations of other hazardous compounds.
- In general, any waste contaminated with trace levels of a poison, carcinogen, mutagen, or teratogen should be collected. For example, solid debris contaminated with ethidium bromide (mutagen) or phenol (poison) should be collected as contaminated debris.

Debris that does not fall into the above categories is not considered contaminated debris and may be disposed of in the regular trash.

If the debris is broken glassware and it does not fall into the above categories, it should be sealed in a cardboard box and disposed of in the regular trash. Email the DRS Chemical Waste Section (cws@illinois.edu) or call 333-2755 with any questions.

Packaging: Contaminated debris should be placed in sturdy plastic bags and closed securely. The outside of the bags should be labeled "[Chemical name] Contaminated Debris" or in the case of spill clean-up materials, "[Chemical name] Spill Clean-up Debris."

Do not use biohazard or radioactive waste bags for chemical waste or chemical contaminated debris (e.g., ethidium bromide waste is a chemical waste, not a biohazardous waste).

Sharps must be placed in special sharps disposal containers, which may be requested from the DRS Biological Safety Section (bss@illinois.edu or 333-2755). Sharps are hypodermic and intravenous needles and syringes, Pasteur pipettes, scalpel and razor blades, blood vials, glass test tubes and centrifuge tubes contaminated with infectious materials, all microscope slides and coverslips, and glassware contaminated with infectious materials.

Paint and Paint Thinner

Separate solid paint sludge from paint thinners by pouring off thinners into a separate waste container. DO NOT put brushes, rollers, paper, or other debris in paint wastes. Keep water and water-based paint wastes separate from oil-based paint wastes. Rinsate from water-based paint clean-up is non-hazardous and can be poured down the drain.

Label wastes as:
1) Paint thinner [UI# 543]
2) Paint-contaminated debris [UI# 8199]
3) Paint sludge—latex [UI# 7802]
4) Paint sludge—oil-based [UI# 7803]

Silica Gel

Collect spent silica gel in wide-mouthed containers or plastic bags. If bags are used, each bag must be placed inside a cardboard box. Do NOT mix silica gel with liquid wastes. Paper, plastic, gloves, or glassware should be separated as contaminated debris. List the primary constituents that have contaminated the silica gel plus the words "Waste Silica Gel" on the outside of the container.

DEA Controlled Substances

The DRS is not registered with the DEA and cannot pick up DEA controlled substances for disposal. Follow the directions below for disposal. (The DRS can pick up "destroyed" controlled substances, i.e., a controlled substance that is dissolved in solvent and soaked up on vermiculite as described below.)

When a registrant has controlled substances that are expired or unwanted, one of the following protocols should be followed:

1. Disposal of liquid or water-soluble controlled substances.
2. Disposal of solid, water-insoluble controlled substances.
3. Disposal of chloral hydrate, paraldehyde, or substances containing 24% alcohol or more (these are also regulated by the IEPA).

If a controlled substance remains in a dispensing unit (i.e., syringe) after use, the remaining substance should be discharged to the sanitary sewer and recorded on a dispensing record for the controlled substance. Another person is required to sign off as a witness on that record to verify that the excess substance was disposed of down the sanitary sewer.

Disposal of liquid or water soluble controlled substances. If the controlled substance is <u>not</u> chloral hydrate, paraldehyde, or contains more than 24% alcohol, the DEA registrant should draft a letter to the DEA <u>prior</u> to disposal (destruction) with the following information:

1. Name and address of the facility wishing to dispose of the controlled substance;
2. Name, address, and DEA registration number;
3. Exact place, time, and date destruction is to take place;
4. Name and positions of persons who will witness the destruction;
5. Method of destruction (pouring down sanitary sewer or dissolving in water and then pouring down the sanitary sewer);
6. DEA Form 41, listing:
   a. Inventory of drugs to be destroyed,

b. Name and strength of drug,
c. Quantity of drug,
d. Technical name of controlled substance,
e. Signature of DEA notification.

When the DEA returns Form 41, the registrant or an authorized representative may conduct the disposal via sanitary sewer. If the substance is a solid, first dissolve it in water (as much as possible). Disposing substances down the drain will render the substances irretrievable.

Witness required: The DEA registrant or an authorized representative and a pharmacist will shall be present for the disposal and sign the DEA Form 41. ***A copy of the signed Form 41 should be made and sent to DRS (per UCSD requirements) before returning it to the DEA.*** Mailing address for DRS: Chemical Waste Section, 101. S. Gregory, MC-225.

Disposal of solid, water-insoluble controlled substances. If the controlled substance is not chloral hydrate, paraldehyde, or contains more than 24% alcohol, the DEA registrant should draft a letter to the DEA prior to disposal (destruction) with the following information:

1. Name and address of the facility wishing to dispose of the controlled substance;
2. Name, address, and DEA registration number;
3. Exact place, time, and date destruction is to take place;
4. Name and positions of persons who will witness the destruction;
5. Method of destruction (mixing with solvent, then absorb the solvent with vermiculite, which will then be sent for destruction via incineration);
6. DEA Form 41, listing:
   a. Inventory of drugs to be destroyed,
   b. Name and strength of drug,
   c. Quantity of drug,
   d. Technical name of controlled substance,
   e. Signature of DEA notification.

When the DEA returns Form 41, the registrant or an authorized representative may dispose of the substance by dissolving it in a solvent such as ethanol and then absorbing it with vermiculite. The vermiculite should then be placed in a sealed container and a chemical waste disposal request completed and sent to the DRS to request that the vermiculite to be picked up for disposal.

Witness required: The DEA registrant or an authorized representative and a pharmacist shall be present for the disposal (dissolving in solvent and then absorbing with vermiculite) and sign the DEA Form 41.
A copy of the signed Form 41 should be made and sent to the DRS (per UCSD requirements) before returning it to the DEA. A copy of the Form 41 should be mailed with the ChemTrak form CWM-TRK-01 requesting a pickup of the vermiculite. Mailing address for DRS: Chemical Waste Section, 101. S. Gregory, MC- 225.

Disposal of chloral hydrate, paraldehyde, or substances containing 24% alcohol or more (these are also regulated by the IEPA). The DEA registrant should draft a letter to the DEA prior to disposal (destruction) with the following information:

1. Name and address of the facility wishing to dispose of the controlled substance;
2. Name, address, and DEA registration number;
3. Exact place, time, and date destruction is to take place;
4. Name and positions of persons who will witness the destruction;
5. Method of destruction (dissolve in water and then absorb with vermiculite so as to make the controlled substance(s) irretrievable);
6. DEA Form 41, listing:
    a. Inventory of drugs to be destroyed,
    b. Name and strength the of drug,
    c. Quantity of drug,
    d. Technical name of the controlled substance,
    e. Signature of DEA notification.

When the DEA returns Form 41, the registrant or an authorized representative may dispose of the substance by dissolving it in water and then absorbing the mixture with vermiculite. The vermiculite should then be placed in a sealed container and a chemical waste disposal request (ChemTrak form CWM-TRK-01) completed and sent to DRS to request that the vermiculite to be picked up for disposal.

Witness required: The DEA registrant or an authorized representative and a pharmacist will need to be present for the disposal (dissolving in water and then absorbing with vermiculite) and sign the DEA Form 41. ***A copy of the signed Form 41 should be made and sent to DRS (per Urbana-Champaign Sanitary District requirements) before returning it to the DEA.*** A copy of the Form 41 should be mailed with the ChemTrak form CWM-TRK-01 requesting a pickup of the vermiculite. Mailing address for DRS: Chemical Waste Section, 101. S. Gregory, MC- 225.

Chapter 7 Chemicals with Special Handling Requirements

There are a number of chemicals that pose special hazards and/or require special handling to ensure the safest environment for those working with them and for those who dispose them. The following groups of chemicals are addressed in this chapter:

Shock-Sensitive and Peroxide-Forming Chemicals

Shock-sensitive chemicals may explode with friction, movement, or heat. Some chemicals are shock-sensitive by nature, others become shock-sensitive through drying, decomposition or slow reactions with oxygen, nitrogen, or the container. Some chemicals that are or can become shock-sensitive will have that hazard noted in the MSDS. **If you find or need to dispose a shock-sensitive chemical, contact DRS at 333-2755 to determine how it should be handled. Do not move or open the container until receiving directions from DRS.**

Specific Instructions for Picric Acid

Dry picric acid is explosive. Picric acid is soluble in water and various solvents. When in solution, picric acid becomes non-explosive and is safe to transport. As a safety precaution, all containers of dry picric acid must be placed lid down in a bucket or tray with one to two inches of water for one day. Next, the container should be removed, opened, and water should be added to the picric acid. Then request a pickup with UI# 8098—Picric Acid (Wetted Powder).

Peroxidizable compounds such as ethers, dioxanes, and tetrahydrofuran, absorb and react with oxygen to form potentially explosive compounds over time. Peroxides are shock-sensitive compounds that can explode if subjected to mechanical shock, intense light, rapid changes in temperature, or heat. In unusual cases, peroxides can explode through a spontaneous reaction. All peroxidizable compounds should be stored away from heat and light. They should be protected from physical damage and ignition sources.

A warning label should be affixed to all peroxidizable compounds as illustrated below to indicate the date of receipt and the date the container was first opened.

PEROXIDIZABLE COMPOUND

Date Received _____ Date Opened_____

Discard or test within_____months after opening

Below is a list that gives examples of common laboratory chemicals that are prone to form peroxides on exposure to air. **If you find a bottle containing any of these peroxide forming chemicals that has crystals, contact DRS (333-2755) to determine how it should be handled. Do not move or open the container until you have received directions from DRS.**

Common Peroxide-Forming Chemicals*

LIST A
Severe Peroxide Hazard on Storage with Exposure to Air
Discard within three months
- Diisopropyl ether (isopropyl ether)
- Divinylacetylene (DVA)[a]
- Divinyl ether
- Potassium metal
- Potassium amide
- Sodium amide (sodamide)
- Vinylidene chloride (1,1-dichloroethylene)[a]

LIST B
Peroxide Hazard on Concentration; Do Not Distill or Evaporate Without First Testing for the Presence of Peroxides
Discard or test for peroxides after 6 months
- Acetaldehyde diethyl acetal (acetal)
- Cumene (isopropylbenzene)
- Cyclohexene
- Cyclooctene
- Cyclopentene
- Diacetylene (butadiene)
- Dicyclopentadiene
- Diethyl ether (ether)
- Diethylene glycol dimethyl ether (diglyme)
- Dioxane
- Ethylene glycol dimethyl ether (glyme)
- Furan
- Methylacetylene
- Methylcyclopentane
- Methyl isobutyl ketone
- Tetrahydrofuran (THF)
- Tetralin (tetrahydronaphthalene)
- Vinyl ethers

LIST C
Hazard of Rapid Polymerization Initiated by Internally Formed Peroxides
Discard or test for peroxides after 12 months
- Acrylic Acid
- Acrylonitrile
- Butadiene b
- Chloroprene (2-chloro-1,3-butadiene)[b]
- Chlorotrifluoroethylene
- Methyl methacrylate
- Styrene
- Tetrafluoroethylene (TFE)[b]
- Vinyl acetate
- Vinyl acetylene
- Vinyl chloride
- Vinylidene chloride
- Vinylpyridine

[a]Polymerizable monomers should be stored with a polymerization inhibitor from which the monomer can be separated by distillation just before use.

[b]The hazard from peroxides in these compounds is substantially greater when they are stored in the liquid phase. If stored in liquid phase without an inhibitor, they should be considered LIST A chemicals.

*Adapted from: Prudent Practices in the Laboratory-Handling & Disposal of Chemicals, National Academy Press, Washington, D.C., 1995.

Gases

There are two types of gas cylinders used on campus:

1. Cylinders supplied by industrial gas vendors containing argon, carbon dioxide, helium, nitrogen, oxygen, air, and other common gases, usually in cylinders with screw-top valve covers. These are provided on a rental basis and should be returned to the vendor. DO NOT purchase these types of gases in lecture bottles.
2. Specialty gases, supplied by various vendors, commonly in "lecture bottles" (cylinders that are usually 12-15 inches long and two inches in diameter). These are usually sold outright.

The DRS Chemical Waste Section now accepts lecture bottles for disposal through the campus chemical waste disposal program. Keep in mind that disposal costs can be extremely high–disposal of a toxic gas lecture bottle can cost over $1,000. Before purchasing specialty gases in lecture bottles, find a vendor that can provide the gas in a rental cylinder. It may be cheaper to rent the gas in a larger container than it is to purchase it in a small lecture bottle. If a lecture bottle must be purchased, design the experiments so that the entire contents of the lecture bottle will be used. For more information, contact DRS by email at cws@illinois.edu or by phone at 333-2755.

Storage of Gases

All gas cylinders should be stored in the upright position. Lecture bottles should NEVER be stored in drawers, as leaks or corrosion of the valve are more likely to occur and the bottles tend to be forgotten until the lab is occupied by someone new. Large gas cylinders should be returned to the vendor. Lecture bottles should be disposed of through the campus chemical waste disposal program as soon as they are no longer needed. Use ChemTrak form CWM-TRK-01 to request disposal of lecture bottles, and indicate the appropriate UI#s from the Master Chemical List (Appendix A). Long-term storage of lecture bottles can greatly increase the disposal costs because of corroded valves or loss of labeling.

Polychlorinated Biphenyls (PCB) Waste

PCB wastes require special handling. Do NOT mix PCB wastes with other wastes. Collect PCB liquids in a polyethylene container. Collect PCB-contaminated debris, rags, and other materials in a 4-6 mil plastic bag or in a box lined with a 4-6 mil plastic bag if sharp objects that may puncture the bag are present. The box may not be longer than 18 inches on any side. If you have PCB-contaminated debris that cannot meet these requirements, call DRS (333-2755) for assistance. Requests for collection of PCB wastes should be on ChemTrak form CWM-TRK-01 using the appropriate UI#s from the Master Chemical List (Appendix A).

Old equipment such as transformers, capacitors, and other high-voltage generating equipment may contain PCBs or PCB-contaminated oil. If you have reason to believe that

any of your equipment may contain PCBs, email the DRS Chemical Waste Section (cws@illinois.edu) or call 333-2755. DRS will come to inspect the unit and, if necessary, test the oil. All PCB-containing equipment that is no longer in use should be disposed of promptly. PCB equipment that is in use should also be disposed of and replaced with non-PCB equipment. Fluorescent light ballasts should be handled as PCB waste if they are NOT stamped with the words "No PCBs." Current regulations require that PCB spills be cleaned up immediately. If you discover a spill in which PCBs may be involved, contact DRS (333-2755) immediately.

For the proper chemical name to use on the ChemTrak form CWM-TRK-01, refer to the "PCB waste" entries below or in the Master Chemical List (Appendix A).

- PCB contaminated oil >5ppm—UI#2052
- PCB contaminated debris—UI#7637 PCB capacitors (large)—UI#2348
- PCB capacitors (small)—UI#7654
- PCB light ballasts—UI#10573

Mercury

All wastes containing mercury are regulated as hazardous wastes. There are many mercury-free alternative devices and compounds now available and their use should be encouraged. The following guidelines provide for the most efficient management of mercury wastes.

Elemental mercury will be collected for recycling by DRS. Observe the following guidelines when packaging elemental mercury for recycling:

- Place in a poly container with a screw-on cap,
- Maximum weight per container is 20 pounds,
- The container must be in good condition (no cracks, holes, leaks),
- No thermometers,
- No amalgams,
- No alloys, reagents, or compounds.

If the mercury waste does not meet the above recycling guidelines, chose the most appropriate UI# for the mercury waste. Several common examples are listed below. These and additional entries can be found in Appendix A. If none of the choices seem appropriate, email the DRS Chemical Waste Section (cws@illinois.edu) or call 333-2755.

- Mercury (elemental)—UI#1181
- Mercury, sulfur—UI#1627
- Mercury, aqueous solution—UI#8352
- Mercury thermometer (broken or intact)—UI#8169
- Mercury manometer—UI#8061
- Mercury switches—UI#8836
- Mercury lamps—UI#7655
- Mercury batteries—UI#5230
- Mercury-contaminated debris—UI#1405 (e.g., debris contaminated with elemental mercury, NOT a mercury compound)
- Mercury debris with asbestos—UI#9560

Collect elemental mercury and glass from broken thermometers in separate, impermeable, sealed plastic containers (handle elemental mercury as indicated above). Wide-mouth polyethylene jars with screw-on caps work well. If you cannot find a plastic jar large enough for the thermometer, place heavy tape over the broken ends, then overbag the

thermometer in a heavy-duty plastic bag. Seal the bag thoroughly.

Solutions Containing Mercury Compounds

Always indicate on the label the specific mercury compound; do not label as "mercury waste." An example of an appropriate label is "Waste Mercuric Iodide Solution." Indicate the concentration of mercury in the solution. Do not mix mercury wastes with other wastes. Avoid situations in which mercury is mixed with organic solvents. Email the DRS Chemical Waste Section (cws@illinois.edu) or call 333-7255 for assistance in locating the UI#.

Aerosol Cans

Use the following procedures to dispose of aerosol cans:

- If the aerosol can is completely emptied and punctured, the aerosol can may be discarded in the regular trash. (Must be BOTH empty and punctured)

- All other aerosol cans must be disposed of through DRS.

Aerosol can (flammable) – UI# 7107
Aerosol can (nonflammable) – UI# 7108
Aerosol can (pesticide) – UI# 7109

Multi-Hazard Wastes

Multi-hazard wastes are wastes that are radioactive and/or infectious as well as chemically hazardous. Try to avoid mixing chemical waste with infectious or radioactive wastes, as these are difficult and often expensive to dispose of.

Infectious and Chemically Hazardous Waste

All research involving biohazards (which include infectious agents such as bacteria, fungi, algae, parasites, viruses, rickettsiae, chlamydiae, tumor cell lines, and recombinant DNA molecules) is monitored by the DRS Biological Safety Section. Research that generates waste that has both biological hazards (e. g., sharps, carcasses, microbiological cultures) and chemical hazards must be reviewed by the DRS Biological Safety Section as well as by the DRS Chemical Waste Section.

Radioactive Chemical Waste

The different types of radioactive chemical wastes are described below:

Naturally Occurring Radioactive Materials (NORM)

Uranium, thorium, and radium compounds are the most common Naturally Occurring Radioactive Materials (NORM). Other naturally occurring radioactive materials may be encountered. Use the following protocol to handle these materials.

1. All solid NORM compounds must be packaged and disposed of in accordance with the procedures for radioactive waste. Contact the DRS Radiation Safety Section (rss@illinois.edu) for instructions.
2. Liquid NORM waste will NOT be picked up for disposal. These wastes must be absorbed or solidified prior to collection. Contact the DRS Radiation Safety Section (rss@illinois.edu) for instructions.

Organic Liquid Scintillation Cocktail Waste

Used organic liquid scintillation cocktail waste contains small amounts of radioactive isotopes in addition to xylene or another organic solvent. This waste is picked up by the DRS Chemical Waste Section; *however,* contact DRS at 333-2755 prior to submitting ChemTrak form CWM-TRK-01 to receive special instructions for preparing the request.

Radioactive Isotopes Mixed with Other Chemicals

Radioactive materials are used occasionally with chemicals that are hazardous. Materials containing radioactive and chemical materials must be reviewed by the DRS Radiation Safety Section (rss@illinois.edu) as well as by the DRS Chemical Waste Section (cws@illinois.edu) prior to disposal.

Chapter 8 Procedures for Requesting Chemical Waste Disposal

The procedures for requesting chemical waste disposal have been developed to comply with the regulations of the IEPA and the EPA. The EPA regulations require that the person generating the waste provide the DRS with a complete and accurate inventory of the chemical wastes to be recycled or disposed of before it is collected. This allows DRS to review the inventory to evaluate any potential hazards and incompatibilities and also to assign the appropriate EPA codes to each waste. If inaccurate information is provided to DRS, the safety of the DRS personnel picking up the waste as well as that of the people who manage the waste before final disposal is endangered. Inaccurate information also puts the U of I at risk of a lawsuit if an accident should occur during the transportation of chemical waste off-campus or at the final disposal facility because a waste container was mislabeled or misidentified.

The EPA also requires DRS to track each waste container from the location where it is produced until it leaves campus for recycling or disposal.

Campus waste generators are required to use the chemical waste pickup request (ChemTrak) forms described below to send an inventory of waste to be collected. The DRS staff will enter the inventory into the waste tracking system, print a label for each container of waste, and send these labels back to the generator along with the date DRS will arrive to collect the properly labeled containers. These pre-printed labels must be affixed to each waste container. DRS will not collect containers that do not have an official ChemTrak labels attached.

Campus waste generators should receive the ChemTrak labels and a notice of when the waste will be collected within two weeks of mailing DRS the properly completed pickup request form(s).

DEA Controlled Substances

DRS does not hold a DEA registration and cannot pick up any DEA controlled substance. Refer to the DEA Controlled Substance Guidance Document or Chapter 6 for additional information on the disposal of DEA Controlled Substances.

Use the Correct ChemTrak form to Request a Pickup

Follow the steps below to determine the correct chemical waste pickup request (ChemTrak) form to use for requesting chemical waste collection. **Note: using the wrong ChemTrak form will delay waste disposal**. Click on the form name to download the appropriate form. When completing the form, follow the instructions on the second page. ChemTrak forms are found at the end of this chapter. The process for completing the forms is grounded is the answers to a few questions:

- *Step 1.* Is the waste identified (not an unknown)?

  Yes: Proceed to Step 2.
  No: Characterize the waste using the screening procedures for unlabeled chemicals as documented in Chapter 5. Then proceed to Step 7.

- *Step 2.* Is the waste a mixture?

  Yes: Proceed to Step 3.

  No: Proceed to Step 4.

- *Step 3.* Is the mixture listed on the Generic Mixtures List (Appendix B), or has it

previously been assigned a UI #?

Yes: Proceed to Step 7.
No: Fill out form CWM-TRK-03: "Request to Establish a New Waste Chemical Mixture." Submit a CWM-TRK-01 form as well (CWM-TRK-03 describes the mixture's chemical composition; CWM-TRK-01 describes the size of containers, amount in the containers).

- *Step 4.* Is the waste a small container (original size less than 100 grams or milliliters)?

  Yes: Create an inventory list of all the bottles and fill out form CWM-TRK-04: "Request for Pickup of Small Containers of Chemicals." The inventory must be sent with the form to be processed.
  No: Proceed to Step 5.

- *Step 5.* Is the waste a multi-hazard waste (radioactive and/or biological hazards present in addition to chemical)?

  Yes: See the multi-hazard wastes instructions in Chapter 7.
  No: Proceed to Step 6.

- *Step 6.* Is the waste on the Master Chemical List (Appendix A)?

  Yes: Proceed to Step 7.
  No: Fill out form CWM-TRK-02: "Request for Pickup of Chemical Waste Without Assigned University ID Numbers."

- *Step 7.* Fill out form CWM-TRK-01: "Request for Pickup of Chemical Waste."

EPA regulations allow for two methods of verifying waste content: *chemical analysis* and *generator knowledge.* As it would be cost prohibitive to analyze every chemical waste container produced at the U of I, the campus has negotiated with the IEPA to allow the use of generator knowledge. The signature required on all ChemTrak forms demonstrates to the IEPA that a responsible person has identified the contents of each container. This signature is used only for the internal (on campus) transfer of chemicals; when waste must be shipped off-campus, a member of the DRS staff must provide the required signature. **Chemical waste should never be sent off-campus without notifying DRS in advance**. The Campus Administrative Manual (CAM) states, "Campus personnel shall not initiate off-site shipments of chemical waste without first consulting with the Chemical Waste Section in order to ensure the waste is being transported and disposed of legally, and that the amount of waste disposed of is properly recorded on the University's annual Illinois Environmental Protection Agency report (see policy number V-B-4.1)."

Using the Master Chemical List (for Single Chemicals)

DRS has created a database called the Master Chemical List for chemical waste management (Appendix A). It contains data on over 12,000 individual chemicals arranged alphabetically. This list provides guidance to the DRS staff for handling waste chemicals. As a condition of the permit DRS has with the IEPA, the chemical name and its related information, such as physical hazards and transportation requirements, must be included in the database before accepting waste at the Special Materials Storage Facility (SMSF).

To use the Master Chemical List, look up the name of the chemical, then list the UI# and

chemical name on the appropriate ChemTrak form. The list is in alphabetical order.

If chemical is not on the Master Chemical List, complete form CWM-TRK-02: "Request to Pick Up a Chemical Waste without a UI#." A unique UI# will be assigned to the chemical. All subsequent requests for pickup of the same chemical should be made on form CWM-TRK-01: "Request for Pickup of Chemical Waste."

Using the Generic Mixtures List for Chemical Waste Mixtures

If the waste for disposal is a mixture, it must have a UI#. Appendix B has a list of generic mixtures To find a mixture on the list, alphabetize the chemicals present in the mixture and look for a matching set of chemicals.

If the mixture is not on the list, or it falls into one of the exceptions listed in the instructions of Appendix B, complete form CWM-TRK-03: "Request to Establish a New Waste Chemical Mixture." A unique UI# will be assigned to the mixture. All subsequent requests for pickup of the same mixture should be made on form CWM-TRK-01: "Request for Pickup of Chemical Waste."

Lecture Bottle Gases

If the waste for disposal is a lecture bottle (partially full or empty), check the list of gases in Appendix C to determine the appropriate UI#. If you do not find the gas on the list, submit a pickup request on form CWM-TRK-02.

Small Containers

To request disposal of containers that ORIGINALLY contained LESS than 100 grams or milliliters (even if still full), use form CWM-TRK-04: "Request for Pickup of Small Containers of Chemicals," and attach an inventory of the containers to the form. **The CWM-TRK-04 form will not be processed without an attached inventory.**

If there are fewer than five small containers in the inventory, use the CWM-TRK-01 form. The CWM-TRK-01 for should also be used for containers of mercury or mercury compounds.

Containers greater than 100 grams or milliliters must be handled in accordance with the normal chemical waste disposal procedures, even if there is very little material left in the container. Containers with residues still may be regulated as hazardous waste if the chemical is listed on the EPA's Acute Discarded Waste List or the Toxic Discarded Waste List. See Chapter 9 for the procedures for decontaminating empty containers.

Labeling Wastes with DRS labels

Using the information from the ChemTrak forms, the DRS staff will generate labels for each container and a laboratory waste manifest. The labels will be sent back to the generator via campus mail along with a letter indicating the scheduled collection date. The generator must then apply the labels to the appropriate container. (The order of the labels will be exactly the same as in the ChemTrak request, so keeping the containers in the order listed until the labels arrive will make applying them easier.) Avoid applying the ChemTrak label in such a manner that the original container label is obscured. Labels should be applied with the text reading horizontal and the barcode oriented vertically. Containers that do not have a unique ChemTrak label will not be collected.

DRS Collection of Waste from Campus

The expected collection date will be indicated with the ChemTrak labels sent through campus mail. Generally, waste collection will be within a week from the date that DRS sends the ChemTrak labels.

If possible, wastes will be collected in the morning (9 a.m. to 12 p.m.) of the designated pickup day. However, the DRS staff may continue pickups in the afternoon if there are too many to complete in the morning. Make the area where waste is stored accessible during those times and have a responsible person available during pickup.

Two DRS staff members will pick up the prepared waste for disposal. They will confirm that all the containers are labeled properly and check off the items on a preprinted laboratory waste manifest. Secondary containment is used by the DRS for the containers, so there is no need to box them prior to pick up, except for silica gel as described in Chapter 6. Storing chemical waste in boxes will only prolong the inspection process.

Containers that have not been properly prepared for pickup will not be taken. Containers that do not meet the chemical waste container guidelines of Chapter 6 will also not be accepted.

Forms Required for Waste Pickups

Use current forms when submitting a waste disposal request. The ChemTrak forms are available for downloading from the DRS website:

CWM-TRK-01 - For chemicals and mixtures that already have a UI#:
Word (fill-in form) or PDF Format.
CWM-TRK-02 - For chemicals that do not have a UI#:
Word (fill-in form) or PDF Format.
CWM-TRK-03 - For mixtures that do not have a UI#:
Word (fill-in form) or PDF Format.
CWM-TRK-04 - For small containers (containers must be less than 100ml or 100g in size):
Word (fill-in form) or PDF Format.

Chapter 9 Decontaminating Empty Containers

Empty containers must be decontaminated before recycling or disposal. All containers should be emptied as much as possible prior to decontamination. The following guidelines assume that only trace residues remain on the inside of the containers.

Containers Smaller Than Seven Gallons

NOTE: If the material that was in the container is listed on the Acute Discarded Waste List, the wash/rinse water MUST be saved and disposed of through the DRS chemical waste disposal program.

Solvents

Water soluble solvents: Rinse twice with water, then completely fill the container with water and empty it to displace vapors. Allow to drain. Before disposing of the container, remove the lid and write "EMPTY" or "MT "on the container's label. Dispose of empty containers as regular trash.

Solvents not soluble in water: Wash with a detergent or rinse twice with a water-soluble solvent such as acetone, then completely fill the container with water and empty it to displace vapors. Allow it to drain. Solvents (other than water) used for cleaning must be collected and disposed as chemical waste; they cannot go down the drain. Before disposing of the container remove the lid and write "EMPTY" or "MT" on the container label Dispose of empty containers as regular trash.

Acids

Neutralize the liquid residues using sodium or potassium carbonate or bicarbonate. Rinse several times with water. The rinse water may be poured down the drain. Before disposing of the container, remove the lid and write "EMPTY" or "MT" on the label. Dispose of empty containers as regular trash.

Bases

Neutralize the liquid residues using citric acid. Rinse several times with water. The rinse water may be poured down the drain. Before disposing of the container, remove the lid and write "EMPTY" or "MT" on the container's label. Dispose of empty containers as regular trash.

Other Liquids

Rinse the container twice with water, then completely fill the container with water and empty to displace vapors. Allow the container to drain. Rinse water may be poured down the drain. Before disposing of the container, remove the lid and write on the "EMPTY" or "MT" on the container's label. Dispose of empty containers as regular trash.

Solids

Water soluble chemicals: Rinse twice with water, then completely fill with water and empty. Allow to drain. Before disposing of the container, remove the lid and write on the "EMPTY" or "MT" on the container's label. Dispose of empty containers as regular trash.

Organic material not soluble in water: Wash with a detergent or rinse twice with a water-soluble solvent such as acetone, then completely fill with water and empty. Allow it to drain. Solvents (other than water) used for cleaning must be collected and be disposed of as chemical waste; they cannot go down the drain. Before disposing of the container, remove the lid and write "EMPTY" or "MT" on the container's label. Dispose of empty

containers as regular trash.

Containers with a Capacity of Seven Gallons or More (Drums)

NOTE: If the drum contained a material listed on the Acute Discarded Waste List, the wash/rinse MUST be saved and disposed through the DRS.

Drums that contained hazardous materials (flammable, corrosive, reactive, or toxic) may not be disposed of in regular trash or recycled unless they have been decontaminated to meet the EPA, IEPA, and DOT requirements for empty drums. Refer to the following instructions to decontaminate drums for disposal or recycling.

Drums That Contained Oil Only (no PCBs or Solvents)

1. Empty as much material out of the drum as possible.
2. Add absorbents or adsorbents (bentonite, kitty litter) to take up any free oil left in the drum.
3. Dispose of absorbents and/or adsorbents in the trash (make sure there is no free-flowing oil.
4. The drum can then be discarded or recycled through the U of I recycler (send a message to cws@illinois.edu for the contact information).

Drums that Contained Hazardous Materials Other Than Oil

1. Empty as much material out of the drum as possible, including easily removable residues.
2. The drum should be washed/rinsed three times with a suitable solvent. If the material is soluble in water, use water to wash/rinse. If the material is not soluble in water, use a suitable organic solvent such as acetone for the first two washes and water for the final rinse.
3. The top of the drum should be removed, using a drum de-header if necessary. The DRS can assist. NOTE: If the drum contained a flammable material, it should be evaluated for potential explosion hazards. Call DRS at 333-2755 for assistance.
4. Wear safety goggles during the washing/rinsing process. Wear heavy gloves to prevent crushed fingers and protect against sharp edges. When washing the drum, gloves that are impervious to the solvent should be worn.
5. For a 55-gallon drum, each wash/rinse cycle will require one to five gallons of the solvent. Smaller drums will require less solvent. The solvent should be sprayed around the side of the drum to dissolve residues. Once in the drum, the solvent should be sloshed around so that residues are dissolved. Use a brush or other mechanical aid to facilitate the cleaning.

   NOTE: Additional wash cycles may be used if the drum does not appear to be clean after three cycles.

6. The wash/rinse material may be disposed via the sanitary sewer if all of the following conditions are met:
   a. The original contents of the drum did not contain a material listed on the Acute Discarded Waste List
   b. Water was used as the cleaning solvent.
   c. The resulting waste has a pH between six and nine.
   d. Concentrations of heavy metals are within the limits set by the UCSD (see USCD restrictions for sewer disposal in Chapter 3).
   e. The final wash solution is not flammable.

NOTE: Email the DRS Chemical Waste Section (cws@illinois.edu) or call 333-2755 with questions about whether the material can be poured down the sanitary sewer. Absolutely no materials should be poured down the storm sewer.

7. Label the drum(s): “This drum has been triple washed/rinsed.” Paint over or cross through any other markings on the drum.
8. Empty metal drums can be recycled through the U of I’s recycler (send a message to cws@illinois.edu for the contact information).Dispose of empty poly (plastic) drums in the dumpster.

Chapter 10 Emergency Response and Chemical Spills

Responding to a Chemical Spill or Emergency

Call 9-911 (METCAD) for assistance in the following kinds of emergencies:

- Medical assistance for injuries,
- Fires,
- Explosions,
- Chemical spills for which assistance is required (complicated spill).

METCAD will dispatch the fire department and/or ambulances as needed. Fire department personnel are trained in managing chemical spills.

Complicated Spills

If the spill meets ANY of the following conditions, call METCAD (9-911) immediately.

METCAD will dispatch a hazardous materials crew from the nearest city fire station. There is no direct charge for this service.

A spill is considered complicated if:

- A person is injured;
- The identity of the chemical is unknown;
- Multiple chemicals are involved;
- The chemical is highly toxic, highly flammable, or highly reactive;
- The spill occurs in a public space, such as corridors;
- The spill has the potential to spread to other parts of the building, such as through the ventilation system;
- The clean-up procedures are not known, or appropriate clean-up materials are not readily available;
- The clean-up requires that respirator be worn, and no personnel have been fit-tested or officially trained to use a respirator (includes cartridge respirators);
- The spill may endanger the environment but reaching waterways or outside ground.

Specific spill response measures for complicated spills:

1. Evacuate the affected area, and alert others in the area to evacuate.
2. Close doors and windows if possible. Open windows can cause fumes and vapors to travel into the hallway.
3. Contact METCAD (9-911). Provide the following information:
   - What is the name of the chemical spilled?
   - What quantity of the chemical is spilled?
   - Where is the spill (building name and room number)?
   - Is anyone injured or splashed with the chemical?
   - Is a fire or explosion involved in the spill?
   - What is your name and phone number?
4. Arrange for someone to meet the emergency responders.
5. Secure the area with signs and warning tape, or post staff outside of the affected area so personnel cannot enter until emergency responders arrive.

Simple Spills

If the spill does not meet any of the conditions for a complicated spill, the spill is defined as

simple. Clean up simple spills as described below.

Response for Simple Spills

1. Prevent the spread of fumes and vapors by closing doors and windows.
2. Remove all potential sources of ignition (pumps, Bunsen burners, mechanical equipment not designed to be spark-proof) if the material is flammable. It may be necessary to shut off power from a remote circuit breaker.
3. Use the necessary personal protective equipment, such as gloves, eye protection, and lab coat or apron.
4. Absorb liquids using absorbent material, preferably sorbent pads or spill pillows. Avoid using any silica product with hydrofluoric acid. 3M™Chemical Sorbents are good to use for most liquids, although they absorb acids very slowly.
5. Small spills of acids and bases can be absorbed with sorbent pads and placed in a bag. If neutralization is attempted, use the carbonate or bicarbonate of sodium or potassium to neutralize acids and citric acid to neutralize bases. Do not neutralize a spill with a concentrated strong acid or base (i.e., hydrochloric acid or sodium hydroxide); a violent reaction may occur. Check the pH to verify it has been neutralized.
6. Spills of powders should be swept up carefully to avoid contaminating the air with dusts from the chemical.
7. If there is only a small amount of free liquids, collect and contain the clean-up materials in a plastic container or thick plastic bag. Place a descriptive label on each container or bag.
8. Decontaminate the area and affected equipment. Ventilate the area if necessary. Soap and water can be used to clean most surfaces. Contact the DRS Chemical Waste Section (cws@illinois.edu) or call 333-2755 with any questions.
9. Dispose wastes by following the instructions in Chapter 8 for the collection of chemical wastes. If there are questions, contact the DRS Chemical Waste Section (cws@illinois.edu) or call 333-2755.

Mercury Spills

1. Cordon off the area to prevent mercury from being tracked out of the area.
2. A mercury sponge is usually adequate for cleaning up the spill from a broken mercury thermometer. Use the sponge to absorb the mercury. Place it and the broken thermometer in a sturdy plastic bag. Close and label the bag “Broken mercury thermometer.”
3. For small spills of mercury, Hg absorb™ can be used to clean up the spill. Place contaminated items in a sturdy bag and use ChemTrak form CWM-TRK-01 to request a chemical waste pickup.
4. For spills too large to clean up with Hg absorb™, contact DRS (333-2755).

   The DRS will contact the labor crew of F&S to arrange for clean-up using a special mercury vacuum cleaner. DO NOT use a regular vacuum cleaner or shop vac, as harmful mercury vapors will be generated and the vacuums will become contaminated. F&S will charge for the clean-up service.

NOTE: The best method of dealing with mercury spills is to prevent them in the first place. Examine all uses of mercury to see if substitutes are available. If not, use trays or other equipment to provide spill containment.

Preparing for Spills

Establish protocols and evaluate potential hazards in advance.

Establish Spill-Response Protocols

Before working with chemicals, determine what could go wrong and how best to respond to a spill, and prepare written protocols for use in the event of a spill. Communicate these protocols to all persons who might be affected. Document laboratory spill-response protocols in the Chemical Hygiene Plan. The UIUC Model Chemical Hygiene Plan is available on the DRS website or at 333-2436.

Have basic spill clean-up materials readily available. Information on spill clean-up materials is listed below. Have a written spill protocol for every chemical being used.

Evaluate Hazards

When spills occur, a rapid, appropriate response can prevent serious consequences; the wrong response can make things worse. Evaluate the potential hazards before using a chemical. The first source of information to consult are the Material Safety Data Sheets (MSDSs); to obtain them, consult the DRS website or call 333-2436. The chemicals that are of most concern in a spill are:

- Air reactive,
- Water reactive,
- Flammable,
- Polymerizable,
- Corrosive,
- Highly toxic.

Once the hazards have been identified, determine:

- Appropriate personal protective equipment for spill response (e.g., gloves, respirators),
- Types of fire suppression equipment,
- Appropriate clean up materials,
- First aid procedures.

Spill Clean-up Materials and Equipment

Prior to starting any work with chemicals, make sure that all the necessary personal protective devices, safety equipment, and containment/clean up materials are readily available. Each individual who may be involved in spill response or clean-up must know the purpose and limitations of all personal protective equipment, safety equipment, and clean-up materials. Prepackaged spill kits are available from various vendors. The prepackaged kits tend to be expensive, so campus units typically make their own kits. To make a kit, include the following items at a minimum:

- Disposable (nitrile or latex) gloves (one box),
- Neoprene gloves (one set),
- Safety goggles,
- Poly scoop,
- Poly dustpan,
- Plastic bags,
- Absorbent material,
- 3M™ Chemical Sorbent (Central Stores Stock No. 39-01-6000) or similar material,
- Five-gallon poly (plastic) pail.

If mercury-containing devices must be used in the lab (if possible, replace all devices

with non-mercury alternatives), the spill clean-up kit should also contain Hg Absorb™ (available from Lab Safety Supply).

The location of spill control kits should be clearly marked and highly visible. Make sure all personnel know the kit's location, are familiar with its contents, and understand its limitations.

Preventing Spills

Listed below are some basic spill prevention steps that apply to storage, transportation, and transfer of chemicals.

General Precautions:

- Reduce clutter and unnecessary materials in work areas,
- Eliminate tripping hazards and other obstructions,
- Have all needed equipment readily available before starting work.

Storage Precautions:

- Use sturdy shelves;
- Store large containers close to the floor;
- Store containers on shelves back from the edge to reduce the danger of falling;
- Use storage shelves with lips to further reduce the danger of items falling;
- Store chemicals by compatibility class first, then alphabetically;
- Inspect the storage area regularly for leaking or defective containers;
- Use appropriate storage containers;
- Periodically check containers under laboratory chemical hoods, sinks, and lab benches for signs of deterioration.

Transportation Precautions:

- Use carts, when appropriate;
- Use safety containers when appropriate;
- Use bottle carriers for any glass bottle larger than 250 ml;
- Use straps to secure gas cylinders when appropriate;
- Identify potential hazards before transporting chemicals;
- Consider purchasing plastic–coated, shatter-resistant bottles.

Precautions When Transferring Chemicals:

- Pay careful attention to the size of container to avoid overfilling,
- Use pumps or other mechanical devices rather than pouring,
- Provide containment to capture leaks and spills.