

SEATTLE UNIVERSITY
CHEMISTRY DEPARTMENT

CHEMICAL WASTE
DISPOSAL GUIDE

Revised by Laboratory Safety Committee
Summer 2008

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INTRODUCTION

One of the most important aspects of laboratory operation is disposing of waste chemicals. This process is strictly regulated by federal and state laws.

The federal government's responsibility for control of chemicals in the environment is managed by the Environmental Protection Agency (EPA).

The EPA defines chemically hazardous waste under the Resource Conservation and Recovery Act (RCRA) of 1976 and several regulations listed in 40 CFR 260-270.

In Washington State, hazardous waste is called "dangerous waste" or "extremely hazardous waste" and is primarily mandated by Department of Ecology with regulations listed in Chapter 173-303 WAC. **Note that regulations promulgated by states and local jurisdictions take precedence over federal regulations and may be different or more restrictive.**

Hazardous/dangerous waste is defined by laws in two ways:

1. Waste that is on certain list of Chemicals, established by EPA and some states. Chemicals are placed on these lists primarily on the basis of their toxicity.
2. Waste that has certain hazardous characteristics, such as: flammability, corrosivity and reactivity.

Not complying with hazardous/dangerous waste regulations can lead to significant fines and penalties. It should be every chemical user's moral and legal obligation to dispose of laboratory waste in ways that have the least risk to health and environment.

The purpose of this Manual, written by SU Chemistry Department Laboratory Safety Committee, is to help our faculty, researchers and students to comply with the regulations as well as create a healthy laboratory work environment and to prevent pollution.

First part of this Manual contains step by step instructions how to collect, categorize, label and sent chemical waste for disposal. It is recommended to begin with "Flowchart" of determining if the waste is in fact "regulated" and then follow appropriate steps to prepare waste for final disposal.

Part two has reprints of Federal and State Waste Regulations as well as local METRO guidelines for sewer disposal.

STEP A

Determining whether chemical waste is hazardous

(1) Is material EPA listed hazardous waste or it is a mixture containing an EPA listed waste? – see Appendix A **YES**

NO

(2) Is material Washington State Department of Ecology listed Dangerous Waste? - see Appendix B **YES**

NO

(2) Does material have waste characteristics, such as: flammability, corrosivity or reactivity? - see “Definitions” part of this Manual **YES**

NO

(4) Is it “Toxic” or contains a “Toxic” component? - see “Definitions” part of this Manual **YES**

NO

(5) Is it “Carcinogenic” or is it a mixture containing a “carcinogenic” component equal to or above the minimum legal concentration? – see “Definitions” part of this Manual **YES**

NO

(6) Is it “Persistent” or contains a “Persistent” component equal to or above the minimum legal concentration? – see “Definitions” part of this Manual **YES**

NO

(7) Is material “Unknown”?
Go to step C

NOT HAZARDOUS WASTE
Go to step D

HAZARDOUS WASTE
Go to step B

STEP B

HAZARDOUS/DANGEROUS WASTE DISPOSAL PROCEDURES

Management of stored hazardous waste is regulated by EPA (40 CFR Part 265.170) and State Dept. of Ecology (WAC 173-303-160) and any violation could be subject to a fine up to \$25,000/day/violation

1. Collecting hazardous/dangerous waste

To prevent unexpected chemical reactions and avoid additional cost of analyses in disposal process, all hazardous wastes should be collected separately within it's characteristic group.

Mixing organic wastes with aqueous/inorganic solutions or solids and within organic group: halogenated with non-halogenated wastes should especially be avoided.

When collecting waste within one characteristic group into one bigger jar, it is strongly recommended to list all components on "Waste Collection Sheet". (see p.4), and attached it to the container.

Always use proper containers, which will not react with the waste or deteriorate in time of disposal process. Glass bottles or jars are usually the safest choice.

Avoid using too large containers for just small quantity of waste – again to keep the cost of disposal down. In process of professional waste disposal the weight of waste is equal actual waste + container!!!

A container holding hazardous waste must always be closed during storage, except when it is necessary to add or remove waste.

Primary waste containers should be kept in secondary ones, large enough to accumulate volumes of all primary containers in case of major spill or damage.

The areas of storing chemical wastes must be inspected often for leaks or deterioration caused by corrosion or other factors.

2. Labeling waste

Use Seattle University Chemistry Department "Hazardous Material" label. (see bottom of this page) Fill out all the blanks including your name and especially content of the container, with (preferably) % concentration of all components.

Using words rather than chemical formulas is required by EPA and DOT Regulations.

Clearly mark at least one major hazard of stored waste. This must be visible to students, employees, emergency response personnel and the public.

All waste containers should always be labeled, even if the container is only used for temporary storage – label it!

Sending waste for disposal

Only Lab Directors may dispose of materials on site.

All hazardous and non-hazardous materials must be collected by a representative from Environmental Services or a department's Lab Director

For waste pick up, contact **Seattle University Environmental Services Department** by one of the following methods:

- Using the Facilities Operations InSite web site request form.
- Schedule a pick-up by e-mail to "jchip" at Environmental Services
- Turn the waste container over to the lab director in your department

STEP C

CLASSIFICATION & LABELING OF UNKNOWN LABORATORY WASTE

With a waste of unknown origin and composition, the goal is determine its properties sufficiently that it can be classified in the same ways that ordinary laboratory waste is.

The following tests based on qualitative analysis methods described in Shriner and Fuson "Systematic Identification of Organic Compounds" and Sorum's "Introduction to Semimicro Qualitative Analysis" will generally provide sufficient information about unknown waste for assignment of its hazard class and allow safe disposal process. See Flowchart on p. 9 of this Manual.

1. Examination - note the appearance of waste: - Liquid
- Solid
- Viscous
- Color
- Odor
- Homogenous
- Layers

2. Exposure to air

Place 0.1 g of unknown waste (2 drops) on a watch glass. Does it smoke or ignite in air? If so – label it: "AIR REACTIVE"

3. Exposure to water

Place 0.1 g of unknown waste (2 drops) to 3 ml of water in a test tube. Is there a flame or a violent reaction? If so – label it: "WATER REACTIVE"

4. Solubility in water

Add 0.1 g of unknown waste (2 drops) to 3 ml of water in a test tube. If the compound is soluble, test for the pH with pH- paper.

pH < 2 label it: "CORROSIVE ACID"

pH > 12.5 "CORROSIVE BASE"

If the waste is insoluble in water, not whether it is more or less dense than water.

5. Oxidation

Water soluble waste:

-Adjust the pH to a little below 7 (unless it is already acidic), add drop of the unknown waste to 1 ml of fresh 10% (aq) KI. A yellow to brown color indicates an oxidizing agent. Label it: "OXIDIZER"

Water insoluble waste:

Add 0.1 g to 1 ml of 10% KI/ Glacial Acetic acid. A yellow or brown color indicates Oxidizing agent. Label it: "OXIDIZER"

6. Ignition test:

Place 0.1 g (2 drops) of unknown waste in a small porcelain crucible (evaporating dish), bring a flame near and watch whether the substance burns and if so, how readily and with what appearance. A sooty yellow flame suggest aromatic ring.

Heat the substance gently and then strongly. This gives an indication of volatility. If the substance is a solid, note if it melts or decomposes and if there is any residue left.

If so – test to see if the residue is soluble in water, test the pH of it.

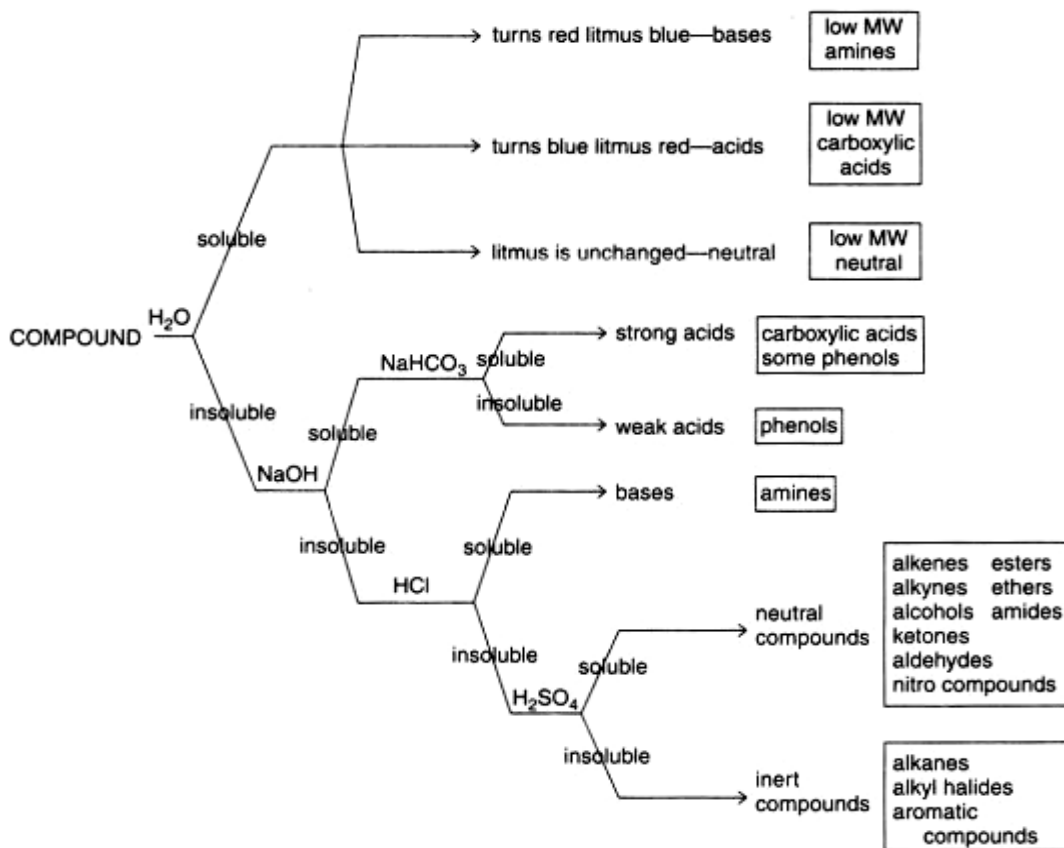
If the substance is flammable, label it: “**FLAMMABLE SOLID**” or ‘**FLAMMABLE LIQUID**’.

ORGANIC SUBSTANCES

7. Solubility test : place 0.1 g of unknown waste in 3 ml of :

- ether
- 5 % aq. NaOH
- 5% aq. HCl
- conc. H₂SO₄

Use solubility test results for broad classification



If the substance is insoluble in any solvent tested, note whether it floats or sinks, as this gives an idea of its density. If the sample sinks – test for halogenated hydrocarbons content.

8. Test for presence of Halogens: - sensitive to approximately 0.5 % content of Halogens:

- heat copper wire until a yellow flame with no green appears
- cool wire by waving in air for 10-15 seconds
- dip wire into sample
- insert sample-coated wire into flame
- a green that halogenated compounds may be present

(Note: some amines show positive interference with this test).

Should more information be needed, the next step might be a simple IR scan, which will indicate functional groups and whether the substance is a single entity or a complex mixture. Additional testing can involve some of the simpler "classification tests" of Shriner and Fuson book. A NMR spectrum can often settle classifications that are still doubtful after having gone through all the above.

SELECT CLASSIFICATION FROM THE FOLLOWING CATEGORIES:

FLAMMABLE

NON-FLAMMABLE

HALOGENATED

NON-HALOGENATED

ORGANIC SOLID

ORGANIC LIQUID

WATER SOLUBLE

WATER INSOLUBLE

INORGANIC SUBSTANCES

9. Test for presence of Cyanides:

-for aqueous solutions – Make a small sample of unknown waste strongly alkaline, add a few drops of 5% (aq) Ferrous Sulfate solution, boil suspension of Iron Hydroxide 30 seconds, add 30% Sulfuric acid dropwise until the Iron Hydroxide just dissolves and see if a suspension of Prussian Blue (Ferric Ferrocyanide) remains

-for nonaqueous solutions: - Heat a small sample of unknown waste in 5 N HCl with air bubbling first through the mixture and then through dilute Sodium Hydroxide to absorb entrained Hydrogen Cyanide; The Prussian Blue test is applied to the Sodium Hydroxide solution.

If the test is positive label the waste: **“AQUEOUS CYANIDE MIXTURE”** or **“SOLID CYANIDE MIXTURE”**

10. Test for presence of Sulfides:

-Acidify a small sample of an aqueous solution or suspend a water-insoluble solid in 5 N HCl, heat it and see if the vapors turn moist Lead Acetate paper black by formation of Lead Sulfide.

If so – label the waste: **“AQUEOUS METAL SULFIDE MIXTURE”** or **“SOLID METAL SULFIDE MIXTURE”**

11. Test for the presence of Heavy Metals:

If the substance is partly or wholly soluble in water or hot 5 N HCl, neutralize a sample of the solution, add a few drops of 10 % (aq) Sodium Sulfide solution and again adjust pH to neutral. It is important to have pH close to 7 as some Sulfides dissolve at low pH, and some with excess sulfide present dissolve at high pH. A precipitate, usually dark colored, indicates the presence of heavy metal ions. Label the waste: **“SOLID HEAVY METALS MIXTURE”** or:

“AQUEOUS HEAVY METALS SOLUTION”

STEP D

SEATTLE UNIVERSITY GUIDELINES FOR DISPOSAL OF NON- HAZARDOUS WASTE

Procedures for the removal of hazardous and non-hazardous waste are similar.

Once a waste has been determined to be non-hazardous by use of the Chemical Disposal Guide:

- Place a non-hazardous label on the container with the current date.
- Schedule a pick-up date by one of the following methods:
 1. Using the Facilities Operations Insite web site request form.
 2. Schedule a pick-up by e-mail to “jchip” at Environmental Services
 3. Turn non- hazardous waste container over to the lab director in your department for scheduled pick-up or disposal.

Only Lab Directors may dispose of materials on site. All hazardous and non-hazardous materials must be collected by a representative from Environmental Services or a departments Lab Director.

APPENDIX A

EPA LIST OF HAZARDOUS WASTES

**&261.31 HAZARDOUS WASTES FROM NON-SPECIFIC
SOURCES**

**&261.32 HAZARDOUS WASTES FROM SPECIFIC
SOURCES**

**&261.33 DISCARDED COMMERCIAL CHEMICAL
PRODUCTS
("U" , "P" lists)**

APPENDIX B

**WAC 173-303-910
DANGEROUS WASTE LIST**

APPENDIX C

METRO GUIDELINES for SEWER DISPOSAL

Flowchart to classify unknown waste
(based on “Prudent Practices in the Laboratory” 1995 edition)