LAFAYETTE COLLEGE

Hazardous Waste Management Plan

Department of Public Safety - Environmental, Health and Safety
Standard Operating Procedure (SOP) #23

1.0 Introduction

As part of the Lafayette College Environmental, Health and Safety (Public Safety EHS) Program, this guide serves as a working document for the proper management of hazardous chemical wastes that are generated at the College.

This plan will be updated frequently. The newest version may be viewed on the Public Safety EHS website or by requesting a copy from Environmental, Health and Safety (EHS). Should you have questions about hazardous waste or other environmental, health and safety issues, or wish to explore the use of less hazardous materials, contact EHS at (610) 330-5330.

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3.0 Objective

This plan has been developed to facilitate the handling, storage, pick-up, and disposal of hazardous waste in a safe and environmentally responsive manner that complies with all applicable federal, state and local regulations.

4.0 Applicability

Each group in the College has an important function and responsibility in handling hazardous waste. The Environmental, Health and Safety Division within the Department of Public Safety is responsible for managing all hazardous waste activities. Specific EHS responsibilities include:

- Implementing federal, state, and local regulations pertaining to the handling, storage, transportation, and disposal of hazardous waste;
- Preparing, submitting, and maintaining applicable records, reports, and manifests;
- Implementing and improving procedures for deactivation, treatment in laboratory, recycling, and disposal of hazardous waste; and,
- Providing technical assistance and training to the College on identifying and disposing of waste.

Laboratory workers and staff employees have significant hands-on, day-to-day responsibilities for the success of the Hazardous Waste Management Program. These responsibilities include:

- Managing and disposing all wastes in accordance with procedures;
- Packaging and labeling surplus chemicals and hazardous waste appropriately;
- Using all necessary personal protective equipment and safety devices; and,
- Seeking advice, when necessary, from EHS or their supervisor about the proper handling and disposal of hazardous waste.

5.0 Management of Hazardous Waste

5.1 Definition of a Hazardous Waste

A hazardous waste is a solid, liquid, or gaseous substance that is specifically listed by the EPA on the basis of its usage or chemical constituents or possesses a hazardous characteristic (e.g. toxic, ignitable, corrosive or reactive with other substances).

Unused or unopened chemicals will meet the definition of a listed hazardous waste if they appear on one of two lists. The P-list contains materials that are hazardous because they are acutely toxic. The U-list contains materials that are hazardous due to their toxicity. These lists apply to unused materials that have one of the listed chemicals as the sole active ingredients or to spill cleanups of these unused materials. The complete P-list is included in Appendix A and the U-list is included as Appendix B.

Additionally, certain used or spent solvents, such as acetone, can be regulated as a hazardous waste if they appear on the F-list. This most common F-listed wastes (F001 through F005) are included in Appendix C.

Characteristic hazardous wastes are not listed specifically by their chemical name but are regulated as hazardous wastes because they exhibit one or more hazardous characteristics. These four characteristics are Ignitability, Corrosivity, Reactivity, and Toxicity.

The **Ignitability** characteristic applies to wastes that are:
- Liquids with a flash point less than 140° F;
- Solids capable of causing fire through friction, absorption of water or spontaneous chemical changes under normal temperature and pressure;
- Oxidizing materials;
- Ignitable compressed gases;
- Examples include ethanol, sodium nitrate, hydrogen gas, xylene and acetone.

The **Corrosivity** characteristic applies to wastes that are:
- Aqueous solutions with a pH less than or equal to 2 or greater than or equal to 12.5;
- This does not apply to solid or non-aqueous materials;
- Examples include hydrochloric acid, nitric acid, and sodium hydroxide.

The **Reactivity** characteristic applies to the following:
- Materials that react violently or generate toxic fumes when mixed with water;
- Cyanide or sulfide bearing wastes which evolve toxic fumes when mixed with acids or bases;
- Materials that are normally unstable or explosive;
- Examples include sodium metal, reactive sulfides, potassium cyanide and picric acid.

The **Toxicity** Characteristic applies to wastes that have the potential to contaminate groundwater if improperly disposed of. These materials are regulated as hazardous waste due to their potential to leach out specific toxic substances in a landfill. There are currently 40 contaminants on the EPA's list that include certain heavy metals, pesticides and organic compounds.

5.2 Storing Waste in Laboratories (Satellite Accumulation Areas)

Each location on campus that generates and temporarily stores hazardous chemical waste is a Satellite Accumulation Area (SAA). The location of the SAA must be at or near the point of where the waste is generated. Hazardous waste generated in one lab cannot be stored in another lab or in a room across the hallway. There are specific requirements for managing hazardous waste within these areas.

The posting shown in Appendix D is required by federal and state regulations to be present at every satellite accumulation area. Contact EHS at extension 5330 to obtain a posting.

5.2.1 Satellite Accumulation Area Requirements

Only a maximum of 55 gallons of hazardous waste may be stored within any Satellite Accumulation Area. In the case of acutely toxic chemical waste (P-list), a maximum of one quart liquid or one-kilogram solid waste may be accumulated at a time.

Once either limit is reached, the container must be removed within three (3) days. However, it is recommended to call Public Safety EHS at extension 5330 for a pick-up as soon as any container is full.

5.2.2 Storage Limits

Hazardous waste containers may be stored in a Satellite Accumulation Area for up to 12 months **from the day waste is first placed into the container** as long as the accumulation limits of 55 gallons or 1 quart liquid or 1kg solid waste are not reached.

5.2.3 Container Management in Satellite Accumulation Areas

Waste containers stored in a SAA must be:

- In good condition and compatible with the waste being stored (e.g. no hydrofluoric acid in glass);
- Kept closed at all times except when filling;
- Labeled with a hazardous waste accumulation tag (available from Public Safety EHS);
- Stored inside secondary containment bins (liquid waste only); and
- Segregated by hazard class and compatibility (e.g. acids must be separated from bases and flammables).

5.2.4 Labeling Waste Containers in Satellite Accumulation Areas

All waste containers must have a hazardous waste accumulation tag (available from EHS) affixed **at the time waste is first placed into the container**. The tag must have the following information:

- The generator contact information and chemical constituents;
- The waste accumulation start date;
- Record waste contents as accumulated (use 2 tags if necessary);
- Chemical percentages (can be completed when the container is filled).

Don't use chemical symbols, abbreviations, or codes for waste identification. When a container is ready for disposal, contact the Hazardous Materials Technician at extension 5225 or EHS at extension 5330 for a pick-up.

5.3 Packaging of Hazardous Chemical Waste

- Similar wastes may be mixed if they are compatible (e.g. flammable liquids).
- Wastes from incompatible hazard classes should not be mixed (e.g. flammables with oxidizers).
- Whenever possible keep different hazardous waste separated so that disposal can remain more cost effective. Separate wastes in the following categories:

1. Miscellaneous solids (e.g. spill clean-up material, grossly contaminated gloves, rags, and towels) should be separated from liquid waste
2. Halogenated solvents (e.g. methylene chloride, chloroform, carbon tetrachloride)
3. Non-halogenated solvents (e.g. xylene, toluene, alcohols); disposal of non-halogenated solvents costs half as much as halogenated solvents
4. Waste oil must be kept uncontaminated so it is possible to recycle
5. Acids
6. Bases
7. Metal bearing wastes. Specific metals of concern are arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.
8. Special waste such as cyanides, sulfides, pesticides, oxidizers, organic acids, explosives and peroxides, should be collected individually and stored separately.
9. Mercury and mercury containing compounds; all mixtures containing mercury in any form must be disposed of as mercury contaminated waste.

- Liquid waste must not contain solids.
- Solid waste material (e.g. absorbents from a spill cleanup of a listed waste) must be in sealable containers suitable for transportation. Clear plastic bags must be used for soft items to allow visual inspection by EHS. Sharps and piercing objects must be placed in a rigid puncture resistant container. Do not use containers with biohazard symbols.
- See Appendix E for a list of potentially incompatible wastes.

5.4 Laboratory Wastewater

Since any material poured down a drain eventually flows into the City of Easton Sewage Treatment Facility, and ultimately the Delaware River, the College is regulated by the City of Easton Sewer Ordinance and the PA DEP concerning the types and quantities of materials that can enter the sewer system.

In accordance with federal, state, and local regulations, “the indiscriminate drain-disposal of chemicals/materials” is prohibited. Inappropriate disposal of certain chemicals into the sanitary sewer may create a variety of hazards including:

- Fire and/or explosion hazards within the drain system;
- Inadvertent mixing, within the drain system, of incompatible chemicals;
- Corrosion of drain pipes;
- Escape of volatile, toxic and/or malodorous substances;
- Biocidal action on wastewater treatment system microorganisms;
- Addition of unacceptable amounts of toxic substances (e.g., heavy metals) to sewage sludge and effluent.

The following materials should never be disposed of through the sanitary sewer system:

- Any waste chemical that meets the EPA’s criteria for being hazardous, either as a listed or characteristic waste;
- Oil, grease, or other water insoluble chemicals;

- Materials that are not biodegradable or would pass through the sewage treatment plant into the Delaware River and be toxic to aquatic organisms or accumulate in harbor sediments;
- Flammable and combustible solvents such as acetone (flashpoints less than 140°F), unless sufficiently diluted in water as part of the laboratory process such that the solution has a flashpoint greater than 140°F;
- Discharges with a pH below 6.0 or higher than 8.5;
- Materials that could interfere with the biological processes of sewage treatment or would contaminate the sludge-making disposal through the normal methods difficult or impossible;
- All compounds that could result in the presence of toxic gases or vapors within the POTW in a quantity that may cause acute worker health and safety problems;
- Malodorous compounds or volatile organic chemicals that can escape from the plumbing system (such as dry traps) causing exposures or obnoxious odors (such as mercaptans or thiols);
- Metallic ions and salts of the heavy metals in solutions or suspension.

6.0 Chemicals that Require Special Handling

6.1 Peroxide Forming Compounds

Peroxide-forming chemicals are a class of materials that have the ability to form shock-sensitive explosive peroxide crystals.

Under normal storage conditions the materials listed in Appendix F have the potential to generate and accumulate peroxide crystal formations. These formations may violently detonate when subjected to thermal or mechanical shock.

6.1.1 Labeling Requirements

- All bottles of peroxide-forming chemicals must have the date received marked on the container.
- When the bottle is first opened, the container must be marked with the date opened.

6.1.2 Storage and Use Requirements

- Do not store peroxide-forming chemicals in direct sunlight as light can accelerate the chemical reactions that form peroxides.
- If the peroxide-forming chemical is flammable and requires refrigeration, then an explosion-proof refrigerator must be used.
- Do not distill, evaporate or concentrate a peroxide-forming chemical until you have first tested it for the presence of peroxides. (Peroxides are usually less volatile than their parent material and will tend to concentrate in the hot distillation pot).
- NEVER UNDER ANY CIRCUMSTANCES touch or attempt to open a container of a peroxide-forming liquid if there are whitish crystals around the cap and/or in the bottle. The friction of screwing the cap may detonate the bottle. If you encounter such a

bottle, contact the office of Environmental Health and Safety immediately for removal. DO NOT TOUCH OR MOVE THE SUSPECT BOTTLE FOR ANY REASON.

6.1.3 Disposal Requirements

There are three classes of peroxide-forming chemicals based upon the peroxide formation hazard:

- Class A – Severe Peroxide Hazard
- Class B – Concentration Hazard
- Class C – Shock and Heat Sensitive

See Appendix F for a list of peroxide-forming chemicals. Contact the Hazardous Materials Technician at extension 5225 or EHS at extension 5330 for disposal.

6.2 Unknown Chemicals

Unknown chemicals present serious problems, since without a label or description chemicals can neither be handled nor disposed of safely.

Every effort should be made to identify the chemical. The best solution to unknown chemicals is to prevent their occurrence. Periodically inspect all chemical containers for missing or damaged labels. Immediately replace or supplement hard to read labels with all essential information. **Never collect any material in an unmarked container with the intent on labeling it later.**

Label commercial products transferred to other containers not only with their name, but also the manufacturer's name and address. The latter information is essential to obtain all MSDSs for the material. Any information that can be provided will make identification of unknowns and subsequent disposal faster, safer, and cheaper.

If a waste is not identifiable as a specific compound, some description of the waste's probable hazards, chemical class, function groups, compatibility, flashpoint and pH is important. If no clue to the identity of the material can be found, it must be considered hazardous and removed by special handling procedures.

7.0 Special Waste Items for Collection

7.1 Compressed Gas Cylinders and Lecture Bottles

The majority of compressed gases used at the College are inert and non-toxic. However, some contain highly toxic or reactive materials that require special handling. Use refillable gas cylinders whenever possible and return to the supplier when empty. If you have a cylinder that cannot be returned to the original supplier, call EHS (x 5330) to arrange for appropriate disposal. Releasing the contents of a cylinder as a disposal method is prohibited. Users should carefully evaluate their processes to avoid over-ordering.

7.2 Aerosol Canisters

Aerosol canisters are used to disperse a variety of chemicals, including paint, lubricants and cleaners. Although aerosol canisters are common, they are often mishandled. Based on the requirements described in Appendix G, the College either recycles or disposes of aerosol canisters as a hazardous waste. Contact EHS at extension 5330 to arrange for a pick-up of your aerosol container.

7.3 Photographic Chemicals and Silver Recovery

Photographic chemical solutions that contain 5 mg/L or greater silver are considered to be a characteristic hazardous waste. Most fixer solutions from manual and automatic processing contain silver levels above 5 mg/L. Developer and stop solutions normally contain lower levels of silver but should be tested to verify. The solutions that contain 5 mg/L or greater silver cannot be put into the sanitary sewer unless the silver level is reduced to less than 5 mg/L.

Any silver bearing solutions or unused photographic chemicals should be tagged as a hazardous waste. Contact the Hazardous Materials Technician at extension 5225 or EHS at extension 5330 for disposal.

7.4 Waste Oil

Waste oil such as pump and hydraulic oil are not considered hazardous waste unless contaminated with solvents or metals. However, they are considered a Pennsylvania DEP regulated waste.

To temporarily store waste oil, use a container within secondary containment and label it as "Waste Oil Only". Maintain a written log to document all amounts and types of oil added to the container. No solvents, oil contaminated with solvents, PCBs, non-petroleum based oils, or any other material should be added to the container. Limit access to the container so that only used oil is added. Waste oil contaminated with hazardous materials must be disposed of as hazardous waste.

When the container is full, contact EHS (x 5330) to schedule a pick-up. The waste oil will be transferred to the College's waste oil storage tank that is located in the Facilities Operations building. Waste oil is picked-up on a regularly scheduled basis by a local oil recycling facility.

7.5 Pesticides

The College participates in the Pennsylvania Department of Agriculture's CHEMSWEEP program. The CHEMSWEEP program allows pesticide users in the state to safely dispose of unwanted or waste pesticides.

Contact Public Safety EHS for disposal of all waste pesticides. Waste pesticide must be stored in accordance with all applicable hazardous waste storage requirements until pick-up.

7.6 Disposal of Empty Containers

Empty containers that are no longer needed must be disposed of properly. A container that never held acute hazardous waste (P-list) is considered empty if all the following conditions exist:

- All chemical has been removed from the container;
- There is less than one inch of residue left in the bottom of the container or;
- There is less than 3% (0.3% for containers >110 gallons) by weight of residue left in the container and;
- For gas cylinders, the contents are essentially at atmospheric pressure.

Once a container has been "emptied" by the appropriate criteria, the label must be defaced by removing it, spray painting over it, or covering it with a bold marker.

Containers that once held acute hazardous waste (P-list, Appendix A) require special handling. For these materials, the container is considered empty if it has been triple-rinsed using a suitable solvent. The rinsate itself becomes hazardous waste. If the container is not first cleaned as stated above, then the container also becomes a hazardous waste. The most common laboratory chemicals found on this list are:

- Acrolein
- Allyl alcohol
- Compounds containing Arsenic
- Carbon Disulfide
- Compounds containing Cyanide
- 2,4, Dinitrophenol
- Nitric oxide
- Nitrogen dioxide
- p-Nitroaniline
- Osmium Tetroxide
- Phosgene
- Phosphine
- Sodium Azide
- Vanadium pentoxide

7.7 Paint and Painting Supplies

There are two (2) common types of paint available today, latex and oil-based. Latex paints are water based and are considered non-hazardous. Oil-based paints are flammable and are considered hazardous.

Older paints and some specialty paints, like aircraft or marine paints, still contain heavy metals or PCBs that can be harmful to people. The ingredients should be listed on the side of the container. If possible, use latex paint because it is the most environmentally friendly and least toxic paint.

Brushes and other supplies used with latex paint may be rinsed with tap water and drained to the sewer, but thinners and solvents used for oil-based paints must be collected as hazardous waste. For latex paints, residues can be evaporated to dryness and then thrown out as ordinary trash.

See Appendix H for paint disposal guidance. Contact EHS at extension 5330 if you have questions regarding the handling and management of paint waste.

7.8 Lead Paint

Paint chips from lead waste removal are usually considered hazardous waste. The College maintains a database of where lead paint has been identified in all on- and off-campus buildings. Additionally, EHS has developed an operating procedure for working in areas that contain lead paint.

For more information on lead-based paint management, contact EHS at extension 5330.

7.9 Asbestos

Asbestos does not meet the definition of a hazardous waste. However, it is regulated by the EPA under the Toxic Substances Control Act (TSCA) and the Clean Air Act (CAA). The College maintains a database of where asbestos has been identified in all on- and off-campus buildings. EHS has also developed an Asbestos Management Plan. The protocols outlined in the plan must be followed at all times.

For more information on asbestos management, contact EHS at extension 5330.

7.10 Biohazardous and Infectious Waste

Biohazardous or infectious wastes are not considered hazardous and are not regulated by the federal EPA. The Pennsylvania DEP has developed standards for the management of infectious wastes.

Infectious and biohazardous waste, including sharps, should be segregated from all other waste types. Specially labeled red or orange "biohazard" bags and puncture resistant sharps containers must be used for the collection of all infectious waste.

The College has developed a plan for the proper handling, storage, and disposal of infectious waste. Contact EHS at extension 5330 for additional information or to schedule a pick-up.

7.11 Radioactive Waste

The College has developed a Radiation Safety Program for the safe management of radioactive waste. For disposal of radioactive waste, contact EHS at extension 5330.

8.0 Universal Waste

Universal wastes are a group of hazardous wastes that are commonly generated by households and businesses such as batteries, fluorescent lamps, and thermostats. The universal waste regulations streamline management requirements to encourage collection and recycling or disposal of these wastes.

8.1 Fluorescent Lamps

Fluorescent lamps contain mercury and are considered hazardous or universal waste. Although low mercury or green-marked lamps may be legally disposed of in dumpsters with regular trash, it is the policy of Lafayette College to recycle all mercury containing lamps in accordance with guidelines below:

- Do not break spent lamp;
- Whenever possible, package spent lights in the original containers;
- Label containers as "Universal Waste – Lamps" and the date when the first bulb is added to the container;
- If lamp is broken, place broken pieces in an impervious container or plastic-lined cardboard box, label it as “Hazardous Waste – Broken Lamps”,
- Do not mix fluorescent lamps with incandescent bulbs.

See Appendix I for disposal guidelines.

8.2 Fluorescent Light Ballasts

Ballasts are used in fluorescent light fixtures. Many types of ballasts contain an oil filled capacitor that may contain PCBs.

- Check the ballast label. If the label says “No PCBs” the ballast can be disposed of in regular trash. All ballasts manufactured prior to 1979 that are not marked “No PCB” should be assumed to contain PCBs.
- If the label does not say “No PCBs” assume that it could contain PCBs and handle accordingly.

Place ballast suspected of containing PCBs in a drum, labeled as PCB Ballasts, and call Public Safety EHS for pick-up.

8.3 Mercury Containing Equipment

Mercury containing switches and thermostats are considered a hazardous universal waste by the Pennsylvania DEP. Metallic mercury found in manometers, thermometers, switches, old-style thermostats, and pressure or temperature equipment is present in many labs and facilities on campus. If mercury needs to be disposed of, place the device in a plastic bag, seal or tape tightly shut, place the bag in a small box, and tag the box with a hazardous waste accumulation tag. Alternatively, designate a wide mouthed plastic jug for storage of broken thermometers, etc., label as “Hazardous Waste,” and indicate contents as “Mercury.” Remember to keep tightly capped. Contact the Hazardous Waste Technician at extension 5225 or EHS at extension 5330.

9.0 Waste Minimization Plan

The College’s Waste Minimization Plan is designed to reduce the total amount of toxic substances used and subsequently disposed of as hazardous wastes. The College emphasizes reduction through improved chemical management and encourages substitution of non-hazardous chemicals whenever feasible and practical.

Consideration of the means of disposal of chemical, biological, and radioactive wastes should be part of the planning of all experiments before they are carried out. The best strategy for managing laboratory waste aims to maximize safety and minimize environmental impact, and considers these objectives during experiment planning. No activity should begin unless a plan for the disposal of nonhazardous and hazardous waste has been formulated.

Whenever practical, order the minimum amount of material possible in order to avoid the accumulation of large stocks of excess chemicals which will not be needed in future research. Such collections of unused and excess chemicals frequently constitute safety hazards, since many substances decompose upon long storage and occasionally their containers become damaged or degrade.

Reduction

- Reduce the quantity of waste produced, either by eliminating or substituting with nonhazardous material, or scaling-back the volumes worked with.
- Clearly mark or label the content of all containers.
- Analyze the waste you generate: is it necessary to generate the waste and what possible modifications can you make to the procedures that would result in the elimination or volume reduction of the waste generated.
- Purchase only the amounts of chemicals you know you will use. Buying in bulk may be less expensive initially, but the disposal cost of most surplus chemicals is many times greater than the original purchase costs.
- Maintain a chemical inventory. By knowing what you have on hand and where it is located you may avoid duplicate ordering and expired chemicals.
- Reduce the scale of your experiments. This decreases the amount of chemicals that are required to be purchased, decreases chemical exposure, reduces air pollution from emissions, and reduces the amount of waste generated.
- Increase the use of instrumental analysis as opposed to wet chemistry techniques whenever possible.

Substitution

- Substitute with non-hazardous or less hazardous materials whenever possible. Some examples of substitution in common laboratory procedures are listed below:
- When appropriate, less hazardous substances should be utilized in experiments such as Carosafe (ethylene glycol) for formaldehyde and cleaning solutions for chromic acids.
- Do not mix non-halogenated solvents with halogenated solvents (if maintained separately), since these can be recycled for beneficial reuse.
- Fluorine and fluorinating reagents are among the most demanding of reagents to handle because of their reactivity and toxicity. Less toxic substitutes have been developed such as F-TEDA-B F4.
- Organic solvents for liquid-liquid extraction or chromatography can often be replaced by other solvents with significant benefits. Benzene, once widely used as a solvent, has been satisfactorily substituted for by toluene.
- Diethyl-ether is flammable and has a tendency to form explosive peroxides. It can be substituted by methyl-t-butyl-ether. Methyl-t-butyl-ether is also flammable but its use

eliminates the need to monitor peroxide formation during handling and storage as it has greatly reduced tendencies to form peroxides.

- Organic solvents for high-performance chromatography can be replaced by supercritical carbon dioxide. While supercritical solvents require specialized equipment for handling, they offer the benefits of large reduction in organic solvent waste.
- Mercury thermometers are easily broken, which results in waste disposal costs and release to the environment. Substitution of alcohol thermometers eliminates these problems. Waste from broken alcohol thermometers can go into a cardboard box that can be disposed of in the regular trash.

Reusing Waste Chemicals

- Used solvent from one process may be used for another process that requires a less pure solvent.
- Reuse solvents for initial cleaning, reserve fresh solvent for final rinse.
- The end product from one experiment can be used as an ingredient for another experiment.
- Another researcher or laboratory may have a beneficial reuse of your waste chemical.

Proper Destruction or Disposal

- Do not stockpile chemicals. Excess or outdated chemicals should not be allowed to accumulate and create an unsafe working environment
- Do not abandon chemicals when you leave the College or move to another lab.
- Label and call in unused chemicals for pick-up by EHS prior to leaving the laboratory. Abandoned materials without labels become unknowns and are costly to dispose of.