Hazardous Waste Management

This guidance section was quoted directly from the EPA's Small Laboratory Guide, with some modifications to the text to provide specific guidance for MSSM or to incorporate NYC regulations where appropriate.

Although much of the activities contained within in are done by the Mount Sinai Medical Center Safety Officer, it is a good objective for all Principal Investigators and research staff, students, fellows and volunteers to understand how chemical waste is identified and moves through Mount Sinai to eventual disposal off-site by permitted, Transfer, Storage and Disposal facilities.

Areas that are "for your information only" are marked to that effect, although there may be some component that you should be aware of or should be meeting in labeling, storing or disposing of waste chemicals.

If you have questions regarding this content, or waste handling in general please contact the Safety Officer (47233) or the MSSM Biosafety Officer (41451).

Source: http://www.epa.gov/sbo/smalllabguide_500.pdf

Hazardous Wastes

Managing the generation and disposal of hazardous wastes is one of the most difficult environmental management challenges for staff in small labs. Common issues to address include classification, storage, labeling, treatment, and disposal of lab wastes as well as identifying opportunities to prevent its generation altogether**. [Most of these activities are handled by the MSMC Safety Officer- you need only to identify individual compounds in mixtures and offer wastes in an acceptable condition]**

Regulatory Considerations

The Resource Conservation and Recovery Act (RCRA), enacted in 1976, was written to provide "cradle to grave" tracking of hazardous waste. Pursuant to RCRA, EPA developed hazardous waste management regulations for generators and treatment, storage, and disposal facilities (TSDFs). In 1984, Congress expanded the scope of RCRA with passage of the Hazardous and Solid Waste Amendments (HSWA). HSWA directed EPA to adopt regulations governing small quantity hazardous waste generators (SQGs) such as many small labs.

Most labs routinely generate hazardous waste and, therefore, are subject to RCRA hazardous waste management regulations (40 CFR Parts 260 to 270). These regulations include requirements governing waste classification, accumulation, disposal, recordkeeping, and emergency preparedness.
EPA has delegated authority to implement and enforce hazardous waste management programs to the states and tribes. State and tribal regulations are at least as stringent as EPA's hazardous waste regulations. Still, it is important to keep up with the EPA regulations since EPA regularly publishes new hazardous waste management regulations that are enforceable in the states even though they may not yet be included in a given state's hazardous waste regulations.

Determine Which Hazardous Waste Requirements Apply [MSMC Safety Officer does this, but needs you to provide accurate information on labels]

Hazardous waste management requirements are dependent upon the type and quantity of wastes the lab generates. In order to properly manage hazardous waste, the lab must identify and inventory its waste streams, characterize these wastes, and then determine and track its waste generator status.

STEP 1: Identify and Inventory Waste

Identify all waste streams generated within the lab or facility. Examples include unused chemicals, process wastes, discarded or spent solvents. Once waste streams are identified determine the volume or quantity of wastes generated in a typical month.

STEP 2: Characterize the Waste

Next, characterize the wastes to determine if they are subject to regulation as hazardous waste.

Hazardous Waste Determination
To determine if a waste is a regulated hazardous waste, generators can use either knowledge or testing (40 CFR 262.11). If you don't know, then manage the waste as hazardous until you find out.

Is it a Solid Waste? Because hazardous waste is considered a subset of solid waste, a hazardous waste must first meet the EPA definition of solid waste. The term solid waste is used very broadly in RCRA and refers to **both nonhazardous and hazardous waste** including solids, liquids, semi-solids, sludges, and compressed gases. A solid waste may be abandoned (i.e., thrown away), ***inherently waste-like*** (e.g., certain dioxin containing wastes), unused or defective military munitions, or a material to be recycled.

Is it a Hazardous Waste? EPA defines hazardous waste in 40 CFR 261.
A solid waste is considered hazardous if it:

Multiple Codes
Hazardous waste may demonstrate more than one characteristic or be both listed and characteristically hazardous waste. Multiple codes then apply.

1. Is Listed on one of the hazardous waste lists [**www.mssm.edu/health_safety**] :

· **F-list (40 CFR 261.31):** Commonly referred to as the non-specific source list. It contains spent solvents, electroplating wastes, wastes related to the production or treatment of chlorinated hydrocarbons, wood preserving waste, and certain landfill leachates. Labs often generate F-listed spent solvents such as methylene chloride.

• **K-list (40 CFR 261.32):** Commonly referred to as the specific source list. It contains hazardous wastes from certain industries. Labs may manage K-listed waste if they accept waste samples from one of the 17 K-listed industrial processes such as pesticide manufacturing, inorganic chemical or pigment manufacturing and ink formulation.

• **P-list and U-list (40 CFR 261.33(e) and (f)):** The list applies to unused, discarded, commercial chemical products that are 100 percent pure, technical grade or with a sole-active ingredient on the P-list. It can also apply to discarded chemical solutions that were made in the lab in lieu of purchasing a commercial product or a spilled product. P-list wastes are classified as acutely hazardous wastes. U-listed wastes are classified as toxic wastes. The list applies to unused, discarded, commercial chemical products that contain a sole-active ingredient that appears on the U-list.

• **State Listed Waste:** State hazardous waste regulators often add wastes, such as waste oils and polychlorinated biphenyls, to their state lists of hazardous waste.

---or---

2. Demonstrates one of the following ***Characteristics***:
[Use the STRICT mnemonic; **"STRICT"** = Li**ST**ed, **R**eactive, **I**gnitable, **C**orrosive, or **T**oxic]

• **Ignitability** (40 CFR 261.21): Ignitable wastes, denoted by the code D001***, are generally liquids with flash points below 60°C (140°F)***. A non-liquid is considered ignitable if it is capable of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and burns in a manner that creates a hazard.

• **Corrosivity** (40 CFR 261.22): Corrosive wastes, denoted by the code D002, are generally aqueous solutions with a pH ≤2 or ≥12.5.

• **Reactivity** (40 CFR 261.23): Reactive wastes, denoted by the code D003, are those wastes that are generally unstable, explosive, capable of detonation when heated under confinement, or react violently with water. Also, wastes are reactive if they generate toxic cyanide or sulfide fumes when subjected to a pH between 2 and 12.5

• **Toxicity** (40 CFR 261.24): Toxic wastes, denoted by the codes D004-D0043, are wastes containing certain regulated constituents. To determine if wastes are toxic, they are subjected to the toxicity characteristic leaching procedure (TCLP). Wastes leaching contaminants at or above the regulated concentrations exhibit the toxicity characteristic and must be assigned the appropriate EPA hazardous waste code. Liquid wastes exhibit the toxicity characteristic if the waste itself contains contaminants above the regulated levels (TCLP doesn't need to be performed).

Is It an Excluded or Exempted Waste? Certain substances are excluded from the regulatory definition of solid and hazardous waste. Three exclusions that are particularly important to many labs are highlighted below.

· **Wastewater:** Mixtures of untreated sanitary waste and other (i.e., hazardous) waste discharged to a publicly-owned treatment works (POTW) are excluded from the definition of solid waste and, therefore, are not regulated hazardous waste (40 CFR 261.4(a)). This exemption also applies to on-site wastewater treatment systems with an NPDES permit. The discharges are subject to stringent water pollution control requirements (see Water Discharges, Section 3.2).

· **Samples:** Samples that are sent to the lab for analysis are not considered regulated waste while awaiting testing, while stored after testing for a specific purpose, or while being transported back to the sample collector (40 CFR 261.4(d)). However, once the samples are run and they are designated for disposal by the lab, they must be treated as a regulated waste.

· **Empty Containers:** Empty containers that once held hazardous materials are not regulated as hazardous waste if they meet the definition of "empty." ***Empty means*** all possible materials removed from the container using common practices, and

– For containers 110 gal or less; residue is no more than 3% by weight of the total capacity;

– For containers greater than 110 gal, residue is no greater than 0.3% by weight of the total capacity.

Containers that held ***acutely hazardous waste*** are considered empty only after being triple rinsed with a solvent capable of removing the acutely hazardous waste residue. ***The solvent rinseate then must be managed as acutely hazardous waste.***

Wastewater Treatment Residues

Even though wastewater may be excluded, sludges, residues and other recovered materials from your on-site wastewater treatments system are not excluded and may be hazardous waste.

Characteristically Toxic?

Check With Your State. Some states include materials in addition to those listed in 40 CFR 261.24. Check with your state or local regulators.

What About Mixed Chemical Wastes?

It is common for labs to generate waste streams that contain several chemicals mixed together. If this is the case, the Mixture Rule defines whether the waste is hazardous.

The Mixture Rule

ANY AMOUNT OF Non-Hazardous Waste	+	Any amount of listed hazardous waste	=	**Listed Hazardous Waste**
ANY AMOUNT OF Non-Hazardous Waste	+	Any amount of characteristically hazardous waste	=	**Nonhazardous waste** if not characteristically hazardous

• If a listed hazardous waste is mixed with a nonhazardous waste the resulting mixture will remain regulated as the listed waste regardless of the quantity of the listed waste present in the mixture.

- If a characteristic hazardous waste is mixed with a nonhazardous waste the resulting mixture **will be regulated as hazardous only if the resulting mixture still exhibits the characteristic**.

Labs may generate waste streams that contain a combination of chemical, biological, or radioactive substances. Multi-hazardous wastes are defined as those that contain more than one hazard in the waste. Any waste stream that presents **more than one type of hazard requires special management consideration because the selected treatment technology appropriate for one type of waste may not be appropriate for the other types. Multi-hazardous wastes must be evaluated on an individual basis and the constituent that poses the greatest hazard should be given priority.**
[This is why we *do not* use "Organic Waste" etc.- for safety reasons!]

Another term describing multi-hazardous waste that contains chemical hazards regulated by the EPA and radioactive substances regulated by the NRC only is "mixed waste." Some examples of lab mixed wastes include:

- Used flammable (e.g., toluene) liquid scintillation cocktails;

- Phenol-chloroform mixtures from extraction of radiolabeled nucleic acids;

- Aqueous solutions containing chloroform and radioactive material typically found in solutions generated by the neutralization of radioactive trichloracetic acid solutions;

- Certain gel electrophoresis waste (e.g., methanol or acetic acid containing radionuclides); and

- Lead contaminated with radioactivity.

STEP 3: Determine and Track Generator Status [not necessary for MSSM-since all lab wastes are handled in a single waste stream by the MSMC Safety Office; the following is "information only"]

Labs that generate hazardous waste are subject to varying requirements depending on how much hazardous waste they generate and accumulate in a month. (See Special Wastes, Section 3.7, for other used oil and universal waste.)

Generator Class. Under the Federal rules, there are three classes of generators.

Conditionally Exempt Small Quantity Generator (CESQG)

- Generate no more than 100 kg of hazardous waste, 1 kg of acutely hazardous waste, or 100 kg of contaminated waste from an acutely hazardous waste spill in a month.

- Accumulate no more than 1,000 kg of hazardous waste at any time.

Small Quantity Generator (SQG)

- Generate between 100 and 1,000 kg of hazardous waste and no more than 1 kg of acutely hazardous waste in one month.

- Accumulate no more than 6,000 kg of hazardous waste for up to 180 days (270 days if waste is to be transported over 200 miles).

Large Quantity Generator (LQG)

- Generate greater than 1,000 kg of hazardous waste or greater than 1 kg of acutely hazardous waste in one month.

- Accumulate greater than 6,000 kg of hazardous waste for up to 90 days.

Remember, states and tribes can define generators differently and set more stringent regulations. For example, the state of Maryland does not have a CESQG classification. Always be aware of and understand state generator requirements.

Oops, I'm Over This Month!
There are no exceptions. If you exceed the generation and/or accumulation limits in any given month, then you are subject to all the requirements of the larger class for that month. This even applies for episodic generation such as one time unused chemical round ups or spill cleanups. Plan ahead!

Hazardous Waste Log. In order to make an initial determination and then track and document the lab hazardous waste generator status from month to month, a facility wide hazardous waste log is recommended. Good information to include in the log is:

For each waste:
- Description of the waste (e.g., waste solvents from labs);
- Type of waste (hazardous or acutely hazardous waste);
- Hazardous waste class;
- Method of characterization (e.g., lab test date, knowledge);
- Amount generated in the month; and
- Amount accumulated in the month.

Totals:
- Amount of all hazardous waste generated in the month;
- Amount of all acutely hazardous waste generated in the month; and
- Amount of all hazardous waste accumulated in the month.

Hazardous Waste Generator Requirements

Once generator status is determined, the lab must develop hazardous waste handling and storage practices and procedures based on all applicable requirements and regulations. The table on the next page presents an overview of hazardous waste requirements that apply to labs depending on their generator status. Some key considerations and differences for small labs are highlighted below.

CESQGs

CESQGs must comply with two basic provisions for managing their hazardous waste:

- **Identify all hazardous wastes generated (i.e. no "organic wastes");**

- Send all hazardous waste to a hazardous waste management facility, landfill or recycler that is permitted by a state to manage treatment, storage or disposal of hazardous waste; and Many CESQGs labs opt to meet SQG requirements as a good management practice to help ensure that hazardous waste is properly managed.

RCRA REQUIREMENTS FOR LABS AS A FUNCTION OF GENERATOR STATUS*			
Requirement (40CFR)	CESQG**	SQG	LQG
Waste Determination (262.11)	Applicable	Applicable	Applicable
Generation Rate Limits (261.5 and 262.34)	<100 kg/mo	100-1,000 kg/mo	1,000 kg/mo or greater
Accumulation Quantity Limit w/o Permit (261.5 and 262.34)	Not to exceed 1,000 kg at any time Not to exceed 1 kg acute at any time	not to exceed 6,000 kg at any time	No limit
Accumulation Time (261.5 and 262.34)	No limit	180 days or 270 if waste is to be transported over 200 miles.	90 days
EPA ID Number (262.12)	Not required***; possible state requirement	Required	Required
Mark Containers with Start Date (262.34)	Not applicable	Applicable	Applicable
Mark Containers "Hazardous Waste" (262.34(a))	Not applicable	Applicable	Applicable
Air Emission Standards 40 CFR 265 Subpart CC	Not applicable	Not applicable	Applicable
Satellite Accumulation (262.34(c))	Not applicable	Applicable	Applicable
Use Manifests (262, Subpart B)	Not required***; possible state requirement	Required	Required
Exception Reporting (262.42)	Not required	Required after 45 days	Required after 35 days
Biennial Report (262.41)	Not required	Not required; possible state requirement	Required
Contingency Plan (265, Subpart D)	Not required, but OSHA (29 CFR 1910.38) requires emergency planning	Basic planning required in accordance with the standards in 262.34(d)(4) and (5) and 265, Subpart C as well as OSHA regulations	Full written plan in accordance with 265 Subpart D, is required by 262.34(a)(4) and OSHA regulations
RCRA Personnel Training (262.34 and 265.16)	Not required, but recommended	Basic training required by 262.34(d)(5)(iii)	Full compliance with the training requirements in 265.16 is required by 262.34(a)(4)
Storage Requirements (without permit) (262.34 and 265)	None, but OSHA regulations under 29 CFR 1910, Subparts H and N, apply, particularly 29 CFR 1910.106	Compliance with technical standards in Part 265, Subparts I and J; for containers and tanks is required by 262.34(d)(2) and (3) and OSHA regulations	Compliance with technical standards in Part 265, Subparts I, J, W, and DD, is required by 262.34(a)(1) and OSHA regulations
Recordkeeping Requirements (262.40)	Waste determinations and generation log required (notification of regulated waste activity, training records, manifests, and land disposal restriction notifications recommended)	Notification of regulated waste activity, waste determinations, generation log, manifests, land disposal restriction notifications, exception reports, and correspondence with local emergency responders (written contingency plan, weekly container inspection & periodic equipment maintenance logs, and RCRA training records recommended)	Notification of regulated waste activity, waste determinations, generation log, manifests, land disposal restriction notifications, exception reports, biennial reports, correspondence with local emergency responders, RCRA training records, and written contingency plan required (weekly container inspection is required & periodic equipment maintenance logs is recommended)
Waste "Designated Facility"	State-approved or RCRA permitted facility or legitimate recycler	RCRA-permitted facility or legitimate recycler	RCRA-permitted facility or legitimate recycler
Land Disposal Restrictions (268.7)	Possible state requirement	Applicable	Applicable

* Adapted from *Laboratory Safety & Environmental Management*, Vol. 5, No. 6.
** Although these items are not legally required under RCRA, most transporters and TSDFs will not handle hazardous waste without them.

SQGs

SQGs are required to meet registration, collection and storage area, emergency planning, and other requirements. SQGs must:

- Register with the appropriate (usually state) environmental regulatory agency using the Notification of Hazardous Waste Generator Activity;

- Comply with hazardous waste container requirements in 40 CFR 265, Subpart I except for air emission standards and a requirement to locate ignitable or reactive waste greater than 60 feet from the property line;

- Meet collection and storage requirements for satellite accumulation and accumulation areas;

- Provide at least one employee on the premises or on-call to respond to any emergency and act as the emergency response coordinator. The emergency coordinator must respond to any emergencies that arise;

- Post the following information next to the telephone in the area:
  - Name and phone number of the emergency coordinator and backup emergency coordinator,

  - Location of the spill control material, fire alarm, and fire extinguishers, and

  - Telephone number of the local fire department unless there is a direct alarm;

- Ensure that all employees are familiar with responding to emergencies and proper waste handling procedures in their work area; and

- Establish and implement recordkeeping procedures for waste characterizations, documentation on generator status, registration, manifests, exception reports, container inspection, land disposal restrictions (LDRs), and correspondence with local emergency responders.

LQGs

Although not common, it is possible for small labs to be LQGs, particularly as a result of episodic generation (e.g. during spring cleaning) or if they manage acutely hazardous waste. LQGs must:

- Register with the appropriate (usually state) environmental regulatory agency using the Notification of Hazardous Waste Generator Activity;

- Comply with hazardous waste container requirements in 40 CFR 265, Subpart I including air emission standards and a requirement to locate ignitable or reactive waste greater than 60 feet from the property line;

- Meet collection and storage requirements for satellite accumulation and accumulation areas;

- Prepare a Contingency Plan that documents the lab preparedness and prevention measures in accordance with 40 CFR 265, Subpart D;

- Develop and implement a formal training program; and

- Establish and implement the same recordkeeping procedures as for SQGs as well as training records, contingency plan and a biannual report. SQGs and LQGs must register with the EPA (40 CFR 262.12) and obtain an EPA identification number. The registration form, EPA form 8700-12, hazard and the actual words "Hazardous Waste" be on the container. Prudent practice would be to mark all hazardous waste containers in the lab with the words "Hazardous Waste" and other words that identify the containers contents (e.g., "waste hexane with trace pesticide contamination").

- **Container Condition and Compatibility**. Containers must be maintained in good condition (i.e., no rust, dents, or leaks, etc.) and must be compatible with the hazardous wastes they contain. Once hazardous waste leaves the satellite accumulation area and it enters an accumulation area "the clock starts." The container is dated, and the lab must ship the waste off-site to a permitted hazardous waste TSDF within the allowable time for the generator class.

For LQGs, waste must be disposed of within 90 days. For SQGs, the waste must be disposed of within 180 days or 270 days if the waste must be transported 200 miles or more for treatment, storage or disposal. If waste is not sent off-site within the required time frame, then the lab is subject to fines and in some cases, very cumbersome and costly RCRA storage permit requirements. Unlike satellite areas, there is no volume threshold for container size and accumulation amount (provided the generator monthly accumulation thresholds are not exceeded).

Regardless of when additional waste is poured into each container, all the waste accumulated in the container must be disposed of within the allowable time based on that start date for a SQG or LQG whether or not the containers are full. Accumulation areas have specific design and operational requirements that must be followed.

Different Containers, Different Dates

A lab generates waste isopropyl alcohol and waste formaldehyde. The wastes are collected in separate 5-gallon containers in satellite accumulation areas located in several labs. When the 5-gallon containers are full, they are carried to the accumulation area within 72 hours. The formaldehyde is accumulated in 55-gallon drums and the isopropyl alcohol is accumulated in a 250-gallon tank. The hazardous waste manager puts the start date on the drum and tank when they start to be used (when the first waste is poured in the empty container/tank). Therefore, two different wastes, generated concurrently in a lab process, may have different start dates in the accumulation area.

- **Labeling**. ***All containers must be marked with the words "Hazardous Waste"*** or with an EPA hazardous waste label.

OSHA Limits
Remember, regardless of satellite accumulation thresholds, OSHA standards limit the quantities of flammable materials such as waste solvent that can be stored in one lab room. ***[Also true with the FDNY]***

Hazardous Waste Collection and Storage

Federal regulations allow for two types of storage areas for SQGs and LQGs, satellite accumulation areas and accumulation areas.

Satellite Accumulation Areas

A satellite accumulation area is an area at or near the process that generates the waste. The area must be under the control of the operator of that process (40 CFR 262.34(c)). A common example for labs is the hazardous waste collection area in the individual lab. Federal regulations allow generators to store up to 55 gallons of hazardous waste or 1 quart of a particular acutely hazardous waste in a satellite accumulation area.

There is no limit on accumulation time. Once a container is full or more than 55 gallons of hazardous waste or 1 quart of acutely hazardous waste is accumulated, the full container or excess waste must be moved to an accumulation area within 72 hours. This is a common compliance challenge for labs.

What if I have more than one type of waste in my lab satellite accumulation area?

The 55-gallon threshold under the federal regulation applies to the **maximum quantity** of waste allowed in a Satellite Accumulation Area (SAA) regardless of the number of waste streams. The EPA does not limit the number of SAAs in a location. However, having large amounts of waste in one location **is not recommended**.

Waste in satellite accumulation areas must be managed as follows:

- **Closed Containers**.

All hazardous waste containers must be kept closed except when it is necessary to add or remove waste. **Evaporation of wastes in fume hoods is prohibited.[by the EPA]**

- **Labeling**.

Federal satellite area rules only require labels listing the container contents, but many states require that the contents, the hazard and the actual words “Hazardous Waste” be on the container. Prudent practice would be to mark all hazardous waste containers in the lab with the words “Hazardous Waste” and other words that identify the containers contents (e.g., “waste hexane with trace pesticide contamination”).

Container Condition and Compatibility.
Containers must be maintained in good condition (i.e., no rust, dents, or leaks, etc.) and must be compatible with the hazardous wastes they contain.

Accumulation Area Requirements [main MSMC Waste Storage area]
Once hazardous waste leaves the satellite accumulation area and it enters an accumulation area ***"the clock starts."*** The container is **dated**, and the lab must ship the waste off-site to a permitted hazardous waste TSDF within the allowable time for the generator class. For LQGs, waste must be disposed of within 90 days. For SQGs, the waste must be disposed of within 180 days or 270 days if the waste must be transported 200 miles or more for treatment, storage or disposal. If waste is not sent off-site within the required time frame, then the lab is subject to fines and in some cases, very cumbersome and costly RCRA storage permit requirements.

Unlike satellite areas, there is no volume threshold for container size and accumulation amount (provided the generator monthly accumulation thresholds are not exceeded). Accumulation areas have specific design and operational requirements that must be followed.

- **Labeling**. All containers must be marked with the words "Hazardous Waste" or with an EPA hazardous waste label. The date accumulation begins must also be marked clearly on each container. (Remember, for unknown wastes undergoing sampling, the accumulation start date is when the waste is generated not when the lab results are returned. Therefore, it is wise to manage all unknown wastes as hazardous).

- **Closed Containers**. All containers must remain closed unless adding or removing waste.

- **Container Condition and Compatibility**. Containers must be maintained in good condition (i.e., no rust, dents, or leaks, etc.) and must be compatible with the hazardous wastes they contain.

- **Incompatibles Storage**. Incompatible wastes must be separated to the greatest extent possible using distance, berms, or containment pans.

- **Inspections**. The area must be inspected weekly to look for any signs of corrosion, dents, bulges, or other signs of deterioration.

- **Preparedness and Prevention**. The generator must comply with 40 CFR 265, Subpart C that requires maintenance and operations of the facility to minimize the potential for release to the environment. The following emergency equipment and procedures must be maintained for the accumulation area and periodically tested to ensure it is in working order:

  – A communications device or alarm system capable of informing facility personnel and local emergency response authorities in the event of an emergency (i.e., phone, two-way radio);

– Portable fire extinguishers (including special extinguishers, foam, and dry chemical, necessary for the waste), spill control equipment, and decontamination
equipment;

- Water at adequate volume and pressure to supply water hose streams, foam producing equipment, or automatic sprinklers;

– Waste containers must be arranged in the accumulation area so that there is adequate aisle space to allow access for emergency personnel and equipment; and

– The following information must be posted next to the telephone in the area:

- Name and phone number of the emergency coordinator, and

- Location of the spill control material, fire alarm, and fire extinguishers and telephone number of the local fire department unless there is a direct alarm.

Hazardous Waste Container

Inspection Logs Inspections should be documented for SQGs and LQGs. Make up an inspection log that staff can use to document that everything has been inspected and checks out OK or that if not OK, action has been taken to correct the deficiency. Even though documented inspections are not required by Federal regulations for satellite accumulation areas, a simple inspection procedure and log can help lab staff maintain a safer working area.

Hazardous Waste Transportation and Disposal [Information only]

If a lab facility is not a permitted TSDF, the facility must transfer its hazardous waste to a regulated TSDF or recycling facility. The state or EPA permits TSDFs and recycling facilities, so it is important to ensure the company chosen to receive the labs waste has an EPA identification number. Because hazardous waste generators bear the burden for the compliant transfer and disposal of their hazardous wastes, it is important to understand all Federal, state and tribal regulations concerning the transfer and disposal of the lab's hazardous waste. The EPA requires generators to follow strict procedures for shipping hazardous waste to ensure it is handled properly.

Before transporting hazardous wastes the generator must ensure the containers are properly packaged, labeled, marked, and the transporting vehicle is properly placarded.

- **Packaging**.

Packaging must be done in accordance with all Department of Transportation (DOT) regulations. See 49 CFR 173, 178, and 179 for specifications.

- **Labeling and Marking**.

Before transporting the hazardous waste packages, the generator must label each package in accordance with DOT labeling requirements (49 CFR 172). The generator must mark all containers of 110 gallons or less used in transportation with:

HAZARDOUS WASTE – Federal Law Prohibits Improper Disposal.

If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency," the generator's name and number, and the manifest document number.

- **Placarding**.

According to 49 CFR 172 subpart F, the generator must placard or offer the initial transporter the appropriate placards and ensure they are used.

Hazardous Waste Manifesting [FYI – ONLY]

In accordance with 40 CFR 262 subpart B, all hazardous waste shipments being sent off-site to be managed at a TSDF must be accompanied by a hazardous waste manifest. Wastes may only be manifested to appropriate designated facilities, such as a permitted TSDF or a recycling facility.

Often, the hazardous waste contractor completes the manifests. However, lab personnel must review the manifest to ensure it is completed accurately and sign the manifest certifying that it is accurate.

The manifest is designed to document the hazardous waste disposal process from cradle to grave as follows:

- **Obtaining the Proper Manifest**. The generator must obtain the manifest from the state receiving the waste. If that state does not supply the manifest then the generator should use the manifest of the state in which they are located. If neither state supplies a manifest then the generator may obtain a manifest from the EPA.

- **Number of Copies**. The manifest must have at least as many copies as required by the generator, each transporter, the TSDF, and one to return to the generator.

- **The Manifest Process**. The generator and transporter sign and date the completed manifest. The generator retains one copy and gives the transporter the remaining copies. A designated representative from the TSDF signs the manifest when the waste is delivered and returns a signed copy to the lab within 35 days for a LQG and within 60 days for a SQG.

- **The Exception Report**. If the generator does not receive the signed manifest within the specified time period he/she must submit an exception report to the EPA.

CESQGs Need a Manifest Too!

RCRA does not require CESQGs to use manifests. However, some states agencies may require a manifest. DOT regulations also require a manifest for hazardous waste transport regardless of generator class . Therefore, hazardous waste transporters may also require CESQGs to use manifests. When the CESQG does not have an EPA ID number, the transporter may accept the notation of “Conditionally Exempt” in place of the ID number.

Land Disposal Restriction Notices

EPA regulations require that nearly all hazardous waste be treated prior to land disposal (40 CFR 268). Hazardous waste generators are required to notify the receiving TSDF when they ship land disposal restricted (LDR) wastes. LDR notices accompany the hazardous waste manifest and include the generator’s identification number, the appropriate treatment standards, and the accompanying manifest number.

Because lab waste typically includes a diverse array of chemicals in small quantities, they present special disposal concerns. In general, chemicals can either be consolidated into bulk waste streams that meet specific characteristics or “lab-packed”. The term “lab-pack” describes the most common method for packaging small quantities of lab waste. Small containers of compatible waste materials are placed intact into a larger packaging unit; usually a steel or fiber drum that contains an absorbent material, such as vermiculite, to cushion the containers and absorb spilled or leaked waste. An inventory is made as the containers are added to the drum. The drum is then sealed and a copy of the inventory sheet is attached to the drum. The drum is then shipped off-site for disposal accompanied by a hazardous waste manifest.

There are advantages and disadvantages to lab packing. This packaging method eliminates the need to transfer wastes and also reduces the occurrence of dangerous reactions resulting from mixing incompatible materials. However, this method is often the most expensive. The decision to consolidate or lab-pack should be made by those who are knowledgeable about the makeup of each waste stream and in consultation with the selected hazardous waste contractor. Note that only individuals who have successfully completed DOT “HAZMAT” training can prepare lab-packs. (49 CFR 173.12 (regulations governing lab-packs), 49 CFR 173 Subpart B (regulations governing packaging of hazardous materials) and 49 CFR 172 Subpart H (DOT training regulations)).

The Best Waste Disposal Option

It is important to decide on the best recycling or disposal method for that waste. Reputable hazardous waste transporters or hazardous waste management facilities can provide advice on the options that are most cost-effective and environmentally preferred to specific situations. Remember, however, that it is always the generator’s responsibility to understand and be in compliance with the regulations. Typical disposal options for chemical wastes include incineration for toxic materials, and landfill for nonhazardous materials. Hazardous waste transporters can also assist labs in meeting DOT shipping and RCRA transportation requirements and help prepare hazardous waste manifest forms.

Hazardous Waste Training

Lab staff should be trained annually in hazardous waste management and emergency procedures relevant to their positions. Obviously, since hazardous waste management responsibilities differ for various staff, so do training requirements. Labs should fashion training programs so that they are appropriate for their operations. RCRA regulations require that this training be formalized and documented for LQGs (40 CFR 262.34 and 265.16). While not explicitly required for SQGs or CESQGs it is a good management practice.

Pollution Prevention and Hazardous Waste

Pollution Prevention (P2) and waste minimization can reduce or eliminate the amount and/or toxicity of hazardous waste that must be recycled, treated, or disposed. Implementing a comprehensive hazardous waste P2 program may reduce the generator status of the lab and therefore reduce compliance requirements. Lab P2 also demonstrates good faith in compliance and this can be an asset when dealing with regulators and other community stakeholders. It can reduce potential environmental liabilities and help protect the environment through more efficient resource utilization. For example, automated analyzers generate less waste, often use smaller amounts of reagents and samples which means there are reduced air emissions, less water use and reduced energy consumption as well.

P2 increases hazardous waste awareness and the staff's adaptability and openness to new technology. In addition, it can improve housekeeping in a lab by leading to better tracking, better labeling and more timely use of chemical stocks. It may also cut expenses by reducing waste treatment and disposal costs, raw materials purchases, and other operating costs and usually increases productivity and safety in a lab.

As noted in Section 2.2, an effective lab P2 program should include a number of key elements, these are: obtaining management support, conducting a waste stream assessment, conducting a feasibility analysis, implementing the selected P2 or waste minimization options, and evaluating the program periodically and implementing recommended changes for improvement. The environmental health and safety (EHS) staff at a number of universities and company labs emphasize P2 in their training sessions to encourage waste minimization from the beginning for a lab employee and to demonstrate its importance to the institution.

There are many ways to prevent or minimize hazardous waste generation. The list below provides some ideas but is not exhaustive.

- Maintain a limited inventory of chemicals on hand so those chemicals do not expire or deteriorate and necessitate disposal and employ other front-end purchasing controls (e.g., purchasing solvents in automatic dispensers to minimize waste due to overages). Only mix what is needed.

- Develop a running inventory of unused chemicals for use by other departments.

- Reduce or eliminate the use of highly toxic chemicals in lab experiments.

- Centralize the waste management function to better track waste generation rates and management costs.

- Establish waste minimization goals.

- Perform routine self-audits and P2 opportunity assessment.

- Perform experiments on a microscale whenever feasible.

- Include in the experiment plan the reaction work-up steps that deactivate hazardous materials or reduce toxicity.

- Treat or destroy hazardous waste products as the last step in experiments. Use caution because a RCRA permit may be necessary.

- Reuse/recycle spent solvents.

- Recover metal from catalyst.

- Use procedures to reduce metallic mercury use (e.g., replace mercury-bearing instruments with alternatives, work with researchers to identify reagent substitutes for mercury salts, and develop a procedure for work on plumbing fixtures in old lab facilities).

- Keep individual hazardous waste streams segregated: hazardous from non-hazardous and recyclable from non-recyclable.

- Polymerize epoxy waste to a safe solid.

- Keep solvent containers closed when not in use.

- Reuse solvents after rotary evaporation.

- Replace chromic acid cleaning solutions with Alconox or a similar detergent and make other product substitutions that can save money and are less harmful to the environment. (e.g., Albany Medical Center (Albany, NY) reports that xylene, which is recycled by distillation, has substituted for limonene in all processes and this avoids 8.8 tons of hazardous chemical wastes, saves $25,000 in waste disposal costs and avoids $73,500 in purchase costs (at $35 per gallon).

- Examine the waste/excess chemicals to determine if there are other uses within the organization before discarding or other back-end inventory management options to employ (e.g., special tracking of chemicals that quickly destabilize to cull them out before they pose risks and are more costly to dispose.) While many lab facilities have chemical exchanges within their institutions, Bowling Green University operates a regional chemical exchange program and successfully worked out liability considerations.

- Examine opportunities for recycling computers.

To minimize the generation of multi-hazardous waste streams, consider the following points:

- Use P2 strategies to reduce multi-hazardous waste to a waste that presents a single hazard. By taking measures to limit the types of hazard in a specific wastestream the waste may be managed by standards methods only for that category; and

- When possible select a single management option. Some waste management methods are appropriate for more than one waste hazard. For example low-level radioactive animal tissue (radioactive-biological waste) can often be incinerated on-site in compliance with NRC regulations, which may be a satisfactory disposal option for both the radioactive and the biological characteristics of the waste. Some multi-hazardous waste can be disposed of safely in the sanitary sewer when allowed by the local POTW (see Water Discharges, Section 3.2). The problems presented by managing mixed wastes can be reduced by applying waste minimization techniques such as:

- Substitution of non-ignitable liquid scintillation fluid (LSF) for toluene-based LSF to reduce a chemical-radioactive waste to a radioactive waste. By substituting a biodegradable scintillation fluid (Escscint) for toluene based fluors and substituting luminescence assays for radioisotopes, scintallation vial disposal decreased by 667 pounds per year at Albany Medical Center and avoided disposal costs totaled $16,000 for 5,000 pounds of radioactive hazardous wastes (scintillation vials);

- Substitution of shorter half-life radionuclides such as $_{32}P$ for $_{33}P$ and $_{131}I$ for $_{125}I$ to shorten the hazard period;

- Use of 2.5ml scintillation vials (mini-vials) instead of 10ml vials to reduce waste scintillation fluid;

- Elimination of methanol/acetic acid and radioactive mixed hazards in gel electrophoresis work by skipping the gel fixing step if it is not required; and

- Prevention of radioactive contamination of lead by lining lead containers with disposable plastic or by using alternative shielding materials.

Thomas Jefferson University (Philadelphia, PA) and Albany Medical Center (AMC, Albany, NY) and other institutions have instituted programs to recycle computer and EDP equipment. AMC reports in its first year an estimated $160,000 was saved by removing from the wastestream and recycling 186 units of computers and EDP equipment.

In-Lab Treatment

Although not P2 or waste minimization, there are many benefits to undertaking appropriate waste treatment techniques in the lab. Federally allowable on-site treatment includes:

- Elementary neutralization;
- Treatment in accumulation containers;
- Onsite Recycling; and
- Burning in Boilers and industrial furnaces.

Section 5 provides additional details on these treatment methods and provides information on state specific allowances and requirements. If it is acceptable to incorporate treatment steps, suitable options for waste minimization (e.g., In-lab treatment) should be considered when planning experiments.

Often steps can be added at the end of the experiment or procedure to eliminate hazardous byproducts and wastes.
Some typical examples include oxidizing organic chemicals with sodium hypochlorite to produce nonhazardous waste, using phase separation of organics from aqueous solutions and liquids from solids.

Other in-lab treatment methods include precipitation of toxic metals, oxidation of inorganic cyanides and sulfides, and treatment of organic peroxides and hydro-peroxides. Ideally, every lab procedure should be reviewed to determine whether acceptable waste treatment steps should be developed and included. Some specific recommendations include:

- Destroy ethidium bromide using $NaNO_2$ and hydrophosphorus acid;
- Treat sulfur and phosphorus wastes with bleach before disposal;
- Treat organolithium waste with water or ethanol; and
- Consider including detoxification and/or waste neutralization steps in lab experiments.

Source: http://www.epa.gov/sbo/smalllabguide_500.pdf

HAZARDOUS WASTE MANAGEMENT PROGRAM CHECKLIST	
Action	**Notes**
Hazardous Waste Identification	
1. Verify waste has been properly characterized to determine that (1) it is hazardous waste and (2) proper EPA identification code numbers have been assigned.	
Generator Status	
2. Ensure the facility has a system to determine the generation rate and quantity of hazardous waste accumulated on-site and uses this data to ascertain generator status	
3. Determine, if required (e.g., SQG or LQG), that the facility has an EPA identification number.	
Satellite Accumulation	
4. Verify each satellite accumulation area (SAA) is at or near the point of waste generation for each waste and is under the control of the operator of the process that generated the waste.	
5. Verify waste containers are labeled "Hazardous Waste" and/or with words to indicate their contents.	
6. Verify waste containers are kept closed and are in good condition.	
7. Verify wastes are compatible with containers.	
8. Verify wastes in any given SAA do not exceed 55 gallons of hazardous waste or one quart of acutely hazardous waste.	
Central Accumulation Area	
9. Ensure every hazardous waste container is marked "Hazardous Waste" and with its accumulation start date.	
10. Verify waste is stored $\leq$90 days for LQGs and $\leq$180 days for SQGs, or 270 days if transported more than 200 miles.	
11. Ensure incompatible wastes and/or materials are separated or protected by physical means (e.g., wall, cabinet).	
12. Determine if internal communications equipment is available (e.g., two-way radio, telephone).	
13. Ensure floor drains are covered to prevent a spill from entering.	
14. Verify that fire extinguishers are in place and that a water supply is available.	

HAZARDOUS WASTE MANAGEMENT PROGRAM CHECKLIST	
Action	**Notes**
15. Determine if decontamination equipment is available (emergency shower, eyewash).	
16. Verify aisle spaces are unobstructed.	
17. Verify containers are inspected for leakage and/or corrosion at least weekly and inspections are recorded.	
18. Ensure the storage area provides secondary containment.	
19. Ensure personal safety equipment is available and usable.	
20. Determine if ignitable and reactive wastes are handled and stored in a manner to prevent fires and/or explosives.	
21. Verify containers are arranged on shelving so that the heavy containers are on the lower shelves and smaller containers on higher shelves.	
22. Ensure the shelving supporting hazardous wastes is in good condition and sturdy enough to support the load.	
Hazardous Waste Disposal	
23. Verify any hazardous waste treated or disposed on-site (e.g., neutralized and/or discharged down the drain) is done so in accordance with all applicable regulations.	
24. Ensure any hazardous waste leaving the site is sent to an appropriately permitted TSDF.	
25. Verify the hazardous waste transporter/broker is licensed, insured and reputable.	
26. Determine if employees responsible for shipping hazardous waste have been trained in accordance with DOT regulations.	
Recordkeeping and Reporting	
27. Verify the following records are retained on-site for at least three years: • Manifests; • Waste analyses results; • Inspection records; • Training records; and • Land disposal restrictions notifications.	

HAZARDOUS WASTE MANAGEMENT PROGRAM CHECKLIST	
Action	**Notes**
28. Determine if hazardous waste manifests signed by the transporter and designated TSDF have been received by the facility within the appropriate time period (e.g., 35 days for LQG and 60 days for SQG).	
Emergency Preparedness	
29. Ensure an emergency coordinator who is familiar with response procedures at the facility has been designated and is on site or on call at all times.	
30. Verify emergency phone numbers (Fire Department, Police Department and Local Hospital) have been posted.	
31. Ensure the Fire Department is aware of the types and quantities of hazardous materials stored in the facility.	
32. For LQGs, determine if a written contingency program has been developed and distributed.	
33. Verify that spill cleanup materials and equipment (e.g., absorbents, neutralizers, and personal protective equipment) are available.	
Management System	
34. Ensure copies of current Federal, state, tribal or local hazardous waste management regulations are available.	
35. Ensure an individual has been designated to manage hazardous waste at the facility (e.g., tracking, accumulation, disposal, minimization and recordkeeping).	
36. Ensure a formal training program (e.g., waste management, and emergency response) is in place.	
37. Determine if a system to track the quantities of chemicals and hazardous wastes on-site is in place.	
38. Determine if the lab has investigated and, where feasible, implemented P2 opportunities.	