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Hazardous Waste Management

1. Purpose / Background

The purpose of this Standard Operating Procedure (SOP) is to outline requirements for identifying, handling, storing, labeling, and disposing of hazardous chemical waste for the protection of the environment and the limitation of regulatory liabilities.

A material becomes a waste when it is designated for disposal. A “solid waste” is defined as any discarded material (gaseous, solid, or liquid) which is abandoned, burned, disposed, spilled, or handled in a manner constituting disposal. The Massachusetts Institute of Technology (MIT) generates a significant amount of solid waste per year. Some of MIT’s solid waste streams meet the definition of hazardous waste and must be managed according to strict federal and state regulations.

2. Scope

This SOP is applicable to all generators of hazardous waste at MIT. Hazardous waste is commonly generated during laboratory operations, facilities operation and maintenance, and a variety of other activities. This SOP addresses procedures for determining whether a waste is considered hazardous and describes MIT’s management of hazardous wastes.

Specific procedures regarding the removal of hazardous waste from Departments, Labs and Centers (DLCs) through their final disposal offsite are addressed in EHS SOP-003, Hazardous Waste Removal and Disposal. Hazardous Waste management costs that fall outside of the routine scope of work by EHS are covered in Appendix A: Hazardous Waste Costs Covered by the DLC.

3. Prerequisites

All personnel involved in generating and/or managing hazardous waste must complete annual hazardous waste training as described in Section 6 of this SOP.

All buildings/facilities in which hazardous chemical wastes are generated must be part of, or contiguous to, a land parcel registered by MIT with the state and federal governments as a generator of hazardous chemical waste. For this purpose, contiguous means that it directly abuts, separated only by a public right-of-way such as a street. Properties which are adjacent diagonally across a public right of way (not directly across from one another) are not contiguous and require separate registration.

4. Procedures

4.1. Waste Determination

The waste generator is responsible for classifying solid wastes as either hazardous waste, universal waste, or non-hazardous waste in accordance with federal and

state regulations. Universal wastes are a subset of hazardous waste but are subject to less control and oversight if they are recycled. Please refer to EHS SOP-0034, Universal Waste Management for the MIT Community, on the EHS website for further details.

There are two methodologies which can be used to determine whether or not a solid waste is a regulated hazardous waste:

- Laboratory testing and analysis can be used to measure the exact constituents in a chemical waste and to determine what physical properties it exhibits, or
- Generator knowledge can be used, based the generator's full, detailed understanding of the waste and its properties.

Note that it is almost always okay to over-classify a solid waste as hazardous as a conservative means of management, but it is never acceptable to under-classify a hazardous waste as merely solid waste. Testing and analysis is often used to demonstrate and document that a waste is NOT hazardous, while generator knowledge is often sufficient to determine that a waste IS hazardous.

Hazardous Wastes pose the greatest threat to human health and the environment and bear the full burden of environmental regulation with fines up to \$72,000 per violation per day. A solid waste is classified as a hazardous waste if it is listed on a federal, state, or local hazardous waste list, or if it exhibits a hazardous characteristic.

4.1.1. Listed Hazardous Wastes

The federal Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (MADEP), and MIT all publish lists of chemicals which must be managed as hazardous wastes. Chemical wastes which appear on the lists must be managed as hazardous wastes.

- EPA lists include wastes from specific sources, from non-specific sources, off-spec chemicals and acutely-toxic chemicals. These lists can be viewed at the EHS website at <https://ehs.mit.edu/regulated-waste-program/chemical-waste/>
- Massachusetts has added petroleum-based oils (vacuum pump oil, motor oil, fuels, cutting oils for example) and polychlorinated biphenyls (PCBs) to the list of wastes regulated in the state.

MIT collects additional materials such as ethidium bromide and nano-sized particles (unbound) to the list of wastes considered hazardous on campus.

4.1.2. Characteristic Hazardous Wastes

Wastes are hazardous wastes if they exhibit any of the following characteristics:

- **Ignitability** - liquids with flashpoints of less than or equal to 60 ° C / 140° F., solids that can ignite spontaneously and oxidizers. Examples include alcohols, organic solvents, oil-based paints, solvent-based adhesives, and permanganates (oxidizers).
- **Corrosivity** – aqueous solutions with a pH equal to or less than 2 or equal to or greater than 12.5. Note that solids, which when mixed with water would yield a liquid which meets this description, should also be collected as hazardous waste. Examples include strong acids and bases.
- **Reactivity** - materials that tend to be unstable at normal temperature and pressure or may react spontaneously with air, water or other chemicals releasing potentially toxic gases. Examples include cyanide or sulfide molecules, and reactive metals such as lithium.
- **Toxicity** – materials that contain one or more of 39 specific contaminants on the EPA's toxicity characteristic list, available at the EHS website at <https://ehs.mit.edu/ignitable-reactive-toxic-corrosive/> The list includes 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and many halogenated materials (ex. chloroform, trichloroethylene, pesticides) which must be managed as hazardous wastes.

4.1.3. Mixture rule: Any time a listed hazardous waste is mixed with a non-hazardous waste the entire mixture becomes hazardous waste. If a waste that is hazardous due to exhibiting a hazardous characteristic is mixed with a non-hazardous waste, the entire mixture becomes hazardous if it continues to exhibit the characteristic. However – deliberately diluting characteristic wastes with other materials to remove the characteristic is a strictly-prohibited form of treatment.

4.1.4. Spills: All wastes generated during the clean-up of a spill of hazardous waste must be disposed of as hazardous waste. For example, if a spill of acetone occurs in a laboratory all of the gloves and absorbent materials used in cleanup become hazardous acetone waste. Note that dust pans and re-useable items that aren't waste can be cleaned and returned to service.

4.2. Hazardous Waste Management

4.2.1. Satellite Accumulation

Every workplace where hazardous chemical waste is generated must designate an area(s) where those wastes will be accumulated. These areas are known as Satellite Accumulation Areas (SAA) and they must adhere to the following rules:

- The SAA must be at or near the place where the hazardous waste is being generated. In general, if you have to walk a long way or pass through a doorway to get there, your SAA is too far away.
- The SAA must be identified with a sign or label that says, 'Hazardous Waste Satellite Accumulation Area'.

- The SAA must be under the control of the people who are generating the waste; those who generate the waste must also manage its accumulation.
- There can only be one active container of any waste stream in a single SAA. Fill the first container, then start the second.
- Full containers must be removed from the SAA within three days of becoming full.
- There can be no more than 55 gallons of hazardous waste in the SAA, and for chemicals which are listed on the EPA's 'acutely hazardous waste' list (P list), there can be no more than one quart in the SAA.
- ONLY hazardous wastes belong in the SAA; virgin chemicals, empty bottles, squeeze bottles should all be placed somewhere else.

4.2.2. Hazardous Waste Container Management

Hazardous waste must be stored in containers subject to the following requirements:

- **Closure** - Containers storing hazardous waste must be closed at all times, unless waste is being added or removed.
- **Condition** - Containers must be in good condition. There may not be severe rusting, dents, cracks, or other conditions that could cause leaks.
- **Compatibility** - Containers must be compatible with the hazardous wastes stored in them. A metal container should not be used to store aggressively corrosive substances.
- **Containment** - Containers must be stored in a 'secondary container' (usually a plastic bin or tray) to contain spills/leaks. Incompatible wastes should be segregated and stored in separate bins to prevent any potentially dangerous reaction.
- **Weekly Inspection** - Containers must be inspected weekly by lab and/or facilities personnel generating the wastes to ensure that they are properly labeled, in good condition, and meet other criteria described above.

4.2.3. Hazardous Waste Labeling

Every container in a Satellite Accumulation Area must be labeled with the following information:

- The words "Hazardous Waste." The 'red tags' that MIT EHS provides already contain this text.
- The name of the chemicals being accumulated in the container. They must be spelled out in full, English words with no symbols, formulas, abbreviations or trade names.
- A statement of the hazard(s) associated with the waste. The MIT 'red tags' have four (4) boxes labeled "ignitable," "corrosive," "reactive," and "toxic."

At least one, possibly all, of these boxes must be checked, depending on the hazard(s) posed by the chemical waste.

- The date the container becomes FULL. One a hazardous waste container in a Satellite Accumulation Area becomes full, it must be dated. It must be removed from the SAA within three (3) days.
- Generator information included as the name of the person who generated the waste, the building and room number, and the principal investigator/supervisor must be written on the label.

4.2.4. Main Accumulation Areas (MAAs)

Containers which become full in Satellite Accumulation Areas must be moved, within 3 days, to Main Accumulation Areas from which they will be shipped offsite. In some cases, generators self-transport their full containers to MAAs. Most generators will place an on-line chemical waste pickup request using [the form](#) available on the EHS website. Hazardous waste removal and disposal is described in detail in EHS SOP-0003, Hazardous Waste Removal and Disposal.

4.2.5. Waste Minimization

Wherever feasible, the generation of waste is to be reduced or eliminated. Minimizing hazardous waste wherever and whenever an opportunity arises will result in a safer workplace, substantial disposal cost savings, reduced liability and a cleaner environment. Typical waste minimization methods include:

- pre-purchasing considerations such as using less raw material,
- process changes with raw material substitution,
- inventory control,
- volume reductions, and
- Recycling/recovery at the point of generation.

4.2.6. Unknown Waste

Unknown wastes are not accepted for disposal. It is the responsibility of the generator to identify all chemical wastes. Polling laboratory personnel, students and faculty members to ascertain the owner of such unknown waste might be necessary to determine its identity prior to disposal. It must be constantly emphasized to researchers that they identify and label all wastes and project products. EMP can be contacted with any questions, or if the identity of the waste cannot be ascertained. In situations where the waste is truly unknown, the DLC will be financially responsible for analytical services to characterize the waste prior to disposal.

4.2.7. Peroxide-forming Chemicals

Chemicals known to be peroxide-forming chemicals must be tested for peroxides prior to disposal if manufacturer and/or recommended expiration dates have been reached. Please refer to the MIT EHS SOP, Peroxide-forming Chemicals (EHS-0042) for details. Peroxide levels must be indicated on the red tag along

with the test date to ensure testing has been completed within the past 30 days and that peroxide levels are at or below 20ppm.

4.2.8. Abandoned Chemical Wastes

If it is discovered that an unknown person has abandoned a chemical or chemical waste on MIT property, the person discovering the unauthorized waste shall contact EHS immediately. EHS will investigate and manage the characterization and disposal of the waste. It is the responsibility of the DLC which manages the location of the abandonment to take the necessary measures to prevent recurrence. The cost of recurring chemical waste abandonment will be borne by the DLC which maintains the location.

4.3 Contingency Plan

As a large quantity generator of hazardous waste, MIT maintains a plan for preventing and responding to emergencies that arise from spills or releases of hazardous waste. EHS Office has developed a HW Contingency Plan to help manage spill response and emergency situations related to hazardous waste management. The Plan is reviewed annually or when changes are required (change in personnel, change in MAA locations, etc.) by EMP, who then notifies the appropriate parties of those changes. The Plan includes:

- a list of names, addresses, and phone numbers (office and home) of all persons qualified to act as emergency coordinator,
- A Quick Reference Guide which summarizes the personnel, waste location/types, and equipment at MIT,
- Maps showing the location and a physical description of the campus and each Main Accumulation Area,
- A list of emergency equipment such as fire extinguishing systems, spill control equipment, communications and alarm systems, and decontamination equipment.

In addition to addressing emergency issues and large releases, MIT has attempted to enter into response/aid agreements with local hospitals, the Cambridge Fire Department, the Cambridge Police Department and emergency spill response companies.

5. Roles & Responsibilities

Each Department, Lab and Center (DLC) is responsible for managing the operations within its spaces so that Institute hazardous waste procedures are met. This includes setting up and managing Satellite Accumulation Areas, timely disposal of old or outdated chemicals, and restricting access to spaces to prevent unauthorized waste dumping or abandonment.

Principal Investigators (PI's)/Supervisors have the primary responsibility for ensuring that their personnel follow the Institute's procedures for the management of hazardous waste(s).

Laboratory and facility personnel are responsible for maintaining an active inventory, for making the initial hazardous waste determination, and following MIT's hazardous waste management procedures including those for satellite accumulation, container management and labeling. Laboratory and facility personnel are also responsible for weekly inspections of all Satellite Accumulation Areas under their control.

EMP is responsible for the oversight of the hazardous waste management program at MIT and provides support in all areas of hazardous waste operations, including:

- Providing training and/or training materials to faculty, laboratory and facility personnel who generate hazardous waste;
- Assisting in hazardous waste determinations;
- Conducting and documenting weekly inspections of all Main Accumulation Areas;
- Performing analytical or hazard characterization testing as needed;
- Providing labels and supplies for hazardous waste management to generators on campus;
- Managing the transportation of the Institute's hazardous waste from SAAs and MAAs through to approved disposal facilities, including management of all associated records and paperwork; and
- Preparing and updating policies and guidance documents related to the proper management of hazardous wastes and notifying DLCs when circumstances arise which require a change in waste management practices.

6. Training

All personnel generating hazardous waste, or who manage those who generate hazardous waste, must receive training prior to working alone in a role which generates hazardous waste, and then receive annual training thereafter. Most campus users take the Managing Hazardous Waste training (EHS training course 501) via the online module or at an in-person session.

Anyone who wishes to conduct a hazardous waste training session on campus, and all staff who will review and sign hazardous waste manifests, must complete annual Advanced Hazardous Waste training (EHS course 502).

As a Large Quantity Generator of hazardous waste, MIT maintains a Hazardous Waste Training Plan which describes training requirements and methodologies for campus personnel.

7. Monitoring Requirements

Hazardous waste generators are responsible for conducting weekly inspections of all SAAs under their control, but are not required to document these inspections. Typically this is done as part of a laboratory Level I Inspection.

EMP personnel inspect Main Accumulation Areas weekly for compliance and to detect leaks, cracks, or deterioration and/or depletion of necessary equipment. These inspections are documented.

8. Record Management

EMP is responsible for maintaining all records and reports required by federal and state regulations. MAA inspections, waste manifest records, exception reports, waste analyses, biennial reports, and training records are stored at the EHS Office in accordance with EHS Records Retention SOP.

Copies of hazardous waste manifests, exception reports, waste analyses and biennial reports are maintained for at least three years. Training records for Institute employees participating in hazardous waste management training sessions are maintained indefinitely.

9. References

Additional resources that may be useful in performing the procedures identified in this SOP include:

9.1 Standards

- 40 CFR 260 – 268 RCRA Regulations for the Management of Solid Waste
- 310 CMR 30 – Massachusetts Hazardous Waste Regulations

9.2 Other SOP/ SOGs

- EHS-0003: Hazardous Waste Removal and Disposal
- EHS-0004: Spill Response Procedures
- EHS-0042: Peroxide-forming Chemicals
- EHS-0026: Laboratory Cleaning, Decontaminating, and Decommissioning
- EHS-0034: Universal Waste Management for the MIT Community
- EHS-0047: Fact Sheet - Lab Waste Stream
- Administrative SOP, EHS-04-0044: EHS Records Retention
- MIT Hazardous Waste Contingency Plan
- PCB Caulking Fact Sheet
- Appendix A – Hazardous Waste Costs Covered by the DLC

10. Definitions

- **Hazardous Waste** – Waste which exhibits certain governmental defined characteristics; is listed by a regulatory agency as hazardous waste; or is mixed with one of the previously mentioned hazardous wastes. These wastes carry full burden of environmental regulation.
- **Satellite Accumulation Area** – A point where hazardous waste is collected, must be at or near the area where it is generated and is under the control of the people generating the chemical waste.

- **Hazardous Waste Main Accumulation Area** – A point where hazardous waste, usually from satellite accumulation areas, are collected and stored prior to shipment offsite for disposal or recycling. These storage areas are maintained by EHS and subject to weekly inspections.

Appendix A: Hazardous Waste Costs Covered by the DLC

The costs for the following types of services are expected to be covered by the Department, Lab or Center (DLC), not the Environment, Health & Safety Office (EHS). Assistance can be provided by the EHS Hazardous Waste Team. Contact environment@mit.edu for more information.

Type of Service	DLC Cost	Way to Minimize Cost
Cylinder Disposal (non-returnable)	Cylinders which cannot be returned and must instead be sent as waste for disposal will incur a cost. EHS will work w/ the DLC to provide a quote of the costs associated with their specific request prior to removing the cylinders. Disposal costs can range from \$100-\$3000(+) depending on the request & volume.	Order reusable lecture bottle gasses when possible; order compressed gasses from vendors that will take back their cylinders and order only what you need.
Unknown Chemical Waste Testing	Each characteristics test will cost the lab roughly \$50. These tests are conducted in the lab by our onsite vendor to determine the basic hazards for safe handling and processing the material.	Ensure all chemical and waste collection containers are clearly labeled with full chemical name, date and initials; verify sample information with researchers leaving the lab or Institute prior to their departure.
Highly Hazardous Chemical Disposal	Explosives, temperature and shock sensitive chemicals generally require additional measures to ensure their safety for transportation and disposal. For example, a police or fire department detail to oversee a remote opening to stabilize the material for shipment may be required. These requests may range from \$500-\$1500(+) depending on the material & volume.	Maintain an active inventory; order only what you need and identify the owner of the material on the container w/ the date of expiration. Determine if a less hazardous chemical can be used for the process as an alternative. Clean out old chemical stores, including refrigerators and freezers, regularly.
Analytical Testing	Testing needed to identify contents of equipment or material slated to leave campus for disposal can range from \$150-\$5000 depending on the required level of analysis.	Make sure all chemical containers are fully labeled. Know the contents and age of your equipment prior to requesting disposal.
Lab Cleanouts	A cleanout may be needed due to a lab move, decontamination request, new PI	Keep an active inventory. Reach out to colleagues in other MIT labs

	coming to campus or a researcher leaving campus with a lot of legacy chemicals to remove at one time. Due to the high volume of chemicals at this one time, a fee associated with chemical management is placed on the lab.	to see if they can use your unwanted chemicals.
Lab Decontaminations	If a DLC has the need for an environmental service provider to fully decontaminate their space (lab, cold or warm rooms, dark rooms, equipment room) the Hazardous Waste Team will work with the lab to ensure competitive rates are received for the service and that the work is completed to their satisfaction. This service may be the result of an Emergency Response, contamination of equipment and workspace due to a specific chemical or process, or a new PI entering a previously used lab. Recent requests have ranged from \$500-\$10,000.	Determine what chemicals are used in the space, as the decontamination may be able to be completed by the lab occupants. Practice good housekeeping during the course of your research and wipe down workspaces routinely with materials such as dilute bleach solutions and Simple Green.
Project* Related Items	Analytical testing, decontamination, removal of abandoned wastes and disposal of project related wastes; such as, waste water, contaminated soil and equipment, oil with PCBs, etc. will be billed to the Project.	Ensure the departing PI is held responsible for costs associated with their residual chemical wastes or decontamination.

**The term "Project" refers to Facilities capital projects and renovations that have Institutional funds allocated to complete a particular scope of work. In the event waste is generated due to a renovation or capital project EHS is available to facilitate the waste management and compliance needs but funds should be allocated through the project.*

While EHS maintains a budget to cover costs for routine hazardous wastes generated as a result of research, education and facilities activities, the items listed above are not covered by the EHS Office, rather by the DLC or Project generating the waste or entity requesting the service. EHS will work with the DLC to secure competitive quotes from environmental service providers and will oversee the operation to ensure full compliance and satisfaction with the work requested.

To avoid these costs, EHS stresses that it is in the lab's best interest to maintain an active inventory of their chemicals, ordering only what is needed and removing expired chemicals before they become more hazardous. Remember, once you've determined that you no longer

need a particular chemical or the expiration date has been reached, the chemical becomes a waste.