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 waste.

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 handled in a particular manner to comply with federal and state regulations.

2. Scope
This SOP is applicable to all generators of hazardous waste at MIT. Hazardous waste is commonly generated from 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 hazardous waste management. Specific procedures regarding the removal of hazardous waste from Departments, Labs and Centers (DLCs) are addressed in the “Hazardous Waste Removal and Disposal” SOP. 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
Departments, Labs and Centers (DLCs) that generate and handle hazardous wastes must manage their waste streams in accordance with this procedure. If a DLC operation that has not previously generated hazardous waste, plans to or begins to generate a waste that may be hazardous, Environmental Management Program’s (EMP) personnel should be consulted. All personnel involved in generating and/or managing hazardous waste must complete the annual hazardous waste training.

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 the EHS SOP on Universal & Electronic Waste management (SOP_0034) on the EHS website for further details.

Hazardous Waste: Hazardous wastes require a greater degree of attention throughout their life cycle. A solid waste is classified as a hazardous waste if it is:

- **Listed Hazardous Waste**
  Federal and state regulations list several categories of substances, which have toxic, carcinogenic, mutagenic, and/or have teratogenic effects in humans, or have an adverse impact on the environment as hazardous waste. These substances are listed by specific sources, non-specific sources, discarded commercial chemical products, container and spill residuals, or are considered acutely hazardous. EPA’s Acutely Hazardous Waste list is of special interest to labs [http://ehs.mit.edu/site/training](http://ehs.mit.edu/site/training), click on Course Materials/Resources link.

- **Characteristic Hazardous Wastes**
Wastes are hazardous wastes if they exhibit any of the following characteristics:

- **Ignitability** - liquids with flashpoints of less than 60 °C or approximately 140 °F., solids that can ignite spontaneously and oxidizers;

- **Corrosivity** – aqueous solutions with a pH equal to or less than 2 or equal to or greater than 12.5.

- **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 (e.g., cyanides, osmium tetroxide, ethers, etc.).

- **Toxicity** – materials that contain one or more of 39 specific contaminants (http://ehs.mit.edu/site/training click on Course Materials/Resources link)
  - Other Hazardous Wastes, including PCB wastes with concentrations that are greater than 50 ppm or 10 ug/cm².

Waste that is by itself would be considered non-hazardous becomes a hazardous waste if it is mixed with a material that meets any of the above criteria. Improperly managed universal wastes are hazardous waste. Massachusetts regulates waste oil as a “State Only” hazardous waste.

### Examples of Hazardous Waste:

- Adhesives (solvent-based)
- Solvents
- Photographic film
- Paint thinners
- Processing waste (fixer only)
- Paints (oil-based only)
- Battery acid and other waste acids
- Ethidium Bromide
- Wastes containing metals such as lead, chromium, silver, cadmium
- Residues of spill materials
- Mercury waste
- Used oil
- Pesticides

## 4.2 Hazardous Waste Management

### 4.2.1 Hazardous Waste Handling and Storage

**Container Management** - hazardous waste must be stored in containers subject to the following requirements:

- **Labeling** - Containers that are used to accumulate or store hazardous waste must have a label that states "Hazardous Waste", type of the waste material in words (e.g., “waste acetone”), associated hazards (e.g., “ignitable”) and, the date. EMP provides hazardous waste labels (red tags); however, other labels might be used with prior EMP approval. These containers should be situated so that labels are clearly visible. Chemical formulas in place of the chemical name are not acceptable and violate HW requirements. The following must also be followed:
  - **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/Containment - Containers must be compatible with the hazardous wastes stored in them. A metal container should not be used to store aggressively corrosive substances. Satellite accumulation containers should be stored in a plastic bin or tray to contain spills/leaks (i.e., secondary containment). 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.

**Accumulation Areas:** MIT has two types of hazardous waste areas to accumulate and store hazardous waste(s): satellite accumulation areas and less than 90-day storage areas.

- Satellite accumulation areas (SAA) are located at the point of generation of a hazardous waste. These areas must be under the control of the lab or the facilities person generating the hazardous waste. Only one active container per waste stream of up to 55 gallons of hazardous waste or one quart of acutely hazardous waste is allowed in an SAA. Once filled (or otherwise ready for removal), satellite accumulation containers must be dated and transferred to a 90-day storage area or arranged to be picked-up within three days. A new container can be started in the SAA once the full container for the same waste stream is dated and a request for removal is placed. EHS Representatives or their designee inspects SAAs weekly; however a record is not required.

- 90-day storage areas (also known as Main Accumulation Areas or MAAs) are designated areas at MIT for the storage of hazardous waste prior to shipment off-site. EMP is responsible for designating and managing MIT's main storage areas including tracking storage time and arranging off-site waste disposal along with other functions. These areas are inspected weekly by the EMP personnel and records are retained. Hazardous wastes stored in these storage areas must be shipped off-site within 90 days for the main campus and within 180 days for auxiliary sites which are Small Quantity Generating sites (BCS, CUP, Tech Square, etc).

**4.2.2 Polychlorinated Biphenyl Wastes (PCBs)**

- Any equipment containing concentrations of polychlorinated biphenyls (PCBs) in concentrations greater than 50 parts per million (ppm) shall be labeled with the yellow “CAUTION: Contains PCBs” tag per 40 CFR 761. Equipment that is likely to contain PCBs includes: a) equipment containing transformers and/or capacitors that was manufactured before July 2, 1979; b) electrical equipment manufactured before July 2, 1979 that uses heat transfer, dielectric, or hydraulic fluids where it is not known if the fluids have been replaced with non-PCB substitutes; and c) ballasts not marked “non-PCB”.

An official hardcopy of this document exists in the EHS Office or on the EHS website. See Legal Disclaimer at: [http://ehs.mit.edu/site/content/legal-disclaimer](http://ehs.mit.edu/site/content/legal-disclaimer)
• Equipment with an unknown date of manufacture and that utilizes transformers, capacitors, dielectric-, heat transfer- or hydraulic fluids shall be assumed to contain PCBs unless testing or other documentation demonstrates otherwise. PCB concentrations must be known as the time of disposal.

• Transformers, electrical switches and capacitors that are part of the power distribution network or are used as part of high voltage research and that are removed as part of a building renovation shall be reviewed for PCB concentration status. Any equipment that has not been tested within the last 10 years and is being removed for disposal shall have the PCB concentration verified. Transformers and capacitors bearing the manufacturer’s “Non-PCB” designation do not require testing, and can be assumed to be non-PCB.

• If the equipment is to be stored, and it is suspected the equipment may contain PCBs, the EHS Office shall be contacted to ensure storage complies with the requirements of 40 CFR 761.

• Contractors shall provide notification of removal of PCB-containing equipment to the Department of Facilities Project Manager, or directly to the EHS Office, as this will trigger an update to the Institute’s PCB Inventory. Serial numbers, manufacturer, and if known, date of manufacture shall all be provided to the EHS Office. If waste disposal is not handled through MIT’s hazardous waste contractor, then the name of the name of the company transporting the waste and the manifest ID number shall also be provided to the EHS Office.

• In the expected rare instance of spills involving PCB materials, the EHS Office shall be contacted to ensure cleanup complies with the requirements of 40 CFR 761.

• If the equipment is to be disposed and is suspected to contain PCBs, EMP can perform PCBs field test or send the oil to be analyzed prior to the disposal.

4.2.3 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:

1) pre-purchasing considerations such as using less raw material,
2) process changes with raw material substitution,
3) inventory control,
4) volume reductions, and
5) Recycling/recovery at the point of generation.
4.2.4. Unknown Waste
Unknown wastes are not accepted for disposal. It is the responsibility of the generator to identify all chemicals. Presence of unknown wastes may require polling laboratory personnel, students and faculty members to ascertain the owner of such unknown waste and 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.

4.2.5 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 to ensure testing has been completed. Levels above 20ppm are not acceptable through the normal waste collection process and EHS must be contacted for further assistance.

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 90-day HW storage 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;
- the location and a physical description (schematic drawing) of each less than 90-day HW storage areas;
- a list of all emergency equipment at the storage areas 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 in place mutual aid arrangements with local hospitals, the Cambridge Fire Department, the Cambridge Police Department and an emergency spill response company.

5. Roles & Responsibilities
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 and for making the initial hazardous waste determination and following MIT’s hazardous waste management procedures.

EMP is responsible for the oversight of the hazardous waste management program at MIT. EMP is primarily responsible for hazardous waste generation, classification, handling, waste minimization, training and disposal questions.

EMP 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;
- Hazardous waste determination;
- Performing analytical or hazard characterization testing as needed;
- The transportation of the Institute’s hazardous waste to approved hazardous waste treatment, storage, and disposal facilities (TSDF);
- Correcting improperly characterized wastes, remanifesting the shipment and investigating the cause of discrepancy reports, should they occur; and
- Notifying DLCs when a change in the regulations requires a change in waste management practices.

It is the responsibility of DLCs and Contractors to properly identify, label, and dispose of materials and equipment containing polychlorinated biphenyls (PCBs) in amounts greater than 50 parts per million (ppm) or 10ug/100cm². The EHS Office may be utilized as a resource to assist in this effort. Contractors are responsible for adhering to waste management procedures and guidelines for proper handling of hazardous materials as outlined in the EHS Contractor Handbook.

6. Training
All personnel generating hazardous waste or involved in the management of hazardous waste must receive annual training. Detailed requirements can be found in the EHS Training website http://ehs.mit.edu/site/training.

7. Monitoring Requirements
EHS Representatives or their designee inspects SAAs weekly but records are not required to be kept. EMP personnel inspect hazardous waste storage areas weekly to detect leaks, cracks, or deterioration and/or depletion of necessary equipment. Weekly inspection checklists for satellite and 90-day storage areas that identify specific inspection requirements for hazardous waste storage areas are available at http://ehs.mit.edu/site/ by role tab.

8. Record Management
EMP is responsible for maintaining all records and reports required by federal and state regulations. MAAs 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. EMP submits the following documents to the regulatory agencies:

- Biennial report to Region 1 EPA consisting of descriptions and quantities of waste generated and minimization activities conducted over the past year.

- A hazardous waste recycling report to DEP for waste recycled over the past year.

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:

Hazardous Waste Contingency Plan

9.1 Standards

40 CFR 260 – 268 RCRA Regulations for the Management of Solid Waste
40 CFR 279 – RCRA Used Oil Management Standards
310 CMR 30 – Massachusetts Hazardous Waste Regulations
40 CFR 761 – Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

9.2 Other SOP/ SOGs

Abandoned Hazardous Waste Management (EHS-0018)
Hazardous Waste Removal and Disposal (EHS-0003)
Spill Response Procedures (EHS-0004)
Peroxide-forming Chemicals (EHS-0042)
Laboratory Moves, Preparation and Decontamination (EHS-0026)
Waste – Universal and Electronic Waste (EHS-0034)
EHS Records Retention (EHS-0021)
Lab Waste Stream - Fact Sheet (FS-0047)
PCB Caulking Fact Sheet
Appendix A – Hazardous Waste Costs Covered by the DLC

10. Definitions

_Hazardous Waste_ – Solid waste which exhibits certain governmental defined characteristics; is listed by name; is listed by process producing it; or is mixed with one of the previously mentioned hazardous wastes.

_Satellite Accumulation Area_ – A point where hazardous waste is collected, usually near the area where it is generated. No more than 55-gallons of hazardous waste or one quart of acutely hazardous waste is allowed at the satellite accumulation area at any one time.
Hazardous Waste Storage Area – A point where hazardous waste, usually from satellite accumulation areas, are collected and stored prior to shipment offsite for disposal or recycling; generally referred to as a less than 90-day storage area. These storage areas are maintained with the assistance of EHS and subject to weekly inspections.
Appendix A
Hazardous Waste Costs Covered by the DLC

Hazardous Waste Costs Covered by DLC – September 2010
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.

<table>
<thead>
<tr>
<th>Type of Service</th>
<th>DLC Cost</th>
<th>Way to Minimize Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder Disposal</td>
<td>Specific costs will depend on the size and type of cylinder for disposal. 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 &amp; volume.</td>
<td>Order reusable lecture bottle gasses when possible; order compressed gasses from vendors that will take back their cylinders and order only what you need.</td>
</tr>
<tr>
<td>Unknown Chemical Waste Testing</td>
<td>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.</td>
<td>Ensure all chemical and waste collection containers are clearly labeled with full chemical name, date and initials; verify chemical information with researchers leaving the lab or Institute prior to their departure.</td>
</tr>
<tr>
<td>Highly Hazardous Chemical Disposal</td>
<td>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 &amp; volume.</td>
<td>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.</td>
</tr>
<tr>
<td>Analytical Testing</td>
<td>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. Typically this pertains to items thought to contain PCBs and heavy metals.</td>
<td>Know the contents and age of your equipment prior to requesting disposal.</td>
</tr>
<tr>
<td>Lab Cleanouts</td>
<td>A cleanout may be needed due to a lab move, decontamination request, new PI 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 the labor, materials, transportation and disposal is placed on the lab to manage. These requests can range from $1500-$10,000(+) depending on volume and types of chemicals identified.</td>
<td>Keep an active inventory. Reach out to colleagues in other MIT labs to see if they can use your unwanted chemicals.</td>
</tr>
<tr>
<td>Lab</td>
<td>If a DLC has the need for an environmental</td>
<td>Determine what chemicals are used in</td>
</tr>
</tbody>
</table>
### Decontaminations
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. 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.

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*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 Department, Lab or Center (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. For specific information regarding lab moves and associated costs, please refer to the EHS SOP on lab moves: Laboratory Moves, Preparation and Decontamination – EHS SOP# 0026.

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.