MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Chemical Hygiene Plan

Effective April 15, 2017

Research Laboratory of Electronics

EXECUTIVE SUMMARY

The below excerpts represent an Executive Summary of the RLE Chemical Hygiene Plan. This summary is designed to provide the main concepts of the plan and allow for easy access to needed information. Although there is an RLE sign off page after reading this summary, this does not replace the campus wide requirement and expectation that you read the Chemical Hygiene Plan in its entirety.

The Chemical Hygiene Plan (CHP) is required by the U.S. Occupational Safety and Health Act (OSHA) of 1970 and regulations of the U.S. Department of Labor including 29 CFR 1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" (the "Laboratory Standard"). The purpose of the Plan is to describe the proper use and handling practices and procedures to be followed by employees, students, visitors, and other personnel working in each laboratory within MIT's Research Laboratory of Electronics to protect them from potential health and physical hazards presented by chemicals used in the workplace, and to keep chemical exposures below specified limits. While the Plan establishes work practices to promote safety in the laboratory, **each individual has the first responsibility for ensuring that good health and safety practices are implemented in the laboratory**. Not only does this individual responsibility promote personal well-being and the well-being of others, it also advances MIT's commitment to excellence in research. This Plan applies to all laboratories in the Research Laboratory of Electronics**,** and all personnel who supervise or work in these labs.

The main EHS points of contact for RLE are EHS Coordinator and Facilities Operation Manager, Al McGurl (almcgurl@mit.edu, x3-2541) and EHS Coordinator Todd Numan (tnuman@mit.edu, x8-7599 or 617-335-7439).

ROLES AND RESPONSIBILITIES

An essential component of any chemical hygiene program is to clearly articulate and clarify the different roles and responsibilities of all the stakeholders who work or visit in areas where chemicals are present. Clarifying roles and responsibilities for implementing the Chemical Hygiene Plan (CHP) will establish accountability, streamline processes, enhance safety, and avoid confusion and questions in meeting the Plan's objective.

- The RESEARCH LABORATORY OF ELECTRONICS (RLE) **CHAIR** is Professor Marc Baldo

- The **CHEMICAL HYGIENE OFFICER (CHO)** for RLE is Professor Marc Baldo.

- The **ENVIRONMENT, HEALTH AND SAFETY (EHS) COORDINATORS** for RLE are Albert T. McGurl and Todd Numan.

The EHS Coordinators SHALL:

- Participate in biannual inspections of laboratory operations.

- Ensure DLC staff receives training required by regulation for safe handling and proper disposal of chemicals and that the training is documented.

- Arrange for decommissioning of laboratory space.

- The **PRINCIPAL INVESTIGATOR** or **LABORATORY SUPERVISOR** (PI/Supervisor) shall:

- Be familiar with this Chemical Hygiene Plan and ensure that all work is conducted in accordance with requirements of this Plan.

- **The PI has the authority to take whatever actions necessary to assure the laboratory operates in a safe manner. This can include temporarily restricting access to the lab until any issues are resolved.**

- Assess all chemicals in the research laboratories under their purview, and ensure measures are

established for safe use, storage, and disposal of the hazardous chemicals within the laboratory.

Such measures include:

1. Preparing additional Lab Specific SOPs for work with potentially hazardous chemicals, equipment or processes when needed.
2. Providing personal protective equipment needed for the safe handling of chemicals.
3. Providing proper containers, containment, and cabinetry for safe storage of materials.
4. Defining the location and processes where particularly hazardous substances will be used, ensuring these areas are labeled, and ensuring that an inventory of these substances is maintained.
5. Pay particular attention to and conduct a risk assessment of all work that researchers are conducting alone. In the case of undergraduates, the PI/Supervisor must provide written prior approval for working alone with hazardous substances, equipment, or operations.

- Ensure new processes or experiments involving hazardous materials are planned carefully and appropriate hazard information, safety equipment, and general or Lab Specific SOPs are available prior to commencing work.
- Ensure the information regarding the laboratory activities recorded in the Space Registration Database is accurate. This information is used in the generation of emergency “green card” laboratory door signs.
- Plan for accidents and ensure that appropriate supplies are in place and procedures are established for responding to an accident, including cleaning up chemical spills.
- Ensure all employees working in the laboratory receive required training for work with potentially hazardous chemical, including lab-specific training on the hazardous materials that they use.
- Ensure that all personnel obtain medical examinations and participate in the MIT medical surveillance program when required due to the materials they are working with.
- Monitor the safety performance of the staff to ensure that the required safety equipment, practices and techniques are understood and are being employed and ensure that action is taken to correct work practices that may lead to chemical exposures or releases.
- When needed, contact the Environment, Health and Safety (EHS) Office to arrange for workplace air samples, swipes or other tests to determine the amount and nature of airborne and/or surface contamination, inform employees and students of the results, and use data to aid in the evaluation and maintenance of appropriate laboratory conditions.
- Ensure laboratory inspections are conducted routinely, and address all areas prescribed in the Level I. and II. Take action to correct conditions that may lead to accidents or exposure to hazardous chemicals, and to correct problems identified during inspections.
- Ensure employees who suspect they may have received an excessive exposure to a hazardous chemical report to the MIT Medical Department for assessment.
- Report all accidents involving an employee’s chemical exposure or involving a chemical spill that may constitute a danger of environmental contamination to the EHS Office, the CHO or EHS Coordinator.
- Investigate all chemical accidents and near misses to determine the cause and take appropriate corrective action to prevent similar accidents.
- Ensure unwanted or excess hazardous chemicals and materials are properly disposed according to all MIT, state, and federal procedures.
- Assist the EHS Office, EHS Coordinator, and CHO as requested.
- Ensure shipping of all hazardous material is done following all state and federal regulations.

- With respect to materials regulated under TSCA, PIs shall ensure that any research agreements, experimental efforts and transfer of materials from the lab are consistent with the definition of "research and development activity" outlined in the EHS SOP "Toxic Substances Control Act (TSCA): Procedures for Core Program Compliance". Laboratory personnel shall contact the EHS Office when a chemical sample will be shipped; when a chemical will be imported into or exported from the U.S.; and, when adverse environmental or human health effects for a new or existing chemical are observed.

- Undergraduates shall not work alone with hazardous materials, equipment or operations that can result in immediate injury or death without prior written approval from the immediate PI or supervisor. Written approval should only be granted after the risk assessment is performed and reviewed by the PI or supervisor with the individual.

- The **ENVIRONMENT, HEALTH AND SAFETY (EHS) REPRESENTATIVE** shall:

- Assist with or provide lab-specific chemical hygiene training for laboratory personnel, as directed by the PI/Supervisor.

- Assist with dissemination of EHS information to laboratory personnel.

- Assist with required routine inspections of the laboratory, correcting problems that can be readily corrected.

- Assist with ensuring essential supplies and equipment are in place for safe work in the laboratory.

- The ENVIRONMENTAL, HEALTH and SAFETY (EHS) OFFICE

Website: www.ehs.mit.edu

Email: environment@mit.edu

Office location: N52-496, 4th floor

Lead Contact: Matt Carey (Radiation Protection Officer)

- **EMPLOYEES, STAFF, STUDENTS**

It is the responsibility of employees, staff and students to follow the procedures outlined in this Chemical Hygiene Plan and all standard operating procedures developed under the plan. Failure to comply with safety procedures could result in researchers being denied access to department laboratories where hazardous chemicals are in use. The responsibilities of employees, staff and students working with or around hazardous chemicals in a laboratory include:

- Read and understand the OSHA Chemical *Laboratory Standard* and this Chemical Hygiene Plan.

- Understand the hazards of chemicals they handle and the signs and symptoms of excessive exposure.

- Understand and follow all standard operating procedures.

- Understand and apply all training received.

- Understand the function and proper use of all personal protective equipment and wear personal protective equipment when mandated or necessary.

- Report to the Principal Investigator or Laboratory Supervisor any significant problems arising from the implementation of the standard operating procedures.

- Report to the PI/Supervisor all facts pertaining to every accident that results in exposure to toxic chemicals.

- Report to the PI/Supervisor or EHS Representative actions or conditions that may exist that could result

in an accident.

- Contact the PI/Supervisor, the Chemical Hygiene Officer, the EHS Coordinator, or the EHS Office if any of the above procedures are not clearly understood.
- If an emergency occurs related to an experiment, provide emergency response personnel with information about the conditions that caused the emergency and the existing situation in the laboratory.
- Laboratory personnel shall contact the EHS Office when a chemical sample will be shipped; when a chemical will be imported into or exported from the U.S.; and, when adverse environmental or human health effects for a new or existing chemical are observed.

TRAINING

The training process begins when you complete a web-based *Training Needs Assessment*. You answer questions specific to your research situation and job duties, and the system will provide you information on your training needs and requirements. You should then proceed to take the required web courses, or sign up for classroom training. As a researcher or employee working in a laboratory at MIT, you must complete the *Training Needs Assessment*, by going to http://ehs.mit.edu/site/training . This will take you to a page that will direct you further.

Training Requirements for Use of Chemicals

The following four components are required if you indicate in the *Training Needs Assessment* that you use potentially hazardous chemicals in a laboratory, or you are a Principal Investigator or Supervisor for those who use potentially hazardous chemicals in a laboratory.

A. **General Chemical Hygiene Training** – This can be taken as a web-based course or by attending a class offered by the Environment, Health and Safety (EHS) Office. This course is required only once **before beginning work** with potentially hazardous chemicals in a laboratory.

B. **Read the Chemical Hygiene Plan** – Signing a confirmation of having read and understood the Plan is required one time **before beginning work** with potentially hazardous chemicals in a laboratory. See http://www.rle.mit.edu/services/ehs/ for the departmental Plan and web-based confirmation form.

C. **Lab-Specific Chemical Hygiene Training** – Review of the following checklist, http://www.rle.mit.edu/wp-content/uploads/2016/11/Link-3-Lab-Specific-Training-Checklist.pdf, is provided by the Principal Investigator, lab EHS Representative, or his or her designee on lab-specific hazards. This training is required **before beginning work** with potentially hazardous chemicals in a laboratory. Training is also done **annually thereafter** (usually within a lab group meeting) or whenever a new hazard is introduced. Other non-chemical topics should be covered as well (laser safety, biosafety, emergency preparedness) with topics covered depending, in part, on the nature of the lab and research being conducted.

D. **Managing Hazardous Waste** – This can be taken as a web-based course or taken by attending a class offered by the EHS Office. Required **before beginning work** with potentially hazardous chemicals and **annually thereafter**.

Safety Data Sheets (SDSs)

Safety Data Sheets (SDSs) are documents, prepared by chemical manufacturers that provide information about the chemical's physical and chemical hazards and recommended exposure limits, and list the means for controlling those hazards. SDSs also provide information about first aid, emergency procedures, and waste disposal. An SDS should be reviewed before beginning work with a chemical to determine proper use and safety precautions. Once a chemical is present in the lab, the SDS should be either book marked electronically or a hard

copy kept on hand for reference, or in case of emergencies.

Chemical Container Labels

Chemical container labels are a good resource for information on chemical hazards. All containers of hazardous chemicals must have labels attached. Most labels provide additional safety information to help workers protect themselves from the substance. This information may include protective measures and/or protective clothing to be used, first aid instructions, storage information and emergency procedures.

Laboratory personnel are responsible for:

- Ensuring that chemical container labels are not removed or defaced, except when containers are empty.
- Labeling any secondary containers used in the laboratory, to prevent unknown chemicals or inadvertent reaction.
- Verifying that chemical waste containers have completed and accurate chemical waste labels.

General Chemical Hygiene Practices

Hazardous chemicals can cause harm when they enter the body in sufficient amounts via inhalation, ingestion, injection or skin absorption. Harmful effects can also occur by eye or skin contact alone. The nature of the hazardous chemical and the routes by which it enters or contacts the body determine the type of controls that are needed. For many laboratory chemicals, exposure limits have not been established. In addition, little is known about the effects of combined exposures. Therefore, all laboratory workers should take steps to minimize chemical exposure via all routes of entry

Introduction to Standard Operating Procedures

A standard operating procedure (SOP) is a written set of instructions or guidelines that detail the uniform procedures to be followed routinely, and safety precautions to take when carrying out a particular experiment or procedure. The development and implementation of SOPs for critical activities is a core component of promoting excellence in a laboratory and for ensuring a safe, healthy, and environmentally sound workplace. For these reasons, you are required to develop additional written Lab Specific SOPs if the general SOPs provided in this Plan DO NOT adequately ensure the protection of personal health and safety, and the environment for a particular activity, operation, or experiment conducted in your laboratory. Lab Specific SOPs must be developed prior to initiating any significantly hazardous procedures.

IDENTIFICATION AND CLASSIFICATION OF HAZARDOUS CHEMCIALS

It is essential that all laboratory workers understand the types of toxicity, recognize the routes of exposure, and are familiar with the major hazard classes of chemicals. The most important single generalization regarding toxicity in chemical research is to *treat all compounds as potentially harmful, especially new and unfamiliar materials, and work with them under conditions to minimize exposure by skin contact and inhalation.*

The major classes of *hazardous and particularly hazardous substances* and their related health and safety risks.

Corrosive Substances

As a health hazard, corrosive substances cause destruction of, or alterations in, living tissue by chemical action at the site of contact. Major classes of corrosive substances include strong acids (e.g., sulfuric, nitric, hydrochloric, and hydrofluoric acids), strong bases (sodium hydroxide, potassium hydroxide, and ammonium hydroxide), dehydrating agents (sulfuric acid, sodium hydroxide, phosphorus pentoxide, and calcium oxide), and oxidizing agents (hydrogen peroxide, chlorine, and bromine). Symptoms of exposure for inhalation include a burning sensation, coughing, wheezing, laryngitis, shortness of breath, nausea, and vomiting. For eyes, symptoms include pain, blood shot eyes, tearing, and blurring of vision. For skin, symptoms may include reddening, pain, inflammation, bleeding, blistering and burns. As a physical hazard, corrosive substances may

corrode materials they come in contact with and may be highly reactive with other substances. It is important to review information regarding materials they corrode, and their reactivity with other substances, as well as information on health effects.

Irritants

Irritants are defined as non-corrosive chemicals that cause reversible inflammatory effects on living tissue by chemical action at the site of contact. A wide variety of organic and inorganic compounds, including many chemicals that are in a powder or crystalline form, are irritants.

Sensitizers

A sensitizer (allergen) is a substance that causes exposed people to develop an allergic reaction in normal tissue after repeated exposure to the substance. Examples of allergens include diazomethane, chromium, nickel, formaldehyde, isocyanates, arylhydrazines, benzylic and allylic halides, and many phenol derivatives. **NOTE that curing agents for many epoxies are isocyanates and are therefore sensitizers. Be sure to wear gloves when working with epoxies, and cure these in a well-ventilated area.**

Flammable, Highly Reactive and Explosive Substances

A number of highly flammable substances are in common use in campus laboratories. Highly Reactive substances are materials that decompose under conditions of mechanical shock, elevated temperature, or chemical action, with the release of large volumes of gases and heat. Some materials, such as peroxide formers, may not be explosive, but may form into substances that will deflagrate or explode.

Explosives are any chemical compound, mixture or device, the primary or common purpose of which is to function as by explosion. The possession or use of explosive materials are highly regulated by federal and state agencies.

Hazardous Substances with Toxic Effects on Specific Organs

Substances included in this category include

(a) hepatotoxins (substances that produce liver damage such as nitrosamines and carbon tetrachloride);
(b) nephrotoxins (agents causing damage to the kidneys such as certain halogenated hydrocarbons);
(c) neurotoxins (substances which produce their primary toxic effects on the nervous system such as mercury, acrylamide, and carbon disulfide);
(d) agents which act on the hematopoietic system (such as carbon monoxide and cyanides which decrease hemoglobin function and deprive the body tissues of oxygen); and
(e) agents which damage lung tissue such as asbestos and silica.

Particularly Hazardous Substances/Select Carcinogens

An agent is an acute toxin if its toxic effects are manifested after a single or short-duration exposure. Chronically toxic agents show their effects after repeated or long-duration exposure and the effects usually become evident only after a long latency period. Many of the substances in frequent use in laboratories are classified as hazardous substances. There are some substances, however, that pose such significant threats to human health that they are classified as "particularly hazardous substances" (PHSs). The OSHA Laboratory Standard requires that special provisions be established to prevent the harmful exposure of researchers to PHSs. Chemicals are classified as *particularly hazardous substances* if they belong to one or more of the following three categories.

Select Carcinogens

Carcinogens are chemical or physical agents that cause cancer. Certain potent carcinogens are classified as "select carcinogens" and treated as PHSs. A select carcinogen is a substance that meets

one of the following criteria:

a) It is regulated by OSHA as a carcinogen,

b) It is listed as "known to be a carcinogen" in the latest Annual Report on Carcinogens published by the National Toxicology Program (NTP),

c) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer (IARC), or

d) It is listed under IARC Group 2A or 2B, ("probably carcinogenic to humans") or under the category "reasonably anticipated to be a carcinogen" by the NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
   (i) after inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m3;
   (ii) after repeated skin application of less than 300 mg/kg of body weight per week; or
   (iii) after oral dosages of less than 50 mg/kg of body weight per day.

Reproductive and Developmental Toxins

Reproductive toxins can affect reproductive health if proper procedures and controls are not used. For women, exposure to reproductive toxins during pregnancy can cause adverse effects on the fetus; these effects include embryo lethality (death of the fertilized egg, embryo or fetus), malformations (teratogenic effects), and postnatal functional defects. Women of childbearing potential should note that embryo toxins have the greatest impact during the first trimester of pregnancy. Because a woman often does not know that she is pregnant during this period of high susceptibility, special caution is advised when working with all chemicals, especially those rapidly absorbed through the skin (e.g., formamide).

For men, the effects of certain reproductive toxins may include decline in fertility, malformations in off-spring, and certain types of cancer. Therefore, adequate protection from exposure must be employed.

Compounds with a High Degree of Acute Toxicity

Compounds that have a high degree of acute toxicity include certain corrosive compounds, irritants, sensitizers (allergens), hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic systems, and agents which damage the lungs, skins, eyes, or mucous membranes. Substances that have a high degree of acute toxicity are interpreted by OSHA as being substances that "may be fatal or cause damage to target organs as the result of a single exposure or exposures of short duration".

STANDARD OPERATIING PROCEDURES FOR WORK WITH HAZARDOUS CHEMICALS

Preliminary Steps and Procedures

All work involving chemicals in MIT laboratories must be conducted using the “Standard Operating Procedures” outlined below. In addition, laboratory workers must determine whether any of the chemicals to be handled in the planned experiment meet the definition of a particularly hazardous substance (PHS) due to high acute toxicity, carcinogenicity, and/or reproductive toxicity. by:

1. Performing a check to see if the chemical(s) meets the definition and is on the PHS list http://ehs.mit.edu/site/content/particularly-hazardous-substance-review-160-mit- chemicals. If your chemical(s) is not listed it should still be evaluated for high acute toxicity,

carcinogenicity, and/or reproductive toxicity.

2. If listed or determined to be a PHS chemical, then do a risk assessment to see if there are any procedures or protective measures "beyond" those already required for hazardous chemicals outlined in this section. Consider the total amount of the substance that will be used, the expected frequency of use, the chemical's routes of exposure, and the circumstances of its use in the proposed experiment.
3. If it is determined that the PHS requires additional protective measures they can be found in Part II section 3.3 p. 35 of the full Plan.
4. If the chemical is not listed or determined to be a PHS or does not require additional protective measures, then follow the procedures for Hazardous Chemicals outlined in this section.

For very toxic or hazardous substances, or specialized practices, consideration must be given to whether additional consultation with safety professionals and development of Lab Specific SOPs is warranted or required.

NOTE*:* Additional consideration should be given to laboratory operations involving hazardous substances that are sometimes carried out continuously or overnight. It is the responsibility of the researcher to design these overnight experiments with provisions to prevent the release of hazardous substances in the event of interruptions in utility services such as electricity, cooling water, and inert gas. Laboratory lights should be left on and appropriate signs should be posted on the entrance door(s) as well as near the experiment identifying the nature of the experiment and the hazardous substances in use. Information should be posted on the signs indicating how to contact you in the event of an emergency.

STEP 1: Determine the toxicity and warning properties of the chemicals to be used in your experiment.

STEP 2: Determine most likely routes of exposure based on how chemicals will be used and their physical or chemical properties.

Inhalation –
Skin Exposure –
Injection or ingestion –

STEP 3: Determine required control measures, personal protective equipment, and proper work practices to minimize exposure.

A. Inhalation Control Measures

Determine When to Use Laboratory Chemical Hoods (Fume Hoods)

Determine Whether Respirators Might Be Required
The MIT Respirator Protection Program is described in full at http://ehs.mit.edu/site/content/respiratory-protection

B. Personal Protective Equipment For Eyes and Skin

Select and wear appropriate eye and face protection.
Wearing eye protection is required by OSHA regulation whenever and wherever potential eye hazards exist. Hazards requiring eye and/or face protection include flying particles; molten metal; liquids including acids and caustic materials, biological or radioactive materials; chemical gases or vapors; and potentially injurious light radiation. Certain laboratories and shops within the Research Laboratory of Electronics require eye

Wear appropriate clothing in the laboratory when working with hazardous substances. Wear shoes that cover your feet – **no flip-flops, sandals, or open-toed shoes**. Confine long hair and loose clothing. Wear clothing that fully covers your legs and arms when handling hazardous chemicals. "At a minimum, a laboratory coat or equivalent protective clothing is required for work with hazardous chemicals, unsealed radioactive materials, and biological agents at BL2 or greater." In some cases, through a hazard assessment, laboratory supervisors may identify situations (a task, experiment, or area) where alternative or more protective apparel must be worn.

Avoid skin contact and ingestion of hazardous substances by using appropriate hand protection, protective clothing, and proper work practices.

Gloves for work with chemicals must be selected based on the potential contact hazard, and the permeability of the glove material. For incidental skin contact with small amounts of chemicals on a surface, or work with most powders, disposable nitrile gloves are usually adequate. For work involving materials that are readily absorbed through the skin, the glove must be carefully selected using glove impermeability charts. Evaluate the need for hand protection from physical hazards like extreme heat (such as removing materials from a furnace or autoclave) or cold (such as use of cryogenics), and make sure appropriate gloves are used.

Ensure that gloved hands that may have contacted chemical or biological agents do not subsequently contact other areas which, may be used by non-gloved hands – such as doorknobs, keyboards, phones, etc.

Properly use and maintain personal protective equipment (PPE).
Personal protective equipment should be kept clean and stored in an area where it will not become contaminated. Personal protective equipment should be inspected prior to use to be sure it is in good condition. It should fit properly and be worn properly. If it becomes contaminated or damaged, it should be cleaned or fixed or, in the case of disposable equipment, discarded and replaced.

Wash your hands with soap and water immediately after working with hazardous chemicals, even if you have had gloves on – wash your hands when you take the gloves off.

Eating, drinking, smoking, gum-chewing, and applying cosmetics in laboratories where hazardous substances are in use is prohibited. Do not store food, beverages, cups, or other drinking and eating utensils in areas where hazardous chemicals are used or stored.

If a food product is used in the laboratory as part of research, label the food product's container "Research Only" or "Not For Human Consumption."

STEP 4: Be Prepared for Emergencies

Before beginning an experiment, know what specific action you will take in the event of the accidental release of any hazardous substances involved. Know the location and how to operate all safety equipment. Be familiar with the location of the nearest fire alarm and telephone, and know what telephone numbers to call in the event of an emergency.

For all accidents requiring emergency police, fire, or medical response, contact Campus Police at 617-253-1212 or 100 from an MIT telephone.

An *MIT Emergency Response Guide Poster* should be posted in every laboratory in an area accessible to all. This Carefully review the guidelines for handling medical emergencies, personal injury, chemical spills and fire in the

laboratory. All staff and students should be familiar with their laboratory's Emergency Action Plan, as it specifies the appropriate response and building exit plans for a variety of life-safety emergency situations.

Chemical Spills – Minor vs. Major

Be prepared in advance. Have spill supplies available for the types of spills that might occur. Know under what circumstances you should clean up the spill, or when you should evacuate and seek help.

Minor; hazardous materials or waste spills that present no threat to personnel safety, health, or to the environment can be cleaned up by laboratory personnel that use the materials or generate the waste. A minor hazardous material spill is generally defined as a spill of material that is not highly toxic, is not spilled in large quantity, does not present a significant fire hazard, can be recovered before it is released to the environment, and is not in a public area such as a common hallway.

Major; hazardous material and waste spills should be reported to the MIT emergency number (617-253-1212, or 100 from an MIT telephone) to receive immediate professional assistance and support in the control and cleanup of the spilled material. Major hazardous materials or waste spills are generally defined as having a significant threat to safety, health, or the environment. These spills generally are a highly toxic material or a less toxic or flammable material spilled in a large enough quantity that may present a significant fire hazard, cannot be recovered before it is released to the environment, or is spilled in a public area such as a common hallway. Upon reporting such a spill, personnel should stand-by at a safe distance to guide responders and spill cleanup experts to the spill area. Reporting personnel should also keep other personnel from entering into the spill area.

In the case of a spill that presents a situation immediately dangerous to life or health, or a situation with significant risk of a fire, personnel should evacuate the area and summon emergency assistance by dialing the MIT emergency number (617-253-1212, or 100 from an MIT telephone), activating a fire alarm station, or both.

Essential Laboratory Work Practices

Properly use, maintain, and dispose of laboratory glassware and other sharps

- Hand protection should be used when picking up broken glass. (Small pieces should be swept up with a brush into a dustpan).
- Broken glassware, syringes, and other "sharp objects" must be disposed of properly. Such waste should be separated from other trash and stored for pickup in clearly marked containers labeled "sharps".

Attend to housekeeping by establishing and following routine cleaning procedures as part of the work you do

- Clean bench tops and other work areas and equipment regularly. Do not allow dirty glassware, expired or unneeded samples or chemicals, and trash or boxes to accumulate. When floors require cleaning, notify RLE Facilities.
- Maintain ready access to exits and safety equipment such as fire extinguishers, eyewashes, and safety showers. Do not store materials in a way that will block access to exits or safety equipment.

Working Alone

As a practice, **working alone** with hazardous materials, equipment or otherwise working under conditions that may create the risk of serious injury (hereafter referred to as hazardous conditions) **should be avoided.**

Anyone at MIT must discuss potentially hazardous activity with their Principal Investigator (PI) or supervisor prior to conducting the work alone, furthermore, **undergraduates** shall not work alone with hazardous materials, equipment or operations that can result in immediate injury or death without prior written approval from the immediate PI or supervisor. Written approval should only be granted after the risk assessment is performed and reviewed by the PI or supervisor with the individual.

Establish and follow safe chemical storage procedures for your laboratory

The following minimum guidelines for chemical storage must be adhered to:

- Access to all hazardous chemicals, including toxic and corrosive substances, should be restricted at all times.
- To avoid the accumulation of excess chemicals, it is recommended that you review the lab's chemical inventory prior to purchasing new chemicals.
- Make sure all containers of chemicals are in good condition.
- Make sure all containers of chemicals (including research samples) are properly labeled.
- Store incompatible materials in separate cabinets. If they must be stored together due to space limitations, provide secondary containment to separate incompatible materials.
- Do not store hazardous liquids above eye-level. Avoid storage of hazardous chemicals on the floor. If such storage is required, provide secondary containment for liquids stored on the floor.
- For refrigerated storage of chemicals, ensure refrigeration equipment is selected properly for the types of materials to be stored. Food should never be kept in refrigerators used for chemical storage.
- Do not store flammable, volatile toxic, or corrosive chemicals in cold rooms.
- Do not store items in the working space of fume hoods.

Take precautions when transporting substances between laboratories

Chemicals must be transported between stockrooms and laboratories in break-resistant or approved secondary containers.

Follow established procedures for handling excess and waste chemicals

Consideration of the means of disposal of chemical wastes should be part of the planning of all experiments before they are carried out. Whenever practical, order the minimum amount of material possible in order to avoid the accumulation of large stocks of "excess chemicals" which will not be needed in future research.

Take additional precautions for work with flammable substances

Flammable substances are among the most common of the hazardous materials found in campus laboratories. The flash point is the lowest temperature, as determined by standard tests, at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid within the test vessel. As indicated in the following table, many common laboratory solvents and chemicals have flash points that are lower than room temperature and are potentially very dangerous.

	Flash Point (°C)		Flash Point (°C)
Acetone	-17.8	Ethanol	12.8
Benzene	-11.1	Hexane	-21.7
Carbon	-30.0	Methanol	11.1
Cyclohexane	-20.0	Pentane	-40.0
Diethyl ether	-45.0	Toluene	4.4

Precautions for handling flammable substances include:

- Flammable substances should be handled only in areas free of ignition sources. Besides open flames, ignition sources include electrical equipment (especially motors), static electricity, and for some materials, (e.g. carbon disulfide), even hot surfaces.
- Never heat a flammable substance with an open flame.
- When transferring flammable liquids in metal equipment, static-generated sparks should be avoided by bonding and the use of ground straps.
- Ventilation is one of the most effective ways to prevent the formation of flammable mixtures.
- Generally, only small quantities of flammable liquids should be kept at work benches.
- Refrigerators used for storage of chemicals must be explosion-proof or flame proof.

Take additional precautions for handling highly reactive or peroxide forming substances

Work with highly reactive materials will generally require the use of special protective apparel (face shields, gloves, lab coats) and protective devices such as explosion shields and barriers.

- Date containers of peroxide-forming materials with date of receipt and date of opening.
- If there is greater than 20ppm, a stabilization permit is required prior to shipment and final disposal.
- If crystals are visibly present on the container or lid, or if the container is open but has not been tested, **DO NOT OPEN, DO NOT TOUCH**. Contact the EHS Office to arrange for disposal.

Take additional precautions for work with corrosive substances

Corrosives can be solids, liquids, and gases and includes acids, bases, oxidizers, as well as other chemical classes. Corrosives may belong to more than one chemical class. For purposes of these standard operating procedures, a corrosive is any chemical that can rapidly damage human tissue, metals, and other compounds, such as wood or concrete by chemical action.

- Store by compatibility.
- Segregate acids from bases, and segregate oxidizing acids (such as nitric acid) from organic acids (such as acetic acid).
- Store corrosives on a lower shelf or in ventilated corrosive storage cabinets.
- Personal protective equipment is important for work with corrosives. Neoprene or rubber gloves, goggles and face shield, rubber apron, and rubber boots should be considered.
- **Always add acid to water, never water to acid.**
- Wherever corrosives are used or stored, be sure there is a working, readily accessible eyewash and safety shower.

Additional Procedures for Work with Particularly Hazardous Substances

A key requirement of the OSHA Laboratory Standard is that all work with *particularly hazardous substances* be confined to designated areas. It is most common for laboratory hoods to serve as designated areas for most research.

It is the responsibility of laboratory supervisors to define the designated areas in their laboratories and to post these areas with conspicuous signs reading "DESIGNATED AREA FOR USE OF PARTICULARLY HAZARDOUS SUBSTANCES--AUTHORIZED PERSONNEL ONLY". Printed signs can be obtained from the EHS Office. Using PHSs outside of areas designated for their use, poses a significant danger to you and the others in your laboratory and surrounding areas, as well as violates MIT and OSHA rules and regulations.

Avoid all skin contact with particularly hazardous substances by using suitable protective apparel including the appropriate type of gloves or gauntlets (long gloves) and a suitable laboratory coat or apron that covers all exposed skin. Always wash your hands and arms with soap and water immediately after working with these materials. In the event of accidental skin contact, the affected areas should be flushed with water and medical attention should be obtained as soon as possible.

Avoid inhalation of PHSs by ensuring that work involving potential for exposure to a gas, vapor or airborne dust is conducted in a laboratory hood, or other suitable containment device such as a glove box. Purchase material in liquid form rather that powder form when possible.

Decontamination procedures should be established in writing, especially those involving chemical treatments, and consist of any necessary periodic (daily, weekly, etc.) procedures performed to control exposure of employees.

If a major release of a particularly hazardous substance occurs outside the hood, then the room or appropriate area should be evacuated and necessary measures taken to prevent exposure of other workers. The EHS Office should be contacted immediately (617-452-3477) for assistance and equipment for spill clean-up.

Vapors that are discharged from experiments involving *particularly hazardous substances* should be trapped or condensed to avoid adding substantial quantities of toxic vapor to the hood exhaust air.

It is required that every research group in the department maintain a list of all *particularly hazardous substances* in use in their laboratories, including an inventory of the maximum quantity present at any given time.

These materials are highly toxic and special precautions should be taken whenever handling concentrated forms, even in small amounts. Stocks of these chemicals should be stored under lock and key. A log must be maintained that tracks the use of these materials.

Special Precautions for Work with Hydrofluoric Acid

Hydrofluoric acid (HF) is a *particularly hazardous substance*, that is less dissociated than most acids and deeply penetrates the skin. *Any* suspected exposure to HF should be immediately flooded with water, decontaminated with calcium gluconate gel, and treated at MIT Medical.

It is a requirement that all employees be trained by the EHS Office before beginning work with HF.

All laboratories using HF must have *unexpired calcium gluconate decontamination gel* on hand. The gel can be obtained at no cost from the EHS Office at 617-452-3477.

Within RLE, all work involving HF-containing materials must include a written SOP. The EHS Coordinator must review this SOP prior to starting work with HF.

Special Precautions for Work with Formaldehyde

Formaldehyde is an animal carcinogen and a suspect human carcinogen according to OSHA and IARC. It is also a sensitizer and can cause allergic skin reactions and asthma-like respiratory symptoms. It is an irritant to eyes, nose, and throat.

Almost all formaldehyde procedures should be performed with ventilation such as a fume hood, slot hood, or vented downdraft table. All work should be done using gloves with adequate resistance to formaldehyde, such as the Best N-Dex brand (a disposable nitrile glove). With proper exhaust ventilation, you should not detect any odors from formaldehyde work nor experience any symptoms of exposure such as eye tearing or throat irritation. If you do, please contact IHP immediately at 617-452-3477 for an evaluation.

Special Precautions for Work with Nanomaterials

Nanomaterials are defined by the ASTM as a material with two or three dimensions between 1 to 100 nm. They can also have different shapes: such as nanotubes, nanowires, crystalline structures such as quantum dots, and fullerenes.

The toxicity of most nanomaterials is currently unknown. Preliminary toxicity testing has indicated that some nanoparticles may be more toxic than the corresponding micron sized particle because of their greater surface area and reactivity. Nanoparticles are similar in size to viruses and are easily taken up by the body's cells, translocate around the body, and can possibly pass into the brain and through the skin.

Work with nanoparticles that may release particles should be conducted in enclosures, glove boxes, fume hoods, and other vented enclosures. All work should be done with gloves, at a minimum disposable nitrile gloves.

PERSONAL PROTECTIVE EQUIPMENT

Laboratory Coats

The MIT Committee on Toxic Chemicals and the Institute EHS Council has established the following policy with respect to laboratory coats:

> "At a minimum, a laboratory coat or equivalent protective clothing **is required** for work with hazardous chemicals, unsealed radioactive materials, and biological agents at BL2 or greater."

In some cases, through a hazard assessment, laboratory supervisors may identify situations (a task, experiment, or area) where alternative or more protective apparel must be worn.

Eye Protection

The Committee on Toxic Chemicals established a policy in 2009 to assure special emphasis is placed on the use of appropriate eye protection for work with hazardous chemicals in laboratories. The policy states:

> "For every laboratory room where hazardous chemicals are stored or are in use, a determination must be made as to the level of eye protection that shall be required. The level of eye protection required shall be identified in writing. Where no determination has been made regarding the level of eye protection required in an area, the default shall be that eye protection is required."

The determination of the level of eye protection required for each laboratory room shall be made by the principal investigator in charge of the laboratory or supervisor in charge of the work area, in consultation with and with the approval of the DLC EHS Coordinator.

Eye protection is also required when there is the potential for eye injury due to other hazards besides hazardous chemicals. Examples of this include working with tools, power tools, and/or shop equipment when

the work emits debris or flying particles, or when working with molten metal. Work with unsealed radioactive sources, lasers, and certain biological agents also require eye protection by regulation.

Eye protection provided shall meet the requirements of ANSI 787.1 – 1989, or equivalent.

In the Research Laboratory of Electronics, appropriate, specific Laser Safety Glasses must be worn when required (open beam, alignment, etc.) in laboratories where class 3b or 4 lasers are in use.

OTHER SAFETY AND STORAGE EQUIPMENT

Laboratory Fume Hoods/Ventilation

It is advisable to use a laboratory hood when working with all hazardous substances. In addition, a laboratory hood or other suitable containment device must be used for all work with "particularly hazardous substances".

The following general rules should be followed when using laboratory hoods:

- No hoods should be used for work involving hazardous substances unless it has a certification label less than one-year-old.
- Always keep hazardous chemicals at least six inches behind the plane of the sash.
- Never put your head inside an operating laboratory hood to check an experiment. The plane of the sash is the barrier between contaminated and uncontaminated air.
- Work with the hood sash in the **lowest possible position.** The sash will then act as a physical barrier in the event of an accident in the hood. Keep the sash closed when not conducting work in the hood.
- Do not clutter your hood with bottles or equipment. Keep it clean and clear. Only materials actively in use should be in the hood. This will provide optimal containment and reduce the risk of extraneous chemicals being involved in any fire or explosion that may occur in the hood.
- Clean the grill along the bottom slot of the hood regularly so it does not become clogged with papers and dirt.
- Promptly report any suspected hood malfunctions to the Industrial Hygiene Program (617-452-3477).
- Do not use a laboratory hood for large pieces of equipment unless the hood is dedicated to this use (large obstructions can change the airflow patterns and render the hood unsafe for other uses).

Fire Extinguishers, Safety Showers and Eyewash Stations

Laboratory supervisors are required to instruct new personnel in the location of fire extinguishers, safety showers, and eyewashes *before* they begin research in the laboratory. Laboratories where a potential fire hazard exists (use and/or storage of flammable and combustible liquids, solids, or gases; any spark producing work, welding, use of open flames, etc.) should be outfitted with fire extinguishers. Researchers are not permitted to use fire extinguishers unless they have attended a Fire Extinguisher Training Session presented by the MIT EHS Office.

Every laboratory where the use of materials that are either corrosive or that otherwise present a significant skin/eye contact or absorption hazard must have access to an unobstructed safety shower and eyewash facility

Safe Use of Warm and Cold Environmental Rooms

These rooms are NOT designed for chemical use because of the minimal ventilation. Do not store flammable, volatile toxic, corrosive chemicals or dry ice in cold or environmental rooms

CHEMICAL CONTAINER LABELING GUIDELINES

Labeling is important for safe management of chemicals, preventing accidental misuse, inadvertent mixing of incompatible chemicals, and facilitating proper chemical storage. Proper labeling helps assure quick response in the event of an accident, such as a chemical spill or chemical exposure incident. Finally, proper labeling prevents the high costs associated with disposal of "unknown" chemicals.

Labeling requirements. With the exception for transient containers that will contain chemicals for brief periods, one day or less, all containers of chemicals being used or generated in MIT research laboratories must be labeled sufficiently to indicate contents of the container. For chemical management contact names and expiration dates should also be placed on the label.

Abbreviations or other acronyms may only be used to label containers of chemicals generated in the lab, if all personnel working in the lab understand the meaning of the label or know the location of information, such as a lab notebook, or log sheet that contains the code associated with content information.

Containers of practically non-toxic and relatively harmless chemicals must also be labeled with content information, including containers such as squirt bottles containing water.

COMPRESSED GAS CYLINDERS

Any person who handles compressed gas cylinders should be informed of their potential health and safety hazards and trained to handle them properly. The EHS Office has developed a standard operating procedure, "Compressed Gases", and reference materials for securing gas cylinders.

CHEMCIAL WASTE MANAGEMENT

Waste Management Responsibility

The responsibility for the identification and proper management of waste chemicals within the Institute prior to pick-up by the Environment, Health and Safety Office or their designated contractor, **rests with the individuals who have generated the waste.**

Training

All personnel using hazardous chemicals must complete the EHS Office Course 501 Managing Hazardous Waste **annually**.

Procedures for Hazardous Waste Generators

A. Waste Identification:

Hazardous waste (HW) includes materials that possess hazardous characteristics (e.g. toxic, ignitable, corrosive or reactive), or substances that are listed as hazardous waste by the regulatory agencies.

B. Containers and Labeling:

Separate containers must be used for different categories of chemical wastes and the container must be compatible with the waste contained. Compatible wastes can be consolidated.

Containers that store hazardous waste must be properly and clearly labeled. Labels must include:

- the words "Hazardous Waste";
- the chemical names of constituents written-out with no abbreviations (e.g. "ethanol");
- the hazards associated with the waste in words (e.g. "TOXIC").
- Ownership (PI and Generator).

At MIT, hazardous waste labels, known as red tags, are available from the EHS Office

Accumulation & Storage:

Satellite Accumulation Areas: SAAs must be established at or near the point of generation and remain under the control of the person generating the waste. SAAs must be clearly delineated and are to be posted with the sign "Hazardous Waste Satellite Accumulation Only." The Environmental Management Program has green "Hazardous Waste Satellite Accumulation Only" stickers available upon request.

SAA Requirements;

- A maximum of 55 gallons of hazardous waste or 1 quart of acutely hazardous waste may be accumulated at each SAA.
- Only one in-use container is allowed per waste stream.
- Hazardous waste containers must be closed unless waste is being added to the container.

Hazardous wastes with free liquids must be kept within secondary containment. EMP will provide secondary containers upon request. In addition, containers of incompatible wastes must be kept segregated and stored in separate secondary containers.

Once a hazardous waste container is filled, the label must be dated and the container removed from the satellite accumulation area **within three business days**. The Environmental Management Program provides a hazardous waste pick-up service for the waste ready for disposal

Hazardous waste areas (satellite accumulation areas) must be inspected on a weekly basis. The EHS Representative, as part of the Weekly Level I Inspection, should inspect any Satellite Accumulation Areas in their areas of responsibility and correct any issues immediately.

Unknown waste chemicals cannot be accepted for disposal.

Gas cylinders are to be returned to the supplier. Some small lecture bottles are non-returnable. The Environmental Management Program will arrange for disposal of lecture bottles. However, the Principal Investigator/Lab Group is responsible for the cost of disposal.

Controlled drugs to be discarded *cannot be disposed of as hazardous waste*. the Environmental Management Program can provide assistance during the process.

Wastes marked as radioactive *must not be sent to the waste chemical storage area.*

Wastes marked as biohazardous *must not be sent to the waste chemical storage area*. In RLE, biohazardous liquids are collected by the lab, neutralized with a bleach solution, and disposed. Non-sharp biohazardous solids are generally disposed in a "burn box". Sharp biohazardous waste **MUST** be placed in a bio sharps bin and collected by EHS.

Sharps waste must be packaged in puncture proof containers *Chemically contaminated sharps waste must not be packaged in Biohazard containers*.

*All non-chemically contaminated sharps waste originating from a Biosafety Level (BL) rated laboratory is considered to be biohazardous***.**

Sharps waste – clean needles and syringes are considered to be "medical waste" and must be packaged in puncture proof containers. No tags are needed, but the laboratory building, room number, and PI/Supervisor's name must be marked on the container.

Sharps waste – cleaned and rinsed glass bottles, glassware, broken glass, shall be collected in a VWR vendor glass box or other sturdy puncture resistant cardboard or plastic container. Any chemical labels must be defaced. Mark the box "clean broken glass"

Sink Discharge/Wastewater

The following materials are the only allowable discharges to laboratory sinks:

- Inorganic solutions with pH between 5.5 and 12
- Soaps/detergents
- Mercury-free Bleach/Wescodyne™/Cidex OPA™ / Quatricide® /Cetylcide II solutions
- Aqueous, soluble and dispersible radioactive isotopes into designated sinks or pipe openings within established limits (detailed lists posted at the designated sinks)
- Infectious/Biological materials that have been properly treated as described in each laboratory's registration protocols
- Non-contaminated growth media
- Purified biological materials such as amino acids and proteins in aqueous or buffer solutions
- Sugars and sugar alcohols (polyols) such as glycerol, xylitol and sorbitol
- Buffer solutions
- Spent photo developer (not fixer)
- Inorganic salts for which both the cations and anions are listed in the following table:

Cations	Anions
Aluminum	Borate
Ammonium	Bromide
Calcium	Carbonate
Cesium	Chloride
Iron	Bicarbonate
Lithium	Bisulfite, Bisulfate
Magnesium	Fluoride
Manganese	Hydroxide
Potassium	Iodide
Sodium	Nitrate, Nitrite
Strontium	Oxide
Tin	Phosphate
Titanium	Sulfate, Sulfide
Zirconium	Thiosulfate

Due to capacity concerns at the MWRA, discharges of clean water to the sewer system are discouraged. Clean Water discharges from once through cooling are not allowed. Water generated Vacuum aspiration is not allowed.

SHIPPING HAZARDOUS AND DANGEROUS MATERIALS

The transportation of hazardous materials and compressed gases over public roads or by air is strictly governed by federal and state regulations. Any shipment of these items that is to travel over public roads or by air must comply

with regulations regarding quantity, packaging, and labeling. The principle regulations are the U.S. Department of Transportation (DOT) (49 CFR 100-185), regulations for shipping hazardous materials.

Individuals affiliated with the Research Laboratory of Electronics who intend to ship any of these types of materials by air or land, domestically or internationally, or convey these items over public roads by Institute or personal vehicles must contact the EHS Office or your EHS Coordinator. Failure to do so is likely to cause refusal or (often excessive) delays in shipment, and may lead to severe fines and criminal penalties.

SECURITY, PRIOR APPROVALS, INVENTORIES AND PROCUREMENT

Laboratory and Chemical Security

To minimize the theft and improper use of hazardous chemicals including toxic and corrosive substances the following actions should be taken:

1. **Inventories must be maintained for all hazardous chemicals.** The use of the CISPro Cloud inventory system is recommended but not required.
2. Access to all hazardous chemicals, including toxic and corrosive substances, should be restricted. Specifically, these materials should be stored in laboratories or storerooms that are kept locked when laboratory personnel are not present.
3. Needles and syringes that could be used to administer drugs should be kept secure at all times either in a locked laboratory cabinet or locked laboratory space.
4. In the case of unusually toxic or hazardous materials, additional precautions are advisable, such as keeping the materials in locked storage cabinets or storerooms.
5. Areas where biological agents and radioactive material are stored should be kept secure when not in use.
6. Restrict access to the laboratory to authorized personnel only and become familiar with these people.
7. Prohibit use of lab space, materials, and equipment without knowledge and approval of the PI.

MIT-Wide Signature Control Program for the Purchase of Certain Hazardous Materials

The MIT Procurement Department through its *Purchasing Policies and Procedures* has established Institute-wide restrictions on the purchase of certain hazardous materials. These materials require pre-approval by authorized MIT agents prior to purchase. These materials include:

- Radioactive Materials
- Controlled Substances, such as drugs
- Hypodermic Needles and Syringes
- Ethyl Alcohol
- Certain Highly Toxic Chemicals
- Certain Poisons
- Nitrous Oxide Gas
- Explosives
- Liquid Petroleum Gases
- Certain Biological Materials

Purchase of Select Toxins

Certain biological toxins are governed by special regulations that require strict controls if threshold amounts are exceeded. Researchers working with regulated toxins must submit paper requisitions to the EHS Office Biosafety Program.

MEDICAL EVALUATION, EXAMINATION, SURVEILLANCE and FIRST AID KITS

When a Medical Evaluation May Be Necessary

Any employee who exhibits adverse health effects from a chemical or hazardous material exposure as a result of MIT-related research or work should report to the Medical Department immediately for a medical evaluation.

Employees or students who work with hazardous materials are entitled to a medical evaluation when any of the following conditions occur:

- The individual(s) develops signs/symptoms associated with hazardous chemicals to which they were exposed;
- Exposure monitoring results are routinely above action level or PEL (permissible exposure limit) for a substance for which there are monitoring/medical surveillance requirements; or
- A spill, leak, explosion or other incident creates a likelihood of exposure.

Information to Provide to the Clinician

At the time of the medical evaluation, the following information shall be provided to the clinician:

- Identity of the hazardous chemicals to which the individual may have been exposed;
- A description of the conditions under which the exposure occurred;
- A description of the signs and symptoms of exposure, if any; and
- A copy of the chemical information sheet (SDS, or Safety Data Sheet) shall be provided.

All patient medical information is protected by law and is considered strictly confidential. A patient, however, is entitled to view his/her medical record. When a work-related exposure has occurred that results in medical examination and/or treatment, the Medical Department will notify the supervisor of the incident, along with any recommended restrictions on work activity.

Additional Steps to be Taken

MIT requires the *Supervisor's Report of Occupational Injury and Illness* to be completed within 24 hours, when a spill or other accident triggers a medical evaluation or examination. The report, to be completed by the Supervisor, is available online at the secure MIT Human Resources website. An MIT personal certificate is required to access this document.

Medical Surveillance

Medical surveillance is the process of using medical exams and/or biological monitoring to determine potential changes in health as a result of a hazardous chemical or other exposure. Examples of hazards that are monitored through the medical surveillance program include:

- Asbestos
- Beryllium
- Noise (Hearing Loss)
- Respirator Use (See Respirator Policy)

This is not a full list of hazards for which medical surveillance is available. Individuals with questions pertaining to occupational hazards and the possible need for medical surveillance are encouraged to contact

the Occupational Medicine Service within the MIT Medical Department.

First Aid Kits

It is the policy of MIT Medical and EHS not to recommend or issue generic first aid kits for general use on the MIT Campus. Such supplies are readily available at E23 Urgent Care, or can be brought to the scene by Campus Police (X100) within minutes if indicated.

EXPOSURE ASSESSMENT (MONITORING & REPORTING)

The EHS Office Industrial Hygiene Program provides exposure assessment services to the Institute community. Exposure assessments are measurements of air contaminants, noise levels, or other health hazards such as heat stress to determine if they are within limits that are considered safe for routine occupational exposure.

RECORDKEEPING

Exposure Assessment

The Industrial Hygiene Program and the Chemical Hygiene Officer will establish and maintain an accurate record of any measurements taken to monitor exposures. Records, including those from monitoring provided by other qualified services, will be managed in accordance with OSHA standard 29 CFR 1910.1020, Access to Employee Exposure and Medical Records.

Medical Consultation and Examination

Results of medical consultations and examinations will be kept by the MIT Medical Department for a length of time specified by the appropriate medical records standard. This time will be at least the term of employment plus 30 years as required by OSHA.

Training

The PI/Supervisor or designee must keep a copy of the outline of the topics covered in Lab-Specific Chemical Hygiene Training. The roster or lists of researchers who have completed the lab-specific training and read the Chemical Hygiene Plan must be submitted to the EHS Coordinator. These training records are then entered into the EHS-MS central training records database. Web-based training records are automatically entered into the database when a course is completed. The EHS Office is responsible for entering training records into the database for the courses they teach. When an employee or leaves the Institute, their training records are moved into an archive training database. Training records are kept for at least 3 years after an employee or student leaves the Institute.

Fume Hood Monitoring

Data on annual fume hood monitoring will be kept by the EHS Office. Fume hood monitoring data are considered maintenance records, and as such, the full data will be kept for one year and summary data for 5 years.

Inspection Reports

A copy of the most recent Level II *Laboratory Inspection Checklist* and *PI Inspection Report*, as outlined below, should always be maintained locally within the Department, Laboratory, or Center by the EHS Coordinator. An additional copy will be maintained centrally by the EHS Office.

Lab-Specific Policies and SOPs

If Lab Specific SOPs are developed in addition to the SOPs contained in Part II. of this Chemical Hygiene Plan, copies must be maintained in the laboratory accessible to laboratory personnel. In addition, copies of the additional Lab Specific SOPs may be included in Part III. of this Chemical Hygiene Plan.

LABORATORY INSPECTIONS AND AUDITS, COMPLIANCE AND ENFORCEMENT

Inspections and Audits

As a component of the MIT Environment, Health and Safety Management System (EHS-MS), the Institute has implemented a framework for conducting laboratory/work space inspections and audits

The purpose of the inspection and audit system is to assist the Institute and laboratories in maintaining a safe work and study environment, ensuring compliance with regulations, identifying the locations where training or retraining is needed, and to fulfill MIT's commitment to environment, health and safety stewardship.

The MIT EHS-MS requires three levels of inspection and audit that must be implemented across the Institute: **Local Periodic Inspections** (Level I. Inspections), **DLC-Wide Inspections** (Level II. Inspections), **Institutional Audits** (Level III. Audit).

Compliance and Enforcement

Each individual at the Institute is responsible for complying with all MIT, state, and federal rules, regulations, and required procedures; and is held accountable for their actions. If a PI/Supervisor does not take appropriate action to address problems noted during inspection or audits, he or she may be subject to compliance and enforcement action. Deliberate failure to comply that results in serious jeopardy to personnel safety and health or the environment may result in loss of laboratory privileges.

ANNUAL SARA III CHEMCIAL INVENTORY

To comply with this regulation, MIT submits a chemical inventory each year on *March 1* that covers both its facilities and laboratory operations. The EHS Representative in each laboratory receives a list of approximately 40 SARA Title III chemicals in December. The quantity of each SARA Title III chemical on hand must be inventoried and reported back to the EHS Office. The EHS Office tabulates the lab inventories for the entire campus and reports total amounts and amounts by location to the required authorities.

For more information

Please browse the Table of Contents below to link with specific sections of the full Plan

Full CHP Table of Contents

Here is a link to the Full version of the RLE Chemical Hygiene Plan presenting information on the entire Table of Contents listed above.

Please CLICK HERE to sign off that you have read the executive summary and browsed the full Table of Contents of the RLE Chemical Hygiene Plan.

The Research Lab of Electronics views this electronic signature as confirmation that you have read and understand your requirements as detailed in this executive summary.

This e-signature does not replace the campus wide requirement and expectation that you eventually read the Chemical Hygiene Plan in its entirety.