In Case You Haven't 'HERD' About...

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Why does a lab need an accurate Chemical Inventory?

THERE are at least three reasons why a Chemical Inventory should be maintained. Reasons include: Safety of Workers, Regulatory Compliance, and Cost Reduction. Often the Safety of Workers and Regulatory Compliance are the driving forces, and for good reason; but at the same time maintaining an accurate Chemical Inventory can drive cost reduction.

Chemicals used in laboratories have the potential to be Toxic, Water or Air Reactive, Flammable, Radioactive, Pyrophoric, Caustic and/or Acutely Hazardous. It is paramount that workers be protected from these hazards and often there are regulations that mandate that people and the environment are protected from these hazards.

Tufts University (TUFTS) is regulated by:

- Environmental Protection Agency (EPA) – Emergency Planning and Community Right-to-Know Act (EPCRA) hazardous chemical storage reporting and other regulations
- Massachusetts Department of Environmental Protection (MassDEP) – Air Pollution Control Regulations
- Occupational Health and Safety Administration (OSHA) regulations
- Department of Homeland Security (DHS) – Chemicals of Interest (COI)
- Centers for Disease Control and Prevention (CDC) – Select Agents and Toxins
- Drug Enforcement Agency (DEA) and Bureau of Narcotics and Dangerous Drugs (BNDD) – Controlled Substances and List I & II regulated chemicals
- International Building Code - Flammable material and other storage limits
- International Fire Code – Flammable material storage limits
- Local Fire Department Requirements – Flammable material storage limits

In order to keep workers safe and comply with these regulations, Tufts Environmental Health and Safety (TEHS) works with members of the laboratory staff who physically inventory every chemical and populate and update their Chemical Inventory. The more accurate an inventory is, the better able you are to protect workers, minimize cost, minimize wastes and comply with the applicable regulations.

The chemical inventory allows laboratory staff to identify chemicals and quantities in their lab. This permits TEHS staff to comply with the numerous Federal, State and Local regulations we are subject to.

Not having an accurate inventory can result in, at best, ordering too much of a particular chemical and not using the chemical before it expires or worse, change to an explosive or reactive chemical. This results in overspending in chemical procurement and increased waste disposal costs. At worst, an inaccurate inventory can result in workers being exposed to unknown hazardous chemicals, or the laboratory/facility being in violation of any number of regulations, subject to fines, and further increased regulatory scrutiny.

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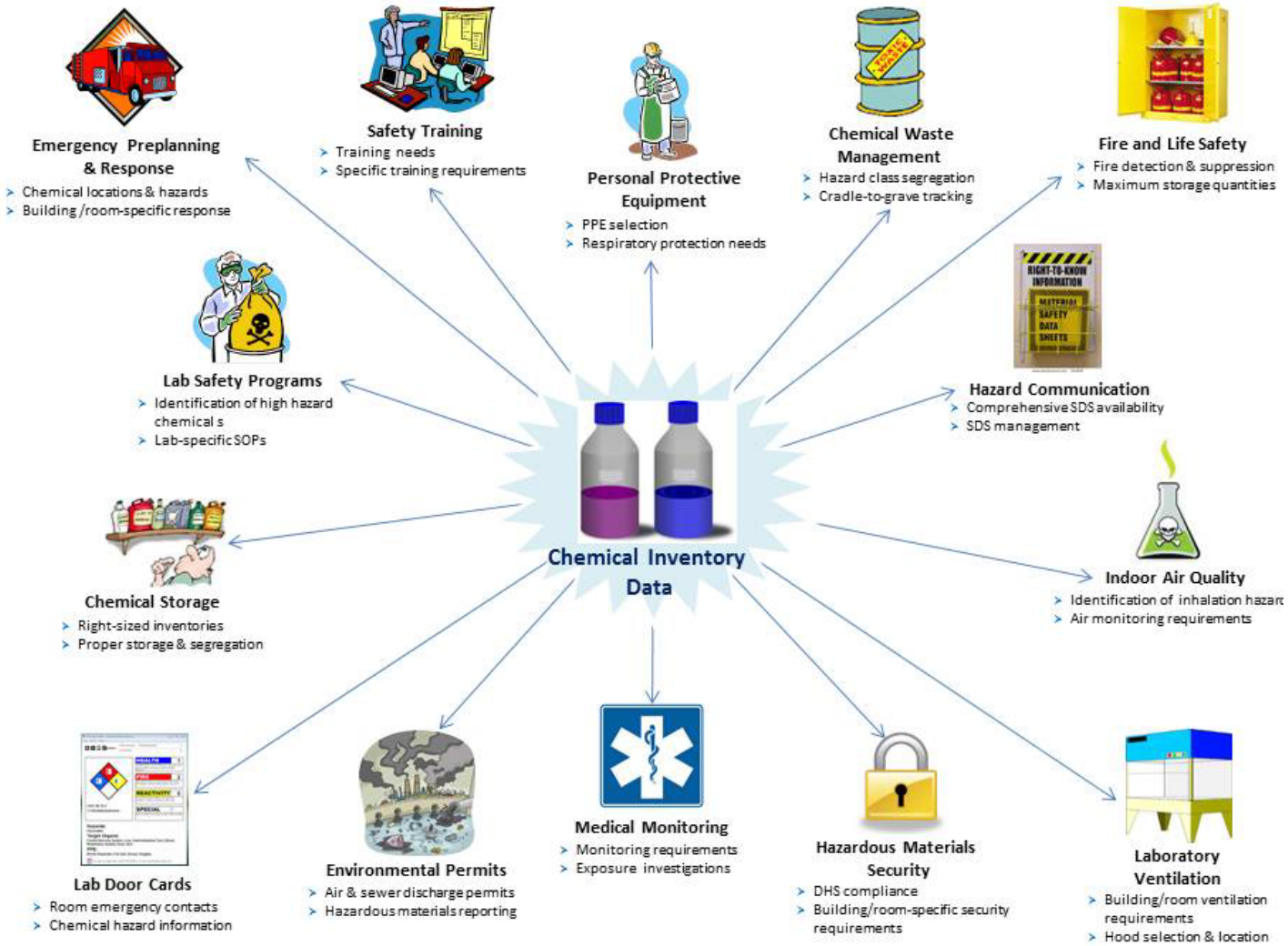
Like many things people often identify the importance of an accurate chemical inventory only after they learn the results of not having one. Accordingly, chemical inventory management is often only scrutinized following an incident in which it was determined that the lack of an accurate chemical inventory has been identified as root-cause or a significant contributing factor of an incident.

In reality there are hundreds of chemical users at Tufts each day and the and the odds of an incident occurring are low, but given that the consequences can be as high as a loss of life and/or multi-million dollar fines it is in everyone's best interest to practice good chemical inventory management. As shown in the diagram below good chemical inventory is at the center of many interrelated areas of responsibility.



"CHEMICAL INVENTORY DATA" DIAGRAM PROVIDED BY BEN OWENS, ASSISTANT DIRECTOR, UNIVERSITY OF NEVADA – RENO

The "Gold Standard" that companies, laboratories and universities to strive for, is a computer based system where inventory additions and subtractions are electronically "live" tracked and perpetually current. This affords the highest quality information and provides the best tools for worker protection and regulatory compliance.

The Hazards of Lithium Batteries

LITHIUM batteries are everywhere. They can be found in children's toys, electronics, computers, iPhones and iPads, e-cigarettes, hover boards, scientific instruments, etc.

PACKAGE OF LI BATTERIES, BEFORE AND AFTER DAMAGE:

Unfortunately, the incidents involving lithium battery fires are also everywhere. This past holiday season, lithium batteries in hover boards were responsible for several house fires. Amazon® suspended sales of hover boards. Lithium batteries have also been responsible for numerous e-cigarette fires; both when the person held it to their face to inhale, as well as while the e-cigarette was in the person's pant pocket. There have been numerous emergency airplane landings as a result of lithium batteries. In a typical scenario smoke suddenly begins to enter the cabin, the fire suppression equipment on airplanes discharges, but is inadequate at extinguishing lithium battery fires. The captain of the plane then needs to quickly perform an emergency landing.

Have you ever noticed when shopping, toys that have the "Try Me" button don't work? Then you realize there is a small plastic pull tab at the battery compartment. Pull the plastic tab out, and the toy works! This pull tab is an insulator to prevent lithium battery fires while the toy gets shipped. Manufacturers began doing this as a result of large fires that broke out in manufacturing, storing and distribution centers.

There are 2 types of lithium batteries:

Rechargeable lithium-ion batteries (sometimes Li-ion battery or LIB). In this type of battery, lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. These are common in consumer electronics. A lithium-ion battery is used for applications that require recharge capability. Lithium ion batteries provide high energy density, and can be recharged time after time. These batteries contain no free lithium metal, but do contain lithium ions and highly flammable electrolytes. Common applications are laptops, cell phones, electric vehicles, hover boards, hospital equipment and some scientific equipment.

Disposable lithium batteries (sometimes lithium primary battery or Li-primary battery). These batteries have lithium metal or lithium compounds as an anode. Lithium batteries, or primary batteries, are single use and incapable of recharge. They contain lithium metal which is highly combustible. They deliver extremely high energy in a small size. They are used where recharge isn't necessary or feasible. Common applications are toys, medical applications, consumer electronics etc.

Lithium-based batteries are inexpensive, lightweight, powerful, and environmentally safer than most alternatives. However, lithium batteries can generate large amounts of energy and there can be a fire and explosion risk associated with them. Storing large amounts of energy, whether it's in larger rechargeable batteries, or smaller disposable batteries, can be inherently dangerous.

The causes of lithium battery failure can include puncture, overcharge, overheating, short circuit, internal cell failure and manufacturing deficiencies. Many incidents reported in the media occurred while the battery was charging. A variety of charging sources were reported – laptop USB ports, auto USB adapters, desktop computer USB ports, and wall adapter USB ports.

The use of ordinary USB port charging connections may be one source of the problem. Not all USB ports are "created equal." The voltage and current provided by USB ports can vary. If you are handling a device that has a history of the lithium battery catching on fire (e-cigarettes, hover boards), make sure you are using the manufacturer's cord and power adapter that came with the device.

Lithium battery failure and overheating results in a process called "thermal runaway," which is a reaction within the battery causing internal temperature and pressure to rise at a quicker rate then can be dissipated. Once one battery cell goes into thermal runaway, it produces enough heat to cause adjacent battery cells to also go into thermal runaway. This produces a fire that repeatedly flares up as each battery cell in turn ruptures and releases its contents. An enormous issue is that these fires can't be treated like "normal" fires and require specific training, planning, storage, and extinguishing interventions. While lithium battery fires might not be "more" dangerous, they are very different and uniquely dangerous.

DAMAGE TO AIRPLANE DUE TO LI FIRE.

Applicable Regulations:

The FAA regulates the amount of lithium batteries you can take on a plane. All batteries are allowed in carry-on baggage and in checked baggage; however, FAA recommends that you pack them in your carry-on bag whenever possible. In the cabin, airline flight crews can better monitor conditions, and have access to the batteries or device if a fire does occur. Spare (uninstalled) lithium batteries (both lithium metal and lithium ion) are prohibited in checked baggage.

If you are traveling with spare batteries in addition to the ones inside your devices, consider placing each battery in its own protective case, plastic bag, or package, or place tape across the battery's contacts to isolate terminals. Isolating terminals prevents hazards due to short-circuiting.

If you must carry a battery-powered device in any baggage, please package it so it won't accidentally turn on during the flight. If there is an on-off switch or a safety switch, tape it in the "off" position.

If you have to ship any lithium batteries via FedEx, UPS or mail, please contact Tufts EHS. Shipping lithium batteries is regulated by the Department of Transportation, and you must be trained and certified to ship them.

Another consideration is that lithium batteries should be isolated from other battery chemistries and commodities. So if you want to recycle them, place tape over the ends of battery before placing them in the battery recycling bins on campus.

Lithium batteries are an integral part of everyday life. But, organizations and individuals should be aware of the unique hazards that these batteries bring to bear.

Lithium batteries are everywhere (and) the incidents involving lithium battery fires are also everywhere!

Machine Shop and Power Tool Safety

A SHOP is any place where manual and power tools are used to make an object from wood, plastic, glass, or other material for art, science, or engineering. There are many shops throughout the Tufts campuses. These locations have a wide variety of equipment and uses. For example in Medford, the garage on College Avenue supports the vehicles and equipment that allows for the day-to-day operations on the campus. In Grafton, a large service and storage area supports the farm equipment. The Chemistry department in Medford has a tool and machine shop that supports that department. In Boston there is a carpentry shop that helps with daily building maintenance.

The single most important aspect of any shop is the skill and knowledge to operate each tool safely. All Tufts employees who work with machines, power tools, or similar equipment are required to take annual training directly related to the equipment they use. Although some students are allowed to use power tools, all of them must have proper training and be supervised while on Tufts property.

One of the most active locations is the Scene Shop at 66 Colby Street. This shop is operated by two full-time Tufts employees. This location also has many students involved in designing and making items related to support the Theater Art department. The shop has drill presses, table saws, band saws, welding equipment, and many different types of other power tools. The shop is inspected once or twice a year by Environmental Health and Safety as well as by the Fire Marshall. Any student using any tool in the shop must be trained by a Scene Shop staff member. In addition to being trained on each individual piece of equipment, there is a staff member on site when the shop is in operation.

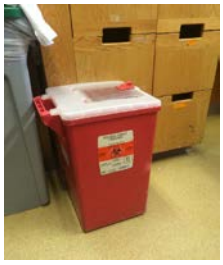
The Occupational Health and Safety Administration (OSHA) developed standards that are designed to keeping workers safe while working on machinery. 29 CFR 1910 211-219 Subpart O Although technically students do not fall under this standard, Tufts adopted a policy that students must also follow the OSHA regulations.

In general there are several steps to keep yourself safe while using machinery or power tools, some of which may appear obvious. They include:

1. Knowing the equipment you will be operating. Read the manual and review any relevant documents.
2. Ensuring that any safety measures such as emergency shut-offs or safety guards are in place and operating correctly.
3. Seeking training from someone with knowledge of the equipment. Be sure to document this training.
4. Ensuring that there are no defects, such as frayed electrical wires or loose parts.
5. Wearing safety glasses, proper gloves and any other safety protection that may be required.
6. If you are a student working on Tufts property with power tools or machines ensure you have been properly trained and are supervised. Most equipment requires routine maintenance, assure this is being completed.
7. Whenever possible when working with power tools or machines, do not work alone.

Although some students are allowed to use power tools, all of them must have proper training and be supervised while on Tufts property.

Biohazardous Waste in the Research Labs
Regulated Medical Waste, Sharps and Liquid Wastes



RESEARCH at Tufts University generates Medical and Biological Waste, or Regulated Medical Waste (RMW), and is regulated by the state of Massachusetts and handled by our RMW vendor. The objective of medical and biological waste regulations is to mandate the treatment of all potentially infectious materials and thereby minimize the risk of infection and injury from the mishandling of these wastes to staff, students, solid waste handlers and the public.

Contact TEHS for assistance setting up and processing your Regulated Medical (Biological) Waste

Individuals generating medical and biological wastes at Tufts University must identify such wastes, collect such wastes in a proper container, disinfect liquid wastes before discharge into the sink and sewer and arrange for the proper disposal of such wastes.

Dry Solid Waste is collected in containers used by the vendor and has a redbag marked with the BioHazard Symbol and wording. These containers are shipped off-campus by our vendor. Dry Solid Waste that is treated on-site by autoclaving is collected in clear bags in a solid container that is appropriately labelled. The use of autoclaves has been discussed in previous articles and can be found on the Tufts EHS Website.

Massachusetts regulations classify the following materials as medical and biological waste and require specific types of processing as well as documentation of that processing:

- **Human blood and blood products (Note: excludes feminine hygiene products)**
- **Animals and animal wastes: if treated with or contaminated with an infectious disease agent presenting a risk to human health or infected with an agent that causes zoonotic diseases as listed in 105 CMR 300.140;**
- **Pathological wastes: human organs, tissues and body fluids from diagnostic procedures including specimens of such materials;**
- **Cultures of infectious agents: including live or attenuated human or animal vaccines**
- **Sharps: any object that can cause skin cuts or punctures including: Needles, syringes, lancets, Pasteur pipettes, broken glassware, broken plastic ware, scalpels, blades, suture needles, and dental wires.**
- **Biotechnology effluent materials: any waste materials made from microbes or their products including microbes and their products made from genetically altered living microbes (recombinant DNA)**

The Massachusetts State Plumbing Code (248 CMR 10) defines any waste containing recombinant DNA as a special waste. Liquid wastes containing recombinant DNA molecules shall be sterilized or (otherwise) treated (decontaminated) at the point of generation before discharge into the sewer system. Please contact TEHS for assistance setting up and processing your Regulated Medical (Biological) Waste.

Tufts EHS is completing a Guidance Document that will be available on the TEHS Website. In it will be defined all the existing streams of Regulated Medical Waste, how forms of Infectious Waste are considered, disposal methods and links to the TEHS documents and regulatory bodies. Please check the TEHS Website regularly for any updates, policies, regulatory requirements, trainings and information that will help make your work environment safer.