

Laboratory Safety



**UNIVERSITY OF
SOUTH FLORIDA**

Environmental Health & Safety

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Contacts and Objectives

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- Waste Management
- Industrial Hygiene
- Asbestos/Indoor Air Quality
- Fire Safety
- Occupational Safety
- Lab Safety
- Insurance/Risk Management
- Building Code Administration

Working in laboratories carries risk of exposure and injury due to hazardous materials. Laboratory equipment and processes can cause physical injury, illness, or cause fires if not properly used. It is essential for everyone working in a laboratory to understand lab hazards and how to protect themselves and those working around them.

Training Objectives

- To provide safety guidelines for workers and researchers in USF laboratories
- To increase awareness of environmental compliance regulations
- To provide safety-related contact information and resources

Individual Responsibilities

The key to having a safe lab environment lies with an individual's commitment to safety. The [USF Chemical Hygiene Plan](#) outlines the responsibilities of individuals working in chemical laboratories. All individuals are required to:

- Follow all University safety procedures as outlined by the Chemical Hygiene Plan, EH&S, and the Principal Investigator
- Attend all required safety trainings
- Report any conditions deemed unsafe to the Principal Investigator, Lab Supervisor, or EH&S

Supervisor Responsibilities

The [USF Chemical Hygiene Plan](#) also outlines the responsibilities of Principal Investigators/Supervisors working in chemical laboratories. All supervisors are required to:

- Determine job-specific safety and compliance procedures
- Provide required safety equipment to staff
- Ensure that everyone receives appropriate safety training
- Ensure that everyone follows safety and compliance procedures
- Ensure correction of identified hazards
- Report all injuries/illnesses to Environmental Health & Safety



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Recognizing Hazards: Resources

1.) Manufacturer's Label

The manufacturer of a chemical must provide a label that indicates:

- Full name of chemical
- Hazard warnings
- Name and address of manufacturer

* Chemical containers without manufacturer's labels should be returned to the manufacturer.

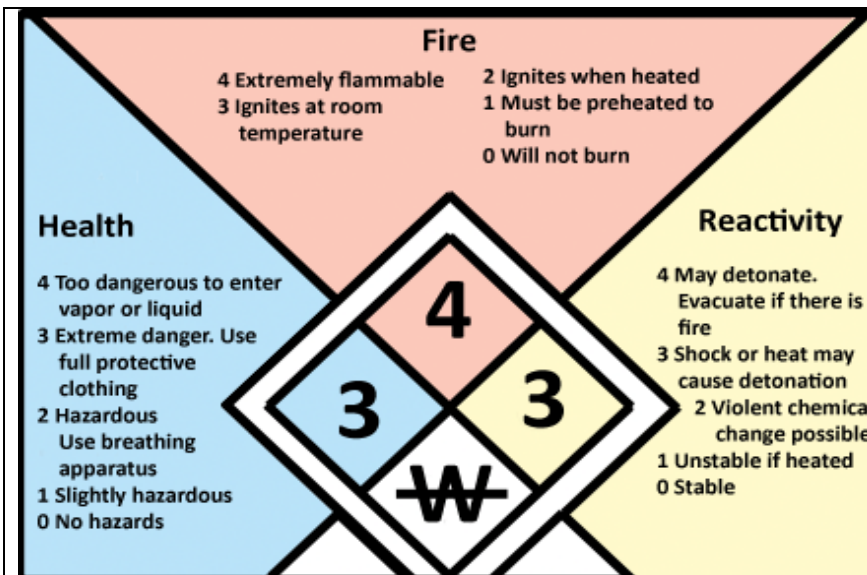
2.) Safety Data Sheets (SDS)

An SDS (formerly called MSDS) is a document, prepared by the manufacturer, which contains safety information for materials containing hazardous chemicals. It tells about:

- Material components
- Dangers
- Safe handling of material

An SDS is shipped with each chemical but can also be found online. Be sure that you have immediate access to the SDS for chemicals you are working with.

3.) NFPA Label



This label was developed by the National Fire Protection Association to identify and rank a material's hazards. Hazards are rated from 0 (no hazard) to 4 (extremely hazardous).

Fire Hazard – labeled in red

Health Hazard – labeled in blue

Reactivity Hazard– labeled in yellow

Specific Hazard – labeled in white (OX=oxidizer, W=use no water, CORR=corrosive, ALK=alkali)

4. GHS Classification

The Globally Harmonized System of Classification and Labeling of Chemicals (GHS), is a universal approach to defining chemical hazards, criteria to compare these hazards, and hazard communication. Hazardous chemical labels and SDSs will present information in alignment with the GHS. It is important to remember that, within the GHS, hazards are rated from 1 (extremely hazardous) to 4 (no hazard), which is the opposite of the NFPA system.

Recognizing Hazards: Hazard Classes

FLAMMABLE

- A material that may catch fire and burn in air
- Any liquid having a flashpoint below 100 degrees F (37.8 degrees C).
- Flammable vapors are usually heavier than air (vapor density > 1), so it is possible for the vapors to travel along floors and, if an ignition source is present, result in a flashback fire.
- Store flammable liquids only in specially designed flammable storage cabinets and refrigerators/freezers or explosion-proof refrigerators/freezers away from ignition sources and oxidizers.



OXIDIZER/REACTIVE

- An unstable material that may ignite, explode, or produce toxic gas under certain conditions
- Examples include sodium, t-butyl lithium, aluminum nitrate, perchloric acid, nitric acid, and sodium peroxide.
- Store away from flammable materials and place in a secondary containment when stored with incompatible materials.



CORROSIVE

- A material that destroys metal and can cause destruction of tissue upon exposure
- Has a pH of less than 2 or greater than 12.5
- Examples include strong acids such as hydrochloric acid and sulfuric acid, and strong bases such as potassium hydroxide and sodium hydroxide.



POISON/TOXIC

- A material that is harmful or fatal if ingested or absorbed
- Toxic chemicals have an LD50 of 50 - 500 mg/kg, single oral dose for rats. Highly toxic chemicals have an LD50 of < 50 mg/kg, single oral dose for rats.
- Store in a secure, sealed container below shoulder level. Use only in designated areas.



Recognizing Hazards: Special Hazards

Never work alone and always follow Standard Operating Procedures (SOPs) approved by your supervisor. Written procedures are **required** for work involving hazardous chemicals (including EPA p-listed, DHS listed, carcinogens, toxic gases, time-sensitive, pyrophoric). Templates for SOPs can be found at <http://www.usf.edu/administrative-services/environmental-health-safety/programs-services/laboratory-safety/sops.aspx>

ART STUDIO

- EH&S offers a Safety & Compliance in the Arts Training, phone: (813) 974-4036



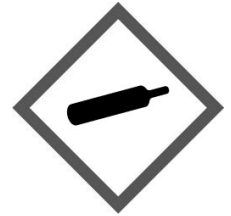
BIOSAFETY

- Wash hands before leaving lab, wear gloves and a lab coat, do not pipette by mouth, do not eat, drink, or apply cosmetics in the lab
- USF Biosafety Program offers a Biosafety course, phone: (813) 974- 5638



COMPRESSED GAS CYLINDER

- Must be attached to a permanent fixture or they may injure someone if they fall
- May rupture, sending metal shards flying or becoming a missile-like projectile from the force of the escaping gas
- Leaking cylinders are asphyxiation, poisoning, or fire hazards depending on the type of gas
- Do not roll or drag cylinders



CRYOGENIC FLUIDS

- Asphyxiation and burn hazard
- Full face protection, apron, and proper gloves
- Metal watches and jewelry on hands should be removed before use



ELECTRICAL/FIRE

- Do not run wires where they may be damaged. To avoid shock, remove metal rings, bracelets, and watches from hands and make sure hands, tools, equipment, and floor are dry. Know the location of the emergency power off.
- Do not use extension cords, daisy-chain power strips, block exit doors or corridors, store items within 18" of a sprinkler head, or prop open fire doors
- EH&S offers a Fire Safety training course



GLASS

- Before using glassware, inspect glass for cracks or chips. Follow careful handling and storage procedures to avoid damaging glassware.
- Clean up broken glass with tongs or a broom and a dust pan, never your hands.
- Dispose of glass in a designated cardboard box lined with a plastic bag



HOT PLATES

- Read and follow manufacturer's directions
- Do not cover heating surface with foil
- Do not leave unattended while heating
- Do not heat volatile materials using a hot plate



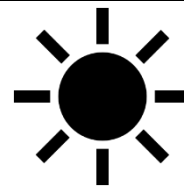
HYDROFLUORIC ACID

- Highly corrosive and penetrates the skin to destroy soft tissue and bone. Burns from dilute solutions are not apparent for several hours.
- Calcium gluconate gel should be applied immediately after exposure. Seek medical attention.



LIGHT SENSITIVE CHEMICALS

- Light causes degradation, forming new chemicals or causing pressure build-up
- Examples include Bromine, Mercuric Salts, Potassium Ferricyanide, and Sodium Iodide



MERCURY

- Use non-mercury thermometers
- Mercury exposure damages every system in the body
- Wearing nitrile gloves, splash goggles and an impervious apron, seal a broken mercury thermometer in a container and call EH&S for pickup



NITRIC ACID

- Highly corrosive and a strong oxidizer
- Store separately from other chemicals or in secondary containment



P-LISTED CHEMICALS

- Are listed as acutely hazardous by the EPA
- Should be marked by a green warning sticker
- Include sodium azide, osmium tetroxide, arsenic, and cyanide compounds
- Complete list in the Hazardous Waste Management Procedures, <https://www.usf.edu/administrative-services/environmental-health-safety/documents/hazwaste-managementprocedure.pdf>
- The empty containers are hazardous waste and must be disposed of through EH&S



PERCHLORIC ACID

- Highly corrosive and forms explosive anhydrous crystals
- Use only in a fume hood designed with a water wash down to prevent crystal formation



RADIATION/LASERS

- USF Radiation Safety offers a Radiation Training Course, phone (813) 974-1194



SHARPS

- Needles and needle-syringe units are disposed of in a red box labeled "SHARPS DISPOSAL"
- Never recap needles
- Razors, scalpels, and sharp pieces of glass, metal, or plastic must be boxed or wrapped securely before disposal as regular trash



SHOP

- EH&S offers a Shop Safety Course



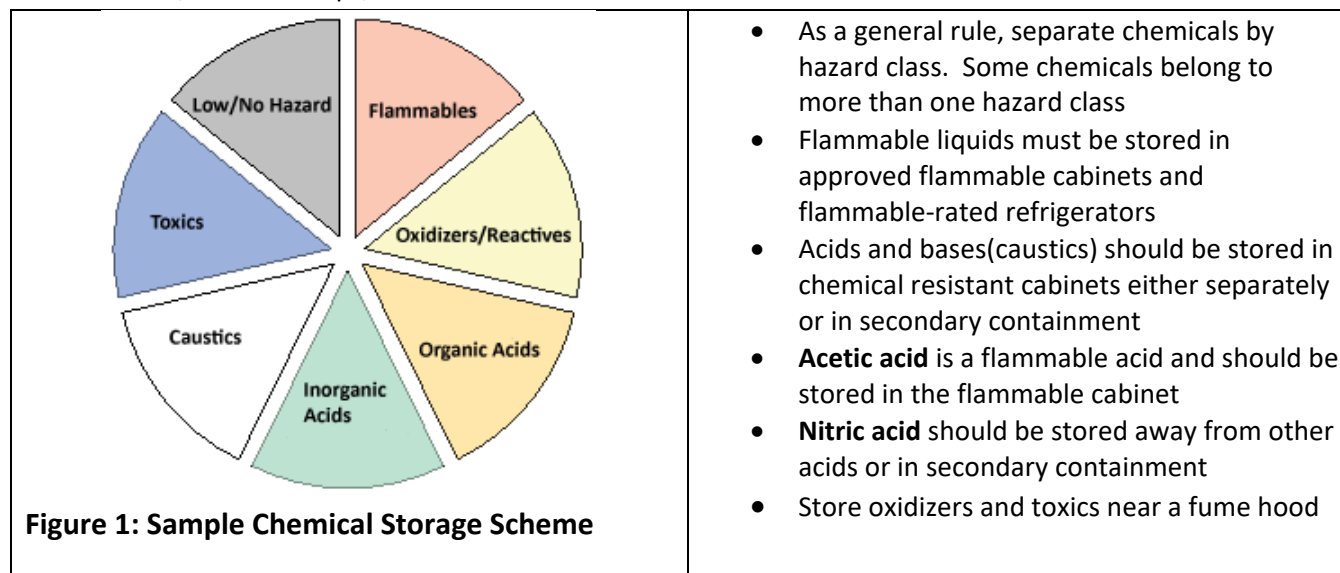
TIME-SENSITIVE CHEMICALS

- Form explosive crystals upon prolonged storage
- Check for crystallization periodically and dispose of after 12-18 months
- Examples include peroxide formers such as ethers, tetrahydrofuran, styrene and explosives such as picric and picrylsulfonic acid
- Do not attempt to open any expired time-sensitive chemicals, contact EH&S



Minimizing Hazards: Chemical Storage

- Do not store chemicals above eye level, especially corrosive liquids. Do not store chemicals in the fume hoods, on bench tops, or on the floor.



Minimizing Hazards: Chemical Inventory

- Keep a comprehensive list of materials being stored in the lab and update yearly
- Useful in keeping track of time-sensitive chemicals with limited shelf lives
- Chematix is USF's online chemical database. Log in at [*** CHEMATIX™ | Chemical Management Software ***](#) for more information
- Mark chemicals with date received, date opened, and date of expiration

Hazard Assessment: Exposure and Risk

Chemicals can enter the body four different ways:

- Absorption through the skin
- Inhalation
- Ingestion (eating and drinking)
- Injection (needles or sharp pieces of glass, plastic, or metal)

Whether or not your exposure will result in injury depends on:

- Exposure frequency
- Exposure duration
- Age, sex, and genetics

Assess your risk by considering these questions:

- What are the hazards?
- What is the worst thing that could happen?
- What can be done to prevent this from happening?
- What can be done to protect from these hazards?
- What should be done if something goes wrong?

Exposure risk can be minimized using:

- Substitution of less hazardous materials
- Engineering controls (example: working in the fume hood)
- Administrative controls (Chemical Hygiene Plan, training)
- Personal protective equipment (PPE)

LD50 (Lethal Dose, 50%) is a measure of a material's acute toxicity and is the individual dose required to kill 50 percent of a population of test animals. The smaller the number is, the more toxic the substance. The LD50 for a material can be found on its SDS or the NIH, ChemIDplus web site, <https://chem.nlm.nih.gov/chemidplus/>. Some LD50's for some chemicals of interest are listed below.

Substance	Animal, Route	LD50 (mg/kg)	Source
Ethanol	Rat, oral	7060	NIH, ChemIDplus
Acetaminophen (Tylenol)	Rat, oral	1944	NIH, ChemIDplus
Caffeine	Rat, oral	192	NIH, ChemIDplus
Nicotine	Rat, oral	50	NIH, ChemIDplus
Sodium Cyanide	Rat, oral	6.44	NIH, ChemIDplus
Botulinum Toxin A	Mammal, oral	<0.1mg/kg	Toxicon, Vol. 58, Issue 1, July 2011

Minimizing Hazards: Personal Protective Equipment & Engineering Controls

Everyone in the lab, including visitors, should wear long pants and shoes that cover the entire foot.

EYE PROTECTION

- Safety glasses protect eyes against flying debris
 - Splash goggles protect eyes against liquid splashes
 - Full face shields over splash goggles provide extra protection when working with corrosive chemicals
 - UV-rated glasses protect against UV exposure, such as while using a transilluminator
 - Since 2005, The National Institute for Safety and Health (NIOSH) has recommended that contact lenses be permitted during work with hazardous chemicals provided suitable eye protection was worn and written guidelines and a hazard assessment were in place.
-



GLOVES

- Wear when handling hazardous materials, sharp, or very hot or cold items
- Latex, vinyl, or nitrile gloves are appropriate most of the time
- Glove compatibility charts provide information for specific chemicals, see <http://www.chemrest.com/>



LAB COATS AND APRONS

- Regular lab coats provide minimal protection. Flame-resistant lab coats should be worn if working with flammable liquids or pyrophorics.
- Impervious aprons provide extra protection against corrosive liquids.
- Do not take lab coats home to wash. Follow your department's procedures.



RESPIRATOR

- Consult EH&S before use. Federal regulations prohibit the use of respirators by untrained employees. If EH&S determines use is necessary, the individual must participate in the University's respirator program. This includes an annual medical evaluation, respirator fit test, and training.



FUME HOOD

- Protects against exposure to hazardous fumes or dusts
- Keep sash as low as possible when using, close sash when not using
- Work at least six inches inside sash and avoid sudden movements



Emergency Response: Spills

Small spills may be cleaned up by the lab as long as personnel have proper supplies, knowledge, PPE, and are comfortable doing so.

- Consult the SDS of the spilled chemical & wear proper PPE prior to clean-up.
- Spread absorbent around spill site and over liquid's surface and wait 15 minutes.
- Collect wet absorbent & transfer to a plastic bucket or bag using dustpan & brush.
- Dispose of as hazardous waste.

SPILL KIT

- Store in an accessible location
- Absorbent material, goggles, gloves, broom, dustpan, bucket
- For biohazardous spills, also have 10% bleach or other disinfectant



If one of the following conditions occurs, call EH&S:

- Spill is large
- Spill involves extremely hazardous chemicals
- Ventilation is inadequate
- No spill clean-up materials
- Personnel uncomfortable handling clean-up
- If a spilled chemical enters the drain, soil or water body

Emergency Response: Accidents

If there is an emergency, call 911 or University Police. Be prepared to give detailed information about your location.

EYEWASH

- If chemicals get into eyes, flush eyes for 15 minutes
- Lab personnel must flush eyewash weekly and keep a record
- Do not block with glassware or equipment



SHOWER

- If chemicals get onto clothes/skin, rinse for 15 minutes, removing contaminated clothing
- FM-Ops flushes quarterly and performs maintenance inspection annually during one of the quarterly flushes. Do not store items under shower



FIRST AID KIT

- Know location
- Check completeness and expiration dates



Emergency Response: Fire

You are not expected to fight the fire. Follow these emergency procedures to assure your safety:

1. Yell out FIRE FIRE FIRE!
2. Alert other building occupants by activating the fire alarm by using the manual pull station.
3. Attempt to extinguish fire, if it is small and you know how to use an extinguisher.
4. Close all doors behind you as you evacuate the building.
5. Call 911 or University Police soon as possible outside the building.
6. Give as much information as possible to the emergency dispatcher.
7. Meet in the designated relocation area at least 150 feet from the building.

FIRE EXTINGUISHER	
<ul style="list-style-type: none"> • USF tests annually • EH&S offers training, call for more information • To use, remember P.A.S.S. (Pull the pin, Aim at the base of the fire, Squeeze the lever, and Sweep back and forth) 	



Fire Code Violations

The top ten violations recorded by the State Fire Marshal are:

1. Extensions cords used as permanent wiring
2. Daisy chaining power strips (i.e., plugging one power strip into another)
3. Blocked exit doors
4. Furniture in exit corridors that block clear egress width

5. Excessive storage that blocks access to fire alarm and electrical panels
6. Storage within 18 inches of a fire sprinkler head
7. Propping open fire doors with door wedges
8. Gas cylinders not properly secured or removed from lab when empty
9. Improper storage of flammable liquids
10. Unapproved portable heaters

Emergency Response: Incident Reporting

Fill out an incident report form, available online at <http://www.usf.edu/administrative-services/environmental-health-safety/reporting/index.aspx>

Workers' Compensation (WC) covers faculty, staff, and official volunteers at the University of South Florida. Teaching and graduate assistants are included as staff.

If you are injured on the job:

- Notify your supervisor
- Supervisor will contact AmeriSys at 800-455-2079
- Proceed to approved medical facility
- Send injury report to EH&S within 24 hours

Hazardous Waste

In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA). This law gave the Environmental Protection Agency (EPA) the authority to regulate all individuals who generate and accumulate hazardous wastes. All labs, studios, and shops that generate and accumulate hazardous wastes are subject to unannounced inspections from the Florida Department of Environmental Protection and/or EPA and are thus subject to fines.

Universal Waste

These materials are subject to hazardous wastes regulations unless they are managed or recycled according to the universal waste regulations.

- Nickel Cadmium, Lithium Ion, Nickel Metal Hydride, Lead Acid, Mercury or Silver Hydride batteries must be segregated and collected in a container labeled with its contents.
- Fluorescent and High Intensity Device (HID) lamps (either used or broken) must be stored in a plastic lined box or metal container labeled "Waste Mercury Bulbs".
- Mercury thermometers, thermostats, and barometers must be stored in a plastic lined box or metal container labeled "Waste Mercury Devices".

Chemical Waste

- At USF, all chemical waste must be treated as hazardous waste and must be collected. No dumping of hazardous wastes, including rags, in the trash or down the drain.
- Empty chemical containers can be disposed in the lab trash or reused to store hazardous wastes, EXCEPT for empty containers that stored acutely hazardous wastes (EPA P-listed). These cannot go in the trash and must be disposed of through EH&S.

- Before disposal, remove or deface the label with a marker and write “Empty” on the bottle. The lids on empty flammable containers should be removed before disposal.
- Lead solder remnants must be collected and disposed of as hazardous waste.
- Only completely empty spray cans with intact nozzles can be put into regular trash. If the nozzle is missing or the container is not empty it is hazardous waste.

Figure 2: Chemical Waste Handling

Collect Waste

- Containers for solid or liquid waste, tags, and labels are available through Chematix
- Must be labeled “Hazardous Waste” and include the date, the percent content of each chemical, and a description of its hazard class (for example: toxic)
- Attach a yellow waste tag when waste is first added

Store Waste

- Keep in a Satellite Accumulation Area (SAA)
- Do not use food or drink containers to store waste
- Floor storage must have secondary containment
- Containers must be kept closed, funnels removed

Waste Pick-up

- Log on to Chematix at [to request pick-up](#)
- Use the Lab Cleanout form to request pick-up of more than 20 items
- Contact Facilities Management to pick up universal waste lamps and batteries

Biomedical Waste



Figure 3: Universal Biomedical Waste Symbol

- Any solid or liquid waste which may present a threat of infection to humans.
- Biomedical (or Biohazardous) waste is managed under the Florida Administrative Code (FAC) 64E-16 (<https://www.flrules.org/gateway/ChapterHome.asp?Chapter=64e-16>) and USF's Written Biomedical Waste Plan (<http://www.usf.edu/administrative-services/environmental-health-safety/programs-services/hazardous-waste/biomedical-waste.aspx>)
- All needles, whether infectious or not, must be disposed of as biomedical waste. Never recap needles.
- Biomedical waste mixed with chemical waste must be managed as hazardous waste. Please separate biomedical waste from biomedical waste mixed with chemical or radioactive waste.
- Place red bags into an outer container prior to use. The outer container must be rigid, leak-resistant and puncture-resistant. Reusable outer containers shall be constructed of smooth, easily cleanable materials and shall be decontaminated after each use.
- USF's biomedical waste service provider, Medigreen, removes waste. The custodial staff will not remove any biomedical waste.

Figure 4: Biomedical Waste Handling**Identify**

- Any solid or liquid waste which may present a threat of infection to humans
- Blood, needles, contaminated sharps
- Animal parts/tissues

Segregate

- Place in a sharps container or red bag
- Non infectious pipettes, tubes, scalpels may go into regular trash if they are well wrapped or placed in the Broken Glass Box
- Do not put any regular trash in with biomedical waste

Label and Store

- The universal biomedical waste symbol and the words “Biomedical Waste”, the facility name (e.g. USF), address, phone number and contact name must be displayed on each container/bag
- Cannot be stored longer than 30 days

Transport

- Wear a lab coat and gloves and use a rolling cart to move waste
- Contractor transports and disposes of all biomedical wastes
- Current contractor is: Medigreen, Orlando, FL

References

Biomedical Waste Management Plan provides the requirements for the proper management of biomedical waste at USF <http://www.usf.edu/administrative-services/environmental-health-safety/documents/bmwplannov2016.pdf>

Chemical Hygiene Plan is a broad outline of chemical safety procedures and must be available to all Principal Investigators, students, lab workers, and volunteers <https://www.usf.edu/administrative-services/environmental-health-safety/documents/chemical-hygiene-plan.pdf>

Contact Lens Use in a Chemical Environment, NIOSH (2005), Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2005–139. <http://www.cdc.gov/niosh/docs/2005-139/pdfs/2005-139.pdf>

Department Of Labor, Occupational Safety and Health Administration Industry Standards, 29 CFR Part 1910 http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1910

Ethics Point collects anonymous reporting of activities that may involve misconduct, unsafe conditions, or other violations of USF System policies <https://secure.ethicspoint.com/domain/media/en/gui/14773/index.html>

Hazardous Waste Management Procedures outlines the regulations and procedures governing the accumulation and management of hazardous waste <https://www.usf.edu/administrative-services/environmental-health-safety/documents/hazwaste-managementprocedure.pdf>

NIH, ChemIDplus provides chemical, physical and toxicological information <https://chem.nlm.nih.gov/chemidplus/>

Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version 2011. Full text available online at http://www.nap.edu/catalog.php?record_id=12654

RCRA Online is a database of documents covering the management of non-hazardous, hazardous, and medical waste <http://www.epa.gov/rcraonline>

Wireless Information System for Emergency Responders (WISER) provides information on hazardous substances and is available as a standalone application on computers and mobile devices <https://wiser.nlm.nih.gov/>

Laboratory Safety Training

Hazardous Waste Refresher

Biomedical Waste Refresher

Hazardous Communication

Personal Protective Equipment

Slips, Trips, and Falls

Hearing Conservation

Golf Cart Training

Asbestos Awareness Training

Fire Prevention Safety Training



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