

# Hazardous Waste Management

Office of Environmental Health and Safety

University of Alabama at Huntsville

2015

The bottom of the slide features a decorative graphic consisting of several overlapping, wavy, horizontal bands in various shades of blue, creating a sense of movement and depth.

# Objectives

- \* To demonstrate the proper methods of laboratory hazardous waste management for compliance with state and federal regulations.
- \* To provide accident management and spill clean-up procedures

# Training Topics

- \* **Regulations**
- \* **Define Hazardous Waste**
- \* **Container Management**
- \* **Waste Labeling**
- \* **Waste Compatibility**
- \* **Storage Area management**
- \* **Waste Minimization**
- \* **Waste- Pickup**
- \* **Spill Clean-up**



# Who Regulates Hazardous Waste?

- Environmental Protection Agency (EPA)
  - Regulates all aspects of hazardous waste
- Department of Transportation (DOT)
  - Regulates hazardous waste transportation
- Department of Homeland Security (DHS)
  - Regulates security threats associated with chemicals.

# Resource Conservation and Recovery Act: RCRA

- ❖ Protecting human health and the natural environment from the potential hazards of waste disposal.
- ❖ Reducing the amount of waste generated, through source reduction and recycling
- ❖ Ensuring the management of waste in an environmentally sound manner.
- ❖ "Cradle to Grave" requirements: Hazardous waste is regulated from the moment it is created through the time of final disposal. Generator is forever responsible for their waste.

# RCRA

- Under the Resource Conservation and Recovery Act (RCRA), EPA regulates individuals who generate & accumulate hazardous wastes.
- All labs, studios, and shops that accumulate hazardous wastes are subject to unannounced inspections by Alabama Department for Environmental Management(ADEM) and/or EPA and can be fined.

# Responsibilities of UAH

EPA views UAH as a hazardous waste generator

- \* Generators are responsible for:
  - \* properly identifying hazardous waste
  - \* proper management of hazardous waste
    - \* Use
    - \* Storage
    - \* Disposal

# Most Common EPA Violations

- \* Most commonly cited EPA violations of hazardous waste regulations are:
  - \* Open containers or **lids** not screwed on tight
  - \* Improper **labels**/identification
  - \* Lack of secondary containment for **leaks**
  - \* **Wastes from multiple locations consolidated in one room**
- \* **The 4L's – Lids, Leaks, Labels and Location**



# EPA Fines for Non-compliance

- \* The EPA does impose fines against universities and colleges
- \* Examples include:
  - \* UAH - \$25,000
  - \* Boston University - \$800,000
  - \* Penn State - \$1 million
  - \* UC Berkeley - \$1 million
  - \* Stanford University - \$1 million

# What is a hazardous waste?

- ❖ Hazardous waste is waste that is dangerous or potentially harmful to our health or the environment.
- ❖ Hazardous wastes can be liquids, solids, gases, or sludge.
- ❖ They can be discarded commercial products, like cleaning fluids or pesticides, or the by-products of manufacturing processes.
- ❖ Hazardous waste are divided into:
  1. **Listed wastes**
  2. **Characteristic wastes**

# Listed and Acutely Toxic Waste

EPA-listed wastes:

- ❖ **F-list**: This list identifies wastes from common manufacturing and industrial processes, such as solvents that have been used in cleaning or degreasing operations
- ❖ **K-list** (source-specific wastes). This list includes certain wastes from specific industries, such as petroleum refining or pesticide manufacturing
- ❖ **P-list** and the **U-list** (discarded commercial chemical products). These lists include specific commercial chemical products in an unused form.
- ❖ **All EPA P-listed wastes are acutely toxic**

# Characteristic Waste

- \* Ignitable
- \* Corrosive
- \* Reactive
- \* Toxicity

# Ignitable

- ❖ A liquid with a flash point below 60° (140°F)
- ❖ A non-liquid, which under standard conditions is capable of causing fire through friction, absorption of moisture, or spontaneous chemical changes
- ❖ An ignitable compressed gas
- ❖ An oxidizer, such as permanganate, inorganic peroxide, or nitrate
- ❖ **Examples include ethanol, sodium nitrate, hydrogen gas, xylene and acetone**



# Reactivity Characteristic

- \* A waste is reactive if it meets any of the following criteria:
  - \* It can explode or violently react when exposed to water or under normal handling conditions
  - \* It can create toxic fumes or gases when exposed to water or under normal handling conditions
  - \* **Examples include sodium metal, reactive sulfides, potassium cyanide and picric acid**












# Corrosive and Toxic Characteristic

- \* The **corrosivity characteristic** identifies wastes that are acidic or alkaline (basic). Such wastes can readily corrode or dissolve flesh, metal, or other materials.
- \* Liquid with a pH less than or equal to 2 or a pH greater than or equal to 12.5. **Examples: hydrochloric acid, glacial acetic acid**

A **Toxic waste** is a material that can be harmful or fatal if you are exposed and can pollute groundwater if released on land. **Toxic wastes are listed by EPA.** There are currently 40 contaminants on the list that include certain heavy metals, pesticides and organic compounds. **Examples: lead-based paints, cadmium, arsenic**



# Hazard Symbols

Hazard Symbols (to be used in pictograms for substances of the particular class)		
		
<b>FLAME OVER CIRCLE—USED FOR THESE CLASSES :</b> <ul style="list-style-type: none"> <li>• Oxidizers</li> </ul>	<b>FLAME—USED FOR THESE CLASSES:</b> <ul style="list-style-type: none"> <li>• Flammables</li> <li>• Self Reactives</li> <li>• Pyrophorics</li> <li>• Self-Heating</li> <li>• Emits Flammable Gas</li> <li>• Organic Peroxides</li> </ul>	<b>EXPLODING BOMB—USED FOR THESE CLASSES:</b> <ul style="list-style-type: none"> <li>• Explosives</li> <li>• Self Reactives</li> <li>• Organic Peroxides</li> </ul>
		
<b>SKULL &amp; CROSSBONES—USED FOR THESE CLASSES:</b> <ul style="list-style-type: none"> <li>• Acute toxicity (severe)</li> </ul>	<b>CORROSION—USED FOR THESE CLASSES:</b> <ul style="list-style-type: none"> <li>• Corrosives</li> </ul>	<b>GAS CYLINDER—USED FOR THESE CLASSES:</b> <ul style="list-style-type: none"> <li>• Gases Under Pressure</li> </ul>
		
<b>HEALTH HAZARD—USED FOR THESE CLASSES:</b> <ul style="list-style-type: none"> <li>• Carcinogen</li> <li>• Respiratory Sensitizer</li> <li>• Reproductive Toxicity</li> <li>• Target Organ Toxicity</li> <li>• Mutagenicity</li> <li>• Aspiration Toxicity</li> </ul>	<b>ENVIRONMENTAL HAZARD—USED FOR THESE CLASSES:</b> <ul style="list-style-type: none"> <li>• Environmental Toxicity</li> </ul>	<b>EXCLAMATION MARK—USED FOR THESE CLASSES:</b> <ul style="list-style-type: none"> <li>• Irritant</li> <li>• Dermal Sensitizer</li> <li>• Acute toxicity (harmful)</li> <li>• Narcotic Effects</li> <li>• Respiratory Tract Irritation</li> </ul>



# Peroxide Formers and Time Sensitive Chemicals

❖ Some chemicals if stored too long can produce organic peroxides capable causing explosions under heat or friction. The unusual stability problems of this class of compounds make them a serious fire and explosion hazard.

❖ **Examples:**

- *Ethers*
- *Tetrahydrofuran*
- *Picric/Picrylsulfonic Acid*

# How to Handle Peroxide Formers?

**Do Not Attempt to Open Expired Peroxide Formers**

## **Time-Sensitive Chemicals**

- \* **Check for crystallization periodically**
- \* **Dispose of no later than 12-18 months after purchase**
- \* **Call OEHS #2171 to pick up all expired chemicals**

# Reactive Chemicals

- \* Old or expired reactive chemicals can be potentially dangerous
- \* Peroxide formers such as ether should not be handled
- \* Notify OEHS immediately if found in your lab



# Who makes the Hazardous Waste Determination?

- **Environmental Health & Safety has the final determination of whether a waste is hazardous and its proper disposal.**
- **Therefore, all accumulated chemical wastes should be treated as hazardous wastes.**

**No Chemical Wastes Down The Drain or in the Trash!**

**Dilution is not the pollution solution.**

- **Contact OEHS for waste pick-up**

## **If unsure whether the waste created is hazardous:**

- ❖ Consult your supervisor.
- ❖ Consult with EPA Waste lists.
- ❖ Refer to the products Material Safety Data Sheet.
- ❖ Contact the Environmental Health and Safety Office # 2171

# Container Management

- Chemical waste must be stored in containers (including lids) composed of materials that are compatible with the waste.
- Chemical waste containers must be in good condition and free of leaks and residue on the outside of the container.
- Keep containers closed at all times except when adding or removing contents. Evaporation of wastes is a violation.
- For liquids, fill containers to about 90% of container volume. Do NOT fill containers to the top. Leave at least 2 inches of space in liquid waste containers to allow for liquid expansion and decanting.

# Container Management

- \* Flammable liquids – original manufacturers or UL listed containers
- \* Concentrated acids or bases-Original containers, or 2.5 Liter ‘acid’ safety bottles
- \* Solid waste – Plastic high density polyethylene bottles
- \* Aqueous waste-glass bottles or HDPE plastic bottles
- \* Milk jugs, soda bottles and food containers unacceptable.

# Closing Chemical Waste Containers

- \* Chemical waste containers must be tightly closed to prevent leakage or spillage.
- \* Containers should be closed with a screw-type lid or other appropriate device.
- \* Plastic wrap, aluminum foil, parafilm and other temporary lids are unacceptable.
- \* A container holding chemical waste must **ALWAYS** be closed, except when waste is actually being added.
- \* If a waste container is used to collect waste from a continuous process (i.e., drainage from a process collected with tubing inserted into a bottle such as HPLC), the container must still be sealed using rubber stoppers with tubing inserts or other appropriate means. It is not acceptable to leave funnels in chemical waste containers.



# Example – Open Containers

Lid open when not in use



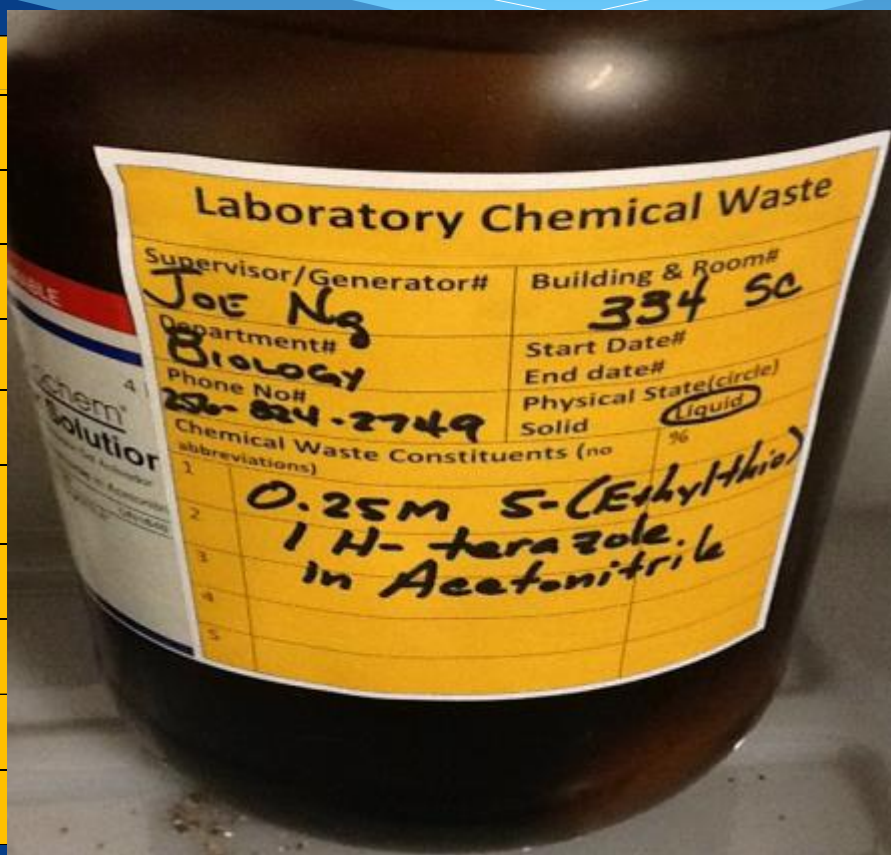
A funnel is not a lid!

# Chemical Waste Labeling

- \* All chemical waste containers must have yellow chemical waste label affixed on the bottle
  - \* Available from OEHS
- \* The following information must be provided on the label (see example of the label later in this section):
  - \* PI Name or Generator name
  - \* Building
  - \* Room number
  - \* Telephone number
  - \* Exact contents of the container

# Yellow Waste Label

Laboratory Waste		
Lab Supervisor/Generator#		Building & Room#
Department#		Start Date# End date#
Phone No#		Physical State(circle) Solid      Liquid
Chemical Constituents (no abbreviations)		%
1		
2		
3		
4		
5		
6		



# Satellite Accumulation Area: SAA

- \* A specific area should be designated in the laboratory as a chemical waste storage area. The area must be marked with “Waste Storage Area” signage (available with OEHS and Department Office)
- \* Waste must be stored in the room it was generated in and cannot be transferred to any area that requires passage through a door.
- \* Chemical waste must be stored with secondary containment so that spills cannot reach sinks, or floor drains.
- \* Incompatible chemical wastes must be segregated to prevent reaction.

# Satellite Accumulation Area: SAA

- \* Satellite Accumulation Area (SAA)
  - At or near the related work process
  - Under the control of the generator
  - Maximum amount stored 55 gallons or 1 quart acutely hazardous
- \* Secondary containment and weekly inspections are strongly recommended.

# Segregation of Waste at SAA

- \* Separate by hazards
  - \* flammable
  - \* toxic
  - \* corrosive
  - \* reactive
- \* Separate by distance and containment.

# SAA Warning Signs



# SAA management

Waste containers stored in a SAA must be:

- \* In good condition
- \* Compatible with the waste being stored
- \* Kept closed at all times except when filling
- \* Labeled with a yellow chemical waste label from OEHS
- \* Stored inside secondary containment bins

Original containers of unused materials do not need a waste label if the original label is clearly legible

- \* Waste must always remain in the lab
- \* Never store waste in PUBLIC AREAS (such as hallways)



# Clean SAA



# Mixing Waste

- \* Divide wastes into separate waste streams

Acids

Bases

Oxidizers

Solids

Photographic waste

Mercury

# Mixing Chemical Waste

- \* Mixing a hazardous waste with a non-hazardous waste may increase the volume of hazardous waste for disposal or increase disposal costs due to differences in disposal options for certain hazardous wastes.
- \* DO NOT mix incompatible materials in the same container.
- \* Consult with OEHS prior to mixing different chemical wastes.

# Mixing Hazardous Waste

- \* Solvents should be separated where possible as halogenated (chloroform and methylene chloride) and nonhalogenated waste (propanol, methanol, and toluene).
- \* Inorganic wastes containing barium, lead and cadmium may be mixed together.

# Empty Containers

- \* A container of a **non-acute hazardous waste**, other than a pressurized cylinder, is empty if:
- \* All wastes have been removed that can be removed through, and
  - \* **If the container is less than or equal to 119 gallons** no more than one inch of residue remains on the bottom of the container, or no more than 3 percent by weight of the total capacity of the container remains;
  - \* **A compressed gas cylinder** that contained hazardous material is empty when the pressure in the container approaches atmospheric pressure.
- \* Empty plastic and brown glass chemical containers may be rinsed with water and **disposed of in a sealed box with trash**. Caps must be removed and labels must defaced and marked “EMPTY”.

# Empty Containers of Acutely Hazardous Waste

- \* Empty containers that contained acutely hazardous wastes are managed as hazardous wastes

# NON-HAZARDOUS WASTE

- \* Materials that are not considered hazardous waste must be disposed as solid waste.
- \* Empty containers must have the labels defaced or removed.
- \* Paper products that are not saturated with hazardous materials and/or biomedical waste can be disposed as non-hazardous waste.
- \* Broken glass and pipettes must be placed in a broken glass rigid disposal container.

# Sharps Disposal

- \* Sharps containers for disposal of these items should be conveniently located and easily accessible in all work places where sharps are used.





# Waste Minimization

1. Practice the concept of *Source Reduction* by simply ordering the smallest quantity of chemical materials
2. Keep an inventory of chemicals on hand.
3. Share surplus chemical with other labs.
4. Purchase mercury-free instruments.
5. Substitute hazardous chemicals with non-hazardous chemicals whenever possible.
6. Reduce the scale of laboratory experiments to reduce the volume of waste being produced whenever possible.

# Waste Pick-up

- \* Picked up by OEHS per specific building schedule or by request.
- \* The Chemical Disposal Inventory Form must accompany all waste and surplus chemicals.
- \* **Waste containers must be stored for pick up in the room in which they were generated**
- \* Chemical wastes must NOT be disposed of by evaporation. This includes evaporation in fume hoods or biosafety cabinets.
- \* It's free!!!!



# On-Site Hazardous Materials Management

- \* Annual review of chemicals
- \* Removal of surplus chemicals and chemical waste
- \* Evaluate gas cylinders, unknowns & potential explosives
- \* Laboratory and Stockroom cleanouts

# Spill Clean up

- **When responding to a small chemical or hazardous waste spill,**
  - **REFER SDS** for the material's hazards and
  - Potential to react with other materials
- **Contact OEH&S for spill clean-up assistance when:**
  - Large spills
  - Spills involving extremely hazardous chemicals
  - Inadequate ventilation in spill area
  - No spill clean-up materials
  - Personnel uncomfortable handling clean-up
  - If a spilled chemical enters the drain, soil or water body

# When Cleaning a Spill

- \* Consult MSDS & wear proper PPE prior to clean-up.
- \* Spread absorbent around and over liquid's surface
- \* Collect wet absorbents & transfer them in plastic bucket or bag using dustpan & brush
- \* Label the contents of bucket/bag using yellow waste tags.
- \* Call OEHS for waste pick-up

# Accident management

- \* Dial 911 on campus for emergencies
- \* Call Office of Environmental Health & Safety
  - \* for assistance with spills that you are uncomfortable handling
  - \* to clean up mercury spills
- \* After hours or on weekends call campus police to contact OEHS staff

# Summary

- \* **Containers must be in good condition.**
- \* **The waste placed in the container must be compatible with the container.**
- \* **Containers must be clearly and legibly labeled with the yellow “Chemical Waste Label”**
- \* **The label must be firmly attached to the container.**
- \* **Containers must be placed next to or near the process that generates the waste.**
- \* **Containers must be kept closed at all times except when adding or removing waste.**
- \* **Containers must be segregated by hazard class (e.g. acids from bases and flammables).**
- \* **Containers and area must be inspected at least weekly for leakage.**



# Acknowledgement of Training

[Click here to acknowledge receipt of training](#)

Contact OEHS at 824-6053 for any questions or  
[www.uah.edu/oehs](http://www.uah.edu/oehs)