
Chemical Lab Safety Rules

Primary Knowledge (PK)

Instructor Guide

Note to the Instructor

This Chemical Lab Safety Rules PK introduces the participants to the basic safety rules associated with laboratories and manufacturing facilities that contain chemicals. The *Chemical Lab Safety Rules Learning Module* consists of the following three units:

- **Chemical Lab Safety Rules PK**
- Chemical Lab Safety Rules Activity
- Chemical Lab Safety Rules Assessment

For more safety learning modules and instructional modules on microtechnology, visit the SCME website (<http://scme-nm.org>).

Description and Estimated Time to Complete

Chemical Lab Safety Rules provides most of the safety rules that you should follow when working in a lab that contains potentially hazardous materials. Many of these rules are common sense; however, you can forget to apply them at times. Applying safety rules at all times ensures that any environment you work in will be a safe environment.

This purpose of this learning module is to instruct you on the general safety rules for facilities and laboratories that use chemicals, and to allow you the opportunity to demonstrate your understanding of these rules and your commitment to apply them in a chemical environment.

In addition to the rules listed in this unit, be sure to study the rules specific to the laboratory or facility in which you work.

Estimated Time to Complete

Allow 25 minutes to read through this unit.

Introduction

Would it be safe to drive a car without knowing the rules of the road? Of course not! It's the people that don't apply these rules that cause accidents. Yes, accidents can still occur, but running red lights, not using turn signals, or using a phone increase the chance for accidents to happen.

So what about applying the rules of a laboratory or manufacturing facility? The same situation applies. Those who apply the rules help to create and maintain a safe environment. Those who don't, create a hazardous environment for everyone.

Employers, employees, students, instructors – anyone working with or around chemicals

- must understand what they are working with,
- must know how to protect themselves and others, and
- must have access to and be able to interpret information about the chemicals in their work or educational environment.

Everyone must know and practice the safety rules for working in a lab or manufacturing environment and the safety rules for working with and around chemicals. Accidents can still occur; however, by applying the safety rules, you can minimize the potential for accidents.

Several of the safety rules listed in this unit are required in order to be "OSHA Compliant". [OSHA – Occupational Safety & Health Association] In case of an audit, everyone in the facility must be seen applying all safety rules.

The rules in this unit cover the basics. Every lab has its own set of safety rules specific to the environment, conditions and chemicals. Therefore, in addition to the rules listed here, you should always learn the safety rules for the environment in which you will be working.

Learning Module Objectives

- Develop safety checklist for at least one scenario related to a laboratory or manufacturing environment.
- Demonstrate your ability to follow the safety rules of your facility.

Dependencies

Knowledge of the terminology associated with hazardous materials and their properties would assist in understanding *why* these rules exist and *why* they need to be applied at all times.

It is suggested that SCME's *Hazardous Materials I and II* be completed prior to this unit.

Key Terms

Chemicals
Chemical handling
Chemical labels
Corrosives
Fire suppression
Safety
Solvents

General Lab Safety Rules

These rules should be applied in any and ALL lab or manufacturing environments.

- Always look for any dangers when entering an environment.
- Locate the Emergency Exits and study the evacuation plan.
- Locate safety showers, eye wash stations and First Aid kits. Know how to use them in an emergency situation.
- No horseplay in a lab or manufacturing environment.
- Develop an attitude of safety awareness!
Safety First!



Eye Wash Station

General Chemical Safety Rules

These rules should be applied any time you are working around or with any type of chemical.

- When working around, working with, or handling hazardous materials, continue to exercise ALL workplace safety practices.
- Treat all chemicals and gases with the greatest respect.
- Always use caution when dealing with chemicals.
- Avoid the use of contact lenses while working with chemicals - even under splash goggles. (If a chemical splashes, it can get trapped between the contact and the eye causing severe damage to the eye.)
- If you are pregnant, check with your instructor / supervisor to ensure that it is safe for you to be in the facility. Do NOT enter if there are mutagens or teratogens in use in the facility.
- USE THE BUDDY SYSTEM. When working with chemicals, work within sight and hearing of at least one other person who is familiar with the kind of work you are doing.

SDS and Labels

- Know everything you can about a chemical BEFORE you handle it or work around it. Study its SDS (Safety Data Sheet).
- Read all labels carefully. Double check the label. Know what you are handling. Do NOT use a chemical if it is unfamiliar to you or it has no label.
- Ensure the chemical container has the proper label.
- Chemicals poured into a smaller container for daily use must be properly labeled. (See SCME's *Chemical Labels* unit.)
- Never obscure, deface, or remove any label.



Working Around Chemicals

- Know the proper procedure for accidents and emergencies. Execute them precisely. (Procedures can be found in SDS's or as part of the lab's policies.)
- NEVER touch, smell, or taste an unknown liquid, gas, or solid.
- When working with chemicals, never touch your face or any exposed skin.
- Do not eat, drink, or smoke when working around chemicals.
- Do not store foodstuffs, cigarettes, gum, etc. where they could become contaminated.
- Do not touch anything (phone, door knobs, tools, etc.) with chemically contaminated safety equipment or tools. You may accidentally transfer chemicals to your co-workers.
- Never use sharp objects around chemical bottles. A puncture may create a spill.

Before Working with a Chemical

Before carrying, pouring or working at a station with toxic chemicals, apply the following rules.

- Never enter a lab or use any chemicals if the exhaust ventilation system appears to be malfunctioning. Notify your supervisor immediately.
- Never adjust a ventilation sash.
- Wear the required personal protective clothing (**PPE**) for the material you are handling. Check the SDS. **In all cases**, wear safety glasses.
- When working with corrosive substances, wear a chemical resistant apron, face shield, and appropriate gloves (two or three pairs – whichever is required).
- Study the SDS for the chemical. Know what you are working with.



[Photo courtesy of Bob Willis]

Transferring Chemicals

- When carrying bottles of chemicals, support them from the bottom as well as from the neck.
- Never walk with open containers/ beakers.
- Do not take or store more of a chemical substance than is necessary for immediate need. Use small bottles with proper labeling.
- Never leave any chemicals on a hot plate!

Pouring Chemicals

- Pour only at stations designed for receiving and ventilating the chemical. Use solvents, paints and other chemicals under exhaust hoods.
- Pour a chemical at the bench designed for its properties. (Acid / Caustic / Solvent)
- Check the surroundings for sources of ignition or obstructions when pouring.
- Twist the bottle cap off SLOWLY to prevent spewing of the chemical.
- Never pour excess chemicals back into the stock bottle. This will contaminate the stock bottle. Properly dispose of excess to ensure the purest chemicals and to reduce waste.
- Never mix corrosive chemicals with organics, or solvents. This will cause an undesired reaction.



ALWAYS pour at a ventilated bench

Safety Rules for Flammables / Solvents

- Use appropriate PPE for solvents. (See the SCME PPE unit.)
- Use solvents / flammables only in areas designed and approved for their use (i.e., Solvent/ Flammables bench)
- Never use a heat source (hot plate, lamps, including infrared lamps, hot blowers) near flammables / solvents.
- Know a chemical's flashpoint. (Refer to the SDS)
- Never work over the maximum temperatures on any hot process!
- Never aspirate a flammable chemical.
- Never fill a bottle with a flammable liquid more than 75% of total volume. Apply the proper label after filling.
- Never mix solvents with corrosives.

Safety Rules for Corrosives

- Always use proper PPE when working with corrosives. (See the SCME PPE unit)
- Corrosives must be stored in the corrosives cabinet.
- Remember the AAA Rule "Always Add Acid to water", never the reverse.
- When adding several acids/bases always add the weaker acids/bases first, then add the stronger acid/base.
- Dispose of wipes that contain corrosive materials into an appropriately labeled corrosive disposal container



Working Around Gases

- Always follow proper protocols when working with gases.
- ALL compressed gas cylinders are dangerous!
- Know the physical hazard of the gases / compressed gases that you are working around. Read the SDS and apply the necessary precautions.
- Never use sharp objects around gas bottles. A puncture may, in the case of compressed chemicals (such as gases), cause an explosion.
- Do NOT change out a compressed gas cylinder unless properly trained and wearing the proper PPE.
- Never mix gases or any chemicals that are incompatible.

Storing Chemicals

- Store solvents in the cabinets clearly marked "Solvents".
- Store corrosives in the cabinets clearly marked "Corrosives" cabinet.
- Do NOT store food or drinks in the same cabinet or refrigerator that is used for chemical storage.
- When returning chemicals to storage, always store chemicals in their proper locations.

Disposing of Chemicals

- Dispose of all chemicals as required.
- Solvents are collected in proper waste containers and disposed of through the facility's hazardous removal team.
- Never pour solvents down the Corrosives Chemicals drains!
- Pour ONLY corrosive chemicals into the corrosives waste drain.
- If properly trained, collect flammables in appropriate containers (usually the bottle that it came in) and send out for disposal.

Waste Disposal

- Dispose of waste in its proper location / container.
- Dispose of corrosive contaminated materials such as wipes and acid gloves into the disposal container marked "Corrosives".
- Dispose of flammable contaminated materials such as wipers and eye droppers into waste containers marked "Flammables."
- Dispose of regular non-contaminated waste such as paper, pens, and plastic into regular waste containers, NOT in the corrosives or flammables containers.
- Dispose of sharps such as broken wafers, and razorblades in the container marked "Sharps Only."

Spills, Splashes or Leaks

Cleaning Tools and PPE after Use

- Treat all spills and leaks as hazardous.
- Never assume that a clear liquid spill on the floor is water. Many chemicals look like water. Use a pH strip to tell if it is corrosive or neutral. Caution - it may still be a chemical if it has a neutral pH.
- Never attempt to clean a spill. Immediately contact the lab manager / supervisor for spill response!
- Rinse off safety equipment (especially gloves) and wipe them dry BEFORE removing. This reduces skin contact with a harmful chemical.
- Clean any tools or instruments that came in contact with the chemical.
- Clean the work station after use and before removing PPE.
- If an acid or caustic splashes on you, immediately go to the Safety Shower, pull the chain, and remain under the shower for 30 minutes or until help arrives.



CO₂ Fire Suppression Systems

- Many facilities are equipped with a CO₂ Fire-Suppression system. In case of a chemical fire, the suppression system floods the room as well as adjoining service chases with CO₂. This removes all the oxygen from the environment and therefore is a danger for humans to breathe.
- When a CO₂ Fire suppression system is activated, get out of the facility as safely and quickly as possible. Make sure your buddy is with you!
- Never enter the facility if the CO₂ fire suppression system has been activated.
- Wait until the Fire Department and proper personnel have said that it is safe to re-enter.

OSHA Compliance

Most lab, manufacturing, and research facilities use the rules and regulations set by OSHA as minimum standards for maintaining a safe environment. OSHA requires any facilities that fall into its purview to follow these rules and regulations. Failure to do so can result in multiple fines and possible closure.

These are some of the basic rules for maintaining OSHA Compliance.

- Never work in an unsafe area.
- Always know the evacuation routes in the event of an emergency.
- Always be aware of your surroundings.
- Always use appropriate PPE where required.
- Report any unsafe work conditions immediately.
- Report any unsafe work habits immediately to the lab manager.
- Report any life endangering issues to the lab manager immediately.

Summary

All labs, manufacturing facilities and research facilities require that anyone who enters the area apply appropriate safety rules.

Each facility has different chemicals but they all have the same basic rules.

Know the rules! Apply the rules!

Let's see how you do

"Your supervisor has instructed you to go into the lab and check all wet benches (solvent and acid benches) for splashes and cleanliness. It has been a couple of weeks since you have been in the lab. You know that some things have been moved around. List the safety rules you would apply and the sequence you would follow to complete this task."

Glossary of Key Terms

Acid - A corrosive material with a pH less than 7.

Aspirate – To remove gas by means of suction.

Base (Chemistry) - A substance that can accept protons or any chemical compound that yields hydroxide ions (OH⁻) in solution. A compound that reacts with an acid to form a salt, as ammonia, calcium hydroxide, or certain nitrogen-containing organic compounds.

Caustic – A chemical that is capable of burning, corroding, dissolving, or eating away by chemical action.

Corrosives - A substance that causes visible destruction or permanent changes in human skin tissue on contact or is highly corrosive to steel.

Safety Data Sheet (SDS) - A form containing information regarding the properties of a particular substance.

Organics - A broad class of substances containing carbon and its derivatives. A carbon compound.

Solvent – A liquid or gas that dissolves a solid, liquid, or gaseous solute, resulting in a solution. That part of a solution that is present in the largest amount, or the compound that is normally liquid in the pure state (as for solutions of solids or gases in liquids)

References

- Safety Data Sheets (SDS) (https://en.wikipedia.org/wiki/Safety_data_sheet)
- Central New Mexico Community College - Regional SMT Lab Safety Rules
- University of New Mexico, MTTC Lab Procedures and Safety
- Chemical Waste Disposal, Princeton University. Environmental Health and Safety. <http://web.princeton.edu/sites/ehs/chemwaste/index.htm>
- Classification of Waste as Hazardous, Princeton University. Environmental Health and Safety. <http://web.princeton.edu/sites/ehs/chemwaste/procedures.htm#class>

Related SCME Learning Modules

- Hazardous Materials Learning Module
- Safety Data Sheets Learning Module
- Chemical Labels Learning Module
- PPE Learning Module

Disclaimer

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