

Some basic rules for laboratory safety

Chemistry

- Always hold bottles containing chemical liquids with two hands.
- Hold the bottle with one hand and hold the other hand under the bottle to catch it should it fall.
- Never return used chemicals to original container.
- Assume that you want to mix 1 liter H_2SO_4 with 1 liter of H_2O . One could pour the H_2SO_4 into the H_2O or the H_2O into the H_2SO_4 . Which way is preferable and why? Answer: Never pour water into a concentrated acid. Because working with diluted systems is preferable, one pours the acid (slowly) into the water.
- Where is shower in case of an emergency?
- Neutralize liquids before pouring them down the drain!
- If one becomes contaminated with a liquid such as HCl , firemen may insist on hosing one down (happened in Boston (not at BU) in 2001).
- When sniffing chemicals, use hands. Do not sniff directly.
- It has been said: “The solution to pollution is dilution”. There are two sides to this principle. What are the pros and contras of this principle?
- Use **benign** chemicals and procedures for processing. Examples: Isopropyl alcohol (IPA) is preferable over methanol. Ethanol is preferable over methanol. Halogenated hydrocarbons are dangerous chemicals. Chemicals containing benzene rings (-phenol, -phenyl) should be avoided. Se, Te, Be_2O_3 are carcinogens. Hg causes a variety of problems.
- No eating in lab.

Wafers

- When holding wafers (and pieces of wafers) with tweezers, hold your other hand under the wafer in case it slips from the tweezers.

Compressed gases

- Free standing compressed gas cylinders are dangerous. Why?
- All cylinders must be attached to a wall at all times.

Electric

- Do not work on energized circuits.
- An old rule is as follows: If you do have to work on energized circuits, always work with only one hand and keep the other hand in your pocket. Why? Answer: Electrical current may flow through your heart when working with two hands in case of an electric shock.
- Secondary accidents may happen as a result of an electrical shock. What are secondary accidents?

Mechanical

- There are many mechanical risks: Falling down a ladder, falling down a stairwell, tripping (cables on floor?).

Lasers

- Powers < 2 mW are eye safe.
- Powers < 10 mW can be problematic but generally OK.
- Powers > 10 mW are dangerous.
- Powers > 500 mW – use extreme caution.
- Use extreme caution when working with UV light.
- Photoflash produced by explosive Mg powder leads to temporary blindness (~ 15 sec)
- Class 1: Laser incapable of causing injury
- Class 2: Laser with power not exceeding 1 mW (laser pointers, etc.)
- Class 3a: Laser with power between 1mW and 5 mW
- Class 3b: Laser with power between 5 mW and 500 mW
- Class 4: Laser with powers in excess of 500 mW

X-ray

- Modern systems have plenty of interlocks
- Do not disable interlocks

Beyond work ...

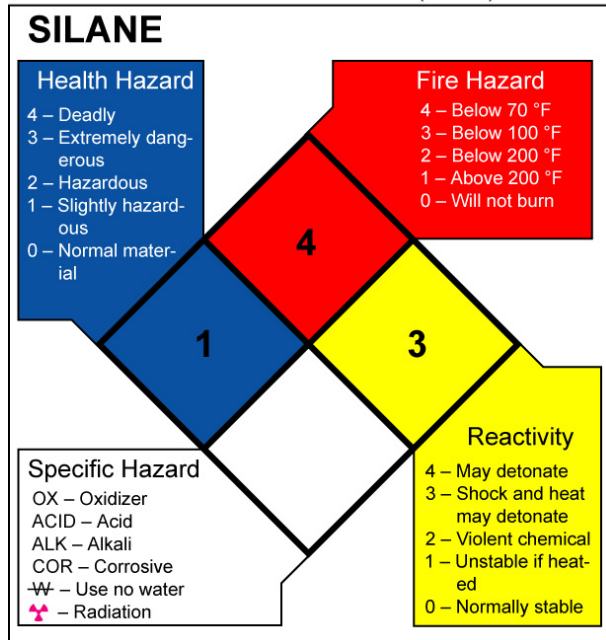
- Be aware of dangers of solar UV radiation.
- Be aware of toxins (e.g. sawing pressure-treated wood can be dangerous).
- Avoid food with preservatives.

- Drive slowly. Remember: $E \propto v^2$. Increasing speed from 50 or 70 miles per hour increases your kinetic energy by a factor of 2.0.

The NFPA diamond

- Used to classify materials for quick identification of danger.
- The following figure shows the NFPA for silane (SiH_4).

National Fire Protection Association (NFPA) diamond:



Always

- Safety first!