CHANDLER-GILBERT COMMUNITY COLLEGE

Creating a Safer Lab Environment Using Principles of Green Chemistry

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Definition of Green Chemistry:

Green chemistry is the utilization of a set of 12 principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical substances.

12 principles:

1. Prevention
2. Atom Economy
3. Less Hazardous Chemical Syntheses
4. Designing Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstock's
8. Reduce Derivatives
9. Catalysis
10. Design for Degradation
11. Real-time analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention

Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

Summary of principles and goals:

12. Inherently Safer Chemistry for Accident Prevention

- chemical's and their forms(solid, liquid, gas) should be chosen to minimize the potential for chemical accidents including releases, explosions, and fires.

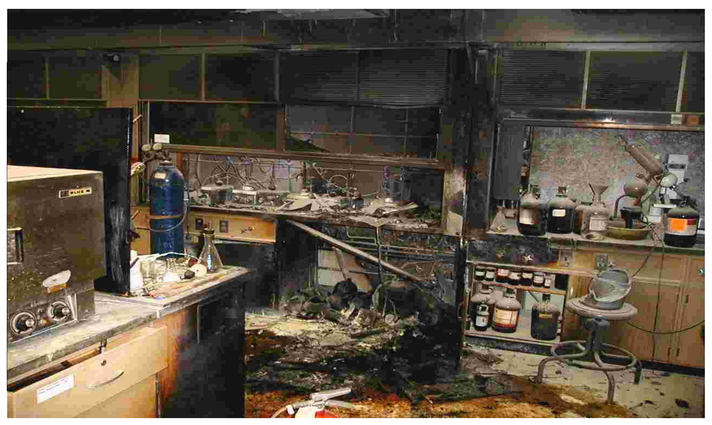
  •Use low vapor pressure substances or solids instead of volatile liquids or gases.
  •Avoid use of molecular halogens in large quantity.
  •Know what measures to take in case of accidental exposure before you begin working with a substance.
  •Keep and understand MSDS for all chemicals that you work with.
  •Seek alternatives for explosive or peroxide forming chemicals.

Fire summary:

On January 1,2001, a fire occurred in a chemistry lab. Inside a fume hood a 4-liter bottle of flammable liquid broke, emptying its contents. Several hot plates were located within the fume hood and ignited the spill. As the fire grew one researcher attempted and failed to put out the fire and called the fire department. Soon after an explosion occurred when more flammable materials stored underneath the fume hood became engaged in the fire. The Lubbock Fire Department arrived and extinguished the fire.

These chemicals were stored improperly. Flammable materials are required to be stored in approved flammable liquids storage cabinets. Storage of chemicals in fume hoods is an improper storage practice.

More chemicals stored improperly. Chemicals stored near the entry to the lab and in exit paths could have impeded the fire department response or the safe exit of laboratory personnel.



The results of a fire that occurred in a Chemistry Building laboratory. A bottle of flammable liquid broke inside a fume hood. Several hot plates were located inside the hood and ignited the flammable liquid.

What went Wrong:

•Improper storage of chemicals
- ✓Excessive amount of reagents and waste
- ✓Toxic and reactive chemicals stored in lab's work area with hotplates.
- ✓Over 100 gallons of flammable liquid was found within six feet of the fire.
- ✓Fume hoods are improper storage area's Flammable liquids kept by entrance/exit could have impeded fire fighters.

Our own suggestions:

- ✓Store hazardous chemicals away from the lab and work areas.
- ✓Use less volatile substances when possible.
- ✓Be aware of toxicity, flammability, and volatility of substances being used.
- ✓Order only what will be used in one year to avoid excessive amounts.
- ✓Use only small amounts of chemicals based on microscale principles.
- ✓Use small containers for daily use to minimize dangers when spills occur.
- ✓Use computer simulations and instructor demonstrations whenever possible to reduce risk and waste.
- ✓Never do chemistry alone
- ✓Carol didn't listen when the teacher told her to wear goggles, now Carol doesn't need them.

Conclusion

Had the individuals involved in this lab fire been practicing inherently safer chemistry for accident prevention, this fire would have never occurred. Luckily no one was injured or worse killed in this fire. By following the 12 principles of Green Chemistry accidents can be prevented and make learning in the laboratory safe, fun and exciting.

References

http://www.nmsu.edu/~safety/news/news-items/tt-chem-lab-fire2.htm
http://www.greenchemistry.uml.edu/html/clickableprinciplesproject_files/frame.htm
http://www.nsta.org/main/news/stories/science_scope.php?news_stories.htm
http://www.cebc.ku.edu/about/green.html