

CHEM 5510 Introduction to Laboratory Safety

1 credit course on chemical safety (1 hour course, Friday afternoons, Fall Semester)

Instructor(s): Chemistry Faculty

This introductory course in laboratory chemical safety is required for all entering chemistry graduate students. Topics to be covered include laboratory emergencies, chemical hazards, lab inspections and compliance, managing and working with chemicals, waste handling, case studies of university accidents, laboratory equipment, biosafety, radiation, and animals, and microfabrication and nanomaterials.

September 5, 2014: Introduction to Laboratory Safety (Rainier, EHS)

I. Introduction

The Texas Tech Incident (Lessons to be learned: Shared Responsibilities)

II. Risks in a Research Laboratory

Health Effects Due to “Hazardous” Chemical Exposure (How Does One Determine the Hazards Associated with Specific Chemicals?, Exposure Routes, Toxicity Risk Assessment)

III. Personal Protective Equipment (PPE)

Proper Attire (Eye/Face Protection, Lab Coats, Gloves, Respirators, Disposal/Removal of PPE)

IV. Emergency Equipment Safety Showers/Eye Washes

V. Key Campus and Department Chemical Safety Contacts Environmental Health and Safety (EHS), Department of Chemistry

VI. Case Study

Dartmouth Chemical Poisoning (Key Lessons)

September 12, 2014: Laboratory Emergencies: Spills and Fires I. General Preparation for Emergencies (Saouma and EHS)

II. Handling the Accidental Release of Hazardous Materials

III. Notifications

IV. Spill Containment and Clean-up V. Leaking Gas Cylinders

VI. Fires

Classification, Fire Extinguishers (how they work, types), Risk Assessment

VII. Case Study

University of Texas Austin Sodium Fire (Lessons Learned)

September 19, 2014: Chemical Hazards I. Chemical Hygiene Plan (Ji)

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II. The New Safety Data Sheets (SDS) versus the Old Material Safety Data Sheets (MSDS)

III. Assessment of Chemical Toxicity

IV. Toxic Hazards

(Dose, Risk Assessment, Types of Toxins, Flammable Hazards, Flammability Characteristics, Flammability Classes, Causes of Ignition, Reactive Hazards, Explosives)

VIII. Case Study

University of Wisconsin – LiAlH₄ Explosion (Lessons Learned)

September 26, 2014: Lab Inspections and Compliance (Miller, EHS)

I. Ordering and Receiving Chemicals

II. Regulatory Compliance – History of Occupational Safety and Environmental Laws

III. Current Research Regulations

IV. Regulatory Inspections that Occur at University of Utah (EPA, OSHA, CDC/NIH, NRC, FAA, DEA)

V. Environmental Health & Safety Department (Roles, Responsibilities, Organization) VI. Inspections (EHS, Self-Inspections)

VII. Case Study

October 3, 2014: Managing and Working with Chemicals. I (Heemstra)

I. General Considerations (Chemical Segregation, Transfer and Transport, Chemical Fume Hoods (Safety, Types, Operation), Other Types of Ventilation)

II. Working with Highly Toxic Compounds

(General Considerations, Planning, Precautions for Minimizing Exposure – Handling, In the Event of a Spill)

V. Case Study

DuPont Facility – Phosgene Release (Lesson Learned)

October 10, 2014: Managing and Working with Chemicals. II (Saouma)

I. Working with Flammable Substances (Standard Operating Procedures) II. Working with Highly Reactive or Explosive Substances

III. Working with Compressed Gases (Parts of the Cylinder, Cylinder Pressure Regulator, Storage Guidelines, Transporting Cylinders, Handling Compressed Gas Cylinders)

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IV. Working with Cryogenics (Health Hazards, Liquid N₂)

October 17, 2014: No class/Fall Break

October 24, 2014: Waste Handling (Kieber-Emmons, EHS)

I. Characterization of Waste

II. Collection and Storage (Lids, Leaks, Labels, Location, Containers) III. Consequences of Mixing Incompatibles

IV. Solid Wastes (Chemicals, Broken Glass, Sharps, Cylinders, Pick-up) VI. Special Cases

VII. Hazardous Waste Minimization

VIII. Case Study

October 31, 2014: A Case Study: the "UCLA Incident" (Looper)

November 7, 2014: Laboratory Equipment. I I. Working with Electricity (Armentrout)

II. Working with Water (liquid)-dependent Equipment (Hazards, Proper Use, Heating Baths)

III. Working with High Pressure/Vacuum

IV. Working with Vacuum Pumps

V. Working with Stirring and Mixing Devices

VI. Working with Heating Devices (Variacs, Oil, Salt, Sand Baths, Microwave Ovens VII. Ultrasonicators and Centrifuges and HPLCs!

VIII. Case Study

November 14, 2014: Laboratory Equipment. II (Bartl, Morse, Harris)

I. Laser classifications

II. Effects of lasers on skin and eyes

III. Protective eyewear

IV. Enclosing laser beams

V. Examples of common mistakes and ways to avoid them

VI. Non-beam hazards

VII. Risk Assessment: when is it okay to violate specific safety rules? The importance of understanding how things work

November 21, 2014: Biosafety, Radiation, and Animals I. Radiation (Buck-Koehntop, Burrows)

II. Chemicals such as acrylamide & ethidium bromide

III. Pathogens

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IV. Biological waste handling V. Recombinant DNA

VI. Mammalian cell culture VII. Case Study

December 5, 2014: Microfabrication and Nanomaterials (Zharov, Anderson, Porter)

I. Hazards of nanoparticles

II. Preventative Measures

III. Disposal

IV. Microfabrication

V. Chemical hazards associated with microfabrication VI. Instrument hazards associated with microfabrication

December 12, 2014: Last day of class – exam