TCE Laboratory Safety Day

Nuclear Engineering
8/21/2023
College Safety Culture

Cutting Edge Safety
Cutting edge engineering requires cutting edge safety.

Unity of Effort
Every instructional or research laboratory has safe operations as a result of a unified effort within the community to appreciate and practice safety culture.

Leadership
Leaders will encourage participation by all to achieve and improve laboratory safety.

Transparency
A transparent environment is encouraged; learning from successes, near-misses and incidents never stops.

Understanding
A shared understanding of strong safety culture exists between our corporate partners and the employers of our students.

Respect
Students, staff, and faculty members will all articulate safety concerns because they are all respected and trusted.

Everybody, Every Task, Every Time
Everyone is responsible for ensuring safe operations for every task, every time.

This website is a great starting place to ensure safety and compliance: https://tickle.utk.edu/research/safety/
College Goal for FY24

- Increase the number of participating faculty members with their research groups in the lab-group meetings on Monday afternoon
  - Clean lab spaces
  - Update chemical inventory
  - Update the CHP with required documents for current and incoming personnel
Our Purpose

- General Safety Training Requirements
- Provide access to resources to meet safety needs
- Communicate safety expectations of the university and the department
- Ensure a safe and productive research environment
General Safety Training Requirements

- All training is online via Canvas
  - Open source training is in-person and must be scheduled in advance
  - Radiation safety office facilitates closed/open source, X-ray, and laser safety training
  - You must contact Radiation Safety to be added to a course

<table>
<thead>
<tr>
<th>Training</th>
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<td>Once</td>
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General Safety Training Requirements

- **Hazardous Communication Training** is updated when a new review of the CHP is required
- **Hazardous Waste Training** is required annually by TDEC
- **Fire Extinguisher Training** required annually by OSHA

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General Safety Training Requirements

- All laboratories must have a list of required training to enter the lab
  - Additional training is process specific through SOPs or more advanced sessions that are particularly hazardous
  - Keys/card access will not be granted unless proof is provided
    - Students, staff, and faculty must have completed all training
    - Everyone entering a laboratory space unescorted or working in the space must have had access granted to them
      - When giving tours, hazards should be communicated to the guest before entering the space (see door placard)
      - Non-compliance with this policy will result in individuals retaking all training modules before access is granted again

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General Safety Training Requirements

- Our website (being updated): [https://ne.utk.edu/safety/](https://ne.utk.edu/safety/)
  - Training matrix by lab consistent with CHP for that lab
  - Dosimetry request form
  - Accident reporting process

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Nuclear Suite Training Requirements

- Nuclear suite includes FNS, ARC, graphite pile, source storage, control room
- Access is granted for one year
  - Listed training must be completed annually
  - We are looking into methods to effectively track training to minimize the burden to all
Chemical Hygiene Plan (CHP)

- Every laboratory is required to have a CHP
  - One CHP can be used for multiple lab spaces **IFF** they have the same significant hazards
    - Example: chemical processing in one lab and none in another should result in two CHPs, one for each laboratory
  - This is reviewed annually during EHS inspections
  - You can download the template here: https://ehs.utk.edu/index.php/table-of-policies-plans-procedures-guides/chemical-hygiene-plans/
- The campus CHP does not need to be duplicated in lab-specific CHPs
- We will go over the more important documents now
Chemical Hygiene Plan (CHP)

- **LS-20-CHP-AppA-LabSpecific-Sec01-Personnel**
  – This document must include all persons with access to the lab

- **LS-020-CHP-AppA-LabSpecific-Sec03-Lab-Specific-Rules-Requirements**
  – This document outlines general laboratory requirements, such as you must wear a minimum set of PPE when entering

- **Folder called “Section 4.1 SOPs”**
  – This is where all **PI-generated** SOPs must be stored
The standard operating procedure

- The template may be downloaded here:
- Document contains a description of the work/procedure, a full list of hazards/chemicals involved, required PPE, location of work, controls (engineering, administrative), waste generation and disposal, additional training (if any), etc.
  - PIs may generate their own SOPs if the template is insufficient
    - I personally use my own template as it allows for additional modification as needed
- This document contains a simple list of primary hazards, effects, and required PPE

<table>
<thead>
<tr>
<th>Task</th>
<th>Hazard Description</th>
<th>Required PPE and Engineering Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical processing</td>
<td>Burns and fires</td>
<td>Fume hood, gloves, lab coat, eye protection</td>
</tr>
<tr>
<td>Radiation use</td>
<td>Cancer and Acute Effects</td>
<td>Dosimeter and proper shielding</td>
</tr>
<tr>
<td>Liquid Nitrogen</td>
<td>Burns</td>
<td>Cryogloves, goggles, face shield, leather shoes, no cuffs on pants</td>
</tr>
</tbody>
</table>
Chemical Hygiene Plan (CHP)

- Section 5: Orientation Checklist
  - Must be filled out for everyone listed on section 1 of the CHP

- LS-020-CHP-AppA-LabSpecific-Sec06.1-Master-List-of-Required-Training
  - This document lists what training is required to enter the space
    - This is where another CHP is needed as training for one lab space may not be the same for another laboratory space
    - I make my students take all the training for all labs under my control
  - This training should be all-inclusive for all SOPs in the laboratory to ensure maximum safety of students/staff, even if they are not conducting all experimental procedures taking place in said laboratory
Chemical Hygiene Plan (CHP)

- **LS-020-CHP-AppA-LabSpecific-Sec07-Prior-Approvals**
  - This document refers to a PI’s specific approval for a particularly hazardous process
  - This document could be used to sign off on all students for being trained on an SOP, but I advise against this
    - Excessive time consumed signing via Adobe for each SOP and student

- **LS-020-CHP-AppA-LabSpecific-Sec09-Exposure-Monitoring-Records**
  - This is for processes where the permissible exposure limit (PEL) may be exceeded over the reporting period. Work with radioactive materials requires consultation with radiation safety.
Chemical Hygiene Plan (CHP)

- LS-020-CHP-AppA-LabSpecific-Sec10-References
  - This is another location where you can link to websites or other entities for reference to items not contained within the CHP
  - Reference to journal articles, reports, etc. for particularly hazardous processes are useful to backup scientific approach and supporting evidence for required training to maximize outcome (safety and results)
Chemical Hygiene Plan (CHP)

- LS-020-CHP-AppF-Chemical-Spill-Response
  - Students are not us and we cannot assume the same level of respect for or response to a dangerous situation
  - The SOP must identify the appropriate response for all experiments in the case of an accident, not just a chemical spill
  - Appropriate pads are required for chemical spills and are easily found online
    - Example: [https://www.absorbentsonline.com/hazmatpadsrolls.htm](https://www.absorbentsonline.com/hazmatpadsrolls.htm)
Chemical Hygiene Plan (CHP)

- Section 8 SDSs and Inventory of Hazardous Chemicals
  - SDS for all chemicals/materials should be placed in this folder
  - The inventory should be updated when new chemicals are ordered and when old chemicals are disposed (also on SharePoint)
  - EHS will check this list during annual inspection

- Section 11 Appendix E PPE Training Certification Forms
  - This document certifies that the PI has properly trained each person on what PPE is required and how to use, inspect for damage, and dispose it
  - Every person working under this CHP must fill out this form and have it signed by the PI
Chemical Hygiene Plan (CHP)

- EHS states that every laboratory should have a physical copy for each laboratory space but can have a digital copy if everyone using the laboratories has access to the CHP
  - Student training will be stored by the department (pending). A document in section 6.2 stating where the training records may be found is necessary
  - Signing the SOPs
    - Include a document for each person that states that they have read and received approval by the laboratory PI for a provided list of SOPs
    - Could also list this on “Sec07-Prior Approvals,” but this will be more work for the PI (repeating digital signatures versus one per student)
Chemical Hygiene Plan (CHP)

- Every student is required to read the CHP and sign these forms, which are stored in the CHP
  - Acknowledgement of training for specific SOPs (section 4.2)
  - Certification that all training has been completed and is up-to-date (section 6.2)
  - Orientation checklist (section 5)
  - Ensure name is added to section 01, Personnel document
  - Section 11, Appendix E PPE training certification form

- The PI is responsible for the safety of all employees, and the most critical step is fully understanding the CHP and relevant SOPs
Chemical Inventory

- The University just changed their inventory process from BioRAFT to an internal Outlook SharePoint.
  - [https://liveutk.sharepoint.com/sites/chemtracker/Shared%20Documents/Forms/AllItems.aspx](https://liveutk.sharepoint.com/sites/chemtracker/Shared%20Documents/Forms/AllItems.aspx)

- All chemicals present in each space need to be included here
  - In an emergency, EHS needs to tell emergency responders what is in the lab so they can safely execute operations

- The inventory in section 8 of the CHP can simply point to this location, but a consistent Excel file between the two locations is ideal
Summary of Important CHP Requirements

- Every lab needs a CHP
- All SOPs need to be evaluated periodically
- All chemicals need to be listed on the UTK SharePoint
- All personnel, including students, need
  - Acknowledgement of training for specific SOPs (section 4.2)
  - Certification that all training has been completed and is up-to-date (section 6.2)
  - Orientation checklist (section 5)
  - Ensure name is added to section 01, Personnel document
  - Section 11, Appendix E PPE training certification form
Door Placard

- The door placard is a quick reference of all hazards in the lab, special hazards of particular risk (e.g., HF processes), and emergency contacts
- Should be consistent with the CHP
- To make or modify the placard, download the template, modify in Adobe (not browser), and submit to the lab placard coordinator – https://ehs.utk.edu/index.php/laboratory-safety/lab-safety-administration/lab-door-placards/
Disconnect boxes

- Do not attempt to work with live wires or circuits (>50 V maximum). This must be coordinated with facilities services.
- To limit fire hazards, no materials may be stored or placed within the working area:
  - 36-48 inches wide
  - 36 inches in front
  - 78 inches high

https://up.codes/viewer/virginia/va-residential-code-2012/chapter/34/general-requirements#E3405.1
Chemical Showers, Eyewash, and First aid

- No items may be stored under or along the wall of safety showers
- Eyewash stations must be clear of obstacles
- Eyewash stations must be checked weekly with a local log for evidence
- Every laboratory needs a first aid kit that is not expired
  - These may already be in your lab upon move-in, but they need to be periodically changed
  - Special first aid items must not be expired (e.g., calcium gluconate gel)
Food, Drink, and Appliances

- The probability that a lab space is suitable for food and/or drink is unlikely
  - This includes coffee makers, minifridges, and microwaves
- If you believe that this is permissible, please email me to evaluate the space for safety compliance
- If storing chemicals in a cold environment, ensure the compatibility of the fridge with the chemicals
  - If they are flammable, they cannot be placed in a dorm-style minifridge!!!
Appropriate Gloves for the Job

- There are many glove options, and the PI must make it clear to their personnel what is safe and what is not
  - Thermal gloves are not suitable for liquid nitrogen
  - Nitrile gloves are not compatible with acetone
- Each vendor will list different compatibilities for different chemicals
  - The thickness of the glove matters!
- General guidance can be found here, but it is not all-inclusive
Table of Glove Suitability by Type and Chemical

### Permeation/Degradation Resistance Guide for Ansell Gloves

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Laminate Film</th>
<th>Nitrile</th>
<th>Unsupported Neoprene</th>
<th>Supported Polyvinyl Alcohol</th>
<th>Polyvinyl Chloride (Vit))</th>
<th>&quot;Canners and Handlers&quot;</th>
<th>Natural Rubber</th>
<th>Neoprene/Natural Rubber Blend</th>
<th>Butyl</th>
<th>Unsupported Chemtex</th>
<th>Butyl</th>
<th>Viton/Butyl Unsupported Chemtex</th>
<th>Viton/Butyl Unsupport</th>
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</thead>
<tbody>
<tr>
<td>1. Acetone</td>
<td>300 F</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<td>2. Acetic Acid</td>
<td>150 G</td>
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<td>3. Acetone</td>
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<td>6. Acrylic Acid</td>
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<td>7. Acrylic Acid</td>
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<td>10. Ammonium Fluoride, 28-30% Ammonia</td>
<td>150 G</td>
<td>150 G</td>
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<td>E</td>
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<td>11. n-Butyl Alcohol</td>
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<td>16. Benzene (Benzene)</td>
<td>150 G</td>
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Cross Contamination and PPE Assignment

- I often see students wearing gloves touching non-work surfaces, their phones, computer, body, doorknobs, elevator buttons, etc.
- Students must be constantly reminded that the gloves are worn for personnel safety, so we don’t touch other items without first removing the gloves.
- PPE is assigned and is not shared by other personnel.
  - Example, years ago a student got HF on a lab coat and another student put it on, requiring that both students go to the hospital for treatment.
General safety in workspaces

- A cluttered work environment is an unsafe environment
  - Work areas should be cleaned at the end of the day
  - No chemicals will be stored in fume hood and no processes left unattended without clear signage and posting (e.g., beaker)
  - Hazardous spills out of the fume hood can be greatly minimized by
    • Using secondary containment when moving from storage
    • Keeping all processes 6 inches from the edge of the hood

- Always evaluate chemical compatibility in your waste streams
  - See EHS training for procedures pertaining to waste streams (labeling)
  - Always check the SDS before creating processes that use mixed waste streams
  - Generally, acids, bases, and solvents should have different waste streams
    • A bomb can be made as simply as mixing $\text{H}_2\text{O}_2$ and acetone
Example of Nitric Acid and isopropyl alcohol

Area in fume hood where waste was stored.

Waste label indicating incompatible waste mixture.
General Safety in Workspaces

- Always ensure that you have sufficient space to conduct your work
  - Coordination with your lab partners is key
- Eye protection is highly recommended when in any laboratory
  - It costs little to wear and the consequences are high
- General tools
  - Only use tools for their intended purpose (a rachet is not a hammer)
  - Always follow manufacturer precautions for tools
  - Training is required to use the machine shop. This training is provided by either your PI or Scott Emert.
Gas Cylinder Safety

- Gas cylinders must always be secured to a wall or appropriate table
- Cylinders must have its regulator removed and capped when not in use
General Safety in Experimental Design

- Unlike ORNL, there is little support on campus to review the safety of processes and custom experiments and apparatuses.
- Feel free to utilize me as a resource to review any new process that there may be a concern.
- At a minimum, no system should be single fault that could cause an immediate danger to life and health.
  - Example, SERF evacuated for 2 hours due to an uncontrolled BCl$_3$ leak.
Safe Working Conditions

- If you see something dangerous, say something
  - Everyone has the responsibility to immediately stop someone from working in an unsafe manner
  - Incidents should be reported to the department heads for further action
Injury Reporting

- All injuries, whether or not medical treatment is required, must be reported to their supervisor
- Step 0: If life threatening, seek immediate emergency care
- Step 1: Report the injury to your supervisor and CorVel at 1-866-245-8588, option 1
  - A 24/7 triage nurse will assess whether immediate care is necessary and will direct the injured worker to the nearest State of TN authorized treating physician
  - If an employee seeks care before calling, a $500 fine will be imposed to the department
  - If not reported by either the employee or employer within 3 business days, a $500 fine will be imposed to the department
  - The employee should never present their health insurance card for treatment of work-related accidents
Injury Reporting

- **Step 2: supervisor completes the paperwork**
  - Workers’ compensation procedures
  - Workers’ compensation injury report
  - Lost time/return to work calendar
  - Transitional duty plan
    - Only required if given light duty work restrictions

- **Complete guidelines and forms may be found here:**
  - [https://riskmanagement.tennessee.edu/workers-compensation/](https://riskmanagement.tennessee.edu/workers-compensation/)
### Location of AEDs:

- Atrium walls
- Basement
- Second Floor
- Fourth Floor

### Floor Wardens in East Wing:

- **Basement:** Scott Emert
- **First Floor:** Ashly Pearson
- **Second Floor:** Jamie Coble, Lawrence Heilbronn
- **Third Floor:** Khalid Hattar, David Donnovan
- **Fourth Floor:** Ken Carter
Protect Your Research!!!

- **Identify** threats that your research may be vulnerable to
  - Power, temperature, security, animals, administrative

- **Prevent** threats through proper engineering controls
  - UPS, cloud or redundant data storage, utilize space only as intended, evaluate supply chain risks and mitigation strategies, communicate with appropriate stakeholders (e.g., FS)

- **Mitigate** damage from incidents
  - Keep CHP and student training up-to-date, anchor equipment to support structures, know how to contact EHS and UTK Police Department
Useful links

- UTNE Safety Website: https://ne.utk.edu/safety/
- TCE Safety Website: https://tickle.utk.edu/research/safety/
- Door Placard: https://ehs.utk.edu/index.php/laboratory-safety/lab-safety-administration/lab-door-placards/
- Injury Reporting: https://riskmanagement.tennessee.edu/workers-compensation/
- Faculty Preparedness Resources: https://prepare.utk.edu/be-ready/
- Emergency Management: https://prepare.utk.edu/be-ready/