Encouraging a culture of safety through educational technology: Developing tools for the 21st century

ACS National Meeting
Indianapolis, September 8, 2013

Debbie Decker, CHO, UC Davis (Chemistry & Biochemistry)
Ken Smith, CHP CIH (UCOP Lab Safety Manger)
Dr. John Palmer, UC San Diego (retired)
Recap – UC Technology Suite

• University of California System has embarked on the development of a suite of (web-accessible) tools to help promote laboratory safety, identify resources, clarify responsibilities, and encourage timely and effective safety orientation for all its students, staff, and faculty.
UC Lab Safety (Technologies)

UC LAB SAFETY

I am a Principal Investigator/ Lab Manager

Research in a lab

UC EH&S Technologies

BIO
BioSafety Information Online
Automates the Biological Use Authorization

CIS
Chemical Inventory System
Collects information related to chemicals to assist with regulatory compliance

CBIS
Chemical & Biological Inventory System
Tool for researchers that allows search on chemical substructures etc.

EFR
Employers 1st Report of Injury (EFR)
Employer’s 1st Report of Injury, an online system that satisfies Cal/OSHA and Labor Code requirements for employers to document and investigate the cause of employee injuries.

FSTOP
Field Safety/ Travel Operations Planner
Enables the person responsible for the field trip to create a focused, custom itinerary based on risk to reduce hazards and increase the personal safety for the participants

LHAT
Laboratory Hazard Assessment Tool
Enables the PI to identify hazards that exist in the lab

LMS
Learning Management System
Comprehensive training management

OHSS
Occupational Health Surveillance System
A system for Principal Investigators (PIs) and their staff to submit a health surveillance survey

SIT
Safety Inspection Tool
A Safety Inspection Tool that automates tracking laboratory safety processes

RADiCAL
Risk Assessment Determination in Chemical Academic Laboratories
Automates SOPs for handling chemicals

WASTE
Waste, Accumulation, Storage and Tracking electronic
A web-based system that provides automated hazardous waste tracking and tagging generation

MIDDLEWARE

ITSERVICES.UCDAVIS.EDU
Accessing EH&S Technologies (InCommon)
What is RADiCAL?

A risk management tool that quickly determines a control-banded Standard Operating Procedure (SOP) to provide researchers with pertinent information to conduct their research safely.

Features:
- Control Banding of Experiments
- SOP Generation
- Routing & Approval of SOPs
- Safe Operating Card
- PPE Tracking
- Chemical Safety Levels

Workflow:
1. Chemical Components Entered
2. Experiment Process & Procedures Identified
3. Chemical Safety Level Assigned
4. Experiment Routed For Approval
5. SOP Generated
6. Researcher Acknowledges SOP & Can Conduct Research

Contact: For more information on RADiCAL or to request a demo, please contact ERIM@UCO edu.

Chemical Safety Levels:
- Level 1: Experiments identified as Chemical Safety Level 1 (L1) require a detailed SOP and are system approved.
- Level 2: Experiments identified as Chemical Safety Level 2 (L2) require a detailed SOP and are routed to the PI for approval.
- Level 3: Experiments identified as Chemical Safety Level 3 (L3) require a detailed SOP and are routed to the PI and campus Chemical Hygiene Officers (CHOs) for approval.
- Level 4*: Experiments identified as Chemical Safety Level 4 (L4) require a detailed SOP and are routed to the Principal Investigator (PI), campus Chemical Hygiene Officers (CHOs), and the Chemical Safety Committee for approval.

*Planned future enhancement.
Lab Safety Fundamentals (LSF)

Lab Safety Fundamentals is the “web-based” version of our lab safety “minimum training (education) standard” required for anyone working in a UC System Lab.

Note: The reporting database did not provide details on learning duration, but a customized report that will provide that information is under consideration. Here a random set of 36 individuals completing the course were reviewed. This is a snapshot of time spent in the course based on how long the learner had the player window for the course open. However just as with most webinar software, the LMS cannot distinguish if the duration included the time the user left the program “open” while working on other tasks.
Satisfaction/Relevancy

Your overall satisfaction with this course
- Very Dissatisfied: 2%
- Dissatisfied: 7%
- Unsure: 11%
- Satisfied: 60%
- Very Satisfied: 20%

The topics covered were relevant to the course?
- Disagree: 2%
- Neutral: 8%
- Agree: 47%
- Strongly agree: 44%
Content / Length

Course content was clear & easy to understand
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Course length & page was appropriate for the topic
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree
Comments Received

- 62 Comments suggesting/requesting additional content or more details on existing content.
- 22 comments were made about quiz questions and the need to reduce the ambiguity of the questions.
- 20 Comments on the length of the course.
LSF – Statistics

- N = Number of learners completing course 1,629
- n = Number of learners leaving feedback 326 (20%)
  (N is now over “4000”)
- 33 % (12/36) learners participating in the course over 2 or more days.
- Average length of time: 120 min
  - [with a standard variation of 79 min].
- Median time to complete the course 79 min.
Note: The reporting database did not provide details on learning duration, but a customized report that will provide that information is under consideration. Above was data from a random set of 36 individuals completing the course were reviewed. This is a snapshot of time spent in the course based on how long the learner had the player window for the course open. However just as with most webinar software, the LMS cannot distinguish if the duration included the time the user left the program “open” while working on other tasks.
LHAT and PPE

PERSONAL PROTECTIVE EQUIPMENT
LHAT

[Lab Hazards Assessment Tool]
Welcome to the LHAT demo system!

- **Principal Investigator**
  Enter here to simulate the role of a Principal Investigator

- **Lab Worker**
  Enter here to simulate the role of a Lab Worker

**Tips:**
- When you test drive the demo system using the roles above you will be logged in with a test account. In the upper right of the screen, you will see "UC TestPI" if you are test driving the PI role, and you will see "UC TestResearcher" if you are test driving the Lab Worker role.
- You may need to close and reopen your browser to test drive different roles.
- When test driving the Lab Worker role and searching for a PI, you will need to search for "TestPI UC" to locate the PI and add a lab.
- There are email notifications in the demo system. For testing purposes, these are sent to a test account so that they do not go out live to users.
- The demo system is loaded with test building and department data.
- Data entered in this demo system is solely for test purposes. It will be flushed periodically and will not be retained.
- If you have questions or feedback about LHAT, please contact Ryan Mosley on the LHAT Development Team at rcmosley@ucdavis.edu.
**Lab Hazard Assessment Tool**

The PI must conduct hazard assessments specific to activities in their laboratories at least once each calendar year. The Laboratory Hazard Assessment Tool (LHAT) identifies hazards to personnel and specifies personal protective equipment (PPE) to protect employees during work activities. The PI must certify that the LHAT is complete and reflective of activities in their laboratories. EH&S personnel are available to assist with completing the Hazard Assessment form or with reviewing it once it has been completed. Your campus EH&S may also be consulted for specific questions regarding PPE requirements.

<table>
<thead>
<tr>
<th>Your Laboratories</th>
<th>Your Hazard Assessments</th>
<th>Lab Roster</th>
<th>Pending Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotechnology Lab</td>
<td>Last Assessed: 9/30/2013</td>
<td>View Roster (Members: 1)</td>
<td></td>
</tr>
<tr>
<td>Karan Lab</td>
<td>Draft Assessment</td>
<td>View Roster (Members: 2)</td>
<td></td>
</tr>
<tr>
<td>Lab One</td>
<td>Last Assessed: 9/30/2013</td>
<td>View Roster (Members: 1)</td>
<td></td>
</tr>
<tr>
<td>Maggie Lab</td>
<td>Create Assessment</td>
<td>View Roster (Members: 1)</td>
<td></td>
</tr>
<tr>
<td>T. Richardson</td>
<td>Last Assessed: 9/30/2013</td>
<td>View Roster (Members: 1)</td>
<td></td>
</tr>
</tbody>
</table>

- **Outfit for Safety PPE Training**
  - Status: Complete

**What Can I do in LHAT?**

- Objectives for the Principal Investigator (PI)
- Objectives for Laboratory Personnel
- Objectives for Environmental Health & Safety (EH&S)
**LHAT**

**[Lab Hazards Assessment Tool]**

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**Laboratory Hazard Assessment**

**Biotechnology Lab II**

Principal Investigator: UC TestPI  
Primary Appointment: BIOTECHNOLOGY PROGRAM  
Phone: 530-655-1212, Ext. 511  
Email: tatfser@ucdavis.edu

Laboratory Phone: 555-887-5309  
Laboratory Locations:
- Academic Surge Building 1st Floor 1005  
- Academic Surge Building 1st Floor 1003

All sections are required. A Hazard Assessment can be saved as a draft to be completed and certified at a later time. Once a Hazard Assessment has been certified, it can only be altered by amending the assessment. All answers to standard and lab specific questions will be retained permanently.

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<table>
<thead>
<tr>
<th>Chemical Hazards</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

I certify that all activities listed in the Chemical Hazards section below are NOT conducted in this laboratory.

<table>
<thead>
<tr>
<th>Lab Activity</th>
<th>Potential Hazards</th>
<th>Active Researchers PPE</th>
<th>Adjacent Individuals PPE</th>
</tr>
</thead>
</table>
| C1. Working with hazardous chemicals (solid, liquid, or gas) | Eye or skin damage  
Potential poisoning through skin contact | Chemical splash goggles for larger volumes  
Safety glasses  
Lab coat  
Chemical-resistant gloves | In adjacent area:  
Safety glasses  
Lab coat |
<p>| C2. Working with hazardous liquids or other materials which create a | Eye or skin damage | Chemical-resistant apron should be | In adjacent area: |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Yes/No</th>
<th>Hazards</th>
<th>Safety Equipment</th>
<th>Adjacent Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2. Working with hazardous liquids or other materials which create a</td>
<td></td>
<td>Eye or skin damage</td>
<td>Chemical-resistant apron should be considered</td>
<td>Safety glasses, Lab coat</td>
</tr>
<tr>
<td>splash hazard</td>
<td></td>
<td>Poisoning</td>
<td>Face shield should be considered</td>
<td></td>
</tr>
<tr>
<td>C3. Working with small volumes (&lt; 4L) of corrosive liquids or acids</td>
<td></td>
<td>Low probability for a splash hazard</td>
<td>Safety glasses</td>
<td>Safety glasses, Lab coat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eye or skin damage</td>
<td>Lab coat</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemical-resistant gloves</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemical splash gogglers</td>
<td></td>
</tr>
<tr>
<td>C4. Working with large volumes (&gt; 4L) of corrosive liquids or acids</td>
<td></td>
<td>Low probability for a splash hazard</td>
<td>Safety glasses</td>
<td>Safety glasses, Lab coat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eye or skin damage</td>
<td>Lab coat</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemical-resistant apron</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemical-resistant gloves</td>
<td></td>
</tr>
<tr>
<td>C5. Working with small volumes (&lt; 1L) of flammable solvents/materials</td>
<td></td>
<td>Eye or skin damage</td>
<td>Safety glasses</td>
<td>Safety glasses, Lab coat</td>
</tr>
<tr>
<td>when no reasonable ignition sources are present</td>
<td></td>
<td></td>
<td>Lab coat</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential poisoning through skin contact</td>
<td>Chemical-resistant gloves</td>
<td></td>
</tr>
<tr>
<td>C6. Working with large volumes (&gt; 1L) of flammable solvents/materials</td>
<td></td>
<td>Major or eye damage</td>
<td>Flame-resistant outer gloves should be considered</td>
<td>Safety glasses, Lab coat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major fire</td>
<td>Safety glasses</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential poisoning through skin contact</td>
<td>Chemical-resistant gloves</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flame resistant lab coat (NFPA 2112)</td>
<td></td>
</tr>
<tr>
<td>C7. Working with any quantity of flammable solvents/materials when</td>
<td></td>
<td>Major or eye damage</td>
<td>Flame-resistant outer gloves highly recommended</td>
<td>Safety glasses, Flame resistant lab</td>
</tr>
<tr>
<td>there are reasonable ignition sources present, or working in areas</td>
<td></td>
<td>Major fire</td>
<td>Safety glasses</td>
<td>coat (NFPA 2112)</td>
</tr>
<tr>
<td>where flammable concentrations of vapors or gas may be present</td>
<td></td>
<td>Potential poisoning through skin contact</td>
<td>Chemical-resistant gloves</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flame resistant lab coat (NFPA 2112)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>44 persons in laboratory room;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Safety glasses</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flame resistant lab coat (NFPA 2112)</td>
<td></td>
</tr>
<tr>
<td>C8. Working with Category 1 or 2 acutely toxic chemicals</td>
<td></td>
<td>Chemicals pose a high level of immediate health risks</td>
<td>Safety glasses</td>
<td>Safety glasses, Lab coat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spills, splash, ingestion, inhalation, absorption</td>
<td>Lab coat</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemical-resistant gloves</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemical protective apron for H310</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In adjacent area</td>
<td></td>
</tr>
</tbody>
</table>
Outfit for Safety PPE Training Certification

Follow the steps below to complete your Outfit for Safety PPE Training Certification. All steps must be completed in order. Your training will only be recorded after you have completed all steps and submitted your training certification in Step 3.

Step 1: View the Outfit for Safety Training PDF
Complete ✔

Step 2: View the Outfit for Safety PPE Training Video
Complete ✔

Step 3: Take the Quiz and certify your PPE training is complete
Complete ✔

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PPE Videos

- Outfit for Safety
  - http://www.youtube.com/watch?v=RXmG8mjUvii
- Splash Zone
- Protect Yourself
Video (Screenshot)

Outfit for Safety
# Outfit for Safety (PPE)

## Outfit for Safety Addendum

### PPE Usage & Limitations

You will be provided with a Laboratory Hazard Assessment that will indicate the hazardous activities in your workplace. The Laboratory Hazard Assessment and associated Standard Operation Procedures (SOPs) will determine the proper Personal Protective Equipment (PPE) necessary to perform those activities safely beyond the other engineering or administrative hazard controls implemented. It is your responsibility to correctly wear the indicated PPE. Each type of PPE that you use in the laboratory has its own specific usage and limitations. The following matrix briefly explains each type of PPE described in the "Outfit for Safety" video and its limitations.

<table>
<thead>
<tr>
<th>PPE</th>
<th>Usage</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Glasses</td>
<td>Are intended to protect the wearer’s eyes when working with materials that may fly towards the researcher's face, and impact the eye with solid materials that may damage the eyeball.</td>
<td>Must meet the requirements specified in the American National Standards Institute 287.1-1989 or later standard.</td>
</tr>
<tr>
<td>Chemical Splash Goggles</td>
<td>Are intended to protect the wearer's eyes if there is a risk of being splashed in the face with hazardous chemicals. If there is a risk of an impact by a solid material, safety glasses should be worn under the goggles.</td>
<td>Must meet the requirements specified in the American National Standards Institute 287.1-1989 or later standard.</td>
</tr>
<tr>
<td>Face Shield</td>
<td>Is intended to protect the entire face or portions of it from impact hazards such as flying fragments, objects, large chips, and particles.</td>
<td>Must meet the requirements specified in the American National Standards Institute 287.1-1989 or later standard and be worn in combination with safety glasses or chemical splash goggles. Not intended to be worn alone.</td>
</tr>
<tr>
<td>Traditional Lab Coat (Cotton or cotton/polyester blend)</td>
<td>Is intended to protect the wearer and the wearer's clothes from incidental splashes of hazardous materials found in research labs.</td>
<td>This coat should not be used while working with bloodborne pathogens in quantities large enough to soak through to the skin, flammable materials greater than 1 L, or smaller quantities of flammable materials when there is a risk of ignition.</td>
</tr>
<tr>
<td>Barrier Lab Coat (Made mostly of polyester)</td>
<td>Is intended to protect the wearer when there is a risk of splash from blood borne pathogens or other biohazardous materials.</td>
<td>This coat should not be used when there is a risk of fire.</td>
</tr>
<tr>
<td>Flame Resistant Lab Coat (6 oz./yd. Nomex is best)</td>
<td>Is intended to protect the wearer when there is a risk of catching personal garments or skin on fire. FR clothing will resist ignition, prevent the spread of fire over the garment, and quickly self-extinguish following removal of the ignition source, such as a Bunsen burner.</td>
<td>FR garments are not designed to be “fire-proof,” nor are they designed to eliminate the risk of burns. If FR clothing is splashed or contaminated with a flammable substance and ignited, the substance will continue to burn on the surface of the garment until the fuel is exhausted. This garment is not fluid resistant and should be immediately removed and replaced (or laundered) if it comes in contact with spilled substances.</td>
</tr>
</tbody>
</table>

### Laboratory Coat Care Instructions

- Hamper to Hamper: Dirty coats go into a hamper that is picked up by the laundry service. The clean coat then is returned to its designated return location on a hanger along with other clean coats.
- Pre-labeled carriers: Dirty coats go into a pre-labeled carrier and are placed into campus mail. The coat is then cleaned by the laundry service and delivered back to the laboratory in an envelope.
- Mixed: A combination of the options above, dirty coats go out by mail and are returned to a central location on a hanger; or dirty coats go out in a hamper and are returned via the mail.

### Laboratory Coat Laundering

Each campus has one or more of the following models for laundering laboratory coats:

- Hampton to Hampton: Dirty coats go into a hamper that is picked up by the laundry service. The clean coat then is returned to its designated return location on a hanger along with other clean coats.
- Pre-labeled carriers: Dirty coats go into a pre-labeled carrier and are placed into campus mail. The coat is then cleaned by the laundry service and delivered back to the laboratory in an envelope.
- Mixed: A combination of the options above, dirty coats go out by mail and are returned to a central location on a hanger; or dirty coats go out in a hamper and are returned via the mail.

### Obtain and Dispose of Protective Eyewear

Protective eyewear can be obtained through your supervisor, department, or campus EH&S. You should obtain and use the eyewear that has been identified by your location hazard assessment, standard operating procedure, or supervisor's instructions.

- Clean your safety glasses or goggles daily with a soft cloth and store them in a clean dry place where they won't be damaged. Make sure the lenses are firmly attached and undamaged. Make sure the face seal around the goggle remains flexible and provides a good seal to your face; the elastic band is not damaged, and the vent hole covers remain in place. Leave scratched, pitted, broken, bent, or ill-fitting safety eyewear.
- Inspect your face shield for proper attachment of the lens to the frame. Check the frame shield lenses when the eye shield is new. Replace the entire face shield if the eye shield is new. Replace the eye shield if the face shield is damaged or broken. If your eye shield should become damaged or no longer functions, discard it in the regular trash. If the eyewear is contaminated with a hazardous material, try to decontaminate them before placing them into the trash, or consider sending them to your campus hazardous waste. Contact your EH&S to discuss your options.
VOUCHER

Personal Protective Equipment (PPE)

Personal Information

UC Test
staff@ucavis.edu
Hazard Assessment Reviewed: 9/06/2013
PPE Training Completed: 9/04/2013

Lab Group Information

Pt. UC Test
Lab Group: Biotechnology Lab II
PPE Department: BIOTECHNOLOGY PROGRAM
Hazard Assessment Certified by Pt: 9/06/2013

Recommended Personal Protective Equipment

The items below can be picked up at your campus Product Distribution Center:

- Safety glasses
- Lab coat
- Chemical splash goggles
- barrier lab coat impervious to fluids

Contact your Principal Investigator or local EH&S Department to receive the items below:

- Respirator (N95 minimum); for some work a higher level may be required
- Solid-front protective laboratory coat or gown

Notes:
- Under UC Policy, full length pants (or equivalent) and closed-toed/closed-heel shoes must be worn at all times by all individuals who are occupying or entering a laboratory or technical area.
- In all cases, chemical splash goggles can be substituted for safety glasses and provide a higher level of protection when working with large quantities of material. For splash or impact protection, either chemical splash goggles or safety glasses need to be worn under face shields.

This box is for EH&S Staff only. Do not mark this box.

1. Lab Coat Size: ____________________________
2. Lab Coat Gender: __________________________
3. Lab Coat Length: Regular or Long (circle one)
4. Eyewear Selection: __________________________
5. Laundry Location: __________________________
6. Lab Coat Rich (staff handles at the event and is in steady state)
7. Date of Distribution: __________________________ (staff handles at the event and is in steady state)
Questions?

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Ken Smith (ken.smith@ucop.edu)

John Palmer (jpalmer@ucsd.edu)