

# 2,700 Miles and a Big Step Forward: The UC Settlement and Princeton University

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ACS Spring Meeting  
April 2017  
San Francisco

# About Princeton



- Population
  - 5200 undergraduates
  - 2700 graduate students
  - 1200 faculty
  - 11,500 staff (5500 FTE)
- 14 science and engineering programs
- Students from >100 countries
- ~185 Principal Investigators
- ~600 Traditional Laboratories





# Extra! Extra!

- Shock and sadness
- Notice to pyrophoric materials users
- Conversations with faculty
- Could this happen here?  
YES!!

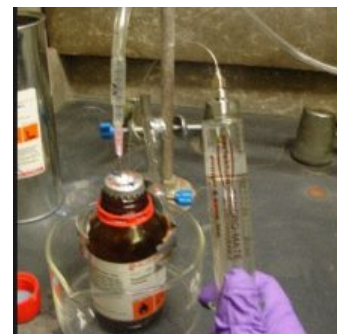


## LAB SAFETY ADVISORY ENVIRONMENTAL HEALTH & SAFETY

February 2009

### WORKING WITH PYROPHORIC MATERIALS

Certain stock reagents and in-situ products, such as t-butyllithium, trimethylaluminum, Grignard reagents, etc., are pyrophoric. Exposure to air, water, high humidity or moisture can cause these materials to evolve heat, fire, flammable or corrosive byproducts by violent decomposition. Since they are typically packaged



# Faculty as Lab Managers



- 5-minute presentation at a faculty meeting for each of the science and engineering departments
- Safety culture, risky behavior
- Managing students and their lab
- Risk, Liability
- Most important...imagine the moment



*Truly a launch point for improving safety culture*



# UCLA vs Princeton in 2009



## Lab Safety Comparison: Princeton and UCLA

Based on UCLA 2009 Report

UCLA 2009 Report	Princeton University 2009	Recommendations
<b>3.0 UCLA Policy 811</b>		
UCLA Policy 811 is a campus-wide health and safety policy outlining broad responsibilities for safety across all faculty and staff.	Princeton's EHS policy accomplishes similar goals. HR policy 8.0 provides more specific requirements for faculty and staff with regard to managing safety.	None.
<b>3.1.4 Laboratory Safety Committee</b>		
UCLA established a campus-wide laboratory safety committee after the incident. The committee developed new policy and compiled the report.	Environmental Safety and Risk Management Committee is the policy-making committee, but does not have the right make-up to conduct reviews of laboratory hazards and issues. The Safety Manager Breakfast program serves as an informal committee.	Establish a Laboratory Safety Committee that is a subcommittee of ESRM and/or the University Research Board.
<b>3.2 Laboratory Hazard Assessment Tool</b>		
Developed a tool to identify hazardous materials used in research and to ensure consistent safety requirements.	The Laboratory Profiling Tool does most of this.	Ensure labs update their profile regularly.
<b>3.3 Laboratory Safety Training</b>		
a. UCLA does not have a training management system.	Princeton EHS has had a training management system for more than a decade.	None
b. Recommends development of a new faculty orientation course that includes clear review of their responsibilities for safety.	Princeton EHS has been conducting lab supervisor training for several years.	None
c. Planning to develop a pyrophorics safety video.	Princeton has little guidance on pyrophorics safety.	Develop materials for the website. Consider a video or link to a video produced elsewhere.
<b>Laboratory Inspections</b>		
a. Did not have a comprehensive approach to lab inspections, relying on multiple inspections of single topics (waste, chemicals, rad, bio, etc.)	Princeton has been conducting comprehensive lab safety inspections for many years.	None.
b. UCLA established short-term turn-around requirements for inspection findings and fixed dates for action by PIs (48 hours critical issues, 30 days non-critical)	Princeton is lax about following up on inspection findings. Princeton does not prioritize findings.	Establish a more formal program for inspection follow-up. Prioritize findings and set action limits.
c. UCLA is developing a formal self-inspection process for labs.	Princeton has self-inspection checklists for labs, but no requirements to use them.	Consider an annual self-inspection requirement.



# Main Opportunities

- Improve reporting and follow-up to lab inspections.
- Share information about incidents on campus.
- Develop more lab-specific SOPs.
- Develop formal POLICIES for PPE and working alone.
- Improve safety culture.
- Improve laboratory management, soft skills for lab managers/PIs
- Improve recordkeeping
- Develop additional training/ information materials for pyrophorics and other higher hazard materials.

# Safety Culture

- Integrated, not a separate thing
- Relies on
  - Good management
  - Caring and understanding
  - Good technical resources and solutions
  - Good safety service delivery model
  - Expedient follow-up
  - Regular check-ups
  - EXCELLENT COMMUNICATION
    - Expectations
    - Information



*An effective laboratory safety program must be **integrated** into the research process rather than being an annual housekeeping exercise conducted days before an anticipated annual laboratory inspection.*

*- C. Merlic, et. al, Report to the University of Hawaii at Manoa on the Hydrogen/Oxygen Explosion of March 16, 2016*



# The 2 BEST Things We've Done...







# Communications Specialist



- Focus on communications and training
- Produce videos
- Make posters
- Branding
- Social media
- Create online training
- Re-think training





# A Tool for Researchers (and EHS)



SAFETY, HEALTH, INSPECTION and EQUIPMENT LABORATORY DATABASE

[shield.princeton.edu](http://shield.princeton.edu)

## Everything you need in one place.





# Opportunity: Inspection Follow-up

- Tablet-based inspections
  - Started with free app: iAuditor
  - Helped with near-immediate report-making and sharing
- Issues assigned to lab manager/delegate
- Follow-up assigned to specific EHS staff
- Automatic reminders
- Easily see status and history
- Easily to track to completion

Chemical	Yes	No	N/A
Bottle carriers, carts, and secondary containments are used to transport chemicals? 🧠* (+2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calcium gluconate gel accessible and within expiration date for hydrofluoric acid use? 🧠* (+3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chemical containers are compatible and in good condition? 🧠* (+3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chemical containers sealed? 🧠* (+3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are chemical storage cabinets properly labeled? 🧠* (+1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chemical storage shelves and cabinets are in good condition? 🧠* (+3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chemicals are properly labeled? 🧠* (+2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



View

Revisions

## Lab Inspection 02/16/2017

Find Individual or Gro

Search

- + Facilities Management
- + Research Management
- + Inspections
- + Izzo Lab
- + Research Tools
- + Training
- + Equipment
- + My Account

### Groups/Spaces:

[Frick Chemistry Laboratory - A09](#)  
[Frick Chemistry Laboratory - A09A](#)  
[Frick Chemistry Laboratory - A09B](#)

### Primary Contact:

### Compliance Liaison:

**Inspection Type:** General Laboratory Inspection

**Inspected By:** [Kyle J. Angielo](#)

### Status:

Finalized

**Last Emailed:** 02/16/2017 ([view](#))

**Confirmed:** 02/16/2017

### Findings:

- Chemical containers are not compatible or in poor condition
- Compressed gases not secured and stored properly
- Extinguisher not inspected within the last 30 days
- Fume hood has not been certified within the past year
- OSHA Particularly Hazardous Substances (PHS) are used or stored in the lab without risk assessments documenting hazards, controls, and disposal

### Summary

EHS conducted a full laboratory survey and found the lab to be generally in compliance with University health and safety policy, with the exception of the findings indicated below.



## Findings

### 1. Chemical containers are not compatible or in poor condition

#### Comments/Corrective Action(s):

Chemical Containers should be compatible with the materials they are containing and in good condition.

Regulatory Citation: Prudent Practices in the Laboratory

Corrective Action(s): Transfer the chemical to a compatible container in good condition.

One copper iodide bottle had a split in the lid. Other bottles seem old and potentially unused.

#### Space(s):

- [Frick Chemistry Laboratory - A09](#)

### 2. Compressed gases not secured and stored properly

#### Comments/Corrective Action(s):

Compressed gas cylinders must be secured from tipping. Straps should be 2/3 from the bottom of the cylinder, and intended for securing. Safety Caps should be in place if the cylinder is not in use.

Regulatory Citation: 29 CFR 1910.101

Corrective Action(s): Secure the cylinder from tipping and ensure the safety cap is in place.

(<https://ehs.princeton.edu/laboratory-research/chemical-safety/compressed...>)

Three x 14" cylinders were not secured. The laboratory has not used them and has agreed to dispose of or return them to the vendor.



Receipt of this Inspection Confirmed 02/16/2017 by [redacted]

#### Actions

Current Status: Finalized

[Set Status to Pending Resolution](#)

[Re-Email Report](#)

#### Assigned Reviewer

Assigned To: [Kyle J. Angielo](#) ▼

☐ Email Assignment [Re-Assign](#)

#### Correspondence

☒ Hide Automated Messages

**Posted** Fri, 02/17/2017 - 4:33pm by [redacted]  
*Pending Resolution -> Pending Inspector Review*

All audit findings have been resolved.

**Posted** Tue, 03/28/2017 - 8:25am by [Kyle J. Angielo](#)  
*Pending Inspector Review -> Finalized*

Dear Liz,

Thank you for resolving all of the findings in the inspection report.

Best,  
Kyle

# Opportunity: Matching Training Requirements with Training Records



## Manage Job Activities for Kleiner Lab

General Chemical Biological Radiological

Name	Works in Experimental Lab Spaces	Performs Research Outdoors	Ships Non-Hazardous Materials Using Dry Ice	Supervises a Laboratory
Select for all	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">Kleiner, Ralph</a>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<a href="#">Arguello, Emilia</a>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<a href="#">DeLiberto, Amanda</a>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">Gao, Michael</a>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Kleiner Lab Training

### Training rule compliance

Listed below are the training rules this Laboratory must comply with along with both the number of users the rule a number of delinquencies there in.

Training Rule	Users	Delinquencies
<a href="#">Introduction to Biosafety Training</a>	4	1
<a href="#">Laboratory Safety Training</a>	4	1
<a href="#">Laboratory Supervisor Briefing</a>	2	0

- Teratogens and/or reproductive hazards
- Non-Ionizing Radiation
  - UV light sources
- Physical
  - Cryogenics and dry ice
  - Inert compressed gases
  - Pressure and vacuum vessels

Hazards Last Certified by PI: 12/08/2016 [Require Recertification](#)

# OPPORTUNITY: Develop More SOPs and Improve Recordkeeping



- Researchers document SOPs
- Maintain records in SHIELD
- Track lab-specific training
- Self-inspections
- Lab profile/hazards
- Lab door hazard signs
- Equipment and records
  - Certifications, warranties, manuals

**EMERGENCY INFORMATION**  
*Contact information for individuals responsible for this lab area is posted on back*

**Recommended Personal Protective Equipment**

Initials \_\_\_\_\_ Date \_\_\_\_\_  
Posted \_\_\_\_\_  
Review \_\_\_\_\_

**Description of Lab Hazards**

	Nitrogen cylinder
	Carbon dioxide cylinder
	acid
	base
	$^{14}\text{C}$ $\text{H}_2\text{S}$
	solvent
	lentivirus

**Key**

	Compressed Gas		Toxic
	Compressed Gas - Flammable		Compressed Gas - Oxidizer
	Flammable Liquid		Oxidizer
	Corrosive		Reactive
	High Voltage		Radioactive
			Flammable Solid
			Laser
			Biohazard

Building: Icahn      Lab Name: Rabinowitz Lab      Room: 210-215 South door

Everything you need in one place!

# Share Information about Incidents



PRINCETON UNIVERSITY

About EHS Contact Us Announcements Safety Data Sheets Reporting

**EHS** PRINCETON UNIVERSITY  
ENVIRONMENTAL HEALTH & SAFETY

Laboratory & Research Workplace & Construction Environmental Programs Health & Safety for the Campus Community

Home > Laboratory & Research > Anecdotes

**Anecdotes**

Accidents do happen in Princeton University laboratories. The following are accounts of a few incidents that help to illustrate the need for the safety precautions outlined in this manual.

- Improper Shelving
- Fires
- Chemical Burns
- Glass Vessel Ruptures
- Incidents Involving Reactive Materials
- Electrical Shock

**Improper Shelving (top)**

**Wall-Mounted Shelves Collapse**

There have been several incidents where shelves have collapsed onto desks and other work surfaces, during work area. In one case, a person working in the instance, the shelves were heavily loaded and the shelving or was incorrectly installed.

**Smart Mailer**

Select criteria to build the recipient list using the filters below.

Department:	Building:	Group Type:	Submit
Designation:	Category:	Hazards:	
Group Name:	Job Activity:	Campus:	

**LAB SAFETY ADVISORY**  
ENVIRONMENTAL HEALTH & SAFETY

JUNE 2012

**MANAGING ACID WASTE**

Last month, a container of mixed acid waste over-pressurized and burst, resulting in minor injuries to two laboratory workers. Similar incidents have occurred in multiple departments throughout the University over the past several years.

**THE INCIDENT**

Two laboratory workers were standing near a wooden cabinet used to store chemical waste when they and others in the lab heard a hissing sound. After several seconds, a glass container inside the cabinet burst violently, forcing the cabinet door off its hinges and striking a lab worker in the back, knocking the lab worker to the ground. Both lab workers were splashed with material from the container and immediately noticed a burning sensation to exposed skin. Small pieces of glass were strewn around the lab area and lab workers noticed an acrid odor and an orange vapor cloud.

All lab occupants evacuated immediately, activating the ventilation purge button on the way out. Two phoned Public Safety at 911 to report the incident.

*The lab coat was unharmed by the acid.*

Both of the lab workers splashed by the acid waste rinsed immediately for several minutes, aided by Public Safety and the Princeton First Aid and Rescue Squad. As a precaution, both were transported by ambulance to a hospital where they were observed for symptoms of respiratory irritation and released.

The lab worker who was knocked to the ground was wearing gloves, safety goggles, and a lab coat, and received a minor injury to the knee and chemical irritation to a small portion of the face. While the lab coat was unharmed by the acid waste, jeans extending below the hemline of the lab coat had acid damage. The other lab worker slightly sprayed by the acid waste had just arrived to the lab and was not wearing protective equipment. Fortunately, this individual was on the opposite, unaffected side of the cabinet and had no obvious injuries.

262 ALEXANDER STREET 258-5294

WWW.PRINCETON.EDU/EHS





# Policies

- Everyone (mostly) wants (sort of) policies
- Lab Safety Policy Working Group
  - Faculty, staff, post-docs, graduate students
  - Currently considering four new formal policies:
    - Personal Protective Equipment
      - Currently rely on OSHA standard
    - Eating and Drinking in the Lab
      - Currently enforced for bio and rad labs, squishy for others
    - Working Alone in the Lab
      - Currently a guideline
    - Minors in the Lab
      - Currently only for minors working/studying in lab



# Speaking of Empowerment...



- Opportunity to build STRONGER relationships
- Dean for Research
- Provost
- Chairs
- Dean of the Faculty
- President

PABLO G.  
DEBENEDETTI

Dean for Research

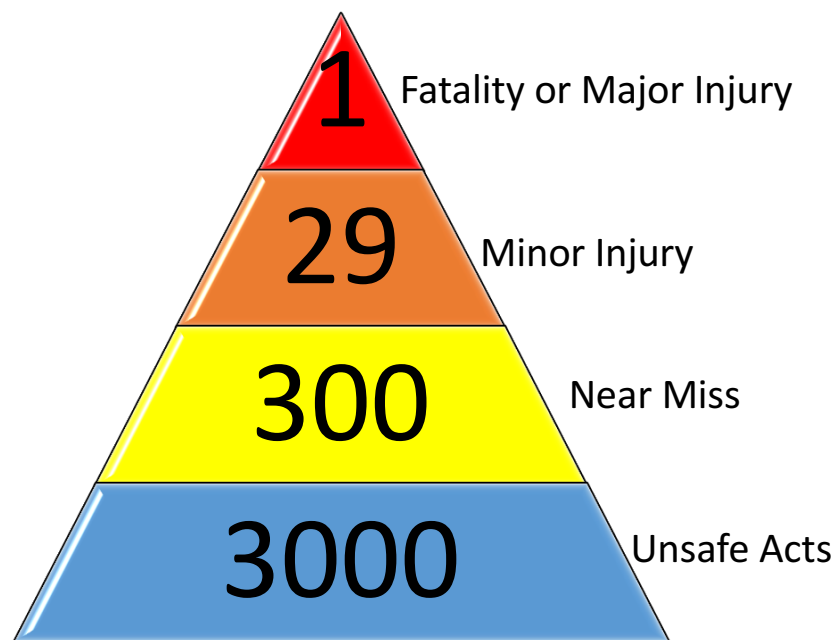


- Presidential Committee on Lab Safety Culture
- Provost Committee on Reducing Administrative Burden for Researchers



# Safety Culture and Behavior

# Heinrich's Triangle

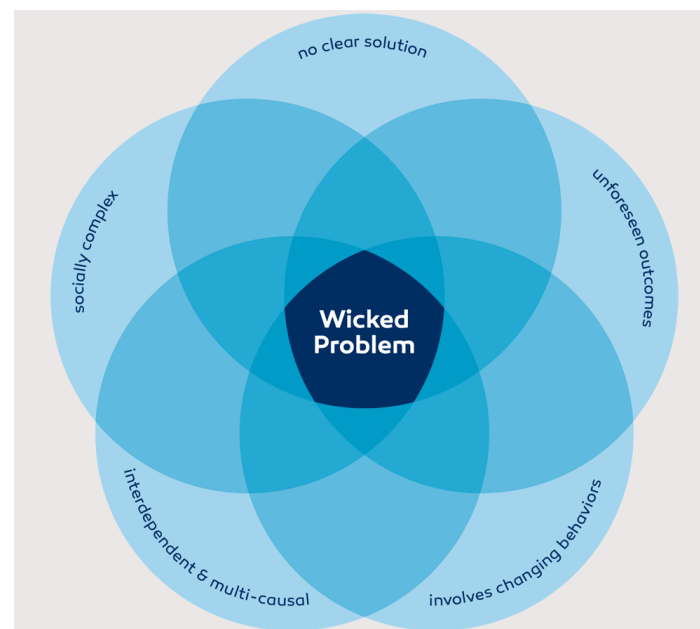




# Choosing to Act Safely

The benefits of academia...

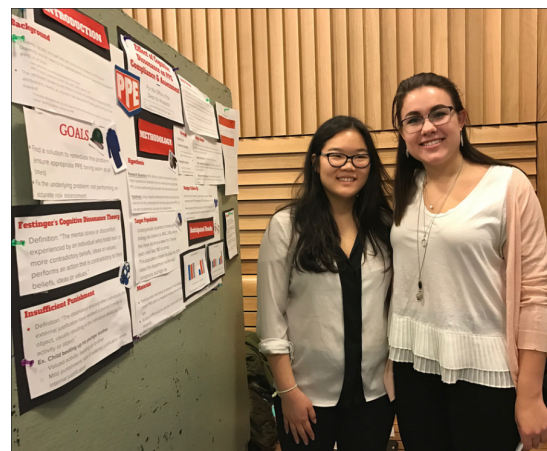
- PSY252 Social Psychology and Behavior Change
- Wicked Problems and Design Thinking
- Campus Behavioral Science Initiative
- Independent Study
- Campus as a Lab



# PSY252

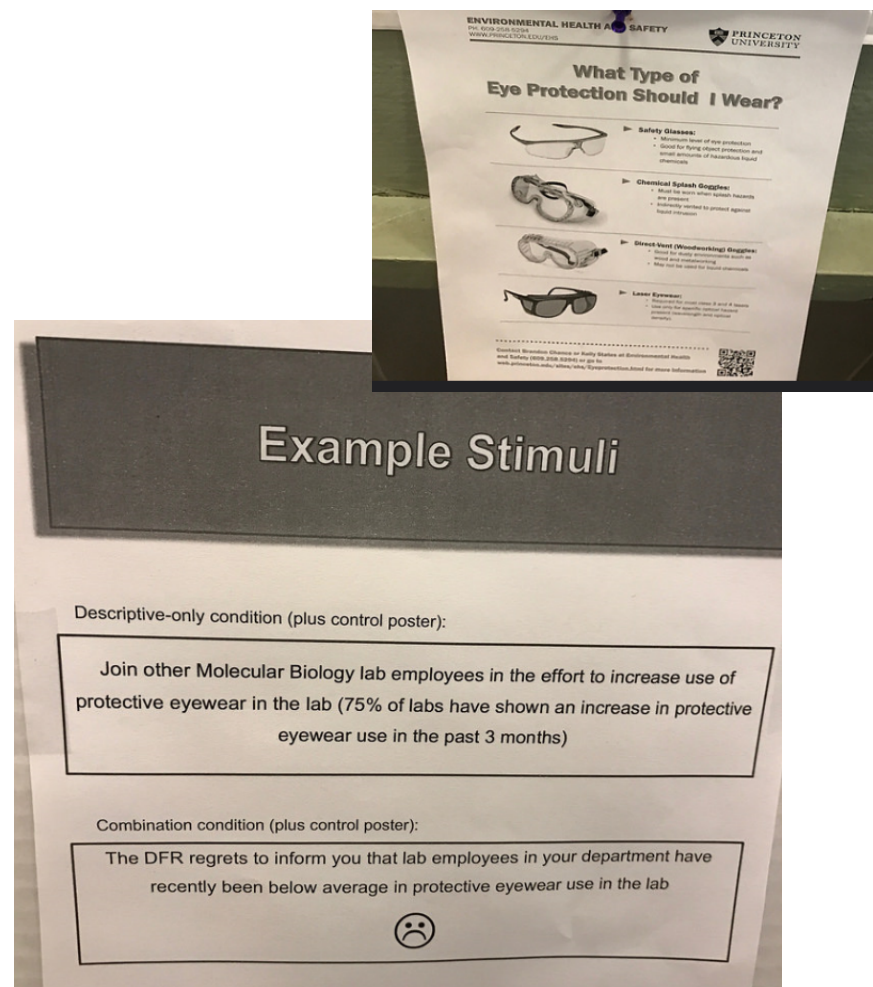


- Students studied question: *Why don't researchers consistently wear eye protection in the lab?*
- Several behavioral psychology themes to the student ideas:
  - Cognitive dissonance
  - Normative Conduct
  - Peripheral and Direct Persuasion
  - Fear Persuasion
  - Optimism Bias
  - Pluralistic Ignorance
  - Channel Factors



# Normative Conduct

- Use **NEGATIVE** language for norming.
  - Everyone else is good, you are not.
- Schultz et al. 2007:
  - Describing positive behavior + positive injunctive norm = maintaining existing desirable behavior
  - Describing negative behavior + negative injunctive norm = reducing undesirable existing behaviors
- Also used emojis





## What next?

- Expand use of our enterprise safety software, streamlining additional processes to INTEGRATE it with research.
- Expand our understanding and use of behavioral psychology concepts to help INTEGRATE safe behavior in the lab.
- Bring more faculty and students into the problem-solving process.
- Build stronger and stronger partnerships.
- Take advantage of the intellectual environment.
- Never stop trying to make things better.
- Learn, look around, pay attention, learn some more.





# Many thanks.

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609-258-6259



“WE<sup>HAVE</sup>  
AN  
INFINITE  
AMOUNT  
TO  
LEARN  
BOTH  
FROM  
NATURE  
AND  
FROM  
EACH  
OTHER.”  
- JOHN GLENN

