DCHAS Innovative Project Grant Report
Laboratory Risk Assessment Teaching Materials

ACS Committee Chemical Safety

CHAS

University of BRISTOL

About This Project

About the Project
This Innovation Project Grant (IPG) provided resources to produce a video short and a supporting slideshow for the video. The video and supporting materials were developed to introduce workers in academic laboratories to the basic concepts of risk assessment.

Intended Audience: workers in and supervisors of research labs who have hands on responsibilities for using and overseeing evolving chemistries.

This slideshow and notes **support initial training of lab workers**; the video itself is designed for **reminder training**. They are teaching tools for laboratory workers and not intended as a complete lab safety training program unto itself. *It is expected that users will adapt the content of the slideshow to address their audiences' needs.*

Making It Happen

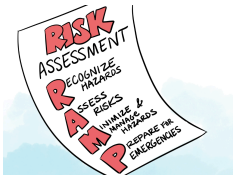
Dr. Tim Gallagher of the University of Bristol in the United Kingdom approached ACS Safety Programs to request assistance in developing a short video to remind research chemists of the importance of ongoing safety awareness and risk assessment. Ralph Stuart, (CHAS Membership Chair) of the worked with Dr. Gallagher to develop an IPG Proposal for funds for hiring a videographer to develop such a video. Dr. Gallagher suggested that Blue Seat Studios be hired for this purpose.

Over the course of 6 months, the team worked together to outline and develop the look and feel of the video. A first draft was presented at the spring, 2018 ACS National Meeting and after feedback was reviewed and incorporated into the video, it premiered at the fall, 2018 National Meeting.

The video is available on the CHAS web site at https://tinyurl.com/chas-ra-video and on YouTube. To date, it has been downloaded about 6000 times.

The RAMP Paradigm

The RAMP paradigm is adapted from ***Laboratory Safety for Chemistry Students*** by Hill and Finster https://www.wiley.com/en-us/Laboratory+Safety+for+Chemistry+Students%2C+2nd+Edition-p-9781119027669



Recognize Hazard
- GHS information from the label and SDS
- Reactivity data from PubChem LCSS
- Physical hazards from processes

Assess Risks
- Write a detailed description of the work
- Review GHS signal words
- Using hazard assessment

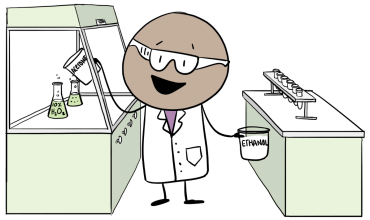
Minimize Hazards and Manage Safety
- Understand laboratory ventilation equipment and rates
- Use PPE based on a risk assessment of likely scenarios and manufacturer's compatibility guides
- Substitute and eliminate when possible

Prepare for Emergencies
- Identify the most likely scenarios
- Prepare emergency equipment
- Review institutional emergency plans

Protect Your Neighbors and the Environment
- Manage lab wastes using institutional waste disposal services; minimize waste
- Incorporate the 12 principles of Green Chemistry
- Report and share your Lessons Learned from lab incidents

Common Lab Risk Assessment Fallacies, part 1

Fallacy 1: Solvents Aren't Chemicals
Some chemists overlook the hazards of solvents as they plan their work. A procedural change that may seem trivial at the scientific level can have serious safety and science implications. One such incident involved adding PEG to a procedure. This led to an explosion which destroyed the experiment and the fume hood. The scientist suffered significant, but non-permanent, injuries The complete description of this incident can be found at http://cenblog.org/the-safety-zone/2014/07/more-details-on-the-university-of-minnesota-explosion-and-response/



Fallacy 2: I'm Safe Because I'm Working with Small Quantities
At the University of Bristol in the UK, a graduate student was working on a planned procedure that involved 1 mL of H_2O_2 and 50 mL of acetone. Overuse of the oxidizer led to the formation of TATP, a known explosive. The graduate student appropriately alerted his PI to the problem, which led to a building evacuation. There was no loss other than an interruption of business, but a risk assessment that identified limits on the amount of peroxide to be used would have avoided this disruption. You can read more about this event at http://cenblog.org/the-safety-zone/2017/02/how-a-student-unintentionally-made-an-explosive-at-u-bristol/

Fallacy 3: A Reaction is a Reaction
One of the reasons for the fatal fire at UCLA in 2008 was that the reaction being performed was scaled up by a factor of three without any change in the equipment used to perform the work. See the C&EN SafetyZone blog entry at https://cen.acs.org/articles/87/i31/Learning-UCLA.html for specific information about the impacts of this change.

Common Lab Risk Assessment Fallacies, part 2

Fallacy 4: I Don't Need Everything Every Time
(I can take my PPE off for this part…)
An explosion at Texas Tech University in 2011 led to serious hand and eye injuries for a graduate student who had removed his safety glasses a few minutes before. See https://www.csb.gov/texas-tech-university-chemistry-lab-explosion/ for details.

Fallacy 5: I Did This Safely Yesterday, So I Can Just Do It The Same Way Today
A checklist is a good way to remember the basics of safe practices, but it can include hidden assumptions about the equipment being used. It is not unusual for laboratory glassware or chemical waste containers to fail due to material stresses. Think critically about the safety implications of the changes you notice as your work proceeds.

Fallacy 6: If I Don't Get Started Now, I Won't Get Finished on Time
Taking the time to plan your research work carefully, both in terms of defining what will happen when things go well as when things go wrong, can save both time and money money – and may save your life !

Fallacy 7: Someone Else Has Already Figured Out How to Do This Safely
In 2016 an undergraduate research student was injured when a glass scintillation vial exploded. The cause of the accident is believed to be an omission of a hydrochloric acid precipitation step while following a synthesis reaction taken from literature. This allowed the unintentional formation of a diazonium salt that exploded during collection. See more details at http://www.depts.ttu.edu/vpr/integrity/lessons-learned/march-2016.php