

# ACS Committee on Chemical Safety, Safety Advisory Panel 2019 Meeting Report

Respectfully submitted by: Ellen Sweet, Chair (ems325@Cornell.edu)

The Safety Advisory Panel (SAP) and invited experts worked in breakout groups on three projects. These included:

- 1) Innovative Project Grant titled: *Development of RAMP Prototype for Organic Chemistry Teaching Lab*
- 2) Revision and renewal of the ACS policy statement titled Safety in the Chemistry Enterprise
- 3) Development of a list of keywords for categorizing safety terms

Attendees:

Ralph Stuart

Leah McEwen

Todd Houts

Marta Gmurczyk

Peter Reinhardt

Robin Izzo

Ellen Sweet

Rob Toreki

Ken Kretchman

Grace Baysinger

Kendra Denlinger

Sammye Sigmann

Scott Goode

- 1) **eRAMP** working group is building an excel workbook of the RAMP process for a chemical experiment that is intended to be used in the educational setting. The goal is to build this into an e-tool for conducting a risk assessment that will pull in resources to assist the user with experimental decision-making. This project will develop a prototype electronic tool that uses the RAMP model recommended by the ACS Committee on Professional Training (CPT) for laboratory classrooms. The interactive tool will incorporate best practices for chemical data collection, green chemistry and risk assessments. It will produce indicators and reports for clear communication between students, instructors, lab managers and safety personnel on these topics. As part of this project, the prototype will be tested in organic teaching labs as a proof-of-concept for integrating safety analysis into the chemistry curriculum and extending the RAMP concept to environmental impacts of laboratory work.
- 2) The ACS policy statement titled **Safety in the Chemistry Enterprise** is under revision. The writing team consists of Peter Reinhardt, Sammye Sigmann, Daniel Kuespert, and ACS staff liaison Brandi Neifert. This will be ready for the vote on

approval by the full Committee on Chemical Safety (CCS) by the next national meeting in August 2019. Upon approval, it will go the ACS Board for final approval.

The writing team also discussed the fact sheet on Chemical Safety information. This will be published on the CCS webpages.

- 3) The **Safety Keywords and Search Categories group** work began at the 2019 Safety Summit that focused on education. The summit identified the need for tools in safety education that curriculum can be built around. These include chemical safety information from reliable sources, laboratory activities, safety related case studies or events, lessons learned, and others. A list of searchable keywords and categories for indexing is under development. See draft of list below. A task force is being formed to take this work forward.

## Search Categories and Key Words

### 1. Administrative Metadata

(required for each item collected)

- 1.1 Title
- 1.2 Author name
- 1.3 Organizational Affiliation
- 1.4 Year of Publication
- 1.5 Name of Publication or Source
- 1.6 URL or DOI reference
- 1.7 Language of presentation

### 2. Intended Audience

- 2.1. Post high school Chemical safety educators (including Teaching Assistants (TA) and chemistry faculty)
- 2.2 Environmental Health and Safety Professionals (staff or consultants)
- 2.3 Elementary and middle school students
- 2.4 First-year undergraduate general chemistry students
- 2.5 General public
- 2.6 High school science students
- 2.7 Laboratory scientists (graduate students, laboratory staff, stockroom managers, PIs)
- 2.8 Second-year undergraduate and advanced chemistry students

### 3. Resource Type

- 3.1 Animation
- 3.2 Blogs and other transient Internet social media
- 3.3 Book or book chapter
- 3.4 Case studies
- 3.5 Database
- 3.6 Guides
- 3.7 Images
- 3.8 Journal articles
- 3.9 Text of laws and regulations
- 3.10 Magazine and newspaper articles (aimed at the general public)
- 3.11 Manuals and documentation related to specific operations or equipment
- 3.12 Meeting abstracts or presentation materials
- 3.13 Multimedia (instruction, talks, lectures)
- 3.14 Opinion papers and editorials
- 3.15 Policy statements
- 3.16 Reference materials – encyclopedias, handbooks, etc
- 3.17 Reports and white papers
- 3.18 Safety letters to C&EN or other technical journals
- 3.19 Software
- 3.20 Voluntary Consensus Standards
- 3.21 Standards, regulatory
- 3.22 Videos

3.23 Virtual reality and augmented reality platforms

3.24 Website

#### 4. Related Fields

(can be optionally provided for any item in the collection)

4.1 Specific chemical(s) or chemical groups involved

4.2 ACS resource

4.3 Fee-based

4.4 Free

4.5 Full-text available

4.6 Peer reviewed

4.7 Quality ranking based on Wikipedia content assessment rubric at

[https://en.wikipedia.org/wiki/Wikipedia:Content\\_assessment](https://en.wikipedia.org/wiki/Wikipedia:Content_assessment)

#### 5. Keywords

5.1 Recognize hazards

##### *5.1.1 Material hazards*

Acute toxicity

Compressed gases

Corrosive

    Acids

    Bases / alkaline

Environmental hazard

Explosive

Flammable

Health hazard

Irritants

Oxidizing

##### *5.1.2 Specific chemical hazards –*

Hazardous catalysts

Peroxide formers

Pyrophoric

Water-sensitive

##### *5.1.3 Specific biological hazards*

Allergens

Carcinogen

Controlled substances

Disinfection

Drugs / pharmaceuticals

Endocrine disruptors

Neurotoxins

Neurotoxins  
Reproductive hazards / teratogenic  
Research animals

#### *5.1.4 Specific physical hazards*

Electrostatic hazards  
Ionizing radiation  
Laser safety concerns  
Magnetic fields  
Nanomaterials  
Non-ionizing radiation

#### *5.1.5 Equipment hazards*

Centrifuge safety  
Hot plates / mantles  
Laboratory ovens and furnaces  
Microwave ovens  
Rotary equipment  
Sharps  
Ultrasonicators  
Vacuum systems

#### *5.1.6 Procedural hazards*

Cryogenics  
Distillations  
E-Beams (electron beams)  
Glassware use  
High or low temperatures  
Hydrogenations  
Pressure above or below atmospheric  
Process plumbing / connectors and tubing  
Tripping risks

#### *5.1.7 Workplace hazards*

Confined spaces  
Electrical power hazards  
Ergonomics  
General lighting  
Ignition sources

#### *5.1.8 Behavioral hazards*

Appropriate clothing  
Care for service animals in labs

- Distracting earbuds / headphones use
- Distracting use of mobile devices
- Eating / drinking in lab
- Horseplay
- Housekeeping
- Pipetting by mouth
- Unlabeled chemicals
- Working alone

## 5.2 Assessment Risk

### 5.2.1 Assessment processes

“What if” / Haz-Op Review

Bow tie diagram

Checklist

Control banding for administrative processes

- Training

- Oversight processes

Control banding for equipment selection

- Laboratory ventilation

- Personal protective equipment

- Chemical storage and usage

Job hazard analysis

Managing change

- Scaling up reactions

- Chemical substitutions

- Personnel turnover

Process safety reviews

### 5.2.2 Assessment resources

Process description

Laboratory Chemical Safety Sheets

Safety data sheets

Chemical inventory

### 5.2.3 Assessment equipment

Exposure assessment

- Detectors and sensors

- Dosimetry

- Survey meters

Chemical test strips

- Peroxide strips

- pH paper

## 5.3 Minimize risk

### *5.3.1 Administrative and management*

Accident / incident investigation  
ADA accommodations  
Program audit  
Chemical hygiene plan  
Chemical segregation  
Chemical storage  
Continuity of operation  
Contractor / visitor safety  
Drills, safety / emergency  
Dual-use chemicals (management of)  
Facilities / infrastructure  
Inspections (internal, regulatory, self)  
Inventory  
Lab design / laboratory design  
Lab security / laboratory security  
Labeling  
Lockout / tagout  
Maintenance  
Occupational exposure limits  
Ordering  
Professional ethics  
Safety culture  
Shipping chemicals  
Signage  
Standard operating procedures and policies  
Training programs  
Transporting chemicals  
Waste management / disposal

### *5.3.2 Elimination and substitution*

Automation  
Eliminate open flames  
Inherently safer design  
Powder substitutes  
Removing hazards  
Solvent substitution  
Substitute aqueous alternatives  
Substitute safer alternatives

### *5.3.3 Engineering controls*

Biological safety cabinets

- Blast shield
- Downdraft table
- Environmental room
- Exhaust
- Filter
- Fire and explosion proof refrigerators
- Flammable storage cabinets
- Fume hood
- Glove box
- Interlock (laser)
- Machine guarding
- Scrubber
- Secondary containment
- Shutoff switch
- Traps
- Ventilation

#### 5.4 Plan for emergencies

##### *5.4.1 Personal protection equipment (PPE)*

- Gloves
- Eye protection
  - Face shield
  - Goggles
  - Laser eye protection
  - Safety glasses
- Hearing protection
- Respirators
- UV protection
- Labware
  - Apron
  - Footwear
  - Lab coats

##### *5.4.2 Preparedness measures*

- Chemical specific measures
  - Mercury spill kit / amalgam
  - Calcium gluconate available for use of Hydrofluoric acid
  - Polyethylene glycol available for use of phenol
- Decontamination equipment
  - Eyewash
  - Floor drains
  - Safety shower



## Emergency Equipment

- Fire extinguisher

- First aid kit

- Fire blanket

## General workplace scenarios

- Floods

- Power loss

- Seismic / earthquakes

- Spill kit

- Sprinklers

- Severe weather / tornado / hurricane

- Utility loss / outage

## Lessons learned

## Response plans

## 5.5 Protect the Environment (Greener chemistry)

### 5.5.1 *Pollution prevention*

#### Chemical substitutes

- Eliminate mercury

- Microscale

- Minimize inventory

#### Reclamation

#### Recycle

### 5.5.2 *Energy conservation*

- Reduced general ventilation

- Variable air volume (VAV)

- Control banding

- Closed hood sash

- Cold storage management

- Reduce single-pass water

### 5.5.3 *Emissions control*