

# Enhancing safety in a chemistry high school classroom: ACS Science Coach approach

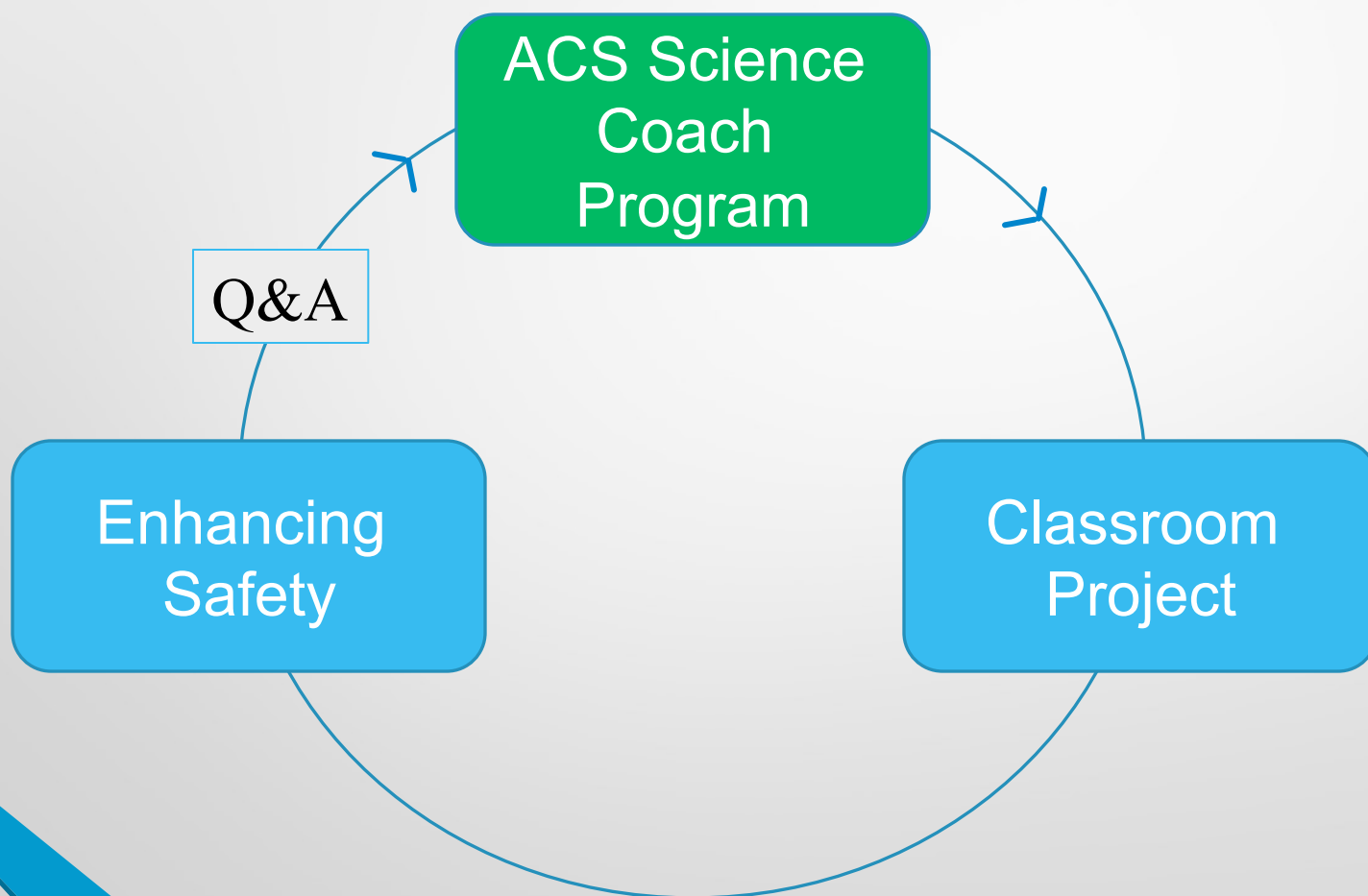
By

Yamaira I. Gonzalez, PhD

University of Delaware & Yamy LLC

252nd ACS National Meeting, Philadelphia  
August 21-25, 2016

# Agenda



“improving one classroom at a time”



# ACS Science Coach

## One-on-one

- Chemists who volunteer with AACT teacher for one school year.
  - 6 visits; 1hr each + completion of 2 surveys
- Activities coordinated between teacher/coach
- Teacher/school secures \$500 donation
  - To enhance education: lab/demo equipment, supplies...

## Science Coach Group (as of 2016)

- Chemist provide chemistry advice to 3 AACT teachers via a private, virtual forum with interaction at least once a month.
- Donation is unavailable at this moment

# ACS Science Coach

## One-on-one

- **Chemists** who volunteer with **AACT** teacher for one school year.
  - 6 visits; 1hr each + completion of 2 surveys
- Activities coordinated between teacher/coach
- Teacher/school secures \$500 donation
  - To enhance education: lab/demo equipment, supplies...

- Chemical engineer,...

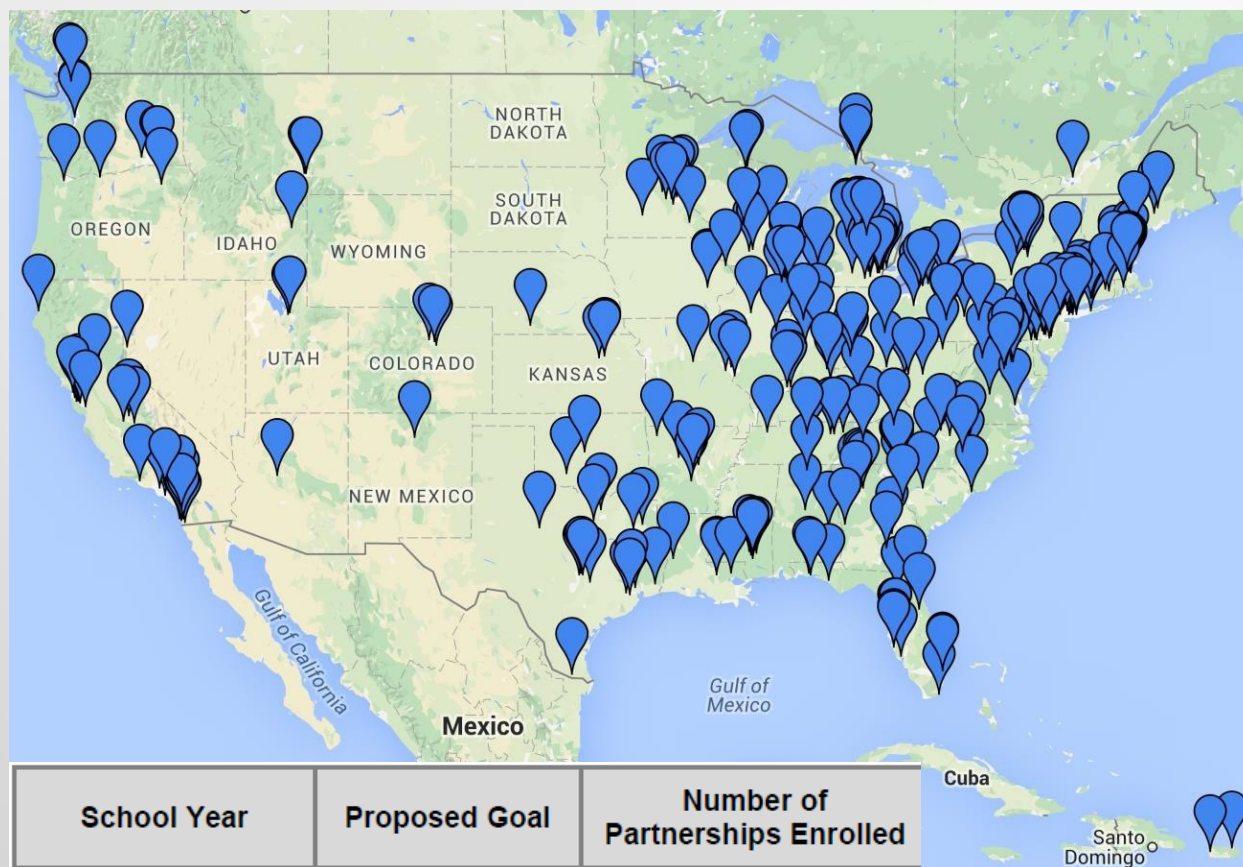


# One-on-One Science Coach

- Help plan and present demonstrations, experiments, and lessons
- Assist with student laboratory activities
- Provide career information
- Assist with a special project
- Advise an ACS High School ChemClub
- Mentor a Science Olympiad Team
- Tutor students



# Where are Science Coach Schools Located?



43 states,  
DC, and PR

School Year	Proposed Goal	Number of Partnerships Enrolled
2012-13	120	97
2013-14	150	168
2014-15	200	200
2015-16	250	TBD

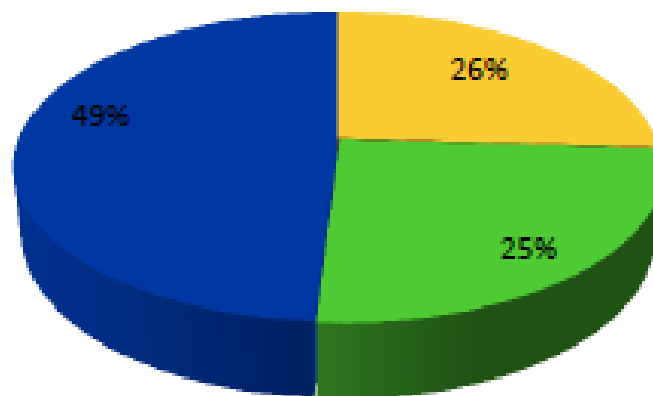
256

ACS Science Coaches  
Program Report, 2015

# Types of schools assisted by coaches

- Private: 19% vs. Public 81%

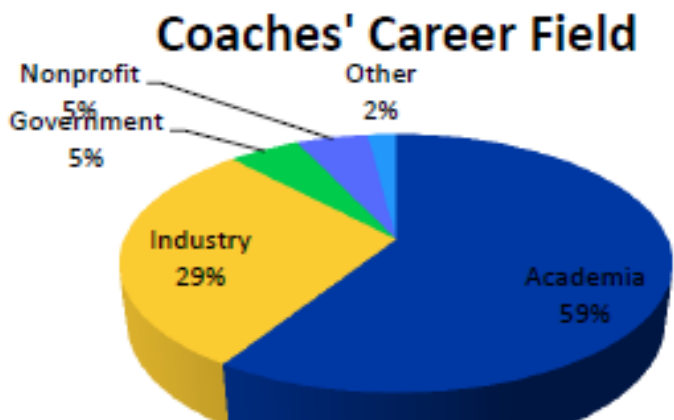
■ Elementary (Grades K-5)   ■ Middle School (Grades 6-8)   ■ High School (Grades 9-12)



Special School Types	Percent
Vocational	1%
Magnet	4%
Charter	5%
Single Gender Schools	1%



# Science Coaches and their Careers



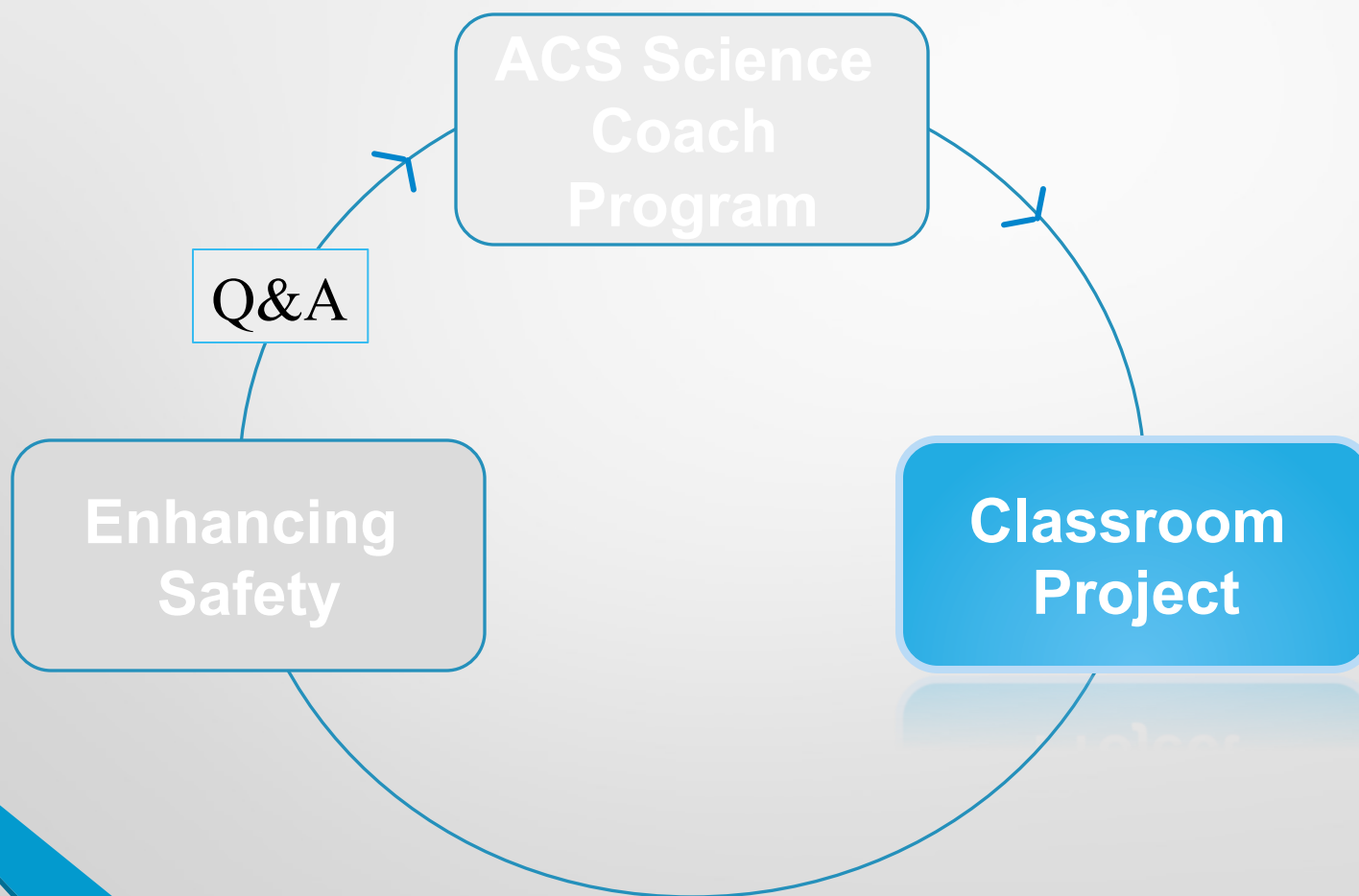
- Majority work in Academia
- 64% full time
- 14% retired or semi-
- 12% grad/postdoc
- 4% part-time

Safety consult = f(type of school, type of project activity)

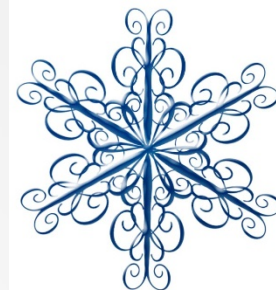
What do science coaches do?	
Assisted during science class or lab projects	74%
Planned lessons and demos	72%
Answered content questions from teachers and students	71%
Served as a guest speaker/presenter	69%
Helped teacher stay current with concepts	58%
Increased confidence teaching chemistry	56%
Provided additional items for the science classroom	54%
Consulted on lab safety issues	24%



# Agenda



# Classroom Project



- High School: Chemistry (9-12)
  - One semester; 24 students/session (4 students/table)
  - 90min daily divided between instruction+ laboratory
  - Traditional labs being taught mostly
  - Direct instruction in group and one-on-one
    - Schoology® - upload videos, articles, proctor tests
- Transitioning to Next Generation Science Standards
  - Comprises gathering, reasoning and communicating information
  - Translating mental models into visual representations
  - Project Topic: fun Holiday experiment in which students could use science & engineering to understand common phenomenon

## Crystal Formation

# Crystal Formation

- Flinn Scientific Inc Activities
  - Kits with materials for all 3 classes. Include safety precautions
- Crystal Ornaments
  - Forming crystals on chenille wires shaped by the students
- Crystal Forest
  - Assemble miniature trees and place them in solutions of ionic compounds



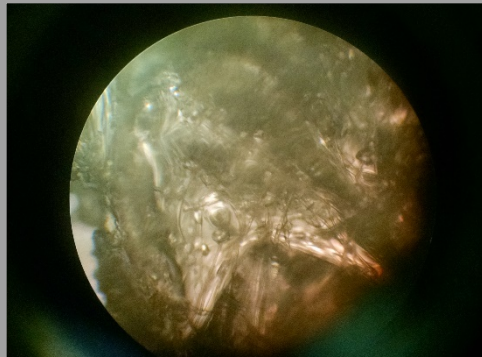
# NGSS Classroom Project: Summary

- Student Pre-work
  - Summarized what they knew “ What are Snowflakes?”
  - Did reading Supersaturated Solutions
- Day 1- Science Coach Intro and Crystal Labs
  - Class demo on sodium acetate crystallization and video
  - Overview lab+ safety precautions + did both lab
- Day 2- Lab and classwork completion
  - Examined crystal ornaments result and trees
  - Reading/questions on assisted nucleation crystal formation
  - Video on how snowflakes form
  - Had to respond “ A snowflake is like my crystal because...”

# NGSS Classroom Project: Summary



- Fun
- Loved the colors
- Creative
- Took lots of pictures
- Fragile (trees) → collapse easily



Microscope  
image of crystals

# Steps & Safety of Crystal Projects

## Crystal Ornaments

Bending of chenille wire (**sharp**)

Ensure it fits beaker-no touching wall

Heat 300 mL H<sub>2</sub>O to 80 °C (**burning**)

Weigh 50 g Na Borate

- **Toxic by inhalation/ingestion**

Add borate to hot water and mix

Insert ornament into solution

Allow solution to cool overnight

Tools: tongs (silicone rubber gripping device); “Surface is hot” sign

## Crystal Forest

Cut tree silhouette and assemble tree

Make solution (**DONE by instructor in advance**)

- Heat water to 80-90 °C.
  - Add NaCl & dissolve
  - Add bluing solution; mix
  - Add household NH<sub>3</sub>; mix; cool
- **Toxic by inhalation/ingestion**

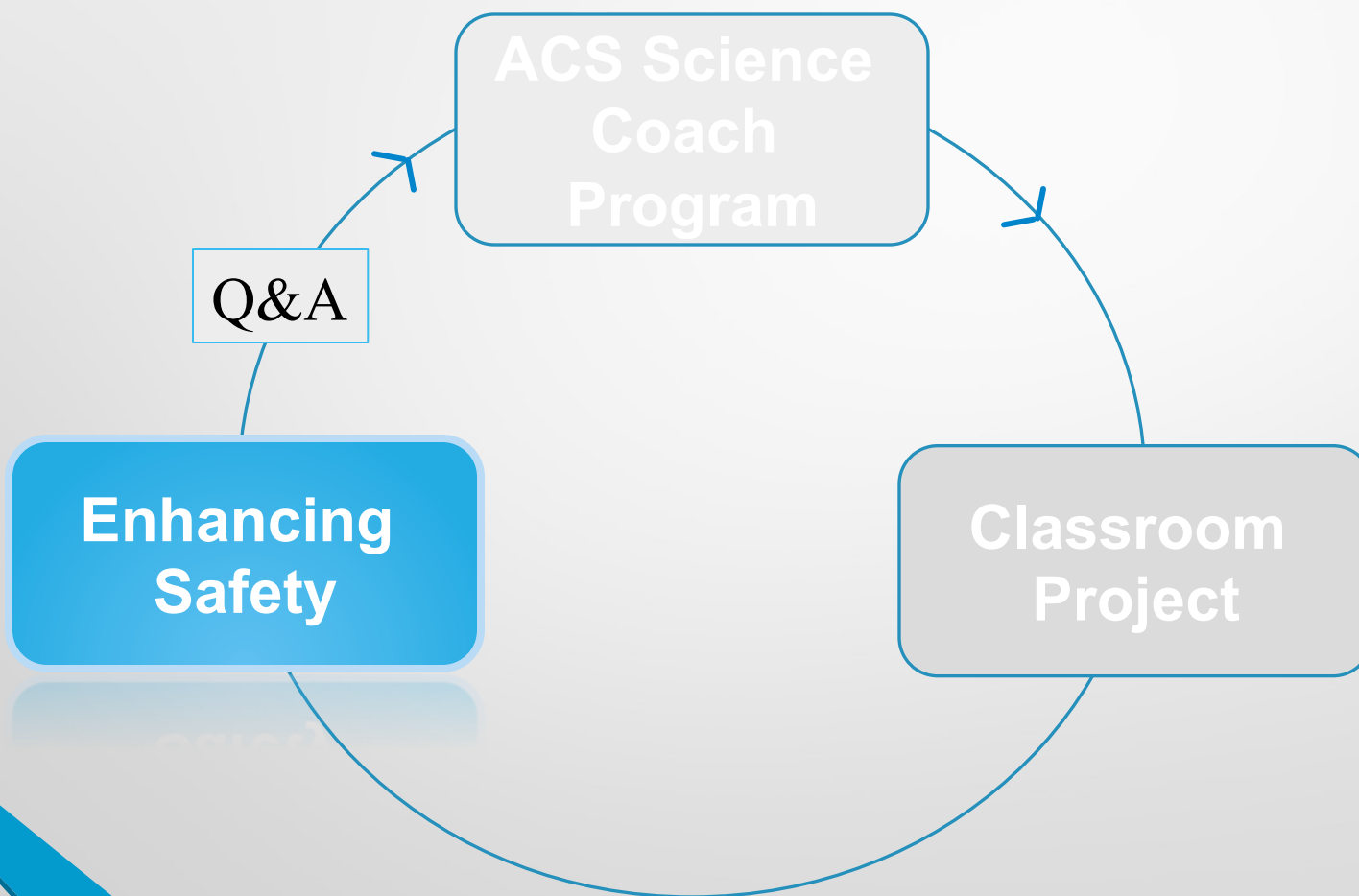
Pour 30mL solution into weighing dish containing tree

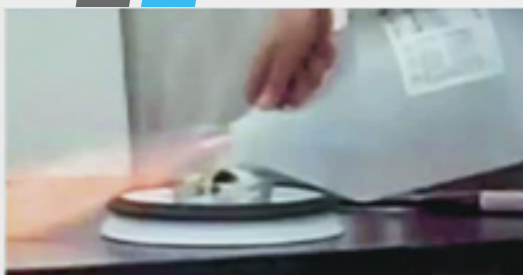
Allow crystals to grow. Do not disturb

**\*Safety Precautions are those listed in Flinn Scientific kits**

**PPE: Splash goggles; nitrile gloves; apron**

# Agenda





# Enhancing Safety



Rainbow  
incident in VA  
Oct 2015

Is there room for  
improvement?

"can I be  
next?"

## 2014 Events:

- Reno museum tornado
- Denver meoh fireball
- Cub Scout 2014  
boric acid+ anti-freeze
- Lack PPE, SOP, engg  
controls

- ACS Coach
- Fresh set of eyes
- Review experiments
- Provide feedback
- ACS Funding

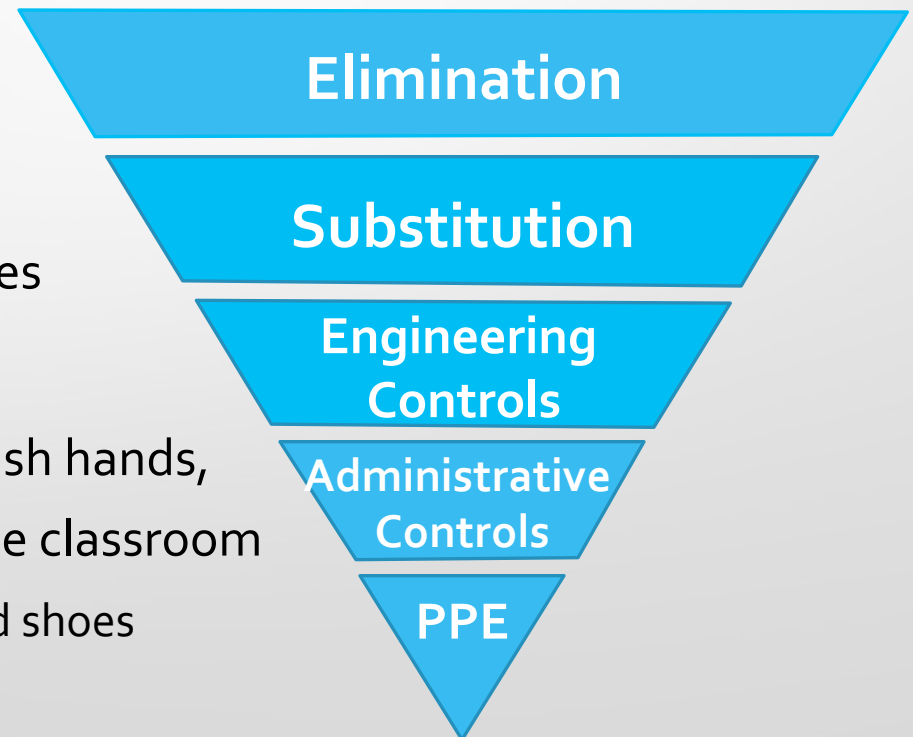
- Flammables
- New Regulations
- Sense of security



# Enhancing Safety

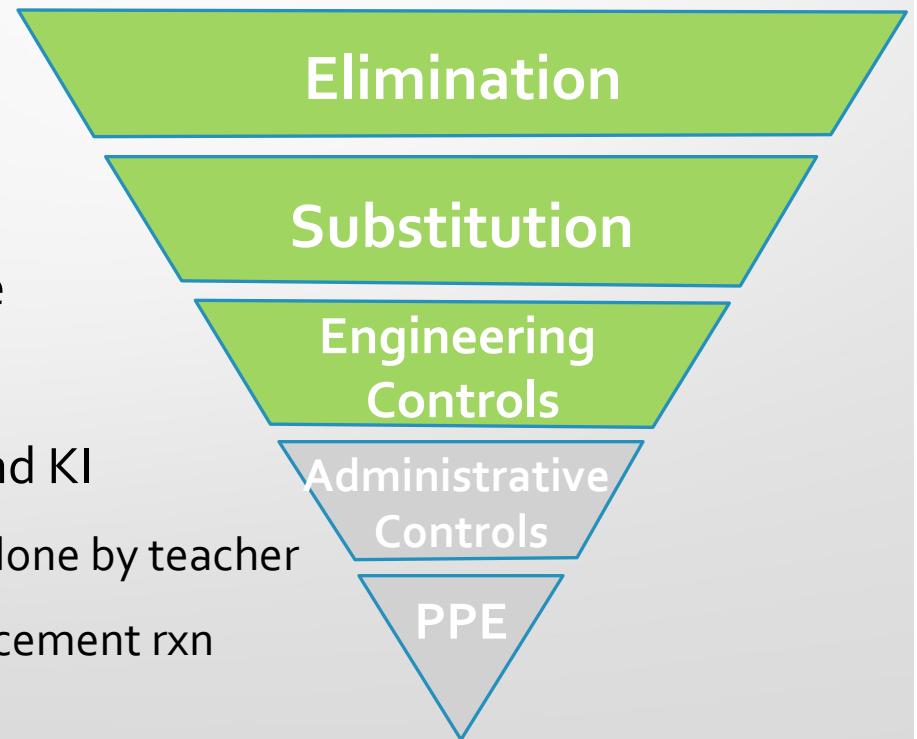
Reviewed 11 lab demonstrations/experiments- **in good shape**

- Separate chemical and prep room which is kept locked
- Safety manual available; safety training offered to students
- Sufficient benches; lab clean, organized; egress not blocked
- Extinguishers, showers/eye station; inspection up to date
- Written procedures available
- Students supervised at all times
- Minimum amounts reagents used
- Students/teacher use PPE, wash hands, follow instructions; signs in the classroom
  - Apron, safety glasses, closed shoes
  - Shorts/skirts not allowed



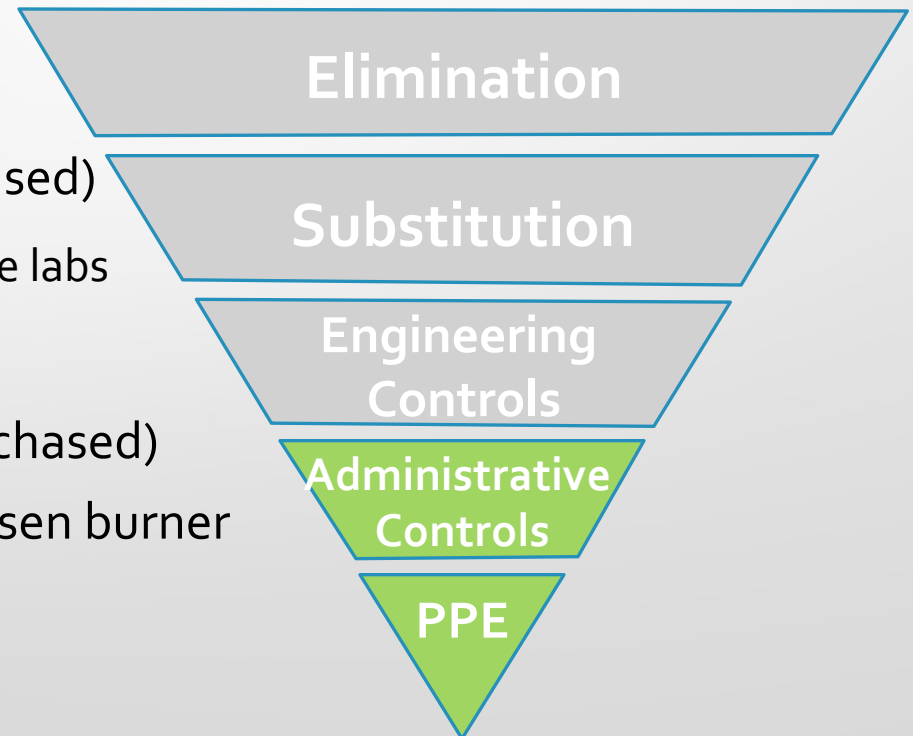
# Enhancing Safety

- Engineering Controls
  - No hood or bench shields in the classroom- typical in classrooms
    - One shield purchased for her demos
  - Redesign Bunsen burner setup
    - Must be secured
- Elimination and Substitution
  - Use heptane instead of hexane
    - “likes dissolve like” lab
  - Displacement rxn  $\text{Pb}(\text{NO}_3)_2$  and KI
    - Eliminate- Confirmed is just done by teacher
    - Or do different double displacement rxn



# Enhancing Safety

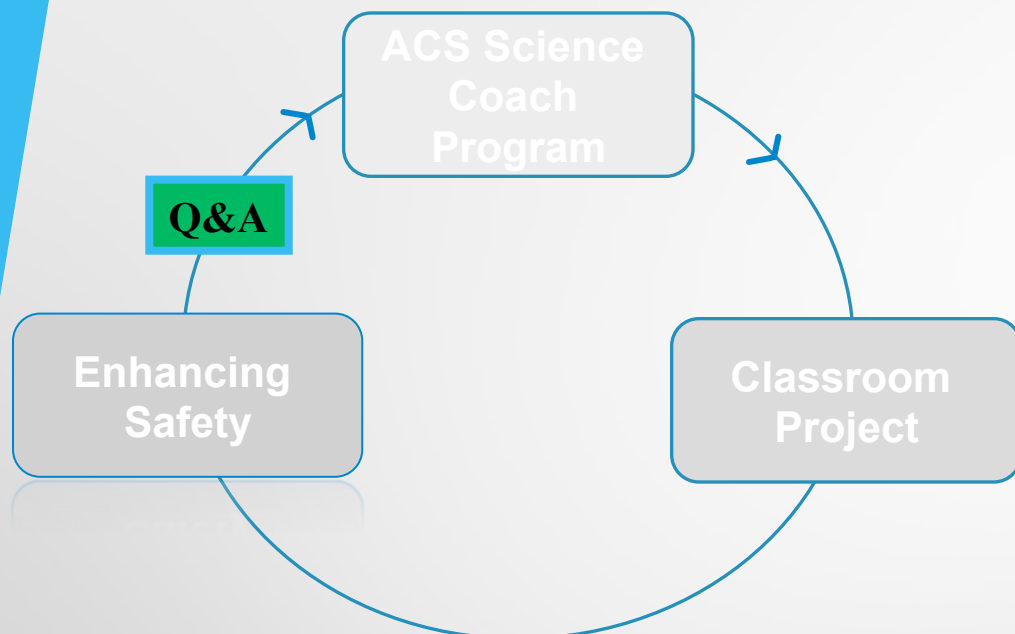
- Administrative Controls
  - More consistent use of signs on each bench "Surface is hot"
  - Update some SOPs to indicate the required PPE
  - Safety training pass grade 70% required. Parent agreement in English & Spanish
- PPE
  - Use of nitrile gloves (purchased)
    - Must wear gloves for some labs
    - Discourage use of latex
  - Shift to safety goggles (purchased)
  - Flame resistant gloves: Bunsen burner
  - FR lab coat for teacher



# Enhancing Safety as Lab Coach

- Suggestions/challenges
  - Do your homework first about school(s) to assist
  - Develop rapport and trust with teacher first
  - Highlight the positive being done school and classroom
  - Ask teacher if she/he interested in mentoring to enhance lab safety
  - Be ready to discuss with administration
  - Do at least 2yrs with the same school if possible
    - Follow up & continuity
  - Motivate colleagues with interest in safety to volunteer

# ACS Science Coaches



**SIGN UP/Info**  
**Booth 827 (Convention Ctr)**

<https://www.acs.org/content/acs/en/education/outreach/science-coaches.html>

“improving one classroom at a time”

## Acknowledgements

- ACS- Patricia Galvan
- University of Delaware
- Dr. Bramie Lenhoff- CBE  
Dept Chair at UD

