

SAFER ELEMENTARY SCIENCE!
NSTA Pre-Service Elementary
Teachers of Science
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***Presenter!**

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ON STAFF AT Glastonbury Public Schools (CT)

- Director of Environmental Health & Safety
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PRIVATE SAFETY PRACTICE

National Safety Consultants, LLC – General Manager

- Trained as Authorized OSHA Instructor;
- National Science Teaching Association (NSTA) Chief Science Safety Compliance Adviser and Blogger

-National Science Education Leadership Association (NSELA) Safety Compliance Officer

-International Council of Associations for Science Education (ICASE) Safety Committee Member

-Author of over 10 safety books and over 800 Professional Journal Articles on Safety

-Safety Researcher at Pennsylvania State University

Getting Up-to-date Safety News

- NSTA Safety Blogger – Ken Roy

<https://www.nsta.org/topics/safety#tab-safety-blog>

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Presenter!

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District Supervisor of Science Instruction –
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What Will We Focus On Today?

- Intro: Doing Safer Science
- I. Legal Standards & Better Professional Practices
- II. Engineering Controls
- III. Standard Operating Procedures
- IV. Personal Protective Equipment
- V. Duty of Care
- VI. Resources



BEST WAY TO LEARN SCIENCE/STEM!

- Hands-on, Process & Inquiry Based science/STEM!
- Doing science/STEM
NOT Reading about science/STEM!



Doing Science & Safety – Balance!

- “Doing” elementary science/STEM successfully can be a balancing act between instructional activities and safety!
- What is a balanced approach?



OBJECTIVES FOR SAFER ELEMENTARY SCIENCE!

- 1. Teachers need to be aware of potential safety hazards in the elementary science instructional space.
- 2. Teachers need to make their instructional space more organized to help reduce the chance of a safety incident.
- 3. Teachers need to better plan for a safer learning environment.
- 4. Teachers need to make students aware of safety in science.



I. Standard Operating Procedures For A Safer Laboratory: Based on Legal Safety Standards

- 29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories
- 29 CFR 1910.1200 OSHA's HazCom Standard
- NFPA Life Safety Code 101

OSHA Lab Standard



Better Professional Safety Practices



I. A. The OSHA Hazard Communication Standard (HCS) or HazCom (Subpart Z, Toxic and Hazardous Substances, 29 CFR 1910.1200)

- a. Purpose
- b. Scope and Application
- c. Definitions
- d. Hazard Determination
- e. Written Hazard Communication Program
- f. Labels And Other Forms of Warning
- g. Safety Data Sheets
- h. Employee Information and Training
- i. Trade Secrets
- j. Effective Dates



THREE ELEMENTS OF ELEMENTARY SCIENCE SAFETY!

To control teacher and student exposure to chemicals and other hazards in the science classroom or field, three general principles apply as a hierarchy of defense:

1. Engineering Controls
2. Administrative Controls (work practices or Standard Operating Procedures- SOPs)
3. Personal Protective Equipment (PPE)

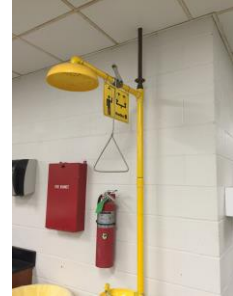
II. ENGINEERING CONTROLS!

- a. Preferred method to deal with hazards.
- b. Definition: Controls which remove or reduce exposure to a chemical or physical hazard by using or substituting engineered machinery or equipment.



Examples of Engineering Controls:

- Fire extinguisher
- Eyewash
- Shower
- GFCI electrical protection
- Ventilation
- Room Footprint
- Goggle Sanitizer



IIA. Eyewash – Engineering Controls

- Used to irrigate eye(s) if a chemical or particle lands in it.
- 10 second access
- 15 minute irrigation
- Tepid water 60 -100 F (15.6 - 37.8 C)
- Activated weekly/logged



IIB. GFCI Engineering Control

- Ground-fault interrupter = GFI
- GFI "breaks" the circuit when an object or water shorts the circuit or attempts to ground – prevents electrocution!



IIC. Goggle Sanitizer Cabinet

- Biologicals vs. Chemicals vs. Physicals!
- Goggle sanitizer cabinet kills bacteria and other life forms.
- Alternatives – alcohol wipes, antibacterial dish detergent.



IID. Ventilation

- Forced air movement to maintain indoor air quality



IIE. PROVIDE ACCESS FOR STUDENTS WITH DISABILITIES

- Tables
- Sinks
- Eyewash
- Wheelchair space



IIF GENERAL STORAGE

- Maintain a storage area/room for materials and equipment with locking cabinets and open shelving secured to wall or floor; equivalent to an area of 9.8 square feet per student.



III. STANDARD OPERATING PROCEDURES (SOPs) !

- SOPs or Work Practices involve changes in work procedures to better protect students and teachers.
- Examples include housekeeping, animal care, student behavior and more.



IIIA. Chemical Hygiene – No Food or Drink in the science classroom or laboratory!



IIIB. Proper Storage Chemicals & Food



Appropriate Chemical Storage



IIIC. Chemicals To Be Recycled



IIID. Labeling of Hazardous Chemicals



NFPA Labeling



Sample GHS Label

The Basic Parts of A GHS-Compliant Label

1 → **n-Propyl Alcohol**
UN No. 1274
CAS No. 71-23-8

2 → **DANGER**

3 → Highly flammable liquid and vapor. Causes serious eye damage. May cause drowsiness and dizziness.

4 → Keep away from heat/sparks/open flames/hot surfaces. No smoking. Avoid breathing vapor/mist/spray/aerosol. Wear protective gloves/protective clothing/eye protection/face protection. If it irritates: Rinse cautiously with water for several minutes. Remove contact lenses if present. Continue rinsing.

5 → Fill Weight: 10.65 lbs. Net Weight: 8.52/5434
Gross Weight: 20 lbs. Fib Date: 6/21/2013
Expiration Date: 6/21/2020
Aster Chemical Company • 711 Roadrunner Pl. • Chicago, IL 60611 USA • www.asterchem.com • 123-444-5567

6 → [GHS Pictograms: Flame, Exclamation mark]

- Product Identifier** - Should match the product identifier on the Safety Data Sheet.
- Signal Word** - Either use "Danger" (severe) or "Warning" (less severe).
- Hazard Statements** - A phrase assigned to a hazard class that describes the nature of the product's hazards.
- Precautionary Statements** - Describe recommended measures to minimize or prevent adverse effects resulting from exposure.
- Supplier Identification** - The name, address and telephone number of the manufacturer or supplier.
- Pictograms** - Graphical symbols intended to convey specific hazard information visually.

Sample label courtesy of Wilson Packaging Solutions • www.wilsonpackaging.com

Relabeling!

- Current commercial labels in your storage inventory are grandfathered and need not be updated.
- When moving the hazardous chemical to another container, the following information must appear on the new label:
 - Chemical Name
 - Concentration
 - Date Prepared
 - Hazard Information



GHS Hazard Communication - Pictograms

<p>Flame over circle</p> <ul style="list-style-type: none"> Oxidizers 	<p>Flame</p> <ul style="list-style-type: none"> Flammables Pyrophorics Self-Heating Emits Flammable Gas Self Reactives Organic Peroxides 	<p>Exploding bomb</p> <ul style="list-style-type: none"> Explosives Self Reactives Organic Peroxides
<p>Skull and crossbones</p> <ul style="list-style-type: none"> Acute toxicity (severe) 	<p>Corrosion</p> <ul style="list-style-type: none"> Corrosives 	<p>Gas cylinder</p> <ul style="list-style-type: none"> Gases under pressure
<p>Health Hazard</p> <ul style="list-style-type: none"> Carcinogen Mutagenicity Reproductive Toxicity Respiratory Sensitizer Target Organ Toxicity Aspiration Toxicity 	<p>Environment</p> <ul style="list-style-type: none"> Aquatic Toxicity 	<p>Exclamation mark</p> <ul style="list-style-type: none"> Irritant Skin Sensitizer Acute Toxicity (harmful) Narcotic effects Respiratory Tract Irritation Hazardous to Ozone Layer

Signal Words

“Danger” or “Warning”

- Used to emphasize hazard and discriminate between levels of hazard.

IIIE. Safety Data Sheet or SDS Format: 16 headings

1. Identification
2. Hazard(s) identification
3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure control/personal protection

Format: 16 headings (cont.)

9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

SDS Accessibility

- Employer is required to provide immediate access for employees to SDSs for all hazardous chemicals!



IIIF. Soil Activities: Pesticides, Herbicides & More!



Compost Pile Activity



Greenhouse Activity

IIIG. Heat Sources

- Candle
- Microwave
- Hot Plate
- Butane
- Alcohol Lamp



IIIIH. Dressing For Science Activities!

- Tie hair back
- Secure Loose clothing
- No hanging jewelry
- No flip flops or other open toed footwear
- No eating or drinking in science classroom or laboratory
- Always wash hands with soap and water after completing an activity



IIII. Hazardous Materials!

- Use only non-mercury equipment
- Safety matches
- Dry ice
- Battery acid



More Hazardous Materials!

- Hazardous Chemicals –
 - Vinegar?
 - Alcohol
 - Clay



IIII. Biologicals – Allergens!

- Use caution when working with plants and animals
- Mold
- Bacteria
- Flowers
- Fruit/Nuts
- Poisonous plants
- Mammals
- Birds
- Owl Pellets
- Other



IIIIJ. CLEAN-UP & Disposal Procedures!

- Assign clean-up duties upon completion of the activity
- Do not allow students to clean-up chemical spills or broken glassware
- Return all materials to appropriate areas as determined by the teacher.



IIIIK. CLEAN-UP & Disposal Procedures!

- Always follow SDS disposal procedures for hazardous materials.
- Flinn Scientific also is a good source.



IIIL. Acknowledgement Forms Student Safety Awareness

- After science activity training, provide safety acknowledgement form noting safety expectations and hazards.
- Both parents and students sign!
- <https://static.nsta.org/pdfs/SafetyAcknowledgmentForm-ElementarySchool.pdf>



IIIM. First-Aid

- Where local BOE policies permit, there should be an adequately stocked first-aid kit easily accessible for emergency use.
- Phone numbers and means of communication available:

School nurse
Poison control
1-800-222-1222



IIIN. FIELD TRIPS

- BOE Policies
- Visit & Survey the site BEFORE bringing students
- Inform parents/guardians/administration (acknowledgement form)
- Be aware of medical and physical issues
- Plan for appropriate adult supervision – 1:10
- Group students in pairs (buddies) or teams
- Have means of communication – cell phone
- Review student behavioral expectations
- Use appropriate PPE



IIIO – Animal Studies!

- The following animals can be worked with in the science classroom/laboratory, but with caution:
- Animals with fur (allergy potential)
- Turtles (Salmonella infection potential)
- Birds (Psittacosis infection potential)
- Fish (bacterial infection potential)



IIIP – Animal Studies!

The following animals should not be allowed in the school or science classroom/laboratory:

- Wild animals
- Spiders which are poisonous such as black widow or brown recluse spiders
- Venomous reptiles and fish
- Scorpions
- Stinging insects such as bees, hornets and wasps (save self-contained observation hives)



IIIP – Animal Studies!

- **Check with local Division of Fish & Wildlife Services**
- **NSTA Position Statement:**
- **“Responsible Use of Live Animals and Dissection in the Science Classroom”**

<https://www.nsta.org/nstas-official-positions/responsible-use-live-animals-and-dissection-science-classroom>



IIIR – Grocery Items for Experiments!

- 1. Know the source!
- 2. Know your student's allergies!
- 3. Read the labels!
- 4. Do not allow eating of items.
- 5. Check for evidence of insects, fungi, etc.
- 6. Wash hands with soap and water after handling.



IIIS – Visitors To Classroom

- Make sure you know who you are inviting in to the classroom to work with students!
- Clearly state the objective or purpose.
- Review safety procedures in advance.
- Review security procedures in advance.
- Advise administration of visitor.
- Get feedback from visitor and students.



IV: PERSONAL PROTECTIVE EQUIPMENT

- When engineering controls are not sufficient, personal protective equipment or PPE must be used!
- PPE includes clothing or other devices worn to help protect a student or teacher from direct exposure to a safety hazard or situation.
- Examples: Gloves, eye protection, aprons



BEST PROFESSIONAL PRACTICE EYE PROTECTIVE DEVICES – NATIONAL SCIENCE TEACHING ASSOCIATION

- ANSI Z87.1 approved chemical splash goggles or safety glasses, as appropriate or directed by your instructor, shall be worn at all times in the laboratory or field, including pre-laboratory work and clean-up, unless the instructor specifically states that the activity does not require the use of chemical splash goggles or safety glasses.
- <https://www.nsta.org/personal-protective-equipment>

Appropriate Eye Protection Devices Indirectly Vented Chemical Splash Goggles



Safety Glasses - Activity

- Eye protection required for:
 - Glassware
 - Sharps – needles, pins, compasses, etc.
 - Large levers – meter sticks



IVC. Personal Protective Equipment

- Body - Aprons



PPE: Electricity Study

- Wires are considered sharps and require eye protection!



V. Duty of Care

High Duty or Standard of Care For Teaching Science/STEM:

- a. Duty of Instruction – adequate direction prior to activity
- b. Modeling of Safety – adequate “showing” of procedure
- c. Duty to warn – showing possible safety issues



Expectations

d. Duty of Maintenance – ensuring a safe environment/equipment

e. Inspection of Safety – ensure safety is being followed

f. Duty of Supervision (Enforcement of Safety)

g. Liability of Safety -

Negligence of Safety – conduct falling below a standard of care established by law or profession to protect form unreasonably risk of harm or failure to exercise due care.



VI. Resources – Internet!

- NSTA Science Safety Portal:
- <https://www.nsta.org/topics/safety>



Let's pause for questions
— from the audience



