Chemical Hygiene Officer
CHO
Training

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Outline

- Are chemicals hazardous?
- Assessment of HazChems
- Legal Requirements
- Roles and Responsibilities of CHOs and staff
- Documentation

LIMITATIONS OF THIS TRAINING

- Time limitation for a very large and deep subject.
- This training does not cover ALL legal requirements, best practices, all aspects of science lab safety, or the role of the CHO.
- Employer is RESPONSIBLE for employee safety; employees must follow rules.
- You must continue to customize the information provided to be SPECIFIC to your situation.

Goals

- Protect the health and safety of staff and students.
- Protect the environment (sewer, storm drains, indoor and outdoor air, solid waste).
- Legal compliance.
- Responsible management of science lab finances.

Paradigm Shift -
Safety built into curriculum and the whole HazMat handling process.

ARE CHEMICALS HAZARDOUS?

- Why and Why not?
- What are the influencing factors?
- How do we know?
  - Assessing chemical hazards.

Today we focus on management and organization of lab safety.

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Too much of a good thing

hazardous waste disposal at a High School

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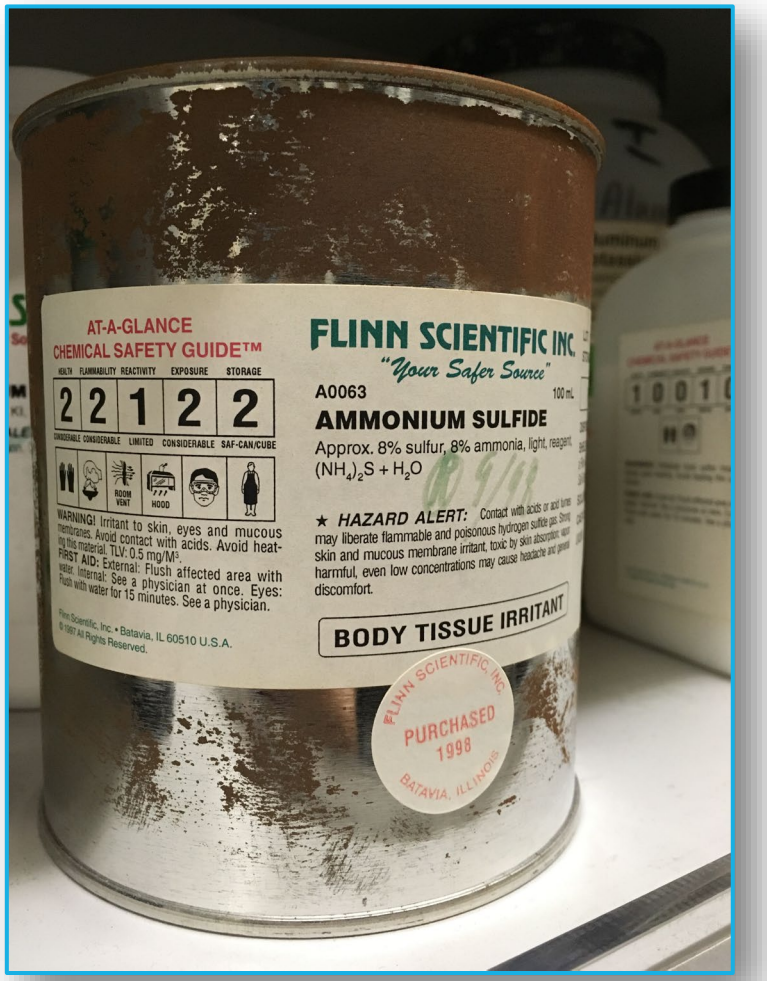
22 YEARS OLD



The label reads:

"May release flammable and poisonous hydrogen sulfide gas."

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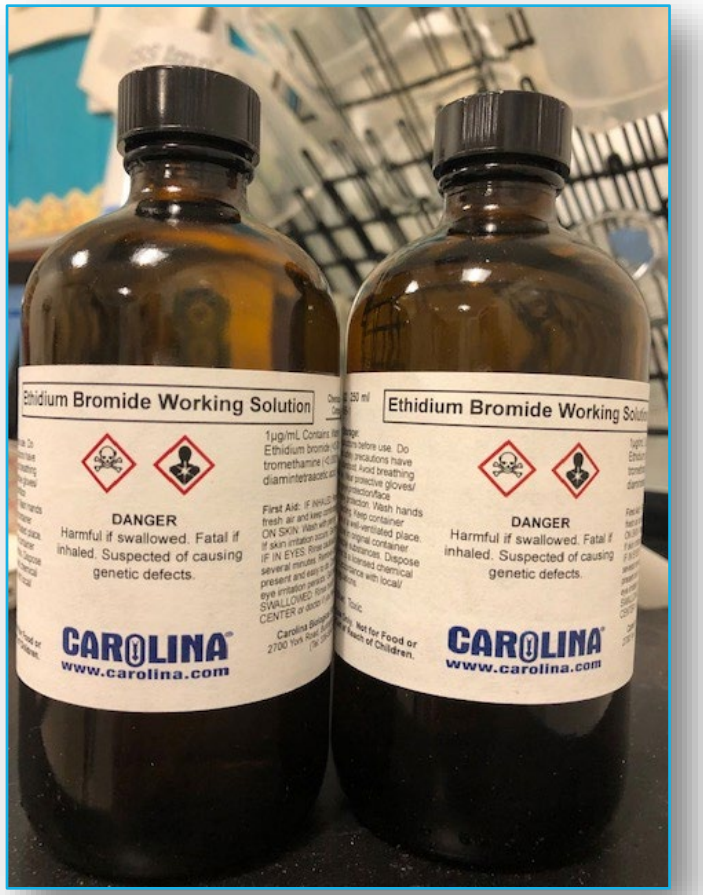
The label reads:

"Fatal if inhaled."



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IN THE NEWS

October 2015:

Five students and teacher injured in school science lab fire in Virginia.

July 2019:

$60 million awarded to N.Y. student engulfed in flames in chemistry accident.

What are the Hazards?

- Unstable/Explosive
- Flammable or combustible
- Highly reactive (with water, air, organics, etc.)
- Toxic (acute and/or chronic toxicity; target organ toxins, carcinogens)
- Corrosives
- Irritants, sensitizers

Reference: WAC Chapter 296-828

EXAMPLES OF HIGH-RISK CHEMICALS IN SCHOOLS:

Peroxide Forming Chemicals & Explosives	Water & Air Reactives	Toxic Corrosives	Carcinogens & Severe Toxins	Inhalation & Skin Absorption Hazards
• Picric acid • Nitroglycerin • Sodium azide • Ethers • Nitrotoluenes	• Potassium • Sodium • Calcium carbide • Phosphorus	• Hydrofluoric acid • Iodine • Bromine • Chlorine gas • Strong acids • Strong oxidizers	• Arsenic • Cadmium • Mercury • Formaldehyde • Cyanides • Chromium compounds	• Formaldehyde • Mercury • Toluene

WHAT INFLUENCES THE HAZARDS?

- **Quality**
  - TNT, sodium metal, concentrated acids, strong solid oxidizers, crystalline iodine, volatile toxins
- **Quantity**
  - How much of the hazardous chemical enters the body
  - How concentrated is the solution we work with?
- **Storage and Use Environment**
  - Safety equipment, ventilation, PPE, techniques
- **Exposure time**
- **Health of the person exposed**

Risk and Dose

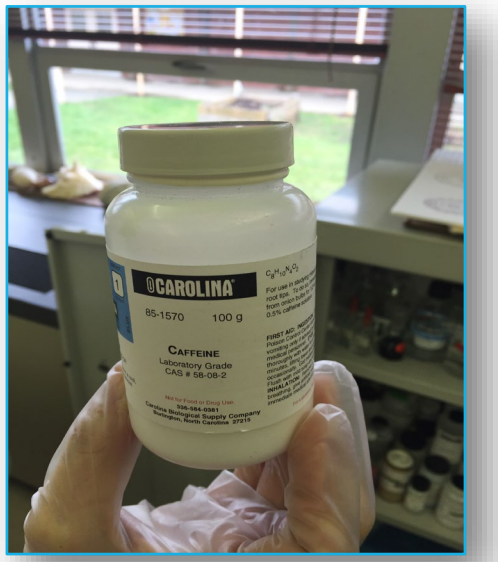
- Dose makes the "poison"

Dose = Concentration X Exposure Time

- Route(s) of Entry
  - Inhalation
  - Skin contact
  - Ingestion
  - Injection

Caffeine Dose

- Generally recognized as safe by the Food and Drug Administration.

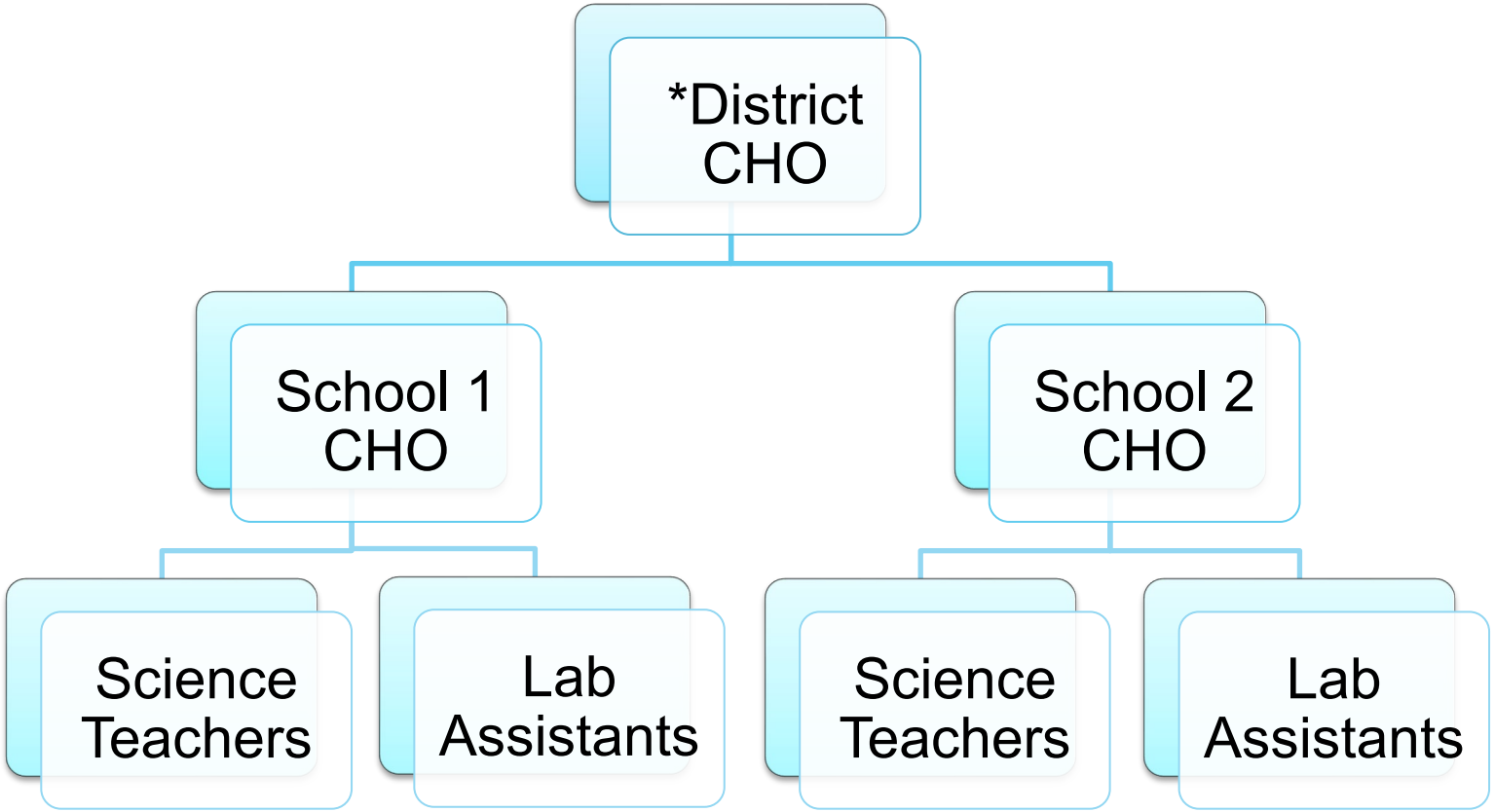


- **Lethal dose:**
  - 50-100 cups of coffee a day (diluted).
  - A few teaspoonfuls of concentrated, pure caffeine powder!

CHO - Definition

OSHA definition from 29 CFR 1910.1450:

"Occupational exposure to hazardous chemicals in laboratories: **Chemical Hygiene Officer** means an employee who is **designated** by the employer, and who is **qualified** by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan."



*Designated and supported by District Administration.

- ✓ Collaboration
- ✓ Coordination
- ✓ Communication

Going from individual "kings" of labs and classrooms to collaborative professional collectives.

District CHO in Schools

- **Designated**
  - For the WHOLE district, by the superintendent's office
- **Supported**
  - By administration, finances, maintenance and operations, custodial services, science, and science staff
- **Trained**
- **Has Authority**
- **Coordinates & Leads**
  - The safety related work of School CHOs

Roles & Responsibilities of CHOs

- Implement the Chemical Hygiene Plan

- Planning
- Outreach and communication
- Documentation
- Inspections
- Training (organizing, verifying and/or presenting)

Determine the what, who, when, how, why, with whom…? of lab safety.

Collaboration & Partners

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Chemical Hygiene Plan (CHP)

- You will receive and editable copy
- It's the same that was distributed by the King County Rehab the Lab program
- Must be customized to your needs and specific situations
- Work on it collaboratively
- Update yearly or when significant changes occur
- Use it as a training tool
- Easily accessible, saved on shared drive

Legal Responsibilities of a Science Teacher*

- Duties of science teachers relating to the modern concept of negligence:
  - Duty of instruction
  - Duty of supervision
  - **Duty of maintenance**

References: NSTA, Council of State Science Supervisors

NSTA Position Statements

- Liability of Science Educators for Laboratory Safety (on liability and duties), revised 2017.
- Safety and School Science Instruction (on good professional practices).
- **Job description specific to Science Teachers by HR?**

Reference: NSTA Positions

Quote From NSTA:

"Educator's duty to maintain the safest learning environment possible while providing science instruction should be shared by school leaders, district administrators, school boards, parents and students."

TEACHING SCIENCE SAFELY

BEFORE you perform an experiment or demo:

- You KNOW the hazards.
- You KNOW both the reagents and the products of the reactions
- You KNOW the worst things that can happen.
- You KNOW what to do and how to do if the worse happens.
- You KNOW and use the prudent practices, protective facilities and PPE needed to minimize risk.
- You have tried out the experiment/demo multiple times before you introduce into the classroom.
- You are aware of the hazards of upsizing experiments/demos and make safety adjustments for it.
- You TEACH SAFETY to students - do you have a "safety contract" with the students and their parents/guardians?

LIABILITY

- Negligence creates liability.

- Negligence:
  - A professional failing to act in a reasonable and prudent manner.

- Can a professional say: "I didn't know."

Chemical Reactions – Evaluate All Compounds

- A + B ⟹ C + D
- Reagent 1 + Reagent 2 ⇄ Product 1 + Product 2 ↑
- Most of the times a mix of reagents and products
- Must know the hazards of both reagents and resulting products
- It can be flammable or toxic gas released into the air, ex burning sulfur

Teachers are Responsible For:

- Own health and safety.
- Student health and safety.
- Health and safety of all who might be exposed to their lab chemicals.
- Short-term and long-term health effects.
- Finances associated with teaching science.
- Potential damage to facilities.

SAFETY

- District safety culture promoted and supported from the top down.
- Everyone assumes personal responsibility and accountability for safety.
- Collaborative effort.
- **Awareness (training) & Safety First mindset.**

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The Law in Washington State

- HazChems in Labs: **WAC 296-828 (2006)**
- L&I Core Rules: **WAC 296-800**
- Other: fire safety, building codes, emergency response, etc.
- Follow Washington State regulations.

The law is only the MINIMUM; follow BEST PRACTICES.

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The Law Addresses

- Chemical Hygiene Plan (CHP)
- Exposure evaluation
- Employee information and training
- Labeling and MSDS/SDS
- Medical evaluations
- Roles and responsibilities (general)

SAFE MANAGEMENT OF HAZCHEMS

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Risk Assessment

- Who?
- What?
- When?
- Why?
  - Is this even needed?
- How?
  - Techniques/step-by-step process?
- Using what?
  - Chemicals?
  - Tools?
  - Equipment?
- Under what conditions
  - Ventilation?
  - Safety equipment?
  - PPE?
- How long and how frequently?

WHAT CAN POSSIBLY GO WRONG?

Anything that can go wrong is a hazard or a risk.

PLANNING
BEFORE PURCHASING CHEMS

- Curriculum – what concepts are thought?
- What experiments and demos?
- What chemicals are needed?
- Are these chemicals hazardous, ban candidates, expensive, hard to dispose?
- How much do we need? (1 to 2-year supply).
- Do we have appropriate lab, storage, safety equipment, PPE?
- What happens at the end (hazardous waste disposal)?
- What happens in case of emergency (spill)?

CHEMICAL HAZARD ASSESSMENT

- Labels
- MSDS/SDS
- School Chemical List posted on WA DOH School Health and Safety web page and "Ban Candidates" list
- NIOSH (hard copy handbook and on-line).

Evaluate hazards BEFORE ordering chemicals –
This is the basis of fulfilling or rejecting an order request.

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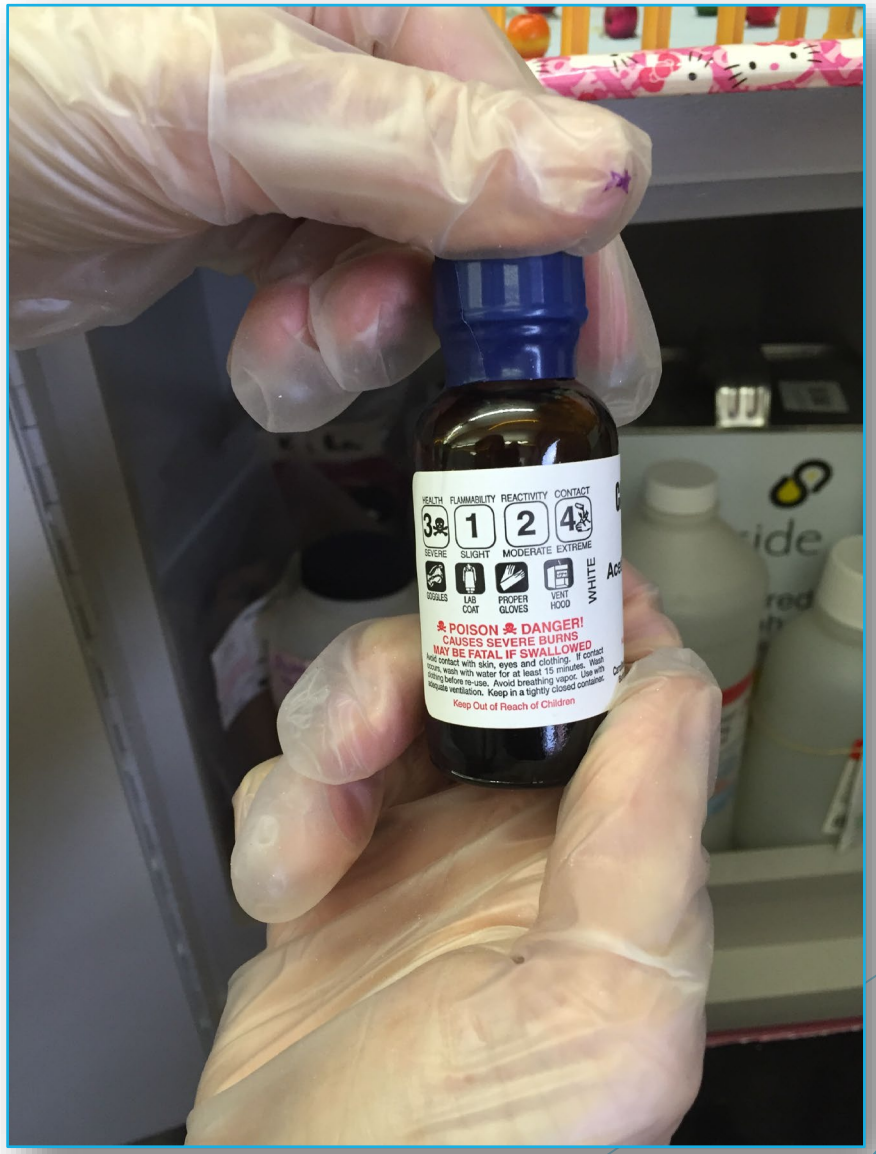
School Chemicals List/Database

Chemical Name	Acute Exposure Hazard	Chronic Exposure Hazard	Environmental Toxicity	Minimum Grade Level Restrictions	Storage Category	CAS #	Inventory Number of Containers	Inventory Containers Capacity	Inventory Units
Abscisic Acid	No acute toxicity data reported	No confirmed human disease-related or reproductive hazard data reported	No fish toxicity data	Elementary demonstrations only	O-1	14375-45-2			
Acetal	Explosion risk from peroxide formation. Flammable. Slightly toxic by ingestion & skin contact. Irritant.	No confirmed human disease-related or reproductive hazard data reported	No fish toxicity data	Ban Candidate	O-3 Flam Cabinet	105-57-7			
Acetaldehyde	Explosion risk from peroxide formation. Flammable. Slightly toxic by inhalation, ingestion and skin contact. Irritant to eyes.	Liver function impairment	Toxic to fish	Ban Candidate	O-3 Flam Cabinet	75-07-0			
Acetamide	Slightly toxic by ingestion	No confirmed human disease-related or reproductive hazard data reported	Non-toxic to fish	Junior High	O-2	60-35-5			

https://doh.wa.gov/community-and-environment/schools/environmental-health

Risk assessment –
read the label



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Assessing Chemical Exposure Hazards

- What are the hazards?
- Which routes of exposure?
  - Inhalation & multiple routes!
- Amount and concentration used
  - Demonstration or student experiment?
- What kind of safety equipment is needed?
- PPE needed?

Purchase
45 Pounds of poison

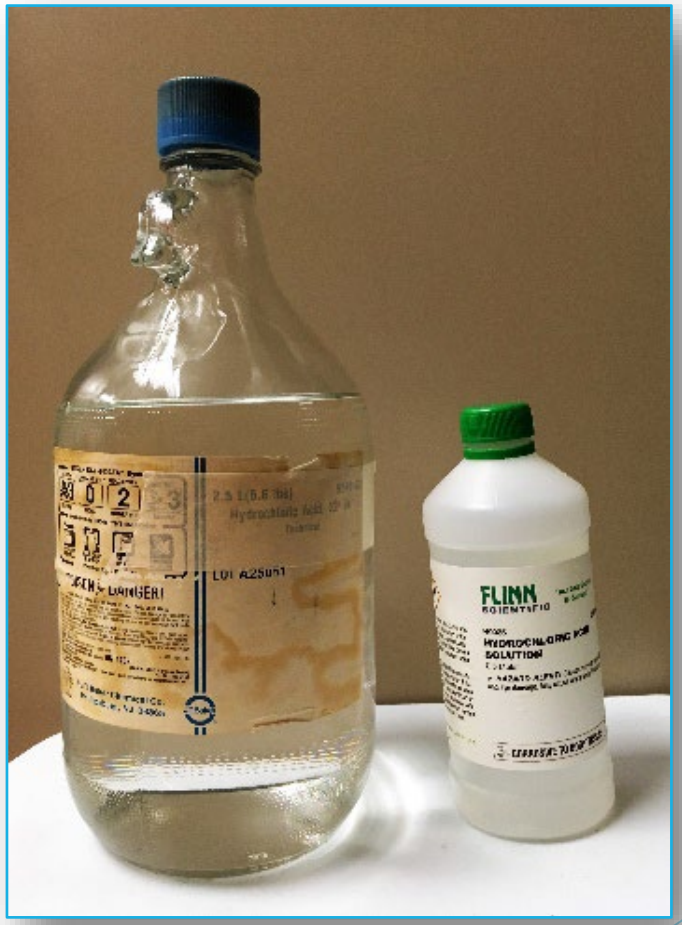
- Smallest amount
- Lowest concentration
- Sturdiest packaging

Approx. 2 years' worth of supplies

Acid purchase and storage
The BAD and the GOOD

Notice:

- Size, weight
- Concentration
- Container Material
- Spill



Storage Overview

- Housekeeping, satellite storage, labeling
- Acid and flammable cabinets
- Too much, too strong, too old
- Separating oxidizers
- Shelf material, lips and height
- Above head/high storage
- Exits, slips, trips, and falls
- Chems going back to appropriate cabinet
- Spills

- Use the FLINN SCIENTIFIC Storage Pattern

FLINN STORAGE PATTERN – INORGANIC (I)

SUGGESTED SHELF STORAGE PATTERN—INORGANIC

INORGANIC #10
Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide

INORGANIC #2
Halides, Sulfates, Sulfites, Thiosulfates, Phosphates, Halogens, Acetates, Oxalates, Phthalates, Oleates, Iodides

INORGANIC #3
Amides, Nitrates (not Ammonium Nitrate), Nitrites, Azides
(Store Ammonium Nitrate away from all other substances—*ISOLATE IT!*)

INORGANIC #1
Metals & Hydrides
(Store away from any water.)
(Store flammable solids in flammables cabinet.)

INORGANIC #4
Hydroxides, Oxides, Silicates, Carbonates, Carbon

If possible avoid using the floor.

INORGANIC #7
Arsenates, Cyanides, Cyanates
(Store away from any water.)

INORGANIC #5
Sulfides, Selenides, Phosphides, Carbides, Nitrides

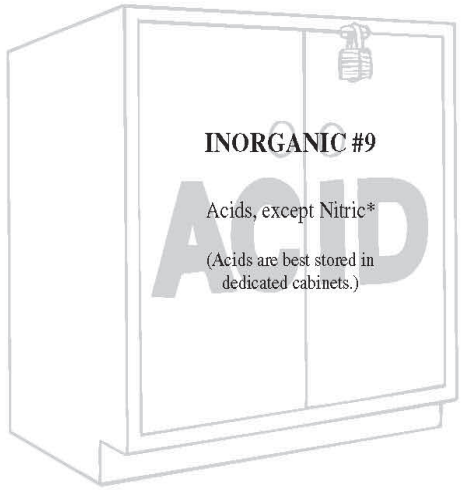
INORGANIC #8
Borates, Chromates, Manganates, Permanganates, Molybdates, Vanadates

INORGANIC #6
Chlorates, Bromates, Iodates, Chlorites, Hypochlorites, Perchlorates, Perchloric Acid, Peroxides, Hydrogen Peroxide

MISCELLANEOUS

Storage Suggestions

1. Avoid storing chemicals on the floor (even temporarily).
2. No top shelf chemical storage.
3. No chemicals stored above eye level.
4. Shelf assemblies are firmly secured to walls. Avoid island shelf assemblies.
5. Provide anti-roll-off lips on all shelves. (Catalog No. SE1069)
6. Ideally, shelving assemblies would be of wood construction.
7. Avoid adjustable metal shelf supports and clips. Better to use fixed, wooden supports.
8. Store acids in a dedicated acid cabinet. Store nitric acid in the same cabinet **only** if isolated from other acids. Store both inorganic and some organic acids in the acid cabinet.
9. Store flammables in a dedicated flammables cabinet.
10. Store severe poisons in a dedicated poisons cabinet.



*Store nitric acid away from other acids unless your acid cabinet provides a separate compartment for nitric acid.

Acid Cabinets – Good & Bad

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USING CHEMICALS SAFELY

- Guidelines in Chemical Hygiene Plan model
- Preparing experiments/demonstrations – **never alone!**
- Safe standard procedures in writing.
- Consider activities - lab/shop environment.
- Clothing and behavior in labs and storage.
- Safety equipment and personal protective equipment (PPE).
- Training for staff and students.

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HOUSEKEEPING

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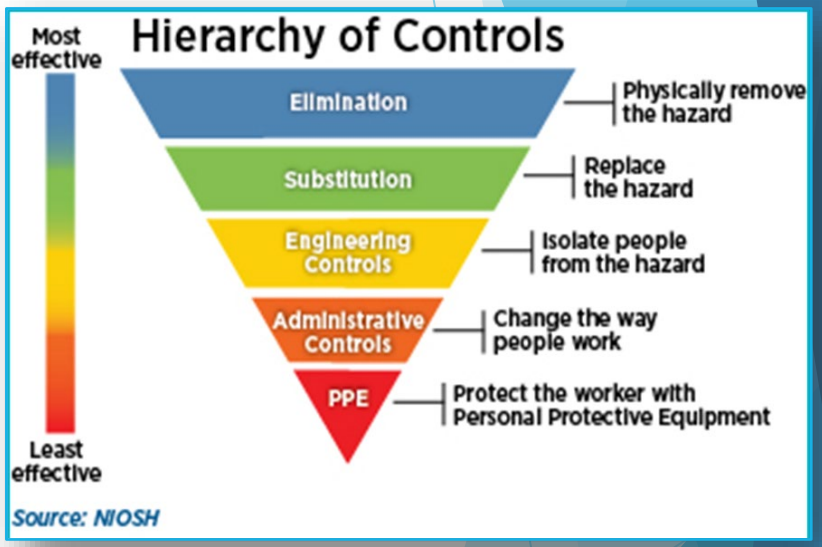
Risk/Hazard Control

- Elimination:
  - Don't buy or dispose of it.
- Substitution:
  - With less hazardous alternatives, smaller amounts or weaker solutions.
- Engineering controls:
  - Building, lab and workstation design; ventilation, fume hood, safety shower, eye wash, sturdy, closed containers.
- Administrative control:
  - CHO, CHP training, safety contracts, fire preparedness, spill plans, waste disposal program.
- Personal Protective Equipment (PPE):
  - Goggles, gloves, aprons, appropriate clothing & footwear.



TRAINING

- At the time of initial assignment:
  - **Train new teachers in August!**

- Before new exposure/hazard is introduced:
  - New experiment, new chemicals, different concentrations, etc.

- Refresher training:
  - Yearly

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LAB (SELF-) INSPECTIONS

Recommend K-12 self-inspection checklist

Enter corrective actions in “notes”

Document - save in central file

Follow-up

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SPILLS – WHO IS RESPONSIBLE?

- Legal requirements
- Spill Plan in writing
- Primary contact
- Trained personnel
- Spill kits
- Proper disposal of wastes
- Notification requirements

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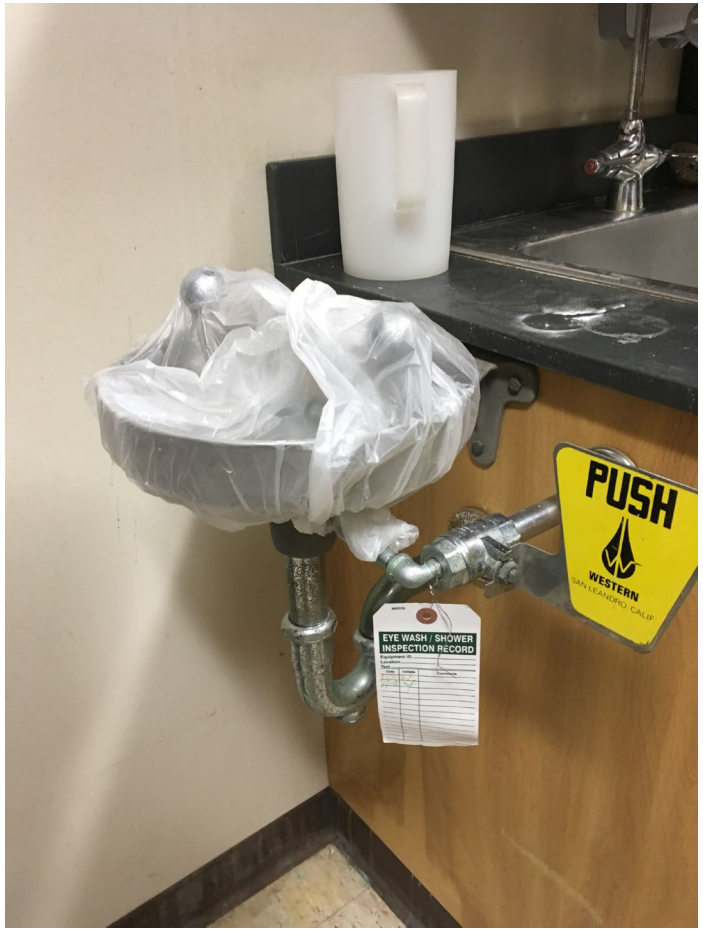
SAFETY EQUIPMENT

EYEWASH AND FUME HOOD???



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Waste Disposal

- PROPER disposal
- NOT sewer, garbage, air, ditch
- What's the balance of materials purchased and materials properly disposed of?
- Highly regulated in WA; use state sources
- Up to 500 times more expensive than purchase
- Small scale experiments reduce waste: www.smallscalechemistry.colostate.edu

- DO YOU HAVE A PLAN AND BUDGET FOR WASTE DISPOSAL?

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Expand on These Subjects:

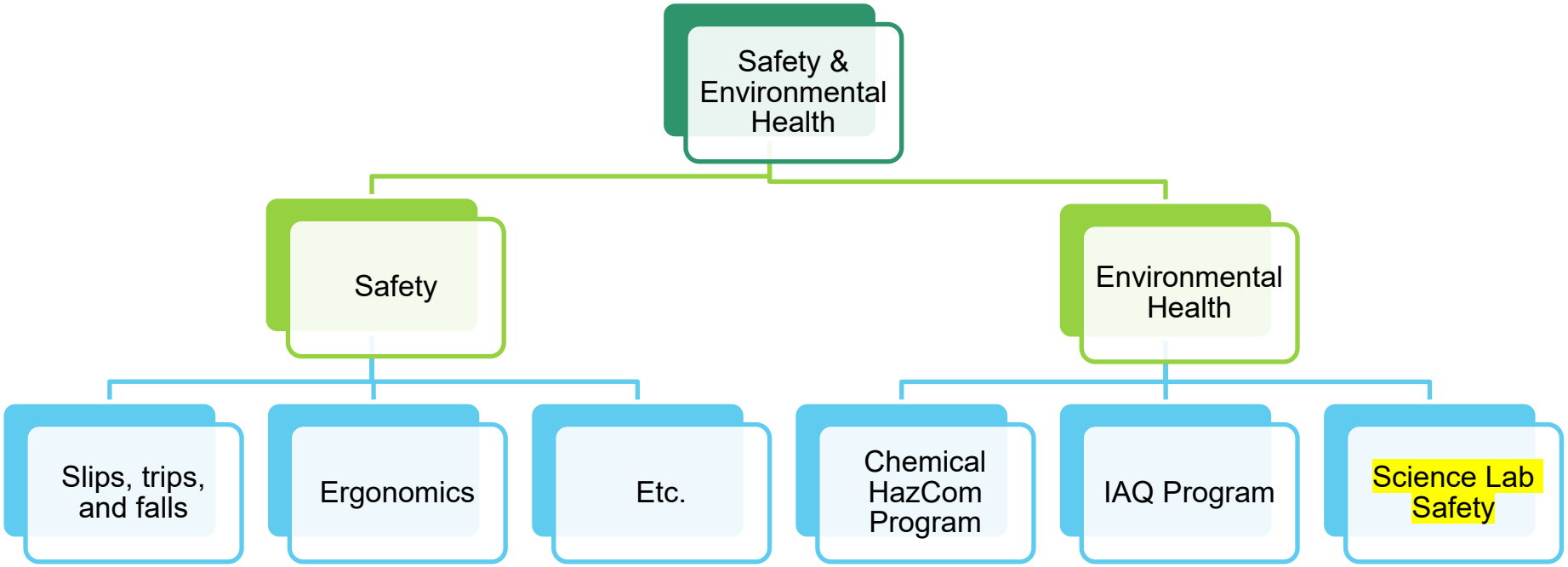
- Hazard communication, inventory, labels, SDS
- Chemical storage
- Safe use of chemicals
- Facilities and safety equipment
- Personal protective equipment (PPE)
- Fire & electric protection
- Spill prevention and cleanup
- Hazardous waste management
- General hazards
- TRAINING

DOCUMENTATION & INSTITUTIONALIZATION

- If it's not in writing it didn't happen.
- Can I find it? Is it up to date?
- Who has access to it?
- Who was trained on it?
- Who remembers it?
- Consider staff turnover.

Recommend saving on district's shared drive: Safety/Science Safety/…

Documenting Safety on District Shared Drive



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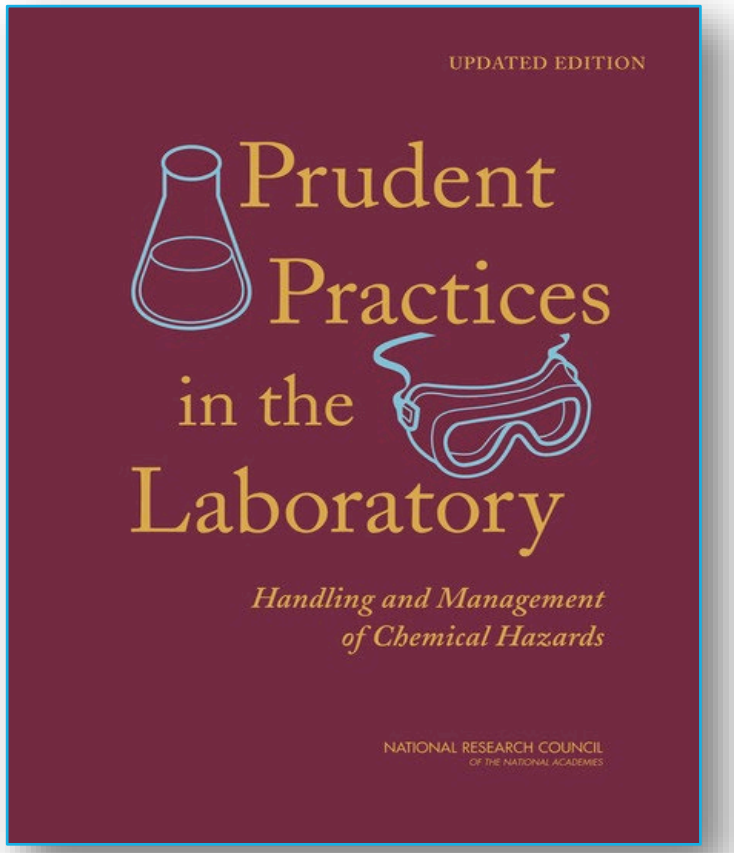
BEST MANAGEMENT PRACTICES

FREE DOWNLOAD



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Action Plan

- Find the CHP and update it or start a new one.
- Evaluate your labs and storage areas.
- Properly dispose of wastes.
- Organize storage area.
- Continue with self-inspections and corrective actions.
- Planning, planning and more planning before purchasing or using chemicals.

- Collaboration

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PSESD on Facebook

PSESD LinkedIn

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PSESD YouTube Channel

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