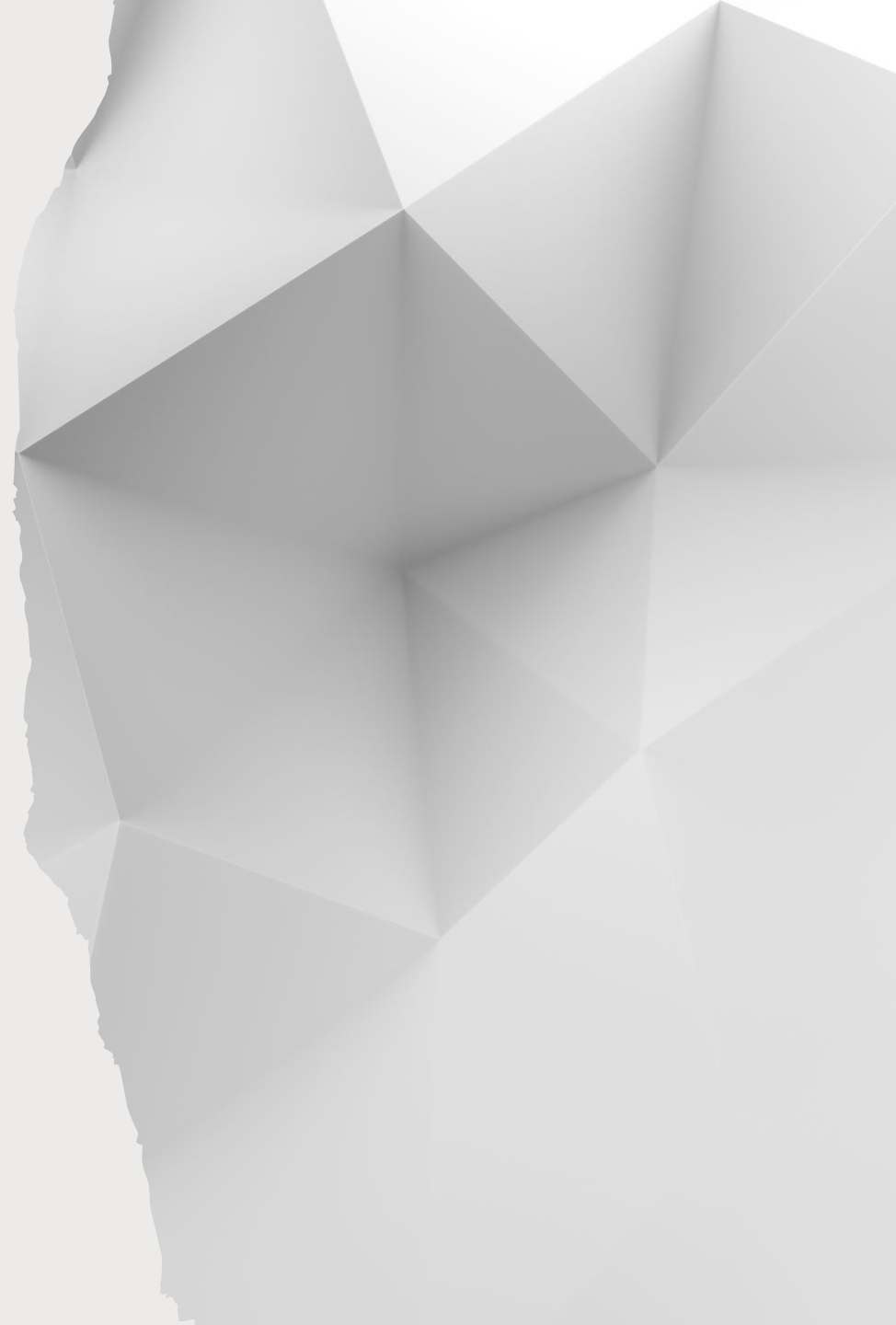


INTRODUCTION TO CHEMICAL SAFETY

Physics and Astronomy Basic Safety
Training Session – Sept. 27th, 2024

Presenter: David Thomas, Director
of Safety for the College of Science

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FUNDAMENTAL CONCEPTS

1

DON'T work with something until you fully understand its hazards and are comfortable working with it

2

DO use the Hierarchy of Controls to mitigate risk

3

DO wear appropriate Personal Protective Equipment (PPE)

4

DO label everything

5

DO store and dispose of reagents appropriately

UNDERSTANDING HAZARDS OF CHEMICALS

1

DON'T work with something until you fully understand its hazards and are comfortable working with it

“How do I fully understand the hazards of what I’m working with?”

Utilize a combination of:

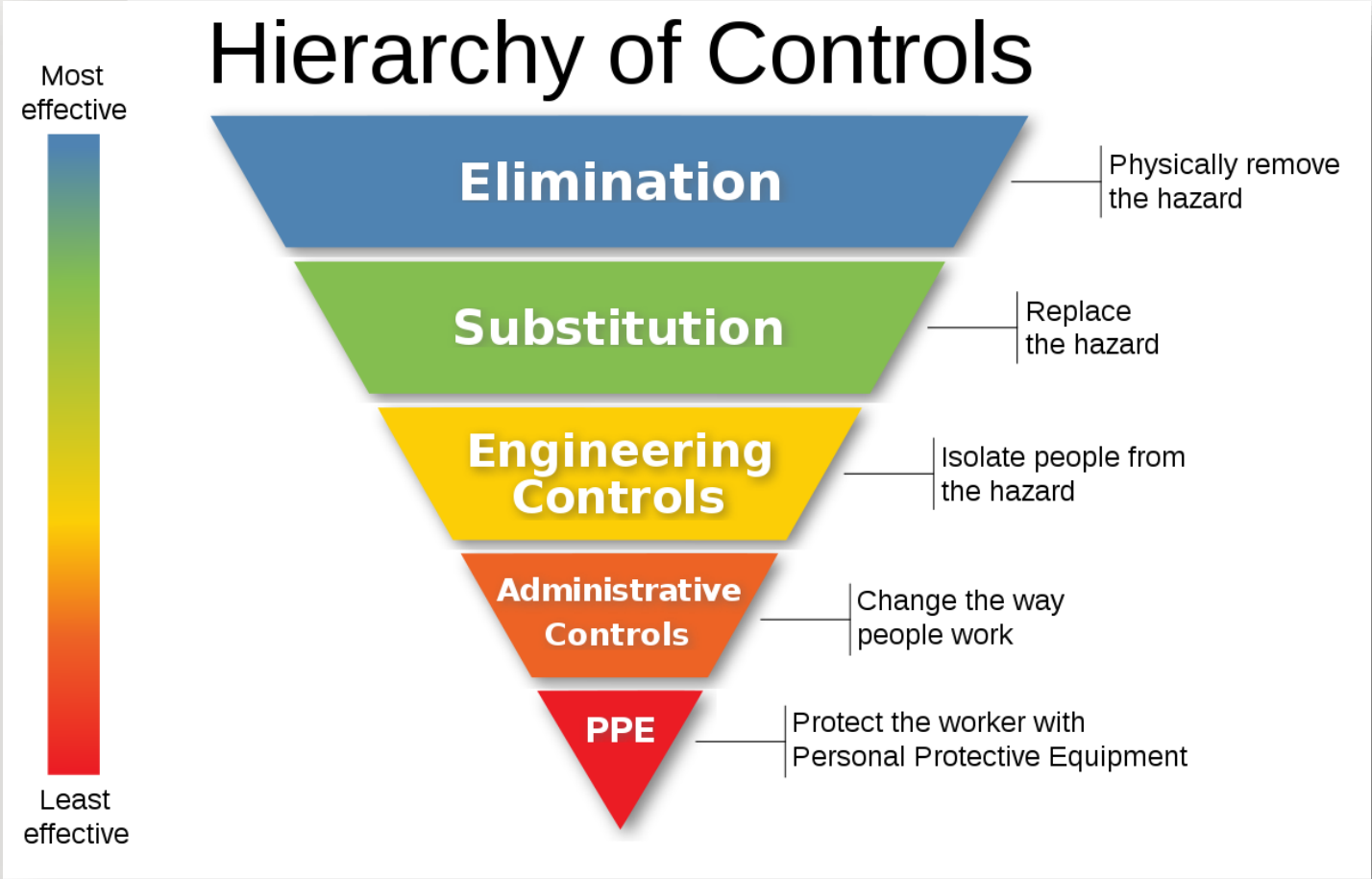
- Safety Data Sheets (SDS) – https://youtu.be/QsppyUfqLpg?si=o4a5na8MJy_w8fhV
- Colleagues
- Standard Operating Procedures (SOPs)

**If you are pregnant or might become pregnant, consult with an occupational medicine physician before working around chemicals. You have a right to choose in you want to work in a lab or not.*

HEIRARCHY OF CONTROLS

2

DO use the Heirarchy of Controls to mitigate risk



CHOOSING PPE

3

DO wear appropriate
Personal Protective
Equipment (PPE)

PPE should be chosen based on hazards and processes you're working with.

- Minimum for “wet” lab (a lab containing chemicals or biologicals):
 - Safety glasses or splash goggles
 - Lab Coat
 - Fully closed shoes and full-length pants (or equivalent)
 - Gloves where appropriate
- Material, type, etc. dependent on what you're doing
- Your PI should provide *appropriate PPE* for you
- All labs must have a PPE hazard assessment

CHOOSING PPE

Material, type, etc. dependent on what you're doing

3

DO wear appropriate
Personal Protective
Equipment (PPE)



CHOOSING PPE

Material, type, etc. dependent on what you're doing

- The chemical resistance guide incorporates three types of information
 - **Application** (It's a reference to you in the context of the type of application, the materials involved in the application or the type of work or activity you're doing)
 - **Special** (Whether the application has "general" or "special" chemical resistance demands)
 - **Exposure** (It's the risk factors, how long you'll use the PPE, how often you'll use it, how often you'll be exposed to the chemical)
 - **Penetration** (It's a reference to the degree that the chemical will penetrate the PPE material with the nature of the application and the nature of the work or activity you're doing)
 - **Level** (It's a reference to the degree of risk you're taking, how often you'll be exposed to the chemical, how long you'll be exposed to the chemical, how often you'll be exposed to the chemical)
 - **Material** (It's a reference to the material you're using, the type of material, the type of material, the type of material)
 - **Manufacturer** (It's a reference to the manufacturer of the PPE, the type of manufacturer, the type of manufacturer)

- **Key to Application and Penetration Ratings**
 - **1 - General** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **1-1/2 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **2 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **3 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **4 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **5 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **6 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **7 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **8 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **9 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **10 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **11 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **12 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **13 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **14 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **15 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **16 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **17 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **18 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **19 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing
 - **20 - Special** - Exposure to the chemical, the type of work or activity you're doing, the type of work or activity you're doing

Special Recommendations (Color Key)

- Green - Use only when the chemical is not a strong oxidizer
- Yellow - Use only when the chemical is not a strong oxidizer
- Red - Use only when the chemical is not a strong oxidizer

Physical Performance Chart

	1	1-1/2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
1-1/2	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
2	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
3	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
4	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
5	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
6	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
7	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
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10	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
11	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
12	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
13	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
14	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
15	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
16	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
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18	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
19	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
20	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

3

DO wear appropriate Personal Protective Equipment (PPE)

Material, type, etc. dependent on what you're doing

CHOOSING PPE

3

DO wear appropriate Personal Protective Equipment (PPE)



Some features to consider:

- Material
- Cuffs vs no cuffs
- Closure Mechanism

LABEL EVERYTHING

4

DO label everything

For Reagent Containers:

1. Name
2. Hazards

X

EtOH

X

Ethanol

✓

**Ethanol (100%)
Hazards: Flammable, Chronic and
Acute Health Hazards**

For Unwanted Materials Containers:

1. "Unwanted Materials"
2. Name – % of Total
3. Hazards
4. Accumulation Start Date
(There are labels through SAM)

Unwanted Materials – Liquids

**Ethanol – 30%
Acetone – 10%
Water – 60%**

**Hazards: Flammable, Chronic and Acute
Health Hazards**

Accumulation Start Date: 3/02/24

CHEMICAL STORAGE

5

DO store and dispose
of reagents
appropriately

Use Hazard Classes as Primary Tool to Segregate Chemicals

- Acids, Organic (Acetic Acid, etc.)
- Acids, Inorganic (Hydrochloric Acid, Sulfuric Acid, Nitric Acid, etc.)
- Bases, Organic (Diamine, Triethylamine, etc.)
- Bases, Inorganic (Sodium Hydroxide, Potassium Hydroxide, etc.)
- Flammables (Ethanol, Acetone, Hexanes, etc.)
- Oxidizers (Peroxides, Perchlorates, Nitrates, etc.)
- Water Reactives (Na/K/Li Metals, Alkali Metal Hydrides, etc.)

*Peroxide Formers (Diethyl Ether, THF, etc.) need special attention when stored in the lab



NIH Chemical Segregation Table: <https://ors.od.nih.gov/sr/dohs/Documents/chemical-segregation-table.pdf>

CHEMICAL STORAGE

5

DO store and dispose of reagents appropriately



Not Cluttered

Lip on Shelving

Labels and Containers in Good Condition

No Liquids Stored Above Eye Level of Shortest Person in the Lab (NO Chemicals Above Eye Level is Better)

Secondary Containment for Liquids and Liquids are Stored Below Solids

**Not good to store reagents in direct sunlight*

NIH Chemical Segregation Table: <https://ors.od.nih.gov/sr/dohs/Documents/chemical-segregation-table.pdf>

CHEMICAL STORAGE

What about flammables that need to be kept cold?

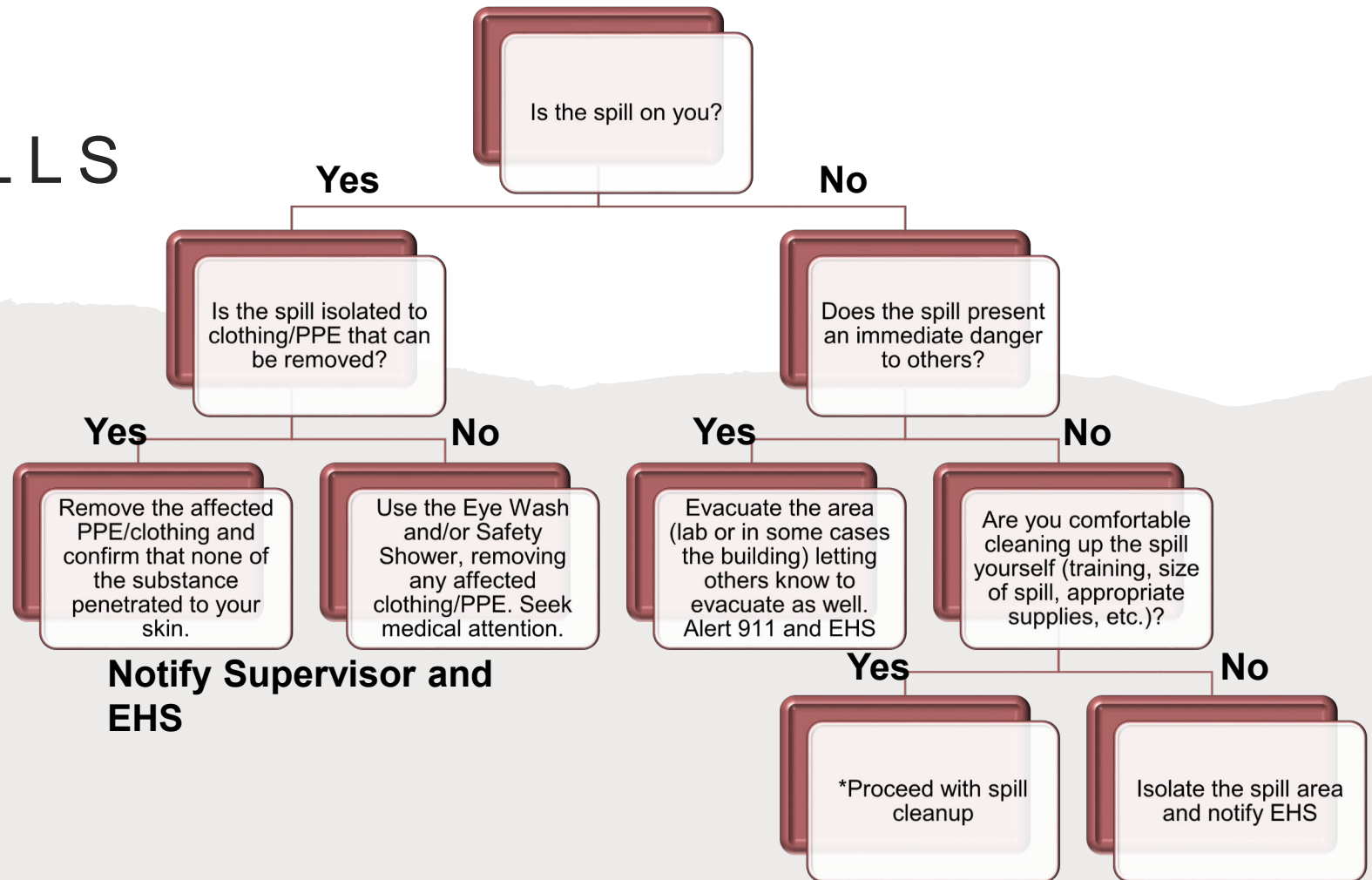
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NIH Chemical Segregation Table: <https://ors.od.nih.gov/sr/dohs/Documents/chemical-segregation-table.pdf>

CHEMICAL SPILLS



*EHS offers various types of spill kits on their website including:

- General
- Biological
- Acid
- Base
- Hydrofluoric Acid

<https://oehs.utah.edu/resource->

CHEMICAL SPILLS



Safety Shower/Eye Wash

- Remove contaminated clothing*
- Flush for at least 15 minutes
- Seek medical attention

*It is a good idea to have an extra pair of clothes in the lab.

Video: <https://youtu.be/6Yx9-dWgg3c?si=teOWluZ7OO4Nug0j>

Notify Supervisor and EHS



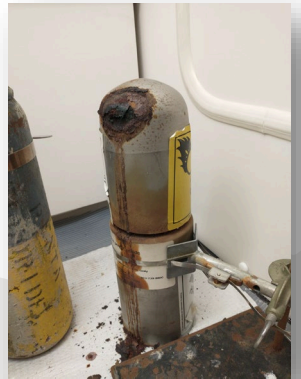
*EHS offers various types of spill kits on their website including:

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LEGACY CHEMICALS ARE A BIG PROBLEM

- Be vigilant.
- You can help change this narrative!
- The U of U is a “mercury free” campus.



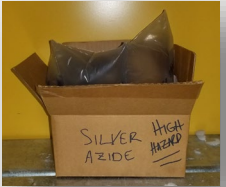
**Bromine
Pentafluoride
Police Escort
~\$30,000**

Holladay homeowner apologizes to neighbors for home explosion

By Shara Park, KSL-TV | Posted - April 26, 2024 at 6:19 a.m.



**Glove Box Cleanout in 2024
Total Person Hours Required = 18 hrs**



**Name: Silver Azide
Amount: 25 g
Primary Hazard: Highly
Explosive**

Description	Unit	Fees	Estimated Cost
Mobilization/Demobilization (Little Rock, AR to Salt Lake City, UT)	Per Trip	\$ 2,635.00 (1)	\$ 2,635.00
Daily Rate (Labor, Lodging, Vehicle, Per Diem)	Per Day	\$ 1,875.00 (2)	\$ 3,750.00
Disposal of Silver Azide	Per Pipe	\$ 1,000.00 (1)	\$ 1,000.00
Rental of D.O.T. Pipe Shipper	Per Pipe	\$ 250.00 (1)	\$ 250.00
Transportation from Salt Lake City, UT to TSDF	Per Load	\$ 6,529.95 (1)	\$ 6,529.95
Transportation of Supplies	Per Load	\$ 500.00 (1)	\$ 500.00

Total Estimated Cost

\$ 14,664.95

RESOURCES TO LEARN MORE

University Bridge Trainings

<https://utah.bridgeapp.com> (Choose the “Environmental Health and Safety (EHS)” Section)

- Chemical Hygiene ~ 45 min
- Laboratory Safety (10 steps) ~ 1-2 hrs
- Hazard Communications – HazCom ~ 11 min

American Chemical Society (ACS) Institute

<https://institute.acs.org/acs-center/lab-safety.html>

- Foundations of Chemical Safety and Risk Management (Free) ~ *17 hrs*
- Foundations for Storing, Organizing and Disposing of Chemicals in Educational Settings (Free) ~ *10 hrs*

University of Utah Environmental Health and Safety

<https://oehs.utah.edu/>

- Resource Center
- Forms/Checklists