



KU

Wonderful Institute for  
Sustainable Engineering

# Fire Extinguisher Training

WEDNESDAY, MAY 27 AT 9:00AM



SIGN IN

*"I am proud to be an engineer."*

- Neil Armstrong





KU

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Sustainable Engineering

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- Neil Armstrong



# Fire Extinguisher Training

Presented by: Emmanuel Ababio



KU

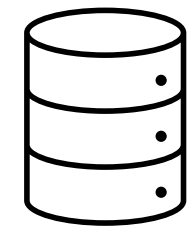
Wonderful Institute for  
Sustainable Engineering

# Outline

I	Basic Laboratory Safety – Fire Hazards & Prevention	
II	Case Study	
III	Fire Tetrahedron	
IV	Fire Classifications	
V	Extinguishing Agents & Extinguisher Types	
VI	Rules for Fighting Fires	
VII	Evacuation Procedures	
VIII	Helpful Links & Information	

# Basic Laboratory Safety – Fire Hazards

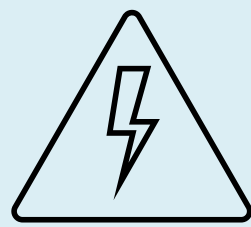
- **Common Fire Hazards**



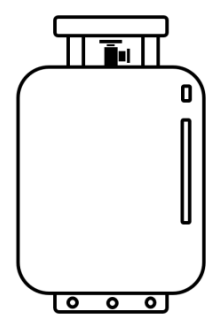
Improper storage or mishandling of flammable solvents



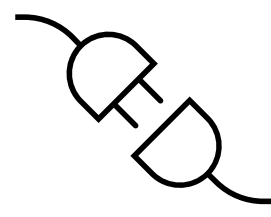
Reactive chemicals



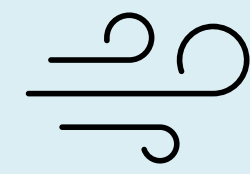
Poorly maintained electrical devices



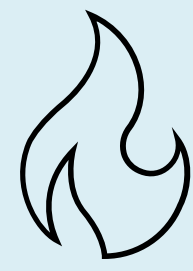
Compressed Gases



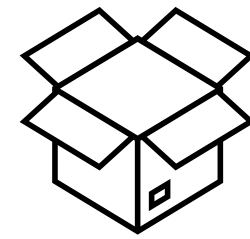
Overloaded power strips or damaged wiring



Inadequate ventilation



Heating devices and open flames



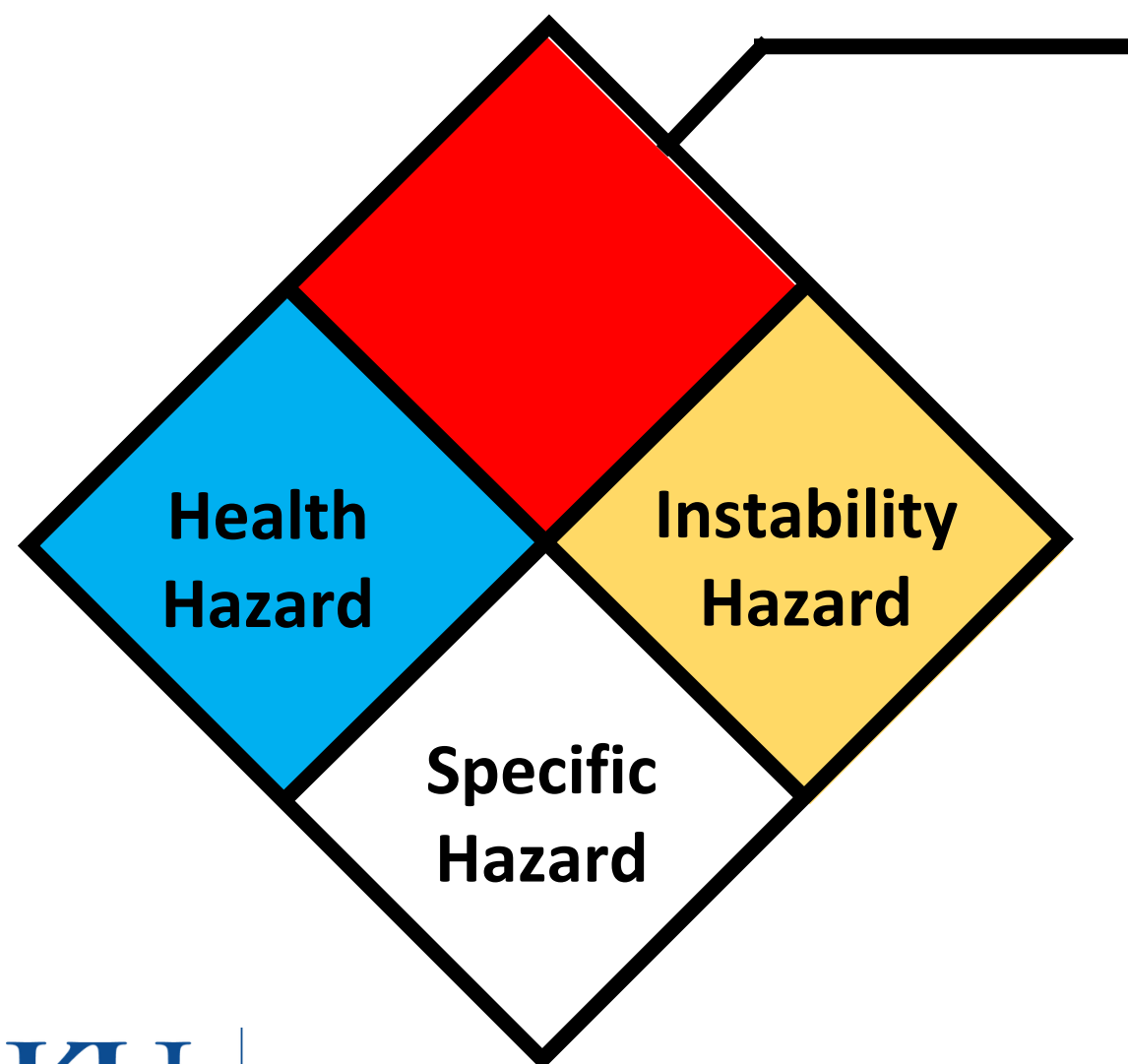
Unused boxes, papers, and other ordinary combustibles



# Basic Laboratory Safety – Fire Hazards

- **NFPA Hazard Classifications**

- Designed for quick, at-a-glance, risk assessment during an emergency
- Additional considerations may be necessary



## **Fire Hazard (Flammability)**

**4.** Flammable liquids, volatile liquids, pyrophoric materials

**3.** Ignites at ambient temperatures

**2.** Ignites when moderately heated

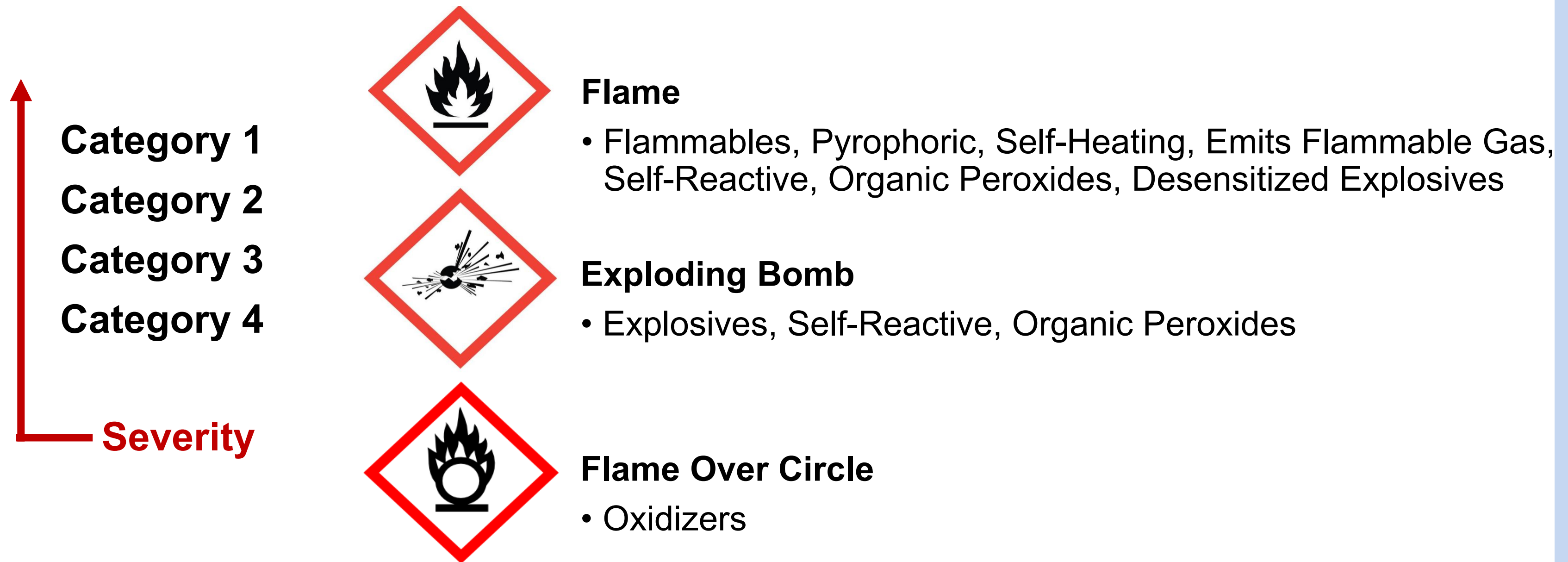
**1.** Must be preheated to burn

**0.** Will not burn

# Basic Laboratory Safety – Fire Hazards

## • GHS Hazard Classifications

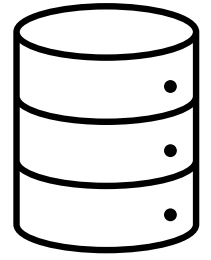
- More detailed and intended for comprehensive chemical safety labeling



# Basic Laboratory Safety – Fire Prevention

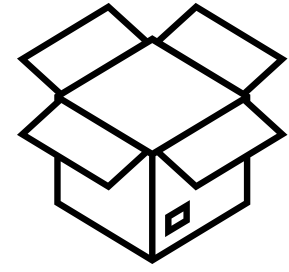
- **Fire Prevention Measures**

## Proper Chemical Storage and Labeling



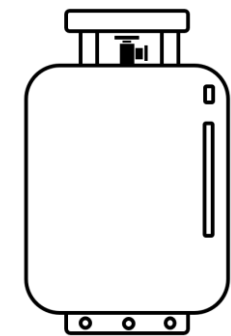
- Store flammable chemicals in designated flammable storage cabinets
- Ensure incompatible chemicals are segregated

## Maintain a Clean Workspace



- Keep work areas clean and free of clutter
- This includes corridors and walkways
- Dispose of waste properly

## Proper Gas Cylinder Storage and Labeling



- Keep gas cylinders upright and secured to prevent them from falling
- Store cylinders away from heat sources
- Regularly inspect for leaks and signs of wear or damage

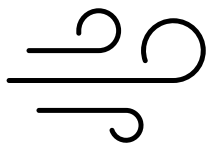


# Basic Laboratory Safety – Fire Prevention

- **Fire Prevention Measures**

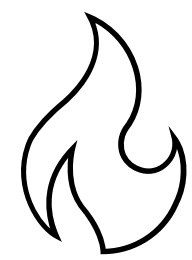
## Fume Hoods

- When using flammable and/or volatile chemicals
- Contains vapors and minimizes the risk of ignition



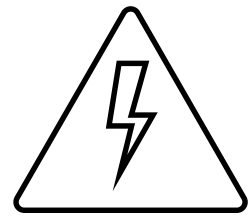
## Minimize Use of Open Flames

- Never leave an open flame unattended
- Keep flammable materials away



## Maintain Electrical Equipment

- Regularly inspect for signs of wear or damage
- Avoid overloading power outlets
- Ensure that all electrical devices are properly grounded



# Basic Laboratory Safety – Fire Prevention

- **Fire Safety Equipment**

- Flame-resistant lab coats
- Fire extinguishers
- Fire blankets
- Fire alarms and sprinkler systems
- Emergency showers



- **Good Safety Practices**

- Maintain a clean workspace
- Understand the different classes of fires and appropriate extinguishing methods
- Know the location of your fire safety equipment
- Familiarize yourself with emergency response procedures and evacuation routes
- Participate in a hands-on fire extinguisher training
- Chemical safety training and documentation
  - Consult SDS for hazard classifications and fire-fighting measures

# When the Hazard List Becomes Real

- Case Study: Texas Tech University — January 7, 2010

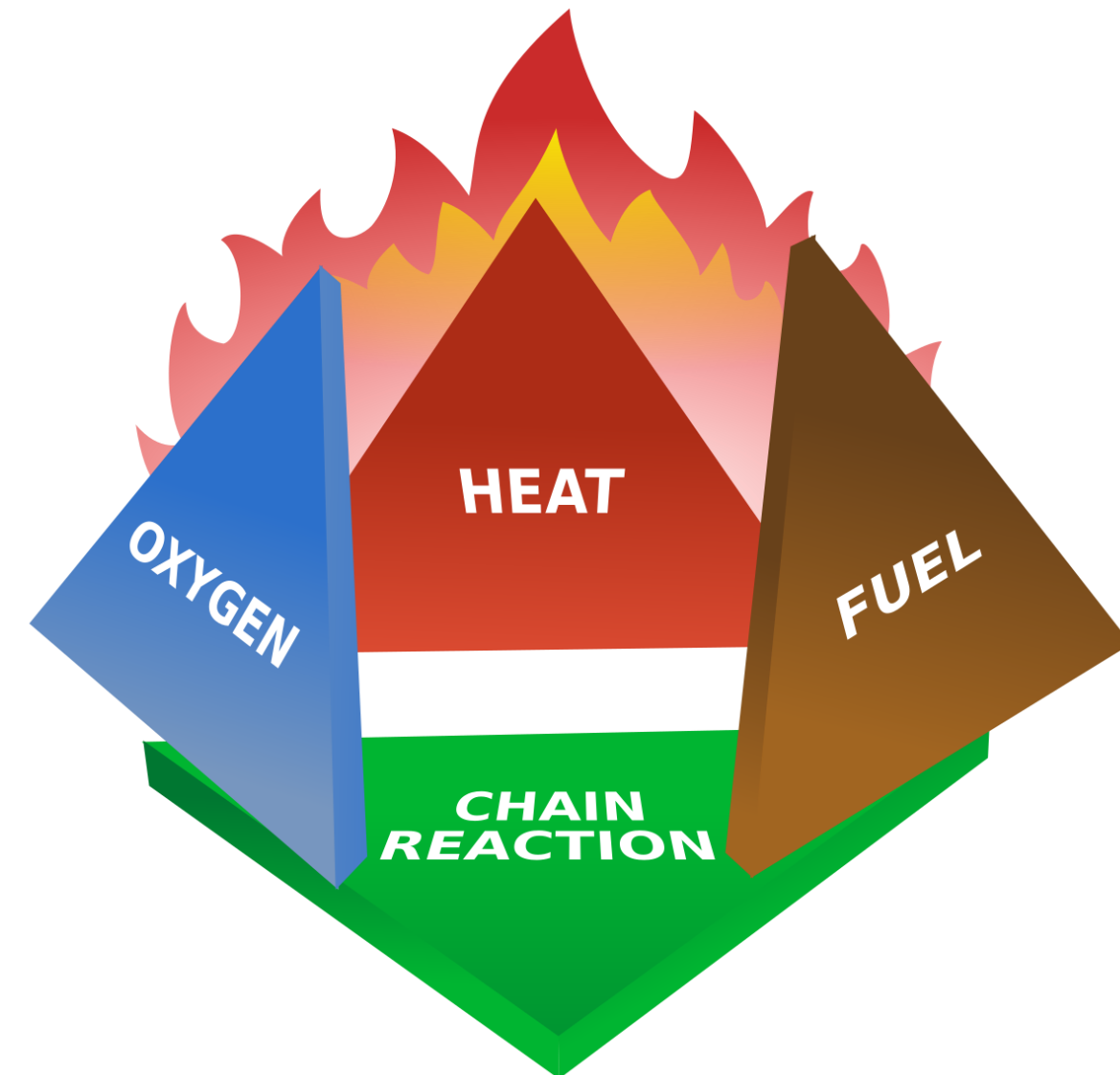


# When the Hazard List Becomes Real


- **Case Study 1: Texas Tech University — January 7, 2010**
  - Graduate student Preston Brown was synthesizing nickel hydrazine perchlorate (NHP), an energetic compound, in a Texas Tech chemistry lab.
  - He scaled the reaction up to roughly 100× the size his group had previously approved as safe — about 10 grams instead of 100 milligrams.
  - While trying to break up the dried product with a mortar and pestle, friction detonated the material.
  - Brown lost three fingers, suffered burns and lacerations to his face and torso, and was partially blinded in one eye.
  - This was the first academic-research incident ever investigated by the U.S. Chemical Safety Board (CSB). The CSB report cited inadequate hazard evaluation, no written protocol for scale-up, and weak institutional oversight.


# Fire Tetrahedron


- Fuel
  - any combustible solid, liquid, and/or gas
- Oxidizer
  - ozone, oxygen, hydrogen peroxide, nitric acid
- Ignition Source (Heat)
  - open flames, sparks, friction, hot surfaces, electrical arcs
- Chemical Chain Reaction
  - free radicals, chemically active intermediates




# Fire Classifications

**A**  **Ordinary Combustibles**  
• wood, paper, cloth

**B**  **Flammable Liquids and Vapors**  
• gasoline, alcohols, oils, and solvents

**C**  **Electrical Fires**  
• Caused by energized electrical sources  
• May turn into a class A or B once de-energized

**D**  **Combustible Metals**  
• magnesium, sodium, potassium, lithium, titanium

**K**  **High Temperature Cooking Oils and Fats**  
• Occur in environments where grease or oil is heated



# Extinguishing Agents

There are **five main** types of extinguishing agents: water, foam, powder, carbon dioxide, and wet chemical.

## Water

- May contain additives (wetting agents, antifreeze)
- Absorbs heat rapidly, soaks ordinary combustibles
- Used **ONLY** for Class A fires

## Foam

- Aqueous surfactants or foaming agents
- Expels a layer of foam
- Conductive, vapor-sealing, absorbs heat
- Many are being phased out



# Extinguishing Agents

## Carbon Dioxide

- Discharges as a cloud (relatively short range)
- Displaces oxygen in the air
- non-conductive, little residue



## Ordinary (BC) Dry Chemical

- Sodium/potassium bicarbonate powder
- Interferes with the chemical reaction
- Non-conductive, minimal cooling effect

## Multipurpose (ABC) Dry Chemical

- Contains an ammonium phosphate base (pale yellow powder)
- Scavenges radicals, non-conductive
- Forms a glassy surface-coating



# Extinguishing Agents

## D Powders

- Suited for specific metals
- Absorbs heat
- Does not react with the burning metal
- Provides a smothering blanket



## Wet Chemical (Class K)

- Discharges a fine spray of aqueous potassium salts
- Reacts with hot cooking oils to form a soapy foam layer
- Prevents oil splatter



# Extinguisher Types

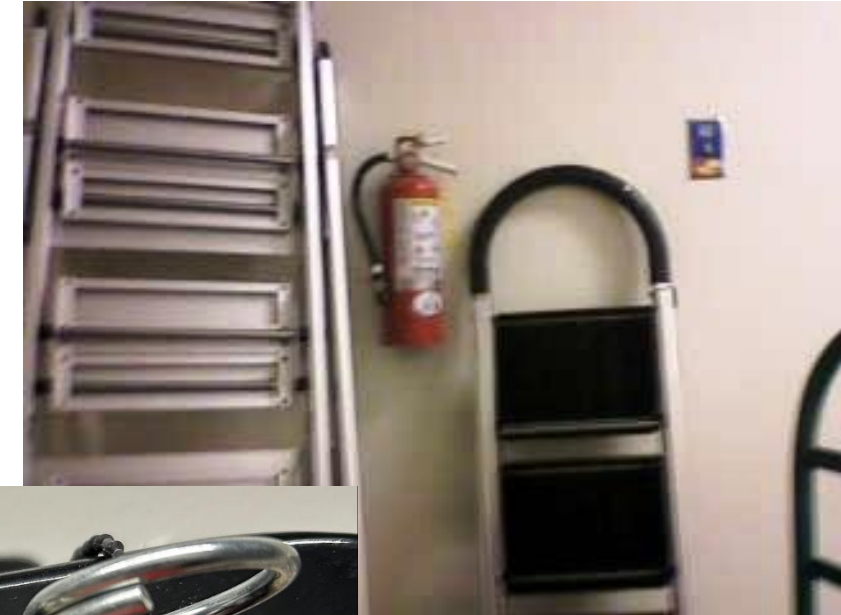
TYPE	<b>CLASS A</b> <i>Ordinary Combustibles</i> <i>(paper, wood, cloth, plastic)</i>	<b>CLASS B</b> <i>Flammable Liquids &amp; Gases</i> <i>(gasoline, alcohols, propane)</i>	<b>CLASS C</b> <i>Energized Electrical</i> <i>(motors, outlets, instruments)</i>	<b>CLASS D</b> <i>Combustible Metals</i> <i>(Li, Na, K, Mg, Ti)</i>	<b>CLASS K</b> <i>Cooking Oils &amp; Fats</i> <i>(commercial kitchens)</i>	<b>Special Notes</b>
<b>Water</b>	✓	✗	✗	✗	✗	Conducts electricity. Spreads flammable-liquid fires. Reacts dangerously with burning metals.
<b>Foam (AFFF)</b>	✓	✓	✗	✗	✗	Water-based — never use on energized electrical. Many being phased out (PFAS regulations).
<b>Wet Chemical</b>	LIMITED	✗	✗	✗	✓	Designed for cooking-oil fires. Reacts with hot oil to form a soapy foam seal.
<b>Carbon Dioxide (CO<sub>2</sub>)</b>	LIMITED	✓	✓	✗	✗	Safe on energized electrical — no residue. Short range. Can asphyxiate in enclosed spaces.
<b>Dry Chemical Multipurpose (ABC)</b>	✓	✓	✓	✗	✗	Most versatile. Ammonium phosphate powder — corrosive residue can damage instruments.
<b>Dry Chemical Ordinary (BC)</b>	✗	✓	✓	✗	✗	Sodium/potassium bicarbonate. Less residue than ABC but no Class A coverage.
<b>Dry Powder (Class D)</b>	✗	✗	✗	✓	✗	Metal-specific — different formulations for different metals. Never substitute another agent.

# Always check the extinguisher label



# Fire Extinguisher Inspection

- Need to be serviced and maintained periodically to ensure they will operate properly when you need them most
- Servicing (annually)
  - Repaired, replaced, recharged by qualified service personnel
- Quick Check (monthly)
  - Is the extinguisher in the correct location?
  - Is the extinguisher visible and accessible?
  - Is the tamper seal intact?
  - Does the pressure gauge read the correct pressure?
- Questions or Concerns regarding your fire extinguisher(s)?  
Please contact KU Facilities Services:  
(785)-864-4770



# Rules for Fighting Fires

If You Discover a Fire. Follow The 4 A's: Activate, Assist, Assess, and Abandon

## Activate

Immediately activate the building fire alarm system

- notifies the fire department to get help on the way.
- sounds the fire alarm bells
- shuts down the air handling units to prevent the spread of smoke.
- If you are in a building without a fire alarm system, dial 9-1-1 from a safe location to report the fire

## Assist

Assist any person in immediate danger to safety, if it can be accomplished without risk to yourself



# Rules for Fighting Fires

## Assess

Determine the most effective method for fighting fire **OR** whether evacuation is necessary. If the fire is small enough, use a nearby fire extinguisher to control and extinguish the fire



## Abandon

Evacuate the building immediately if the fire is too large or spreading



# Rules for Fighting Fires

Do not fight a fire under any of the following conditions...

- You don't know what is burning.
- The fire is spreading rapidly.
- You don't have the proper equipment.
- You can't do so with your back to an exit.
- The fire might block your means of escape
- You might inhale toxic smoke.

# Remember P.A.S.S

- **P**ull the Pin
- **A**im low and point the nozzle at the base of the fire
- **S**queeze the activating lever
- **S**weep from side-to-side



# Do not fight a fire alone. Use a Buddy!

1. Monitor and help each other.
2. Buddy places a hand on your right or left shoulder, depending on which hand you use to fight the fire
3. Attack the fire by simultaneously moving forward. Never turn your back on the fire
4. If the fire flares or the situation worsens, your buddy's job is to pull you to safety
5. Once fire is out, assess the situation. Make sure the fire is completely extinguished. Back away from the fire without turning your back



# General Evacuation Procedure

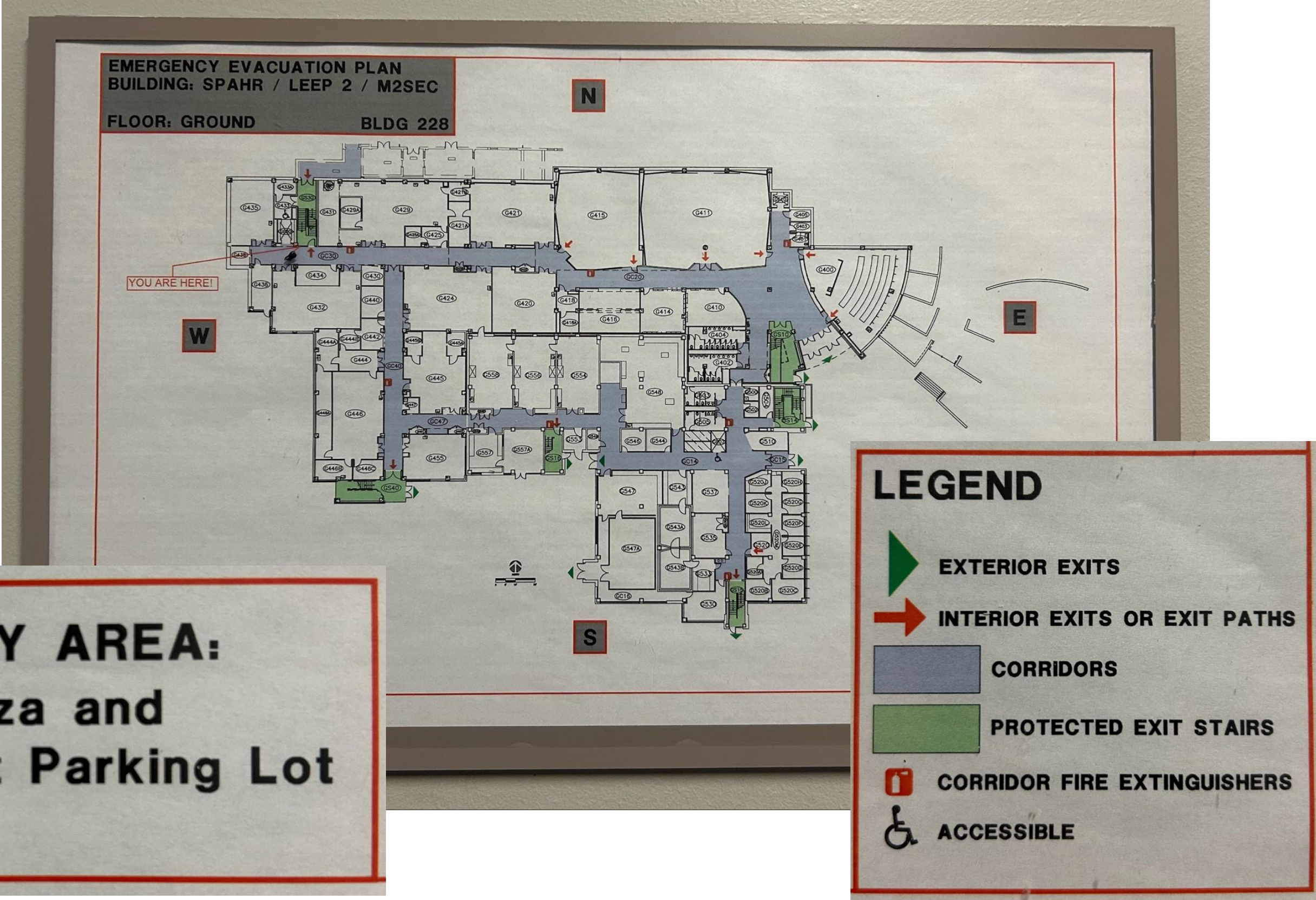
- Some KU facilities are equipped with accessible elevators that are specifically designed for emergency use
- “Emergency Exit Elevators” can be used by people with disabilities or other conditions needing assistance to evacuate
- In the event an elevator is shut down because it is affected by fire, utilize alternate routes designated by the emergency plan.

“ELEVATOR AVAILABLE FOR OCCUPANT EVACUATION”

“ELEVATOR OUT OF SERVICE USE EXIT STAIRS”



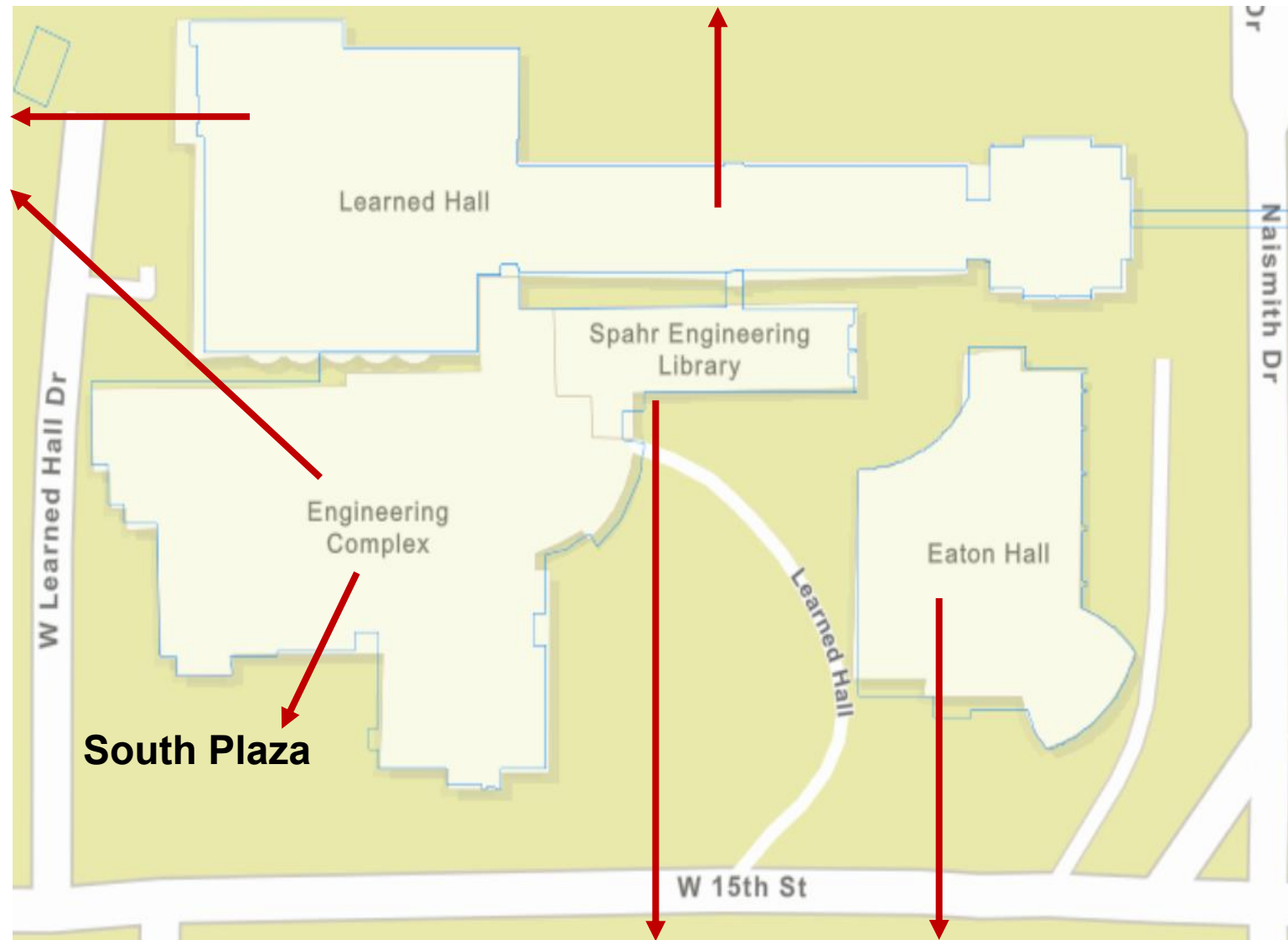
# Emergency Evacuation Plans



# Emergency Evacuation Plans

Grassy Area (North)

Lot #41  
(Northwest)



Lot #54 (South)



In inclement weather, report to the parking garage directly south of Lot #54

- For detailed information regarding emergency evacuation plans and maps, please visit: <https://enr.ku.edu/safety>



# Remember R.A.C.E

- **R**escue anyone in immediate danger or help them get to a safe area, if it can be accomplished without risk to yourself
- **A**lert others by activating any available alarm system
- **C**ontain the fire as much as possible by closing doors and windows behind you during evacuation
- **E**xtinguish/Evacuate: only attempt to put out the fire if it is safe to do so.

# Helpful Links & Information

- For any event (active or potential) which is an immediate threat to health and safety: Dial 911
  - On campus, this will contact the KU Public Safety Emergency Communications Center. Appropriate emergency assistance will be immediately sent to the scene.
- For non-emergency safety concern reporting please contact KU-EHS via email ([ehsdept@ku.edu](mailto:ehsdept@ku.edu)) or telephone (785-864-4089)
- For routine assistance...
  - If you have any questions regarding your fire extinguishers, please contact KU-Facilities Services (785-864-4770)
  - Check with your building manager or contact KU-Fire Martial (785-864-3431) for more information about exits designated for emergency use and emergency evacuation plans

# Helpful Links & Information

- School of Engineering Emergency Evacuation Plans and Maps
  - <https://enr.ku.edu/safety>
- Developing a Personal Action Plan
  - <https://kupolice.ku.edu/accessibility-emergency>
- Get Emergency Notifications
  - <https://alerts.ku.edu/>
- University Emergency Planning
  - [emergencymgt@ku.edu](mailto:emergencymgt@ku.edu)
  - 785-864-5900

# Thank you for listening!

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