

## **PRESENTER'S GUIDE**

# **"FLAMMABLES AND EXPLOSIVES IN THE LABORATORY"**

**Part of the Laboratory Safety Series**

# **OUTLINE OF MAJOR PROGRAM POINTS**

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The following outline summarizes the major points of information presented in the program. The outline can be used to review the program before conducting a classroom session, as well as in preparing to lead a class discussion about the program.

- **A "flammable" is a substance that will readily catch fire and burn.**
- **Xylene, a commonly used chemical, might or might not burn depending on its condition.**
  - If it is cooled below its "flashpoint" it will not ignite.
- **A substance's flashpoint is the lowest temperature at which it gives off vapors that will burn.**
  - The vapors burn, not the substance.
- **Both flammables and explosives can be very dangerous.**
- **Explosives can be subject to very rapid chemical reactions or decomposition. This:**
  - Releases gas and heat.
  - Has the potentially violent results.
- **Gasoline is highly flammable.**
  - It ignites at as low a temperature as -45 degrees Fahrenheit.
  - Yet gasoline may still not ignite in certain situations.
- **Gasoline's "limits of flammability" also affect ignition.**
  - The lower flammable limit is the minimum percentage of vapor to air required for ignition.
  - The upper flammable limit is the percentage of vapor to air above which ignition is no longer possible.
  - For instance, diethyl ether has a range of 1.9% to 36.5% (by volume of air) for ignition.

- **Most "lower flammable limits" are reached quickly.**
  - This makes it easy for fire or explosion to erupt.
  - The surrounding air will also be above toxic limits.
  
- **"Ignition temperature" is also important.**
  - This is the minimum temperature required to cause self-contained combustion regardless of the type of heat source.
  - For example, carbon disulfide has an ignition temperature of 80 degrees Celsius (easily ignitable by a lightbulb or steam line).
  
- **It is important to remove equipment that causes heat or sparks from the areas where flammables and explosives are used. This includes:**
  - Stirrers.
  - Pumps.
  - Bunsen burners.
  - Hotplates.
  
- **Use a heating mantel or water bath to heat flammables.**
  
- **You should consult Safety Data Sheets (SDSs) for information on flammables/explosives, including their:**
  - Flashpoints.
  - Ignition temperatures.
  - Flammability limits.
  
- **Adequate ventilation is needed to keep chemical vapors from reaching lower flammable limits.**
  - You want to minimize the release of vapors.
  - Look for chemicals requiring auxiliary ventilation.
  - Use lab hoods to confine and remove vapors.
  - Hoods can also help to prevent flashback.
  
- **Always transport flammable materials in secondary containers such as:**
  - Rubber acid-carriers.
  - Plastic-jacket overpacks.

- **Transport carts should have large wheels.**
  - This helps when crossing uneven surfaces.
  - Don't use instrument, equipment or mail carts (they are too easy to tip).
- **All flammable chemicals should have a specific storage space.**
  - Return the material to this location after use.
  - Storage areas should eliminate exposure to heat or sunlight.
- **Flammable liquids should be stored in approved safety containers.**
  - Red/yellow labels identify materials with low flashpoints.
  - "Arrester spouts" help prevent flashback.
- **Be careful not to store materials in undesirable places, where they can be easily knocked over or interrupt air flow.**
  - Such as on bench tops.
  - Or in hoods.
- **Store flammables in amounts greater than one liter in approved cabinets.**
  - These cabinets don't require venting.
  - If they are vented, vent pipes should have flame arresters.
  - Keep cabinet doors closed and locked.
- **Do not store flammables in lab refrigerators unless they are explosion-proof.**
- **Several sources should be consulted regarding correct storage procedures:**
  - NFPA standards.
  - Company policies.
  - Your supervisor.
- **Strap flammable gas cylinders to benches or wall racks.**
  - This keeps them steady.

- **Specialized training is required to work with compressed gases and their cylinders.**
  - Rely only on the cylinders' labels for information, not on their color.
  - Don't "mix" flammable gases which may react.
  - Check all connections before use.
  
- **You should create contingency plans for flammable/explosive spills, since they often spread quickly.**
  - Remove or turn off ignition sources.
  - Keep cleanup equipment/materials nearby.
  
- **Use appropriate absorbents for cleanup.**
  - Vermiculite does not keep vapors from rising.
  - Carbon absorbents may be more appropriate.
  
- **Many chemicals are dramatically affected by increases in temperature.**
  - They can decompose quickly.
  - They may become dangerously reactive.
  - Light mechanical shock can begin reactions.
  - Catalysts can also have an effect.
  - These chemicals are called "explosives".
  
- **Other conditions can also create explosive situations.**
  - Certain chemicals will explode when they are mixed (such as calcium carbide with water).
  - Chemical impurities (such as organic peroxides from diethyl ether) also have the potential to explode.
  
- **Always check Safety Data Sheets (SDSs) before handling or storing explosives.**
  - Look for indications of potential problems.
  
- **You should protect yourself as much as possible when using explosives in experiments.**
  - Use the smallest possible amounts.
  - Place your equipment behind shields.
  - Wear appropriate PPE (face shield, gloves and lab coats of slow burning material).

- **Frequently check stored containers of explosives.**
  - Look for corrosion or contamination.
  - Keep them well away from shelf edges.
- **Disposing of flammable and explosive waste can often pose serious problems.**
  - Ask your supervisor/safety officer about applicable regulations.
  - Know your facility's disposal plan.
  - Most materials should not be flushed down drains (they can contaminate the environment).
  - Waste containers should be properly labeled and segregated.
  - Recycling is a possibility.
- **Plan ahead in case of fire or other emergencies.**
  - Know evacuation routes and fire exits.
  - Know locations of emergency equipment, including fire extinguishers.
  - Only use emergency equipment you have been trained on.

**\* \* \* SUMMARY \* \* \***

- **Working safely with flammables and explosives takes a concentrated effort.**
- **They are dangerous.**
- **You should always take your time when using them.**
- **Learn the rules.**
- **Design your experiments carefully.**