

MAJOR PROGRAM POINTS

"FLAMMABLES AND EXPLOSIVES IN THE LABORATORY"

Part of the "LABORATORY SAFETY SERIES"

Quality Safety and Health Products, for Today...and Tomorrow

Outline of Major Points Covered in the "Flammables and Explosives in the Laboratory" Course

The following outline summarizes the major points of information presented in the course on "Flammables and Explosives in the Laboratory". The outline can be used to survey the course before taking it on a computer, as well as to review the course when a computer is not available.

- **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 Material Safety Data Sheets (MSDS's) 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 Material Safety Data Sheets (MSDS's) 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.**