SAFETY TRAINING

Training Solutions, Delivered!

Flammables and Explosives in the Laboratory

Leader's Guide, Fact Sheet & Quiz

Item Number: 3055

This easy-to-use Leader's Guide is provided to assist in conducting a successful presentation.

PREPARING FOR THE MEETING

Here are a few suggestions for using this program:

a) Review the contents of the Fact Sheet that immediately follows this page to familiarize yourself with the program topic and the training points discussed in the program. The Fact Sheet also includes a list of Program Objectives that details the information that participants should learn from watching the program.

b) If required by your organization, make an attendance record to be signed by each participant to document the training to be conducted.

c) Prepare the area and equipment to be used for the training. Make sure the watching environment is comfortable and free from outside distractions. Also, ensure that participants can see and hear the TV screen or computer monitor without obstructions.

d) Make copies of the Review Quiz included at the end of this Leader's Guide to be completed by participants at the conclusion of the presentation. Be aware that the page containing the answers to the quiz comes *before* the quiz itself, which is on the final page.

CONDUCTING THE PRESENTATION

a) Begin the meeting by welcoming the participants. Introduce yourself and give each person an opportunity to become acquainted if there are new people joining the training session.

b) Introduce the program by its title and explain to participants what they are expected to learn as stated in the Program Objectives of the Fact Sheet.

c) Play the program without interruption. Upon completion, lead discussions about your organization's specific policies regarding the subject matter. Make sure to note any unique hazards associated with the program's topic that participants may encounter while performing their job duties at your facility.

d) Hand out copies of the review quiz to all of the participants and make sure each one completes it before concluding the training session.

3055 FLAMMABLES AND EXPLOSIVES IN THE LABORATORY
FACT SHEET

LENGTH: 15 MINUTES **PRODUCTION YEAR: 2014**

PROGRAM SYNOPSIS:
Because they're always dangerous, working safely with Flammables and Explosives in a laboratory requires you to know what you're doing and maintain your focus at all times. It's critical to understand the characteristics of the materials being used and how to handle a possible emergency. This program discusses the properties of Flammables and Explosives, the importance of proper ventilation and storage and how to clean up spills, among other safe practices.

PROGRAM OBJECTIVES:
After watching the program, the participant will be able to explain the following:
- The limits of flammability and avoiding heat sources;
- How to handle gas cylinders and explosives;
- The need for proper ventilation and storage;
- Safe work practices and waste disposal;
- How to clean up spills and perform an evacuation.

INSTRUCTIONAL CONTENT:

INTRODUCTION
- A flammable can be simply described as a substance that will readily catch fire and burn.
- Xylene is a commonly used flammable substance. There can be two identical amounts sitting side-by-side in identical dishes, yet one will ignite. The other one won't.
- The reason? The Xylene that didn't ignite was cooled by dry ice. The other was heated to just over 81degrees, the flashpoint of Xylene. "Flashpoint" is the lowest temperature at which a substance gives off vapor that will burn.
- One of the first things you need to remember when you're dealing with Flammables and Explosives is that it's the vapor that a substance gives off that burns, not the substance itself.
- Flammables and Explosives are two classes of materials that can always be dangerous. While Flammables can ignite and burn, Explosives are subject to very rapid chemical reaction or decomposition and can release gas and heat with potentially violent results.
- Flammables and Explosives are both materials that you want to be very careful with.

FLAMMABLES
- Let's look at another highly flammable material gasoline. Its vapors ignite easily at temperatures as low as negative 45 degrees Fahrenheit.
- Yet even when it's at its flashpoint and a spark is created, gasoline may not catch fire. Whether it does will depend on the gasoline's "fuel-air mixture" and "limits of flammability".
- Materials have both lower and upper limits of flammability. A substance's "lower flammable limit" is the minimum percentage of vapor-to-air that's required for ignition to take place. The "upper flammable limit" is the percentage of vapor-to-air beyond which ignition is no longer possible.
- For example, the limits of flammability for Diethyl Ether range from 1.9 percent to 36.5 percent by volume of air. This means it will ignite if the atmosphere is only 1.9% Ether and it can't ignite if the atmosphere contains more than 36.5% Ether.
- Remember, most lower limits are reached quickly, so it can be very easy for a fire or explosion to erupt in a lab.
- And keep this in mind. If there is enough vapor in the air to create a flammable atmosphere, the atmosphere will usually be above toxic limits as well.
- In addition to having their flammability limits affect when they will burn, all flammables also have an ignition temperature. This is the minimum temperature that is required to cause self-contained combustion, regardless of the heat source that is involved.
- Carbon disulfide, for instance, has an ignition temperature of 80 degrees centigrade. As a result, it can easily ignite

via a nearby lightbulb or steam line.
- Similarly, the surface temperature of a hot plate will ignite Diethyl Ether.
- So, when you are working with Flammable and Explosive materials, you should remove equipment that will cause heat or sparks from your work area if at all possible. Even things like stirrers and pumps can cause problems.
- And never use an open flame or a hot plate to heat flammables. Instead, use a heating mantle or water bath.
- Static electricity, which can be generated just by walking across a rug, is another thing that you need to be concerned about. So, whenever you can, be sure to use static guard devices when you're working with Flammables and Explosives.
- If you have any questions, consult the Safety Data Sheets of the chemicals that you're using for information on the flashpoints, ignition temperatures and flammability limits.

GAS CYLINDERS AND EXPLOSIVES
- Many gases that are used in laboratories can be both Flammable and Explosive, so it's important to know how to store gas cylinders as well.
- Strap or chain flammable gas cylinders securely to benches or wall racks, so they don't fall and knock valves open or break hose lines.
- Fittings and hoses should be checked regularly, to see if they've developed any leaks.
- Don't store gases that could react next to one another.
- Maintaining the correct labeling on a cylinder is important as well. You can't rely on the paint color to tell you what's in it. Many suppliers don't adhere to a strict color code.
- When you take a cylinder out of storage, check all connections for leaks once again. Use a dilute soap solution at fittings and valves. Bubbles will tell you if a leak exists.
- In addition to sharing some characteristics with Flammables, Explosives have unique attributes of their own.
- Many of them are affected dramatically by increases in temperature. They will decompose quickly or become dangerously reactive. Light, mechanical shock and certain catalysts can also start a reaction.
- You also need to be concerned about mixtures when you think about explosives. Some chemicals form an explosive compound when they're brought together, such as calcium carbide and water.
- Impurities in a sample can be dangerous as well. Organic Peroxides can form on containers of Diethyl Ether.
- These peroxides are notoriously unstable and explosive. They're also highly flammable, and far more susceptible to shock than even dynamite. Something as simple as the friction caused by opening a contaminated jar can cause an explosion.
- To make sure that you’re familiar with any of the problems that could surface with these substances, check your Safety Data Sheets and other guides before you handle or store them.

VENTILATION AND STORAGE
- Ventilation is particularly important when you’re working with Flammable and Explosive chemicals. You must have enough ventilation to keep the vapor in the air from reaching your materials' lower flammable limits. Working under a hood can help to confine and remove flammable and toxic vapors.
- Local ventilation controls also help prevent "flashback", the accidental reverse flow of flame back to a container.
- But in some cases, you’ll need to use auxiliary ventilation when working with Flammables and Explosives.
- How you transport Flammable and Explosive materials is also critical. They should always be carried in secondary containers. Rubber acid carriers are a good choice. Plastic jacket overpacks also work well.
- If you need to cross any uneven surfaces, be sure to use carts with large wheels. Don't use instrument, equipment or mail carts; they're too easy to tip over and chemicals can easily be knocked off of them too.
- Every chemical should have a specific storage place where it's returned to after each use. Flammables and Explosives are no exception. Avoid locations that have exposure to heat or direct sunlight.
- Flammable liquids should be stored in approved safety containers. Red containers with yellow tape identify substances having low flashpoints. Arrestor spouts help prevent flashback.
- Be sure to label the containers. You don't want any confusion where Flammables are concerned.
- Storing your chemicals on a benchtop is not a good idea. It's too easy to knock them over. And on a bench, they're not protected from fire.
- In-hood storage is also unadvisable. The containers interfere with the airflow in the hood, and the chemicals increase the number of materials that could be involved in a hood fire.
- Amounts of Flammable and Explosive Chemicals exceeding one liter in volume should be stored in approved

flammables cabinets. The cabinets don't have to be vented, but if they are, the vent pipe should have a flame arrestor. In some areas, local building codes may prohibit venting cabinets into the outside air. Keep cabinet doors closed and locked.

- Never store flammables or explosives in a lab refrigerator unless it's been certified as explosion proof.
- The National Fire Protection Association and your facility's policies regulate how much flammable and explosive material can be stored within lab areas. You should consult your supervisor to determine what the permitted storage levels are.

SAFE WORK PRACTICES AND WASTE DISPOSAL

- Safe work practices also play an important role when you're using Flammables and Explosives. When you're working with them, use the smallest amounts possible to attain the desired reaction.
- If there's a potential for explosion, place your equipment behind a blast shield. Wear a face shield and appropriate gloves. You should also use a lab coat that's made from a slow-burning material.
- Make frequent checks of stored containers. Look for evidence of corrosion or contamination. Push containers back from shelf edges if they've gotten too close.
- Disposing of waste from Flammable and Explosive materials can be tricky. This is another place where you should consult Safety Data Sheets. Be sure to take all the appropriate precautions.
- Very few of these materials can safely go down the drain. Generally, water treatment plants cannot filter out toxic substances like Flammables.
- If you are permitted to use drain disposal, Flammables should always be diluted so they don't pose a fire hazard. Simple reactions inside pipes can cause explosions.
- You may be able to recycle some of your chemicals, depending on what you're working with. But never wash explosive residues down a drain, or schedule them for recycling. Consult your supervisor regarding how you dispose of these wastes.
- More than likely, you'll need to package up your waste for disposal. Waste containers should be properly labeled and placed in a separate area for pick-up.
- You also need to ask your supervisor or safety officer about federal and local disposal regulations. Your facility has a complete plan on how to dispose of chemical waste so read it!
- Remember, you're the one who is ultimately responsible for the disposal arrangements for the materials that you use. So be sure you know what you’re doing.

CLEANING UP SPILLS AND EVACUATION

- When you're working with Flammable and Explosive materials, it's especially important to know what to do in case of an emergency. To start, read through your facility's Emergency Plan. Create contingency plans for spill situations. Remember that flammable liquids spread quickly. The larger the spill area the greater the chance of fire, so all ignition sources in the lab should be turned off.
- Keep spill clean-up equipment and materials nearby. Personal protective equipment is also important. See your supervisor about respirator training.
- Remember, vermiculite absorbents don't keep vapors from rising into the air. Ask your supervisor about using activated carbon absorbents, some of which combat this problem.
- When you are working with Flammables and Explosives, you should always think about what you should do in case of an emergency.
- Reread your facility’s Emergency Plan. Know the locations of fire extinguishers and emergency safety equipment, but only use them if you've been properly trained to do so.
- Study evacuation maps and know where your exits are. With a fire or explosion, evacuating your lab may be the only thing you can do.

CONCLUSION

- Because they’re always dangerous, working safely with Flammables and Explosives requires you to know what you’re doing and maintain your focus at all times. Let's review.
- Know which of the materials you work with are Flammable or Explosive, and what their characteristics are. When you're working with Flammables and Explosives, make sure there are no potential ignition sources nearby. Be sure you have enough ventilation to remove volatile fumes and vapors from your work area. Know how the Flammable and

Explosive materials you work with should be handled and stored. And be prepared in the event a Flammable or Explosive emergency occurs.

- By being on your toes, and taking appropriate safety measures, you'll be able to work with Flammables and Explosive materials safely and securely.

ANSWERS TO THE REVIEW QUIZ

1. b
2. a
3. a
4. b
5. a
6. a
7. a

FLAMMABLES AND EXPLOSIVES IN THE LABORATORY
REVIEW QUIZ

The following questions are provided to determine how well you understand the information presented in this program.

Name_____Date_____

1. The highest temperature at which a substance gives off vapor that will burn is called its "flashpoint".

a. True
b. False

2. The percentage of a vapor necessary in the air for ignition to take place is called the limits of flammability.

a. True
b. False

3. The minimum temperature required to cause self-contained combustion, regardless of the heat source, is known as "ignition temperature".

a. True
b. False

4. A flammable and explosive substance's Safety Data Sheet contains no information regarding its hazard characteristics.

a. True
b. False

5. Amounts of Flammable and Explosive Chemicals exceeding one liter in volume should be stored in approved flammables cabinets.

a. True
b. False

6. A red/yellow label affixed to a flammable liquid container indicates that the material has a low flashpoint.

a. True
b. False

7. Vermiculite absorbents don't keep vapors from rising into the air.

a. True
b. False