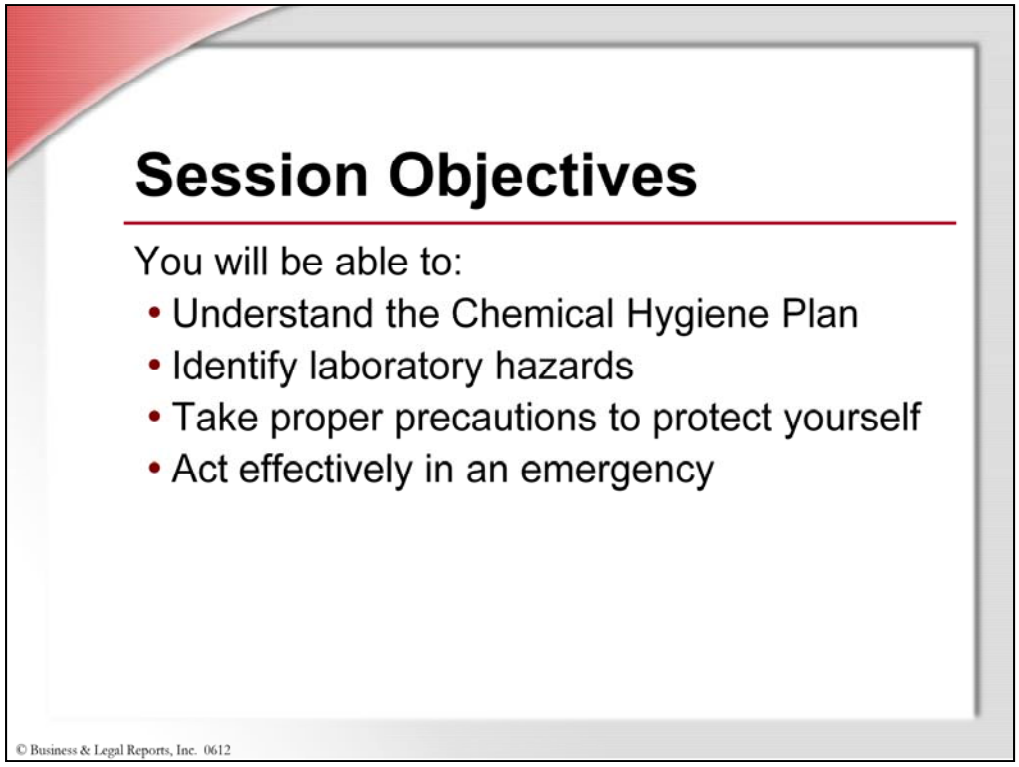
Slide Show Notes

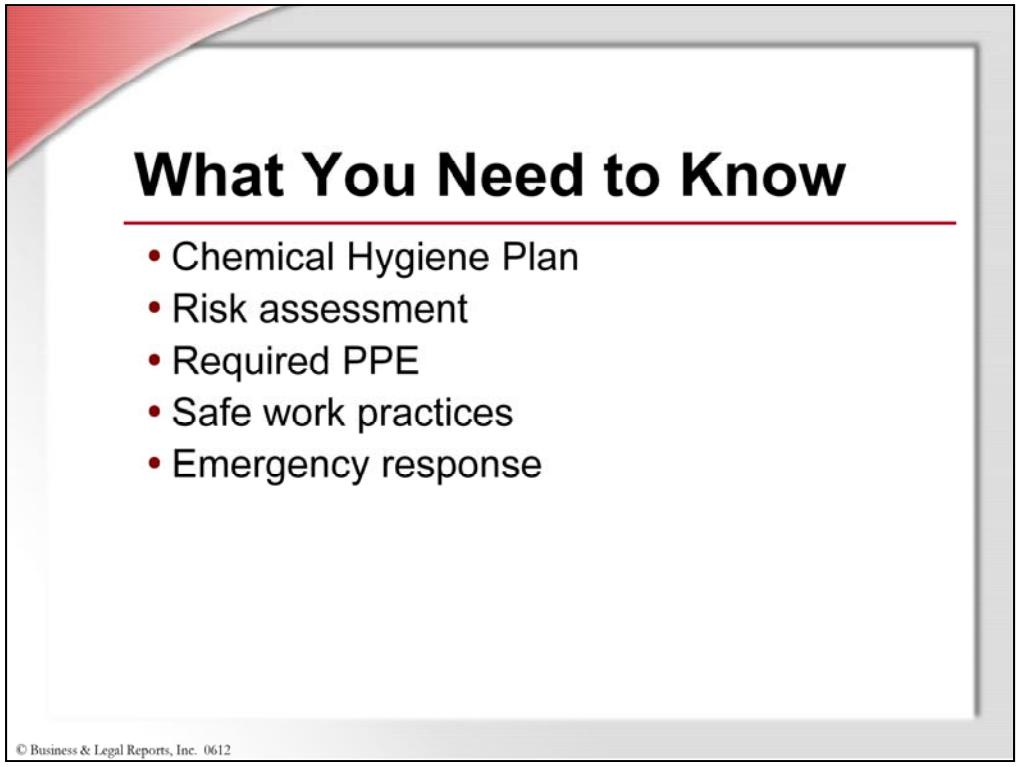
- Welcome to laboratory safety training. This session is designed for lab workers in general industry.
- Laboratory work requires knowledge, skill, and attention to detail. Those qualities also have to be applied to all your job responsibilities—including safety. Laboratories have a variety of safety and health hazards. You need to understand each hazard and take proper precautions to protect yourself and your co-workers at all times.
- The purpose of this training session is to review lab safety requirements to ensure that you know how to prevent accidents, injuries, and illness on the job.



Slide Show Notes

The main objective of this session is to make sure that you know what you need to do to protect your safety and health on the job. By the time this session is over, you should be able to:

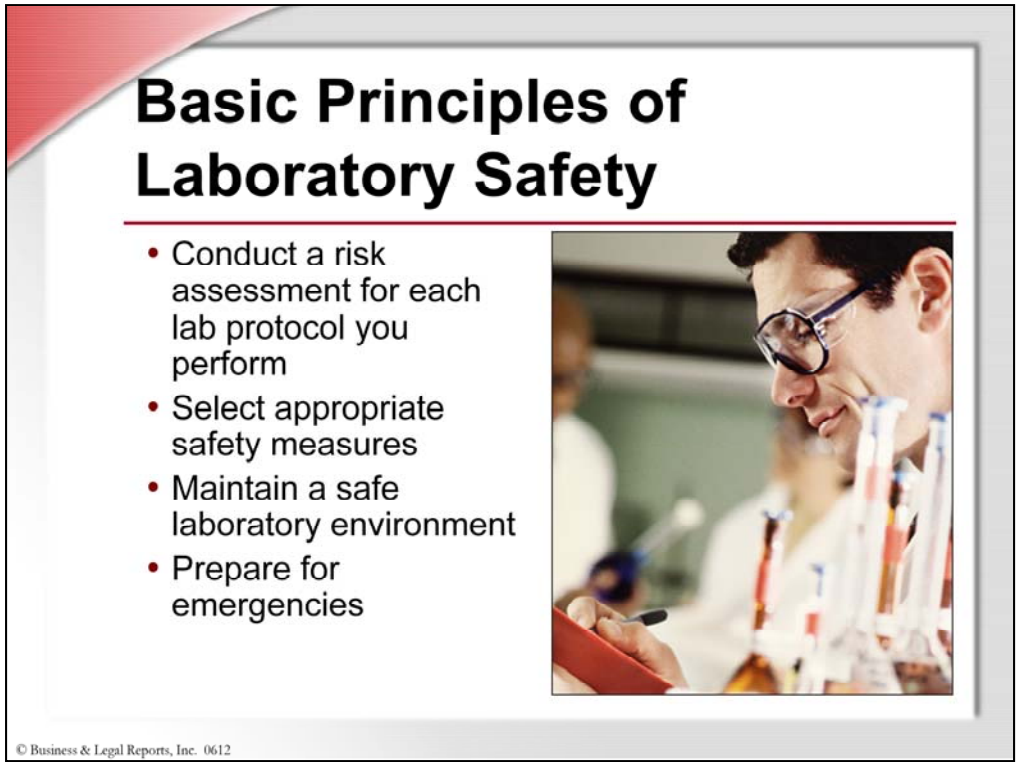
- Understand the Chemical Hygiene Plan;
- Identify laboratory hazards;
- Take proper precautions to protect yourself; *and*
- Act effectively in an emergency.



Slide Show Notes

During the session we will discuss:

- The purpose and content of the Chemical Hygiene Plan;
- How to assess the risks you might face working in the lab;
- The personal protective equipment you may need to use;
- The work practices required to keep you safe; *and*
- How to respond effectively in an emergency situation.

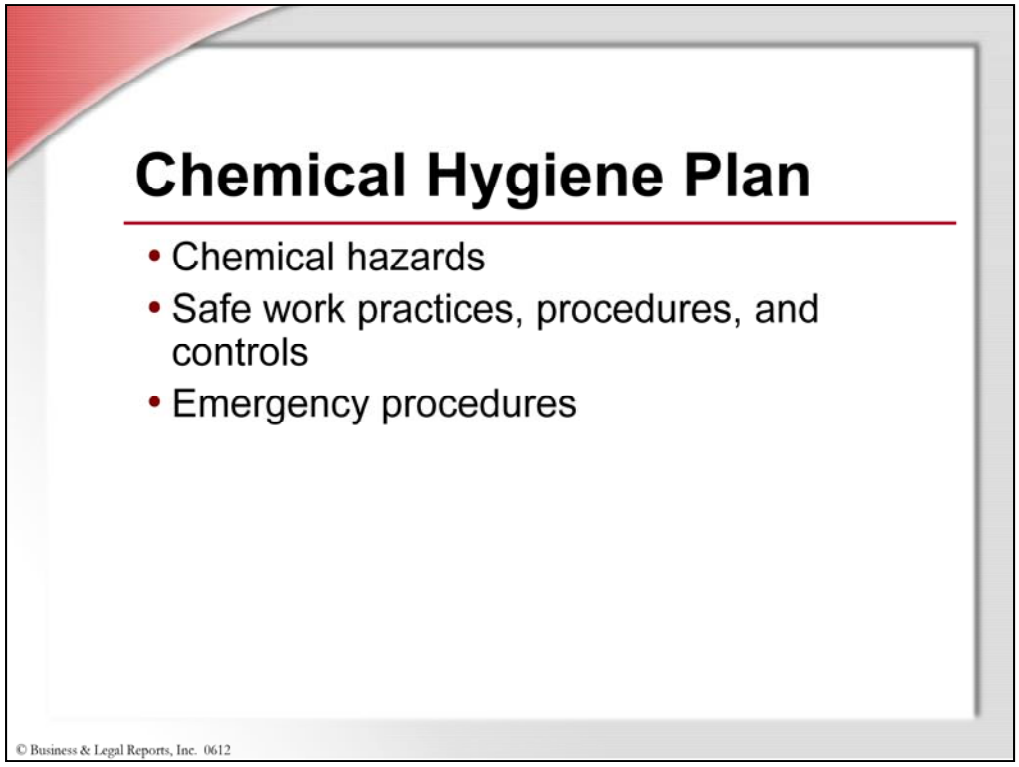


Slide Show Notes

Let's begin with the four basic principles of laboratory safety:

- First, for each lab protocol you perform, you need to conduct a risk assessment to identify all the hazards associated with the operation.
- Second, you must select appropriate safety measures, including work practices, personal protective equipment, and engineering controls, to minimize or eliminate those risks.
- Third, you need to maintain a safe laboratory environment at all times. This includes concerns like safe housekeeping and proper storage of chemicals.
- And fourth, you must prepare for emergencies. Even though we hope that by taking the first three steps, you can avoid fires, spills, injuries, and other emergencies, you must be prepared to deal swiftly and effectively with emergency situations should they arise.

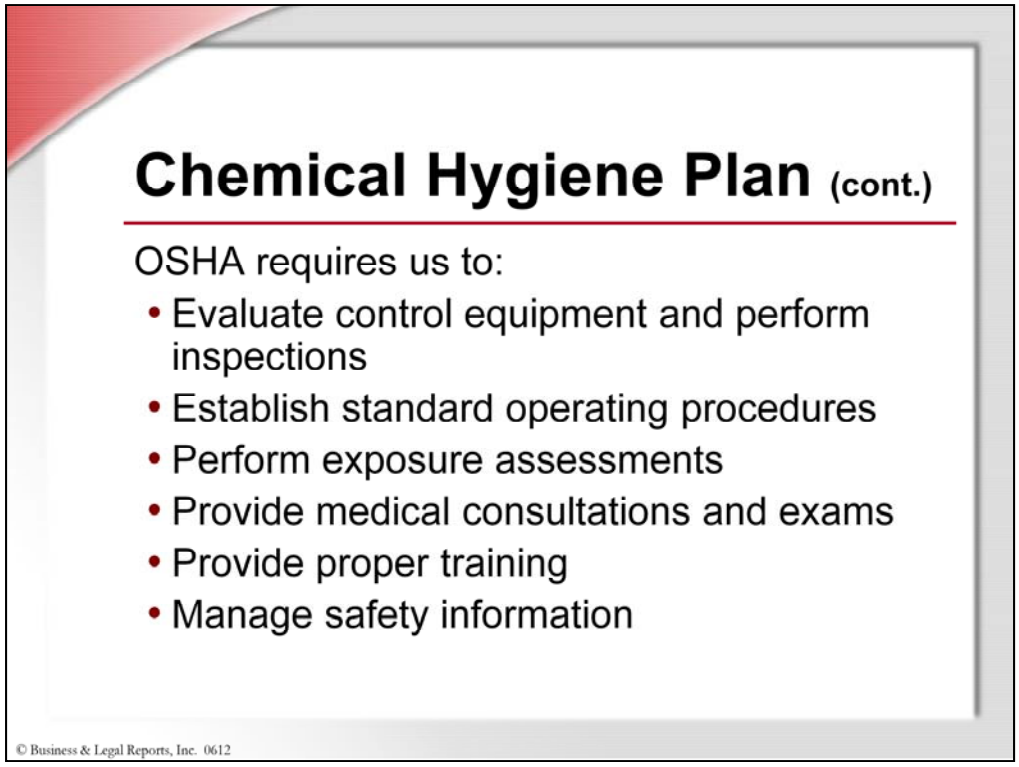
These principles form the basis of this training session, so keep them in mind as we progress from slide to slide.



Slide Show Notes

The Chemical Hygiene Plan is required by OSHA's laboratory safety regulations. The four basic principles of laboratory safety are supported by our facility's Chemical Hygiene Plan, which describes:

- The hazards associated with chemicals present in the lab;
- The work practices, procedures, and controls in place to protect lab staff; *and*
- The emergency procedures, including spill response, evacuation, and first aid, that you may need to take in the event of an accident or other emergency incident.



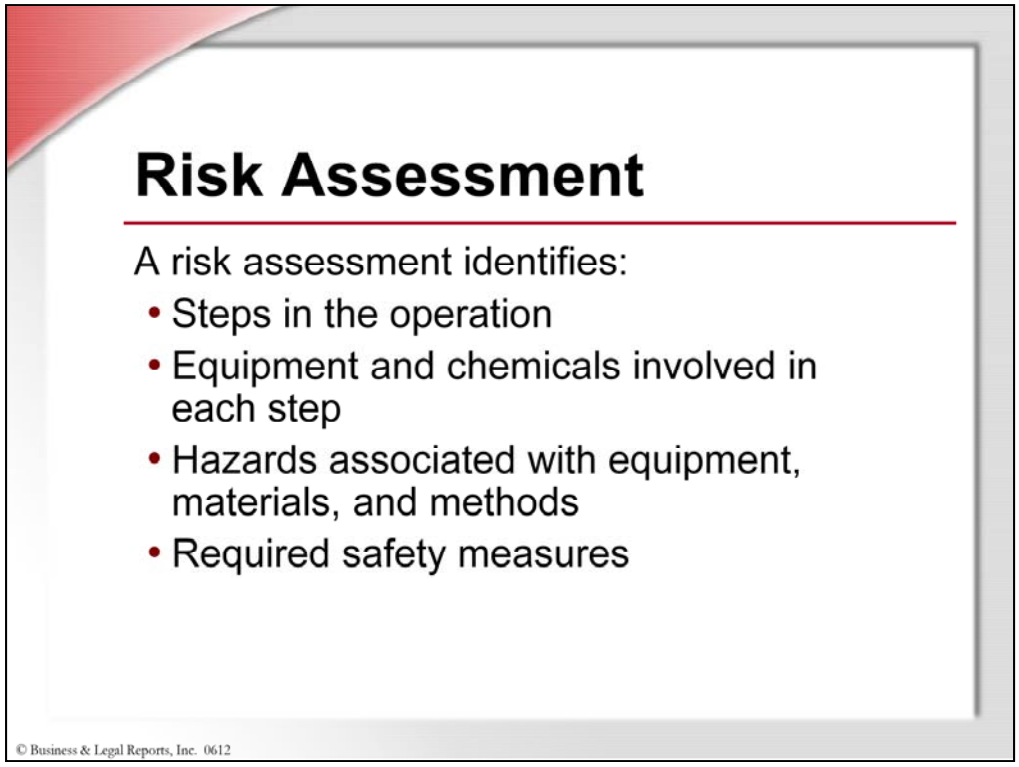
Slide Show Notes

The Chemical Hygiene Plan also describes what management has to do to fulfill its OSHA responsibilities for lab safety. We must:

- Regularly evaluate lab control equipment and perform lab inspections;
- Establish standard operating procedures for routine and high-hazard lab operations;
- Perform exposure assessments to monitor exposure to hazardous chemicals, vapors, and fumes;
- Provide medical consultations and examinations, as needed;
- Provide proper safety training;
- And finally, manage material safety data sheets and other safety reference materials.

Have you read the Chemical Hygiene Plan? It's important for you to read and understand the plan. If there is anything about it you don't understand, be sure to speak to your supervisor.

Review the facility's Chemical Hygiene Plan. Make sure trainees know where they can obtain additional copies of the plan, if necessary.



Slide Show Notes

Now let's begin our review of lab safety hazards with the first principle, which is to conduct a risk assessment for each lab protocol you perform. A risk assessment identifies:

- The steps in the particular operation you are going to perform;
- The equipment and chemicals involved in each step, including chemicals' names, concentrations, and volumes;
- The hazards associated with the equipment, materials, and methods; *and*
- The required safety measures based on the hazards, materials, and methods.

Do you perform a risk assessment for each lab protocol you perform? Think about what you would include in a risk assessment for a protocol you perform regularly.

Have trainees write a risk assessment for one of the lab protocols they perform regularly.

Slide Show Notes

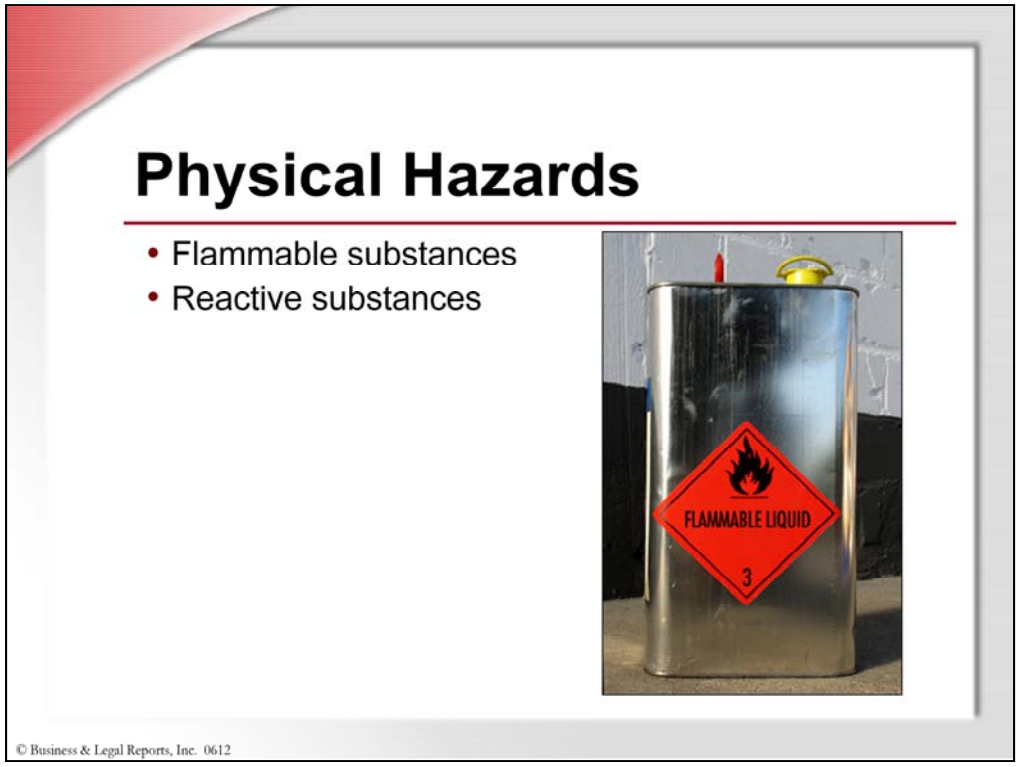
One of the most important tools for identifying hazards and safety measures for the chemicals you work with is the material safety data sheet, or MSDS. While labels contain some safety and health information, the MSDS contains the most complete information. This is where you can find the information you need to conduct an accurate risk assessment.

You will find the following essential information in an MSDS:

- Physical and chemical properties of the substance;
- Health hazard information, including both short- and long-term health effects;
- Permissible Exposure Limits, or PELs, and symptoms of exposure;
- A description of how to safely handle the substance under normal and emergency conditions; *and*
- A description of first-aid and medical treatment if overexposed.

Do you know where to find the information you need in an MSDS?

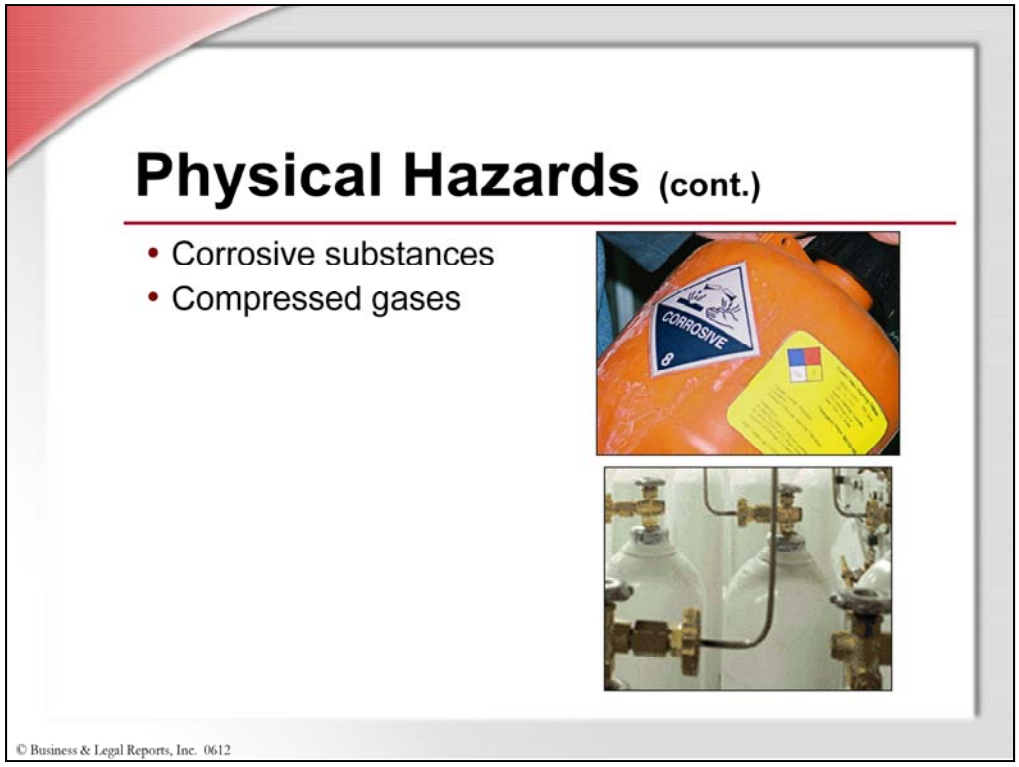
Briefly review an MSDS for a common lab chemical, pointing out where to find necessary health and safety information. Make sure trainees know where they can obtain copies of MSDSs.



Slide Show Notes

Before working with any chemical it is important to understand its physical hazards. You may be dealing with substances that present serious physical hazards. For example:

- Flammable substances can catch fire easily. Chemicals with low flashpoints of less than 100 degrees Fahrenheit are considered flammable. Keep these materials away from flames and hot equipment. Keep their containers closed. Fumes or vapors from flammable materials can be ignited by electrical equipment and even static electricity.
- Reactive substances can react with other chemicals, air, or water. Some materials become unstable over time and begin to react with themselves. Sometimes exposure to sunlight or warm air will contribute to this reaction. Some chemical reactions can be explosive.

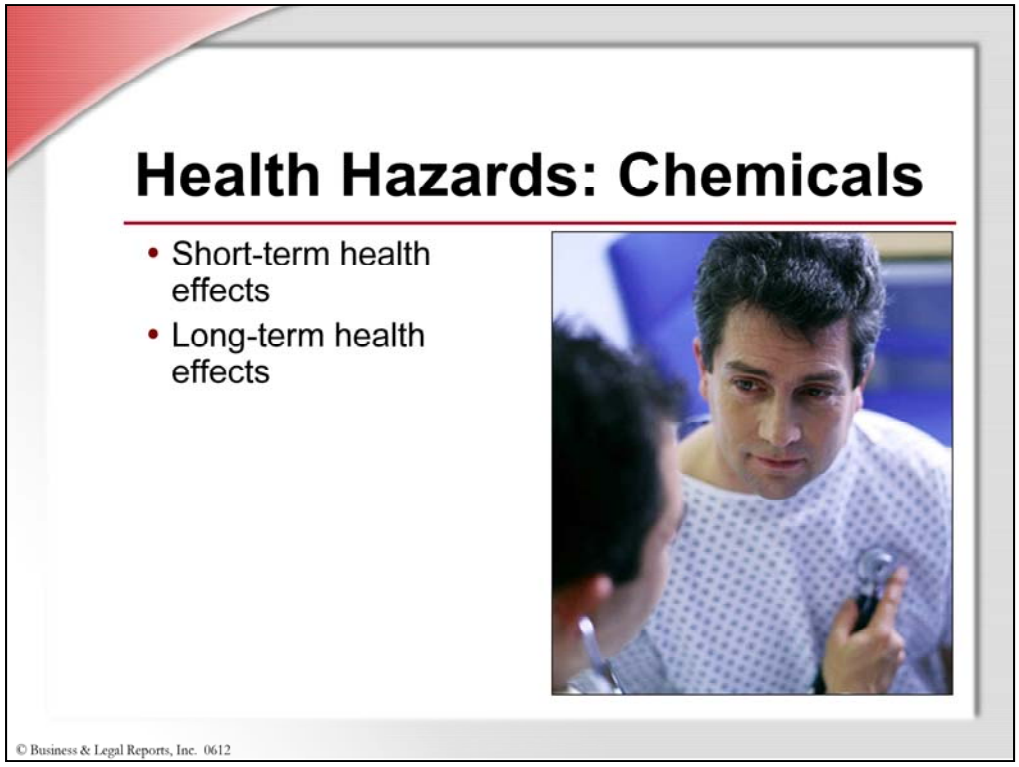


Slide Show Notes

- Corrosive substances such as acids and caustics will burn your skin and eat through other materials such as metal. Corrosives can only be stored in certain containers such as glass or some plastics. Be sure to wear appropriate skin protection when working with caustics.
- Compressed gas cylinders can explode if exposed to heat or shock. Be sure to handle and store compressed gases safely.

If you handle any of the chemicals in these classes, special precautions need to be followed. These precautions are defined in the Chemical Hygiene Plan. Be sure to consult the plan before you proceed.

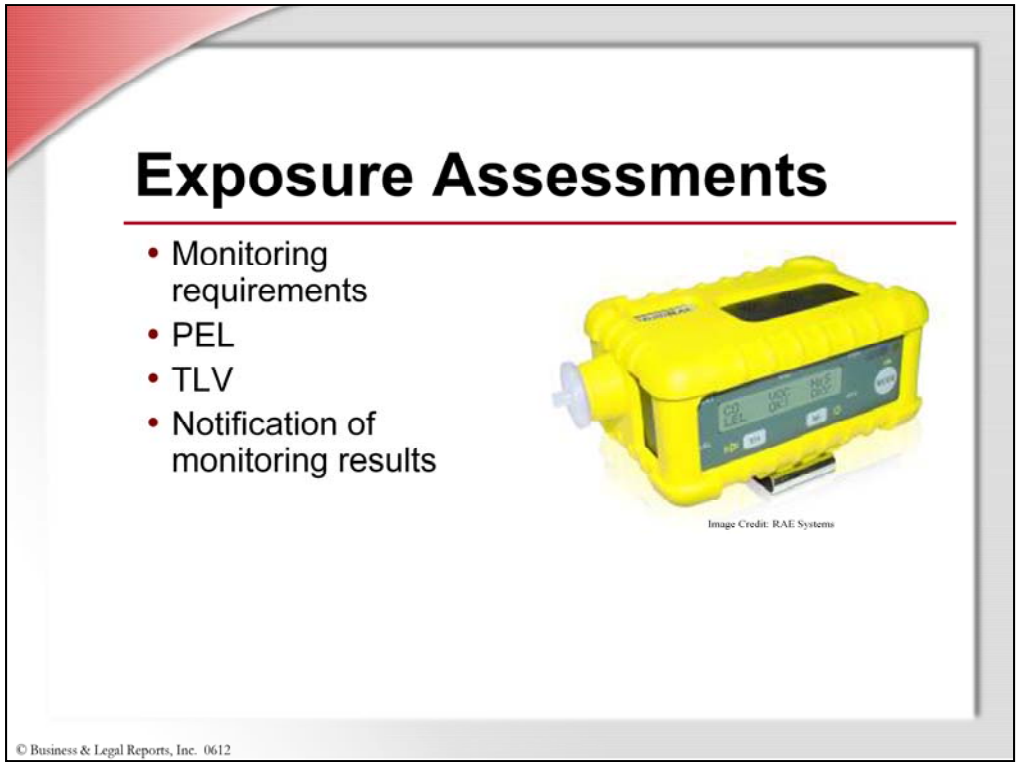
Review special precautions in the Chemical Hygiene Plan for handling chemicals in these four classes.



Slide Show Notes

Many chemicals also present health hazards. The health effects of a hazardous chemical can be short- or long-term.

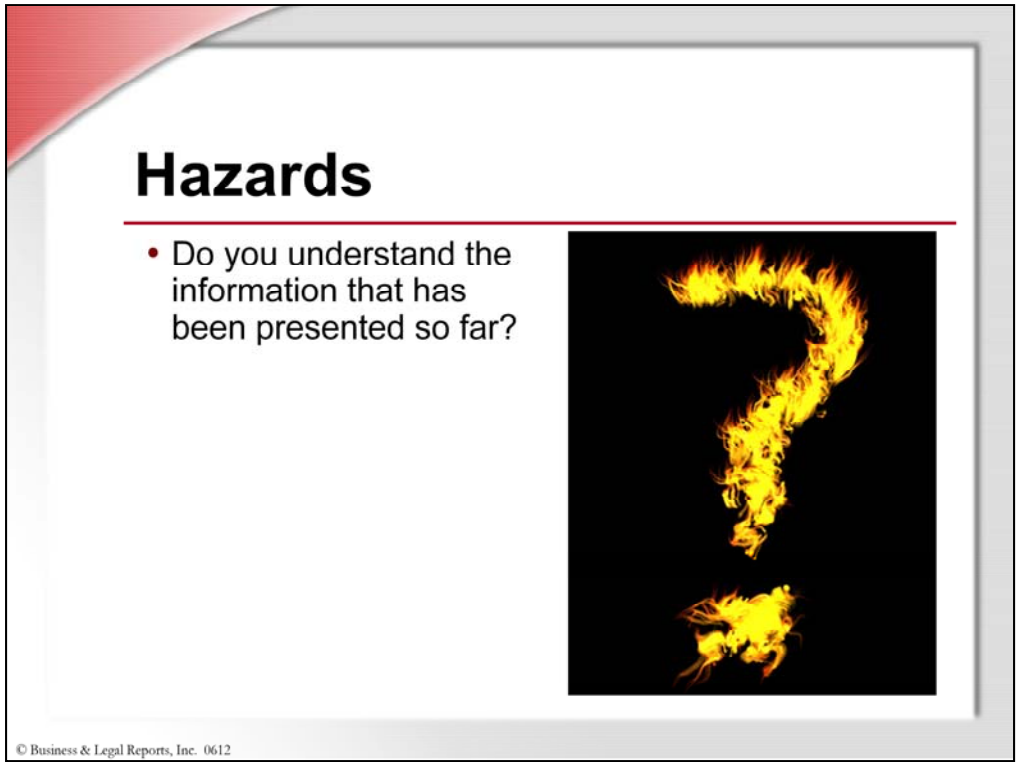
- Short-term health effects include dizziness, nausea, and headache. Other short-term effects include irritation to the eyes, nose, throat, or upper respiratory tract; persistent cough, wheezing, or tightness in the chest; chest pain; and difficulty breathing or shortness of breath.
- Long-term health effects can include internal organ damage, reproductive problems, and cancer.



Slide Show Notes

To identify airborne chemical hazards in the laboratory we may also conduct monitoring to make sure you are not being overexposed to toxic fumes or vapors.

- If a substance is regulated by an OSHA standard that requires monitoring, we will monitor exposure levels if there is reason to believe that exposure routinely exceeds safe levels.
- OSHA determines PELs for each regulated chemical. If your average exposure to a chemical is below the designated PEL for an 8-hour day, no extra protection is required. However, if you are exposed to levels higher than the PEL, steps must be taken to reduce exposure—for example, by better local ventilation and wearing a respirator.
- The Threshold Limit Value, or TLV, is another number used to assess exposure levels. In most cases, the TLV and the PEL will be the same. You will find either the TLV or the PEL, or both, for a chemical substance in the MSDS.
- We will notify you about the results of any monitoring we perform in the lab.



Slide Show Notes

Now it's time to ask yourself if you understand the information that has been presented so far.

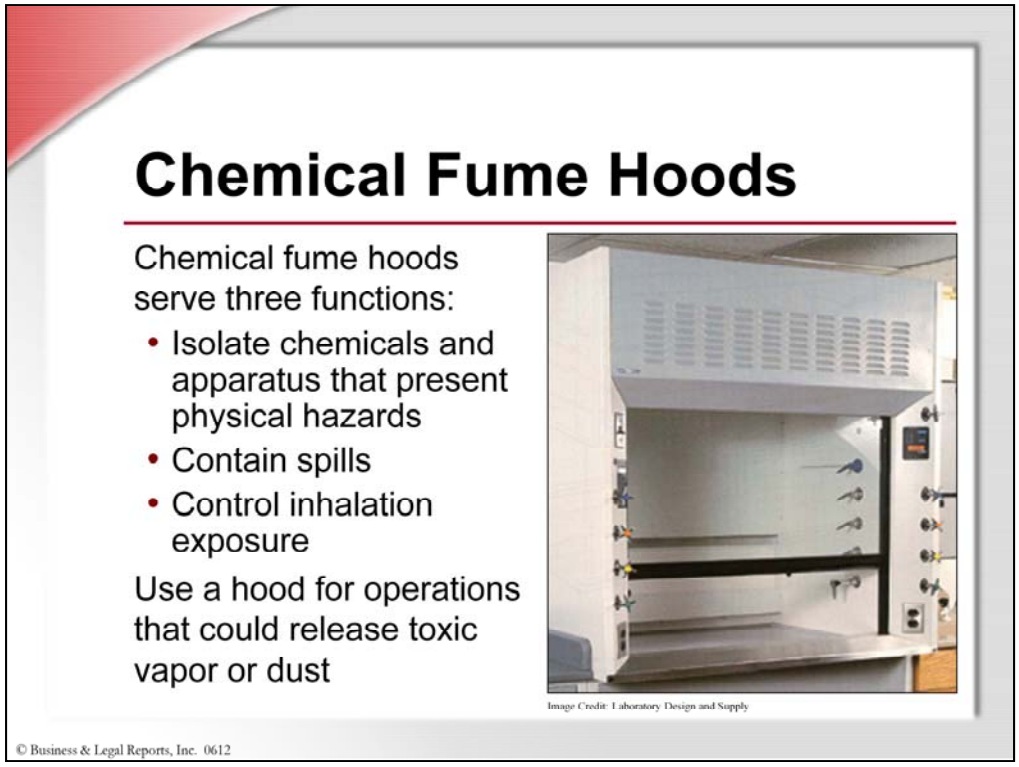
- Do you understand what we've discussed about our Chemical Hygiene Plan? Do you understand the hazards you face working in a laboratory?

It's important for your safety that you understand the Chemical Hygiene Plan and the hazards you may encounter in your work.

Answer any questions trainees have about the information presented in the previous slides.

Conduct an exercise, if appropriate.

Now let's continue with a review of the second and third basic principles of lab safety—taking proper precautions and maintaining a safe laboratory environment.



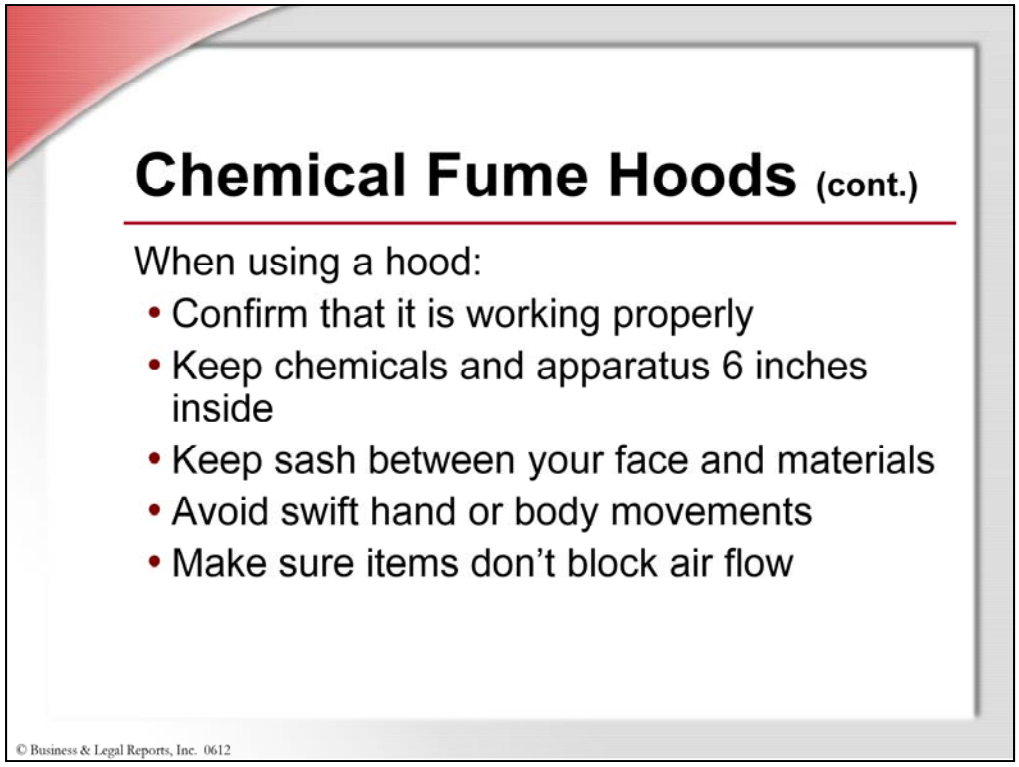
Slide Show Notes

We'll begin our discussion of lab safety measures with engineering controls. Whenever possible, we try to engineer out safety and health hazards. One of the basic controls we use in the lab is the chemical fume hood. Although general laboratory ventilation provides some airborne contaminant control, it must be supplemented by the local exhaust protection provided by fume hoods.

Chemical fume hoods serve three essential functions.

- They isolate apparatus or chemicals that present physical hazards—the closed hood sash provides an effective barrier;
- They contain spills that occur when dispensing chemicals; *and*
- They control inhalation exposure, protecting you from health hazards.

Hoods should be used for any operations that could release toxic vapor or dust. OSHA suggests using a hood whenever working with any volatile chemical that has a TLV less than 50 parts per million.



Slide Show Notes

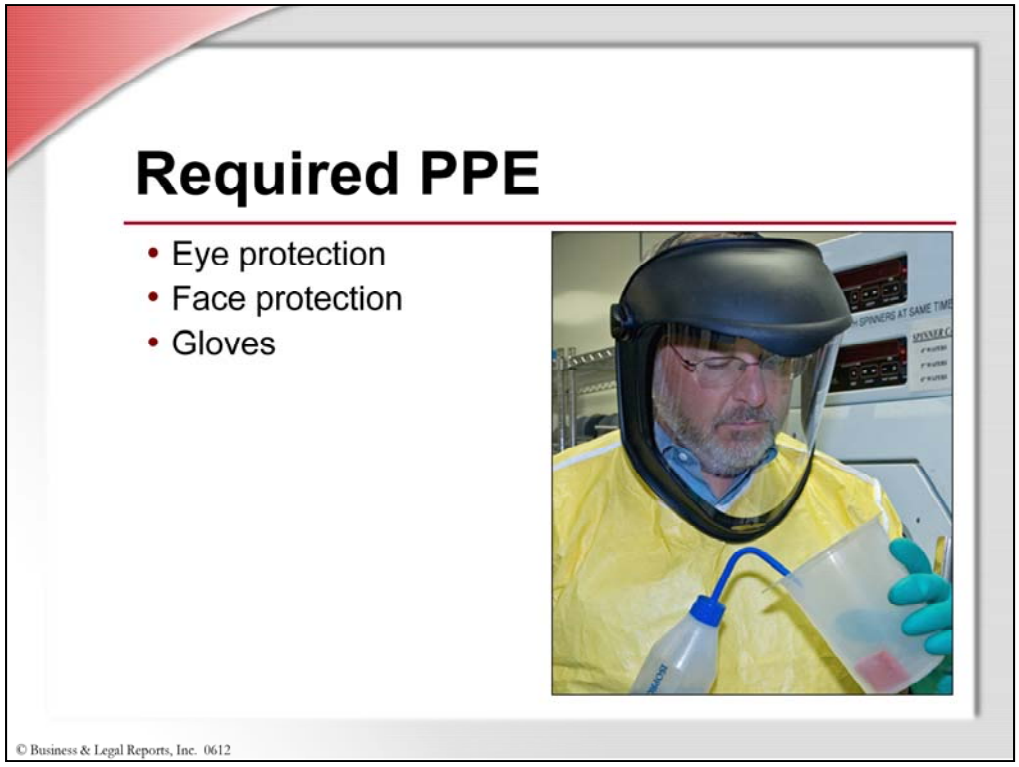
When using a chemical fume hood:

- Confirm that the hood is working properly by checking the continuous monitoring device.
- Keep chemicals and apparatus at least 6 inches inside the hood.
- Keep the sash between your face and the materials you're working with.
- Avoid swift hand or body movements in front of inside the hood.
- And finally, make sure that materials, chemicals, or other items in the hood do not block air flow.

When not in use, keep hood sashes open 3 to 6 inches to let air flow through the hood and purge it.

Think about other safety procedures you are required to follow when using a chemical fume hood.

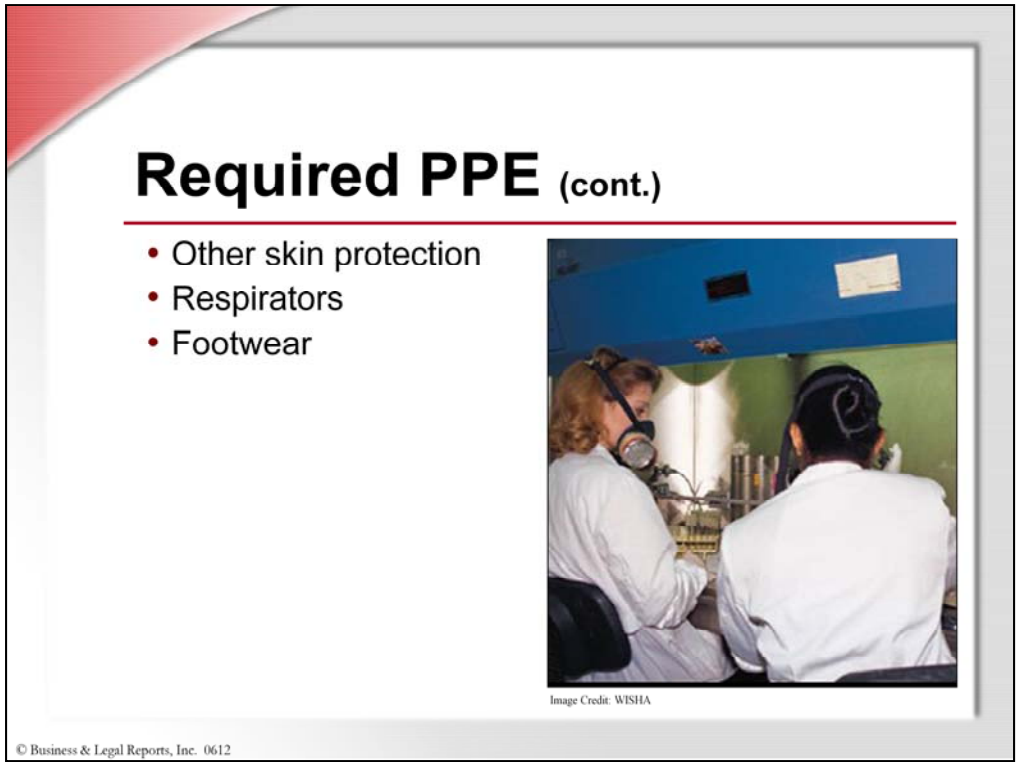
Discuss any other procedures required for the safe use of fume hoods in your facility.



Slide Show Notes

When engineering controls alone cannot eliminate hazards or reduce their effect to safe levels, personal protective equipment is required to provide a barrier between you and the hazards. A variety of PPE may be required for the various tasks you perform in the lab. For example:

- Safety glasses or goggles should be worn at all times when working in the laboratory.
- Face shields should also be used when pouring, mixing, or stirring chemicals, or performing any other activity that might cause chemicals to splash up into your face. But remember, face shields do not provide eye protection. Safety glasses or goggles must always be worn under a face shield.
- Gloves should be worn when working with almost every type of chemical. Different types of gloves will protect against different hazards. You may need latex, rubber, nitrile, or butyl gloves. Consult the chemical label and/or MSDS, or check with your supervisor for information about selecting the right gloves for the job.



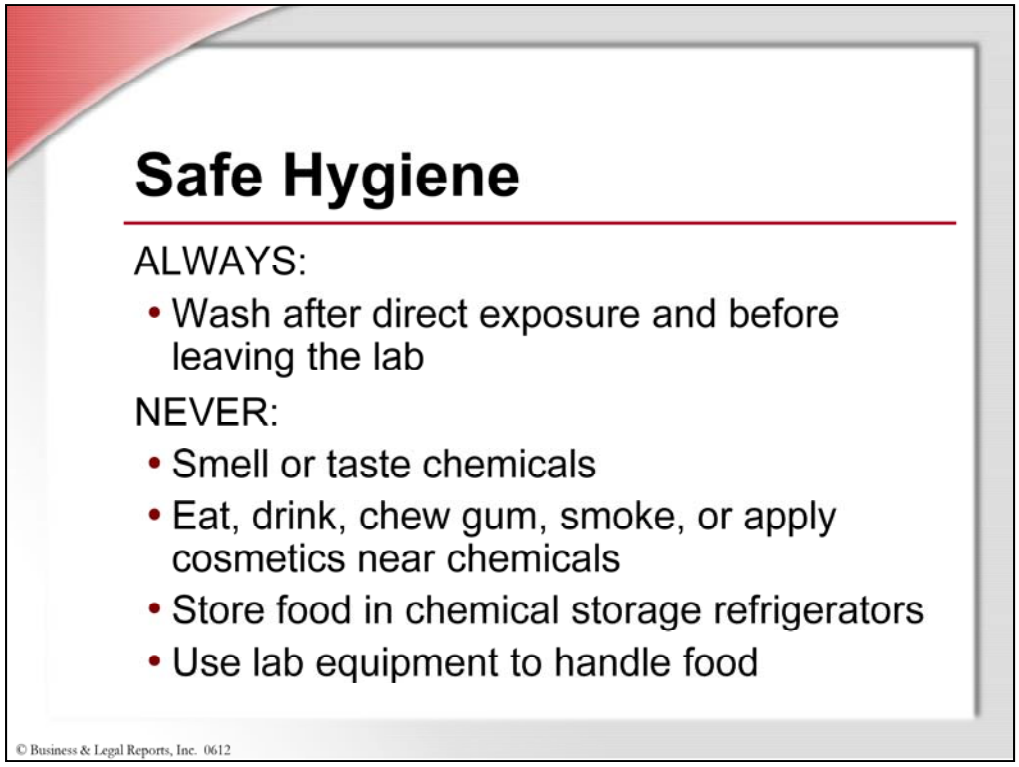
Slide Show Notes

You might also need other types of PPE. For example:

- Other skin protection, such as lab coats, plastic aprons, Tyvec suits, or other chemical-resistant clothing, may be necessary. Make sure to choose the appropriate material to protect against the hazards of the chemical you're using. Check the MSDS or speak to your supervisor to be sure you're using the right protection.
- Respiratory equipment is required if engineering controls and ventilation do not reduce chemical exposures below safe levels. Check the MSDS and talk to your supervisor to be sure you select proper respiratory protection.
- You should also wear appropriate footwear to protect your feet. Wear sturdy shoes with slip-resistant and chemical-resistant soles in the lab. Don't wear sandals or flip-flops because they will not protect your feet from chemical exposure or broken glassware.

If you are unsure about the type of PPE you need, consult the MSDS and/or talk to your supervisor.

Bring samples of the different types of PPE trainees are required to use in the lab. Review when each type should be used, and demonstrate proper use and fit.



Slide Show Notes

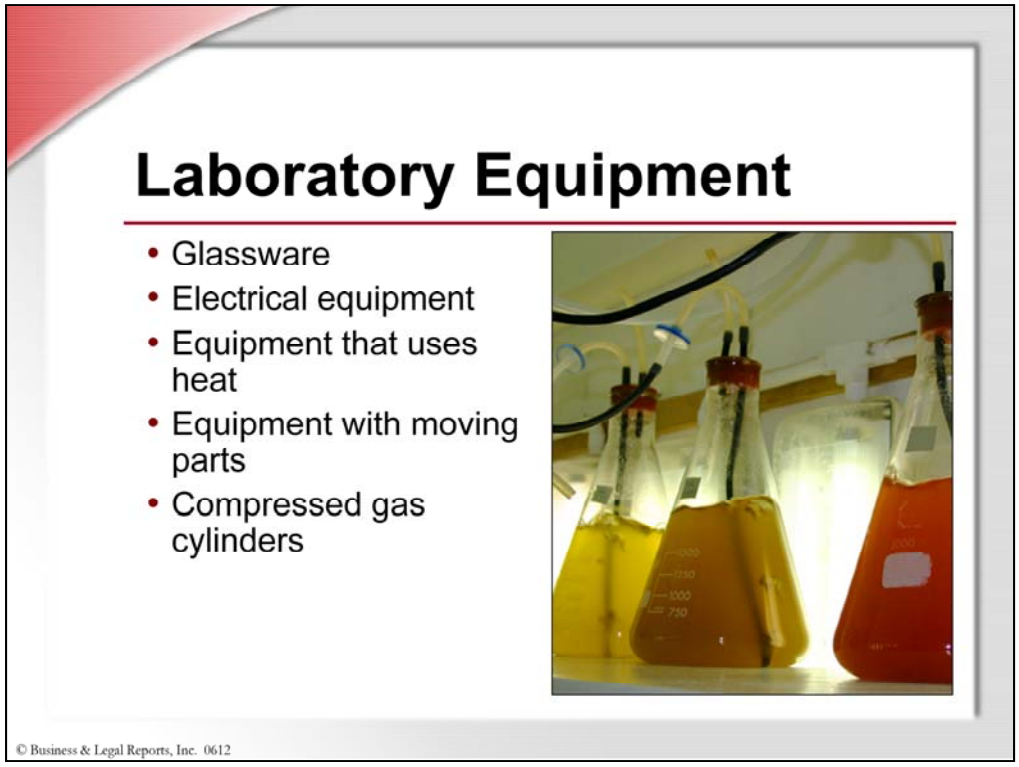
Practicing safe hygiene is another safety measure that you must take when working in the laboratory.

Always

- Wash exposed skin after any direct contact with a hazardous chemical. Also wash thoroughly before leaving the lab to prevent contaminating areas outside of the lab, such as your office, car, and home.

Never:

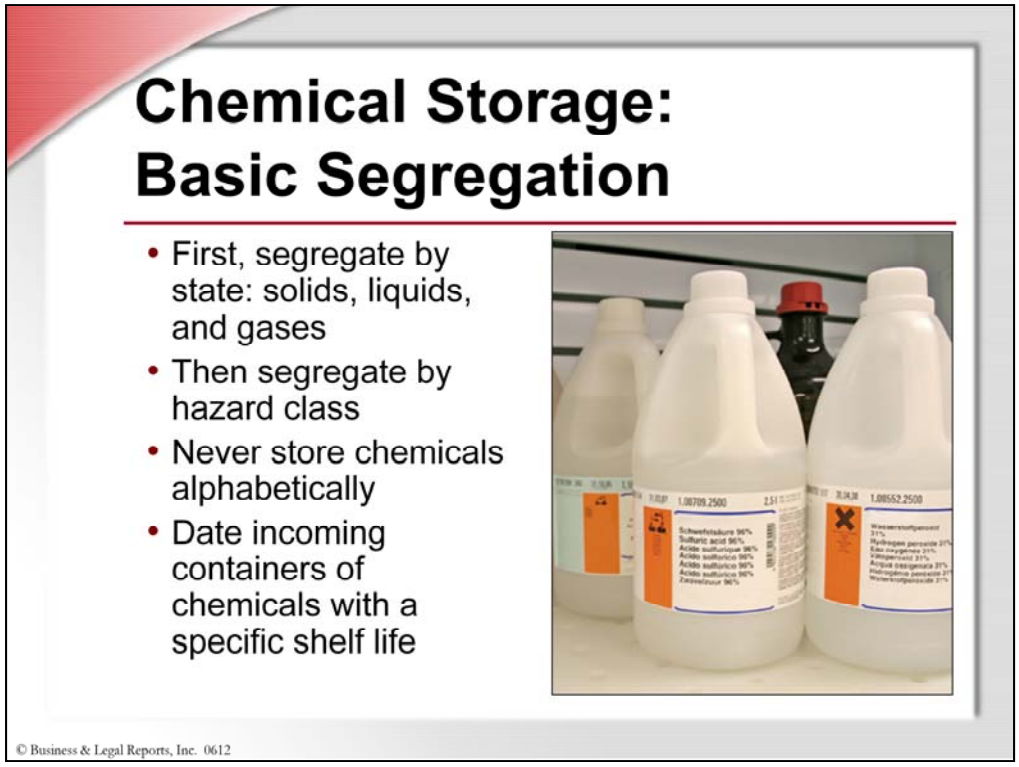
- Smell or taste chemicals;
- Eat, drink, chew gum, smoke, or apply cosmetics near chemicals;
- Store food in chemical storage refrigerators; *or*
- Use lab equipment, such as glassware or utensils, to handle food.



Slide Show Notes

Lab safety also involves using lab equipment properly. Lab equipment can pose a variety of hazards if you're not careful. For example:

- Glassware can break, causing chemical, biological, and cut hazards. Use the right type for each job, and discard chipped or cracked glassware.
- Electrical equipment creates shock, burn, and fire hazards. Never touch electrical equipment with wet hands or while standing on a wet floor. Report any equipment that shocks or gets too hot or warm. Don't attempt to do repairs unless you have been trained.
- Equipment that uses heat (like autoclaves) can burn your skin. Use tongs or heat-resistant gloves.
- Equipment with moving parts, like centrifuges, can catch your clothing or open up suddenly, showering you with hazardous materials. Keep clothing and long hair away. Make sure loads are balanced, the top is locked down, and the equipment has stopped before you open it.
- Compressed gas cylinders can explode or contribute to the spread of fire. Use them carefully, report leaks, and make sure they're properly secured.



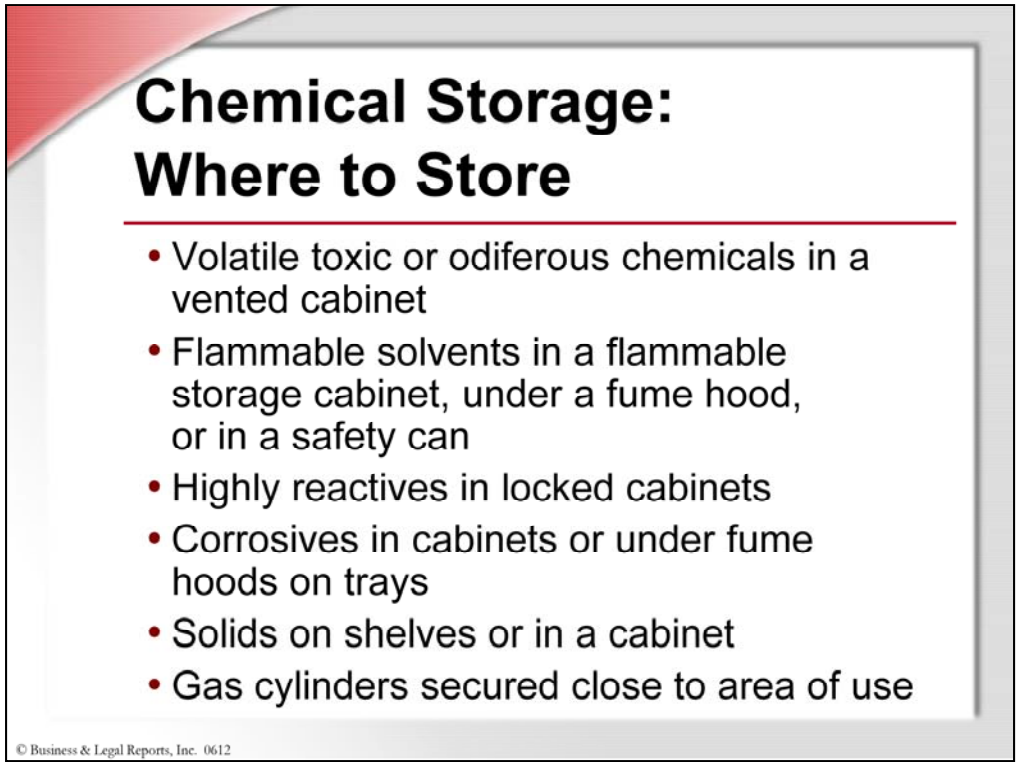
Slide Show Notes

Chemicals should be stored according to a segregation scheme that keeps incompatible chemicals apart.

- First, you should segregate chemicals by state—in other words, according to whether they are solids, liquids, or gases.
- Then, within those classifications, you need to store by hazard classes.
  - For solids this means segregating into four groups—oxidizers, water reactives, flammables, and all others.
  - For liquids it means segregating into five groups—acids, caustics, oxidizers, flammables and combustibles, and perchloric acid.
  - For gases it means segregating into three groups—toxics, oxidizers, and flammables.
- Never store chemicals alphabetically. You could be putting incompatible chemicals alongside one another.
- Also be sure to date incoming containers of chemicals with a specific shelf life so that you'll know when any unused portion needs to be discarded.

Do you know and follow the rules for safe chemical storage in the lab?

Review your chemical segregation scheme and storage procedures.



Slide Show Notes

You also need to know where various chemicals should be stored in the lab.

- Volatile toxic or odiferous chemicals should be stored in a vented cabinet.
- Flammable solvents should be stored in a flammable storage cabinet, under a fume hood, or in a solvent safety can if stored on a bench.
- Highly reactive substances should be stored in locked cabinets away from heat or light and incompatible materials.
- Corrosives should be stored in cabinets or under fume hoods on trays.
- Solid chemicals should be stored on shelves or in a cabinet under a bench.
- Gas cylinders should be stored as close as possible to where they are used to minimize the length of pressurized tubing. Cylinders should be secured to prevent them from falling over.

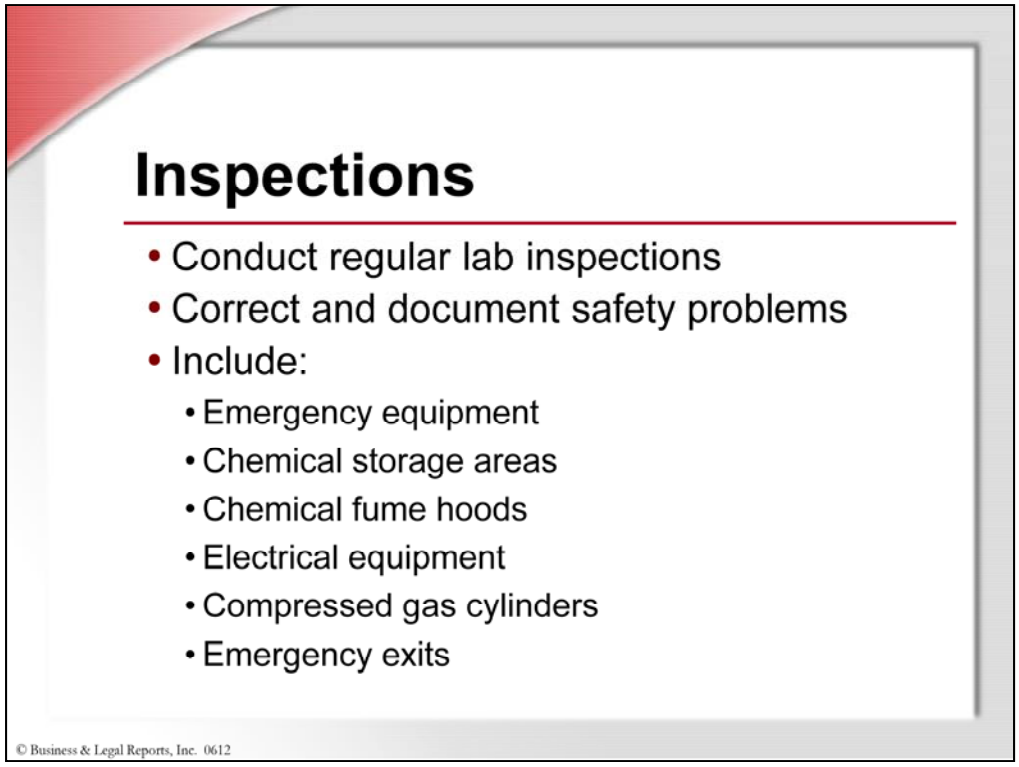
Slide Show Notes

Good housekeeping practices also play an important role in lab safety. Good housekeeping prevents accidents and reduces the risk of harmful exposures. Here are some key points to keep in mind:

- Keep work and walking surfaces clean, dry, and uncluttered.
- Never store chemicals on the floor.
- Keep only materials you're currently working with on your lab bench.
- Transport chemicals safely using trays or carts to prevent dropping them.
- Make sure you have clear access to stairways and hallways, exits, emergency equipment, and utility controls at all times.

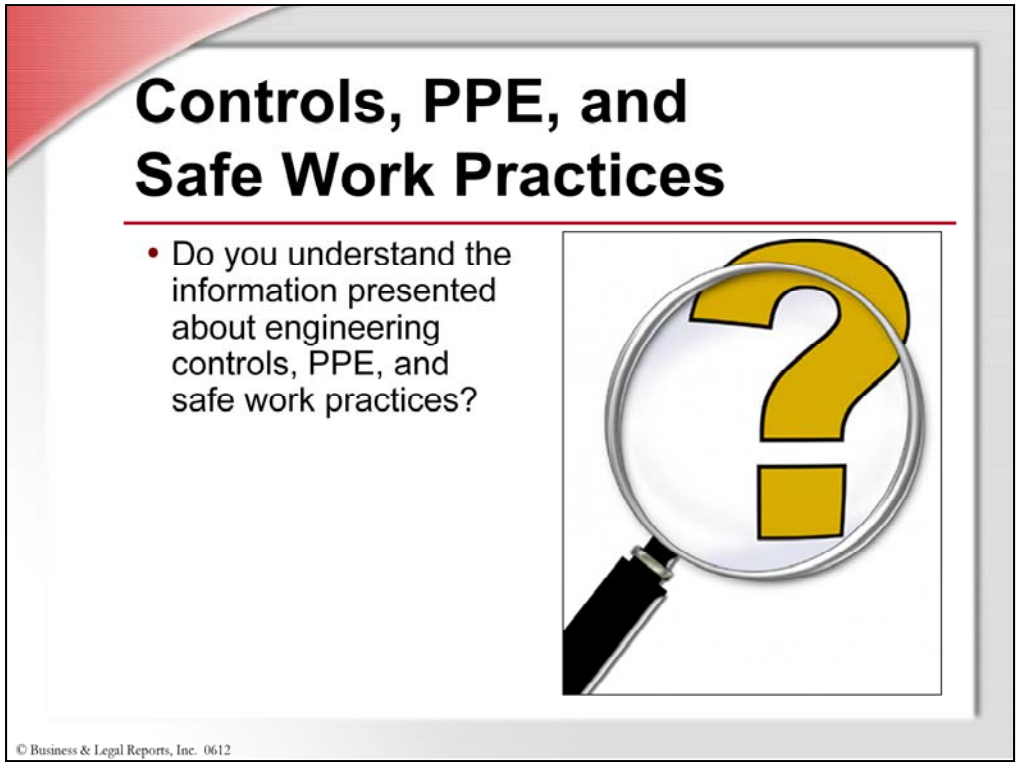
Think about any other safe housekeeping responsibilities you are required to fulfill.

Discuss safe housekeeping responsibilities and requirements.



Slide Show Notes

- Conduct regular lab inspections using a checklist.
- Safety problems noticed during an inspection should be corrected as soon as possible, and the correction should be documented.
- Include the following in your inspections:
  - Emergency equipment such as eyewash stations and emergency showers, fire extinguishers, and spill equipment. Eyewash stations and emergency showers should be checked weekly, and other equipment should be inspected on a regular schedule.
  - Chemical storage areas. Inspect regularly for leaks or damaged containers.
  - The face velocity of chemical fume hoods. Evaluate regularly.
  - Electrical equipment to make sure cords and plugs are in good condition.
  - Compressed gas cylinders for leaks and to make sure they are properly secured.
  - Exits, including stairways, halls, and exit doors, to make sure they remain clear.



Slide Show Notes

- Do you understand the information in the previous slides about engineering controls, required PPE, and safe work practices?

It's important that you understand this information because these essential safety measures protect you from injuries and illness.

Answer any questions trainees have about the information presented in the previous slides.

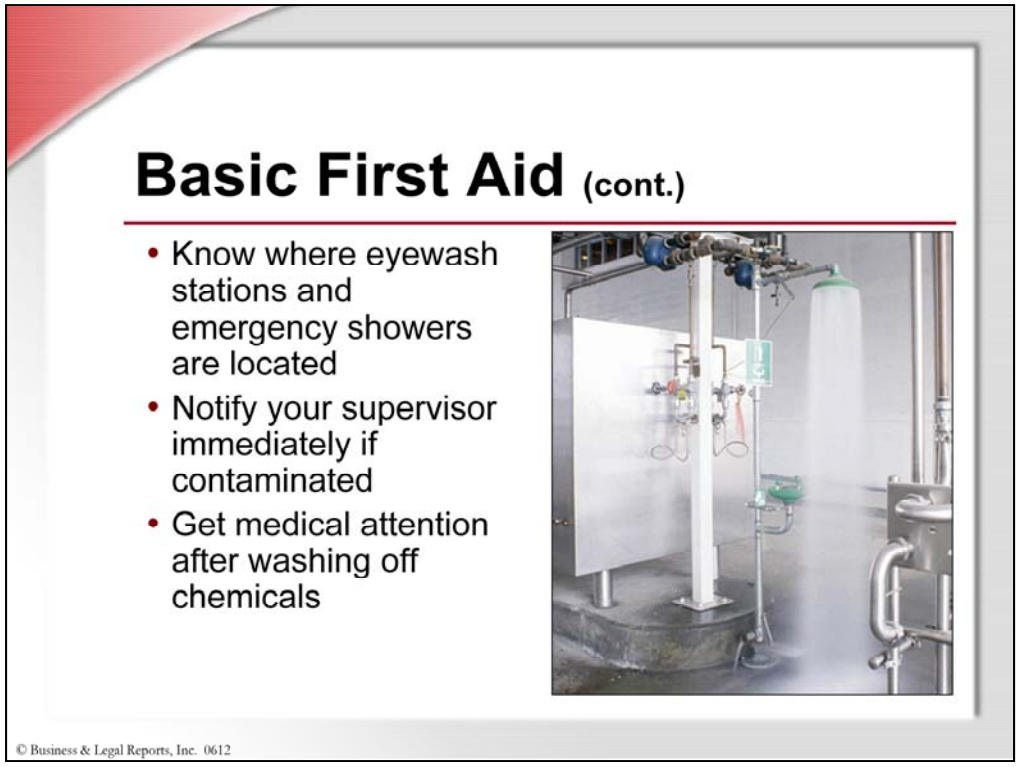
Conduct an exercise if appropriate.

Now let's conclude the session by talking about the fourth principle of basic laboratory safety—preparing for emergencies.

Slide Show Notes

Everyone should know basic first aid for possible lab emergencies. The information on this slide is general. While it is sufficient for most chemicals, remember that you should refer to the label or MSDS for more specific first-aid information.

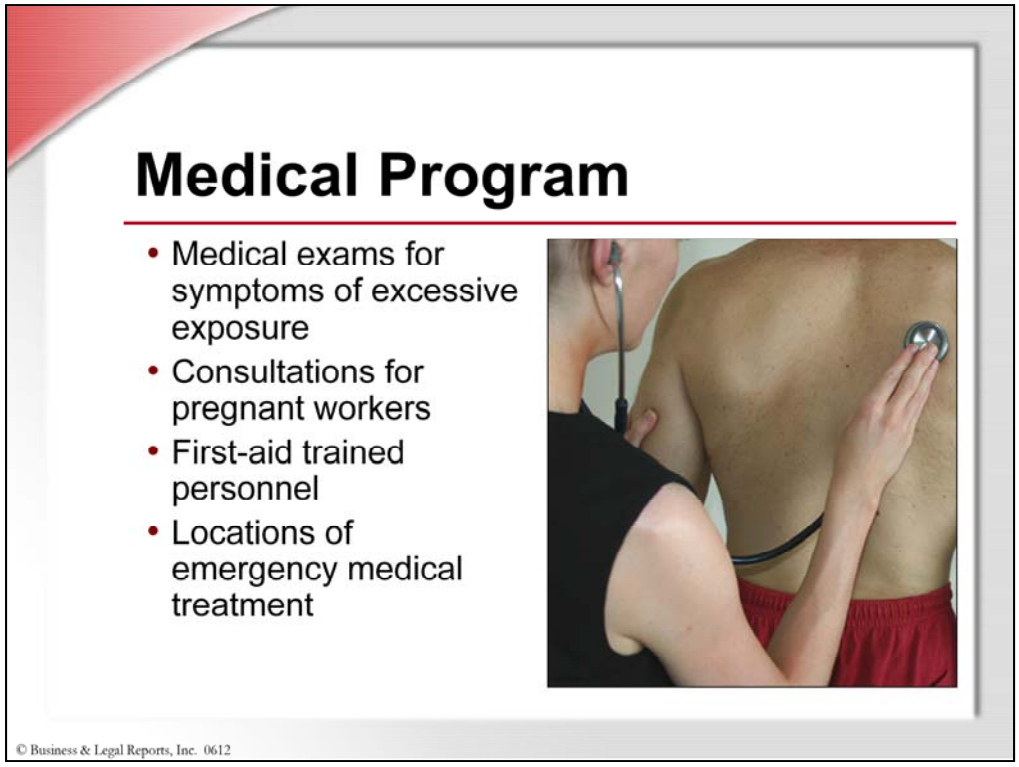
- For chemicals in the eyes, call for help, and then irrigate the eyeball and inner surface of the eyelid with cool water for 15 minutes, using an eyewash station or other water source. Forcibly hold eyelids open to ensure an effective wash. Remove contact lenses as soon as practical.
- For chemicals on the body, call for help, and then remove contaminated clothing and footwear. Next, flood the affected body area with water, using an emergency shower or other effective water source. Remove jewelry to facilitate removal of residual material. Do not use neutralizing chemicals, creams, or lotions.
- For inhalation of chemical fumes or vapors, move into fresh air. More severe cases might require the administration of oxygen.
- A swallowed chemical requires immediate medical attention to remove the chemical from the stomach.



Slide Show Notes

Here are some other points to remember about first aid in the lab:

- Make sure you know where the nearest eyewash station and emergency shower are located;
- Notify your supervisor immediately if you are contaminated; *and*
- Get medical attention for any exposure after washing off chemicals.



Slide Show Notes

- OSHA's Laboratory Safety Standard requires you to have access to medical consultation and/or examinations when you have signs or symptoms of excessive exposure to chemicals you handle or when exposed to a chemical during a spill or other incident.
- In addition, medical consultations are often provided for employees planning to conceive a child or those who are already pregnant.
- The OSHA standard also requires us to have people trained in first aid and CPR in the laboratory during every work shift.
- And our Chemical Hygiene Plan lists where to get emergency medical treatment.

Do you know the procedures for obtaining necessary medical consultation or treatment?

Review procedures for obtaining necessary medical consultation or treatment.

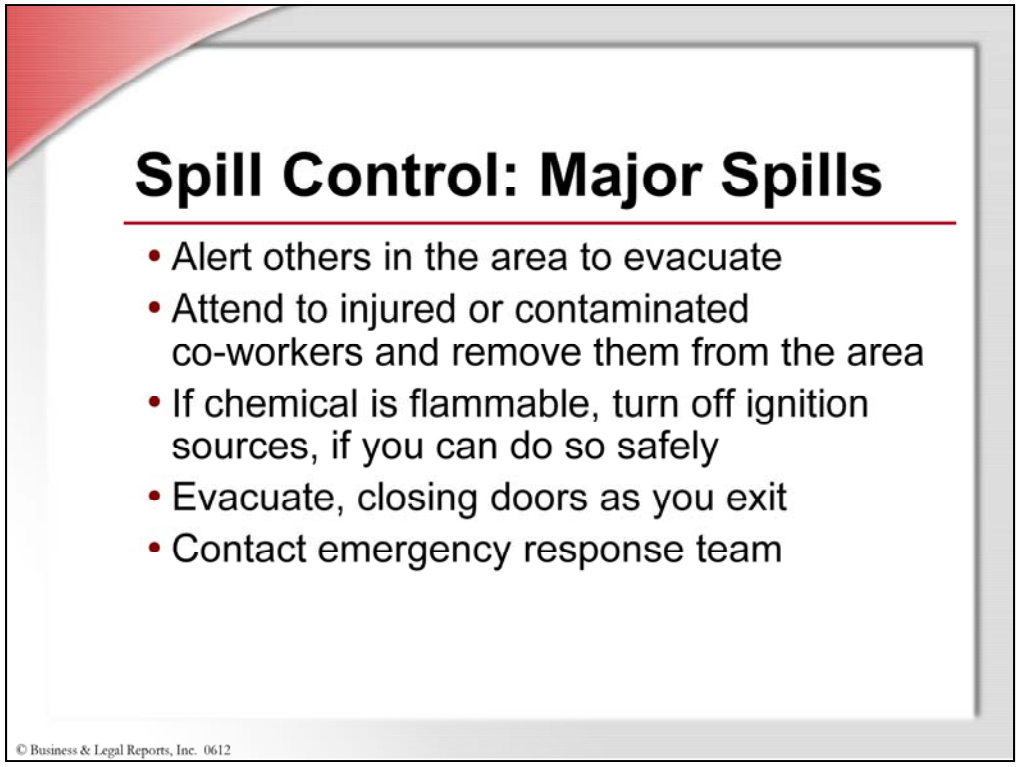
Slide Show Notes

Being prepared to control chemical spills in the lab is another important component of effective emergency response.

Before cleaning up any chemical spill, you should know the hazards associated with the spilled material. Minor spills involve chemicals with low toxicity where there is little fire or reactive risk.

The steps involved in responding to a minor spill include the following:

- Alert people in the immediate area.
- Increase ventilation by opening a window or turning on ventilation systems.
- Don appropriate PPE—at a minimum, gloves, goggles, and lab coat. Respirators are generally not required for minor spills of chemicals with low toxicity.
- Absorb the spill with vermiculite or other approved absorbent materials.
- Collect residual chemical and cleanup materials in sealed containers for disposal as hazardous waste.
- Clean the spill area with water only.



Slide Show Notes

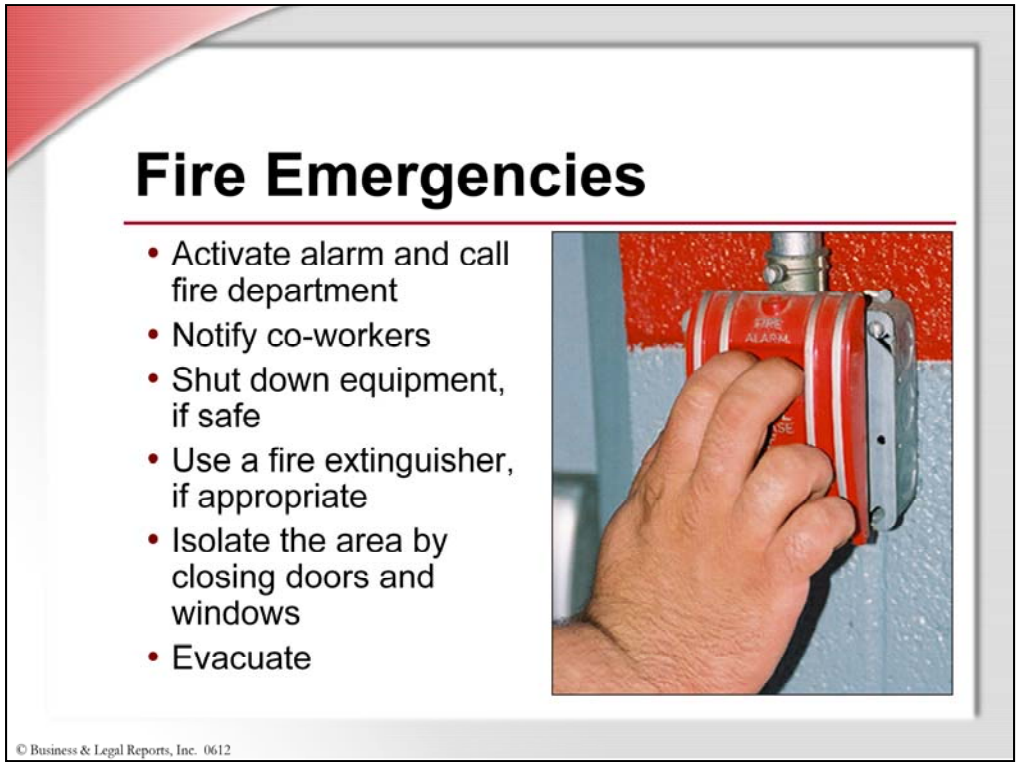
Major spills involve highly toxic, flammable, or reactive chemicals. These spills require different procedures. Immediate evacuation of the area is required, and major spills should only be contained and cleaned up by our specially trained and equipped response team.

In the event of a major spill in the laboratory:

- Alert others in the area to evacuate.
- Attend to injured or contaminated co-workers and remove them from the area.
- If the spilled chemical is flammable, turn off ignition sources, if you can do so safely.
- Evacuate, closing all doors as you exit.
- Contact the emergency response team, and stay in the area at a safe distance to provide information to the responders.

Would you know how to respond effectively to a major spill?

Review your facility's emergency procedures for spills involving highly toxic, flammable, or reactive materials. Make sure trainees know how to contact the emergency response team and what information to provide team leaders.



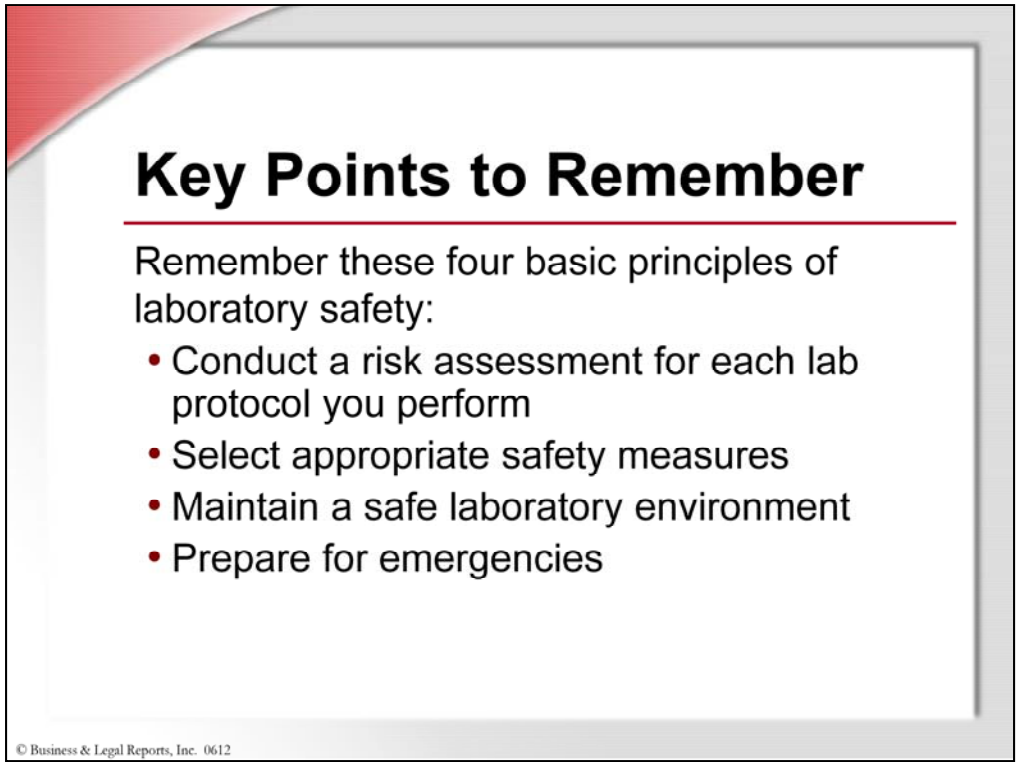
Slide Show Notes

Finally, if you discover a fire or see smoke in the laboratory:

- Activate the alarm and call the fire department.
- Notify co-workers in the immediate area.
- Shut down equipment in the area, if this can be done safely.
- Use a portable fire extinguisher to control a small fire or protect your evacuation route.
- Isolate the area by closing windows and doors.
- Evacuate following the emergency procedures you've been trained to use.

Are you prepared to respond effectively in a fire emergency? Do you have a primary and alternate evacuation route? Do you know how to use a fire extinguisher correctly? Do you know where alarm boxes are located and how to activate the alarm? Do you have emergency numbers posted by your phone?

Review emergency procedures for laboratory fires.



Slide Show Notes

Here are the main points to remember from this session on laboratory safety:

- Conduct a risk assessment for each lab protocol you perform to determine the hazards you face;
- Select appropriate safety measures, such as engineering controls, PPE, and work practices to eliminate or minimize risks;
- Maintain a safe laboratory environment at all times; *and*
- Be prepared to handle lab emergencies swiftly and effectively.

This concludes the Laboratory Safety training session.

Give trainees the quiz, if appropriate.