

# LESSON 4: CONTROLLING CHEMICAL HAZARDS

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## INTRODUCTION

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Everyone who works with chemical hazards needs to know how the hazards are controlled. This lesson introduces you to engineering controls, personal protective equipment, and administrative controls that may be required to protect you from chemical hazards in your workplace. Then it describes ways that you can detect uncontrolled hazards and help make your workplace safer for everyone.

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## LEARNING OBJECTIVES

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When you have completed this lesson, you should be able to do the following

List and define three basic types of engineering controls.

Identify examples of substitution, isolation, and ventilation controls.

Distinguish between general and local exhaust ventilation.

Define personal protective equipment and identify limitations that apply to its use.

Match types of Personal Protective Equipment (PPE) with types of physical hazards or exposure hazards.

List and identify four basic types of administrative controls.

List and recognize four common ways that workers can identify uncontrolled chemical hazards,

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## LEARNING RESOURCES

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- Videotape Segment 4A: Controlling Chemical Hazards: Engineering Controls, Personal Protective Equipment
- Workbook Application Exercise 4A: Working With Engineering Controls and PPE
- Videotape Segment 4B: Administrative Controls and Hazard Recognition
- Workbook Application Exercise 4B: Controlling Chemical Hazards: Administrative Controls
- Lesson Summary

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## DIRECTIONS FOR PROCEEDING

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*Complete the following steps in order. You might want to check off each step as you complete it.*

- 1) Read the workbook introduction to Videotape Segment 4A.
- 2) Watch Videotape Segment 4A.
- 3) Complete Application Exercise 4A in this workbook.
- 4) Read the workbook introduction to Videotape Segment 4B.
- 5) Watch Videotape Segment 4B.
- 6) Complete Application Exercise 4B in this workbook,
- 7) Read the lesson summary.

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## **INTRODUCTION TO VIDEOTAPE SEGMENT 4A: Engineering Controls and Personal Protective Equipment**

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Controlling chemical hazards often requires a combination of control methods. In this videotape segment, you'll see how one facility decided to use a combination of engineering controls and personal protective equipment to protect workers from the hazards associated with use of a corrosive cleaner.

Notice the different types of engineering controls available to protect you from chemical hazards. Also watch for examples of how each type is used. Pay particular attention to the distinction between general and local exhaust ventilation, and learn to recognize appropriate applications for each. Then look for the types of personal protective equipment available to control both physical hazards and health hazards. Finally, learn why proper selection and use of PPE is essential to your safety and health.

Now, watch Videotape Segment 4A.

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**NOTES**

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**APPLICATION EXERCISE 4A:  
Working With Engineering Controls and PPE**

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*Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.*

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1) Match the application with the type of control method.

Using steam cleaning instead of solvent-based cleaning

A) Engineering

Wearing chemical splash goggles

B) Personal  
Protective  
Equipment  
(PPE)

Using a ventilation system to remove toxic dusts

Complete enclosure of a sand blast operation

Wearing a respirator to remove toxic vapors from your breathing air

2) Most paints no longer contain lead-based pigments because lead paint is a health hazard. What type-of control is used when lead-based pigments are replaced by non-toxic pigments?

A) Isolation

B) Ventilation

C) Substitution

D) PPE

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*Now fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to Videotape Segment 4B when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.*

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**APPLICATION EXERCISE 4A**  
**Working With Engineering Controls and PPE**

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<b>Answer</b>	<b>Additional Information</b>
1) A	Using steam cleaning instead of solvent-based cleaning
B	Wearing chemical splash goggles
A	Using a ventilation system to remove toxic dusts
A	Complete enclosure of a sand blast operation
B	Wearing a respirator to remove toxic vapors from your breathing air

Engineering controls include:

- *SUBSTITUTION* — replacing a hazardous chemical, process, or piece of equipment with a less hazardous one
- *ISOLATION* — using an enclosure, barrier, or distance to separate workers from hazards
- *VENTILATION* — mixing fresh air with contaminated air in a work area, or preventing release of airborne hazards by removing them at the source.

Personal protective equipment (PPE) includes eyewear, face masks, clothing, gloves, boots, and respirators — equipment that workers wear to prevent or reduce their exposure to hazardous chemicals.

- 2) c      Substitution can be used to do any of the following
- Replace a hazardous *CHEMICAL*, such as lead-based pigment, with a less hazardous chemical, such as a non-toxic pigment.
  - Replace a hazardous *PROCESS*, such as solvent-based cleaning, with a less hazardous process, such as steam cleaning.
  - Replace a hazardous *PIECE OF EQUIPMENT*, such as a broom, which can create a dust hazard, with a more efficient piece of equipment, such as a wet vacuum cleaner.

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**INTRODUCTION TO VIDEOTAPE SEGMENT 4B:  
Administrative Controls**

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In addition to engineering controls and Personal Protective Equipment, controlling chemical hazards requires information and training, safe work practices, good housekeeping, good personal hygiene, and monitoring. As you watch this videotape, look for examples of each of these administrative controls.

Also pay close attention to ways that you can help to control chemical hazards. Notice how a simple change in work practices can reduce or eliminate an exposure. See why it's important to report any medical symptoms you may experience. And be alert for ways of using your senses to detect potential hazards.

Now, watch Videotape Segment 4B.

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**NOTES**

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**APPLICATION EXERCISE 4B:**  
**Administrative Controls and Hazard Recognition**

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*Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there **may be** more than one correct choice for a question. When you complete the **exercise**, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.*

- 1) Can a change in work practices help to control a chemical hazard?
  - A) Yes
  - B) No
  
- 2) How does good housekeeping help to control chemical hazards?
  - A) Capturing the hazard as it forms at the source
  - B) Mixing and diluting the hazard with air
  - C) Containing and removing the hazard
  - D) Putting a barrier between an individual worker and the hazard
  
- 3) Suppose you report exposure symptoms to your supervisor. What does this tell your supervisor?
  - A) You use sloppy work practices.
  - B) An exposure hazard may exist.
  - C) Routine medical monitoring is required.
  - D) You're on the alert for potential hazards.

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**APPLICATION EXERCISE 4B:**  
**Administrative Controls and Hazard Recognition**

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<b>Answer</b>	<b>Additional Information</b>
1) A	<p>A simple change in work practices and good personal hygiene can often help to control your exposure to a chemical hazard, For example:</p> <ul style="list-style-type: none"><li>• Changing your position so you breathe less vapor</li><li>• Washing your hands before eating or drinking</li><li>• Handling volatile materials in a chemical laboratory hood</li><li>• Covering or capping chemical containers when not in use</li></ul>
2) C	<p>The goal of housekeeping is to contain and remove hazards, and requires the following</p> <ul style="list-style-type: none"><li>• Proper storage and handling</li><li>• Proper clean-up procedures</li><li>• Prompt removal and correct disposal of chemical wastes</li></ul> <p>Local ventilation captures chemical hazards at the source. General ventilation mixes and dilutes the hazard with air. PPE and isolation put barriers between people and hazards.</p>
3) A B D	<p>Reporting medical symptoms that may be caused by exposure to a health hazard in your work area tells your supervisor that —</p> <ul style="list-style-type: none"><li>• an exposure hazard may exist; and</li><li>• you are on the alert for potential hazards.</li></ul> <p>Experiencing medical symptoms does NOT necessarily mean that the exposure is caused by your work practices, but it could be. Nor does it necessarily mean that medical monitoring is required. It DOES mean that a hazard MAY exist, and that this potential hazard should be evaluated and, if necessary, controlled.</p>

4) Label each statement either true or false,

I'll always be able to see, smell, or taste an exposure hazard.

     Most airborne hazards can NOT be seen.

If's smell disappears, I am no longer breathing the chemical.

Monitoring may be required to detect hazardous exposures, even if the chemical has a strong odor.

Any chemical I can smell or taste is entering my body.

<b>Answer</b>	<b>Additional Information</b>
4) F	You cannot sense odorless, colorless, and <del>sa</del> tasteless gases like carbon monoxide. Although you can see bulk solids and liquids, airborne forms are often invisible.
T	
F	You can smell or taste some airborne hazards. But remember, anything you can smell or taste is also entering your body. Also
T	remember that your sense of smell is limited.
T	You may not be able to smell the very small amounts of an airborne hazard that can harm you. And some chemicals deaden your sense of smell — the smell disappears even though you're still breathing the hazard.

**5) Which** of the following clues alert you to a potential, uncontrolled health hazard?

Drop in noise level near a ventilation system

Abnormal reading on a gas gauge

Worker with a cold sneezing

Liquid being used up more quickly than usual

Sound of a near-by explosion

Maintenance worker vacuuming

Sudden build-up on exhaust vents

Unusual smell

Burning sensation

**6) Regina** routinely handles mercury, a liquid that can buildup in the body overtime and can cause irreversible brain damage. How could medical monitoring help protect Regina?

A) Detect uncontrolled exposure hazards

B) Prevent occurrence of immediate exposure symptoms

c) Prevent irreversible brain damage

D) None of the above

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*Now go back to page 4-9, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.*

**Answer      Additional Information**

- 5) (Y)      Drop in noise level near a ventilation system  
(Y)      Abnormal reading on a gas or vacuum gauge  
(N)      Worker with a cold sneezing  
(Y)      Liquid being used up more quickly than usual  
(Y)      Sound of a near-by explosion  
(N)      Maintenance worker vacuuming  
(Y)      Sudden build-up on exhaust vents  
(Y)      Unusual smell  
(T)      Burning sensation

Anything unusual may alert you to a potential hazard —

- Drop in noise level
- Abnormal gauge or meter readings
- Using up a material more quickly or slowly than usual
- Sounds associated with accidents or emergency situations, such as explosion or fire
- Changes in the way equipment or materials look
- An odor you don't normally smell
- A sensation you don't normally feel

- 6) A C      Medical monitoring helps to detect uncontrolled and improperly controlled exposure hazards. When a medical exam or lab test indicates an exposure problem, a hazard exists. Identifying, evaluating, and controlling this hazard prevents repeated exposure. Sometimes, it can also prevent occurrence of more serious health effects that develop slowly over time.

Immediate health effects appear while you are being exposed, or shortly thereafter. Medical monitoring itself cannot prevent occurrence of immediate symptoms or subsequent long-term health effects.

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## LESSON 4 SUMMARY

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There are three basic methods of controlling chemical hazards.

- Engineering controls
- Personal Protective Equipment (PPE)
- Administrative controls

*ENGINEERING CONTROLS* include the following

- SUBSTITUTION* — replacing a chemical, process, or piece of equipment with a less hazardous or more efficient one.

*Example:* steam instead of solvent cleaning

- ISOLATION* — using an enclosure, barrier, or safe distance to separate workers from exposure hazards.

*Examples:* machine enclosures, enclosed control rooms, splash guards

- GENERAL VENTILATION* — mixing an airborne hazard with fresh air to reduce exposure levels; this is only suitable for hazards of low toxicity that mix readily with air.

*Examples:* fans, make-up air vents

- LOCAL EXHAUST VENTILATION* — capturing an airborne hazard as it is released and taking it out of the workplace to eliminate exposure.

*Examples:* hoods, slots, and dust collectors

*PERSONAL PROTECTIVE EQUIPMENT* puts a barrier between the hazard and the individual who wears it. It can protect against both physical hazards and health hazards.

. *PROTECTIVE GLOVES AND CLOTHING*

*Examples:* hats, hoods, boots, impervious gloves, cloth gloves, rubber aprons, lab coats, impervious boots

• *EYE AND FACE PROTECTION*

*Examples:* safety glasses, splash goggles, face masks and shields

. *AIR-PURIFYING RESPIRATORS*

*Examples:* Respirators with a cartridge or filter that removes contaminants from the air you breathe

. *AIR-SUPPLIED RESPIRATORS*

*Examples:* Self-contained units that supply air from a tank carried on the back; air-line units that provide air from a remote source

To protect you, PPE must be matched to the **specific** hazard. For example, cloth gloves are useless for protection against a corrosive liquid, PPE is also useless unless *you wear it*. Proper fit, correct *use*, and routine maintenance are also critical.

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## LESSON 4 SUMMARY

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*ADMINISTRATIVE CONTROLS* include the following

. *DOCUMENTATION, INFORMATION, AND TRAINING*

*Examples:* warning labels, MSDSS, Hazardous Chemical Inventory, written Hazard Communication Program

. *WORK PRACTICES*

*Examples:* using all available controls correctly, reporting uncontrolled hazards promptly

. *HOUSEKEEPING* — containing and removing hazards

*Examples:* vacuuming toxic dusts, proper storage and handling, correct disposal of chemical wastes

• *MONITORING* — checking the effectiveness of other controls

*Examples:* Air and wipe samples for area monitoring, personal sampling for individual monitoring, medical exams and laboratory tests

Always be alert for uncontrolled chemical hazards in your workplace. You can see bulk liquids and solids, but most airborne hazards are invisible. You can smell or taste some airborne chemicals, but not others. Some chemicals deaden your sense of smell, and others cannot be detected by smell at the very low levels that can harm you.

Remember, anything you smell or taste is entering your body.

In addition to sensing the chemical itself, you can detect exposure hazards by doing the following

- . Spotting equipment failures — a ventilation system that stops working, damaged chemical containers, faulty PPE
- Spotting leaks, spills, fires, explosions, uncontrolled chemical reactions, or other emergency/accident situations
- Recognizing health effects produced by exposure, such as headache, dizziness, coughing, irritation, or nausea
- Watching for anything unusual or out of the ordinary.