

BENZENE AND HEALTH

WORKBOOK

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MCD 000010851

SAL 000019675

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Read "Introduction" and "How to Use This Program" before you begin viewing the slide-tape program.

MCD 000010852

INTRODUCTION

In 1978, the Occupational Safety and Health Administration (OSHA), a government agency that is part of the Department of Labor, established new standards regarding occupational exposure to benzene.

Benzene is a hydrocarbon that can take liquid or vapor form. Medical evidence indicates that benzene can cause health problems, and that job-related exposures should be reduced below the limits that were previously in effect.

If you work in an area where you are, or could be, exposed to benzene, your employer is carrying out a plan to reduce the benzene exposure in your workplace, wherever the exposure exceeds limits OSHA specifies.

Part of your employer's job in carrying out a benzene health and safety training program is training you and other employees about the potential hazards of benzene. This program will discuss those hazards.

The program will list the potential health hazards of benzene; describe first aid action for acute exposures; illustrate standard protective equipment that you may need to wear when working around benzene or benzene products; introduce you to some of the air sampling equipment used to detect airborne benzene concentrations; and name some ways benzene exposure can be reduced or eliminated.

The information in this program is presented mainly through color slides and a taped narration. This workbook is used to review what you learn, and as a reference.

The reference section at the end of this workbook contains technical and safety information about benzene. A table describing what kind of respirator should be used for what concentration of airborne benzene whenever respiratory protection is necessary is also included in the workbook. When you have completed the program, read the reference materials so you can become more familiar with benzene.

At the conclusion of the program, you will take a review test. This will help you retain the important program points.

As new information or technical opinions about benzene become available, OSHA may change some of the regulations stated in the 1978 standard on occupational exposure to benzene. If this occurs, your company will make you aware of what information stated in this program has changed and should be noted.

Go on to the next page.

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HOW TO USE THIS PROGRAM

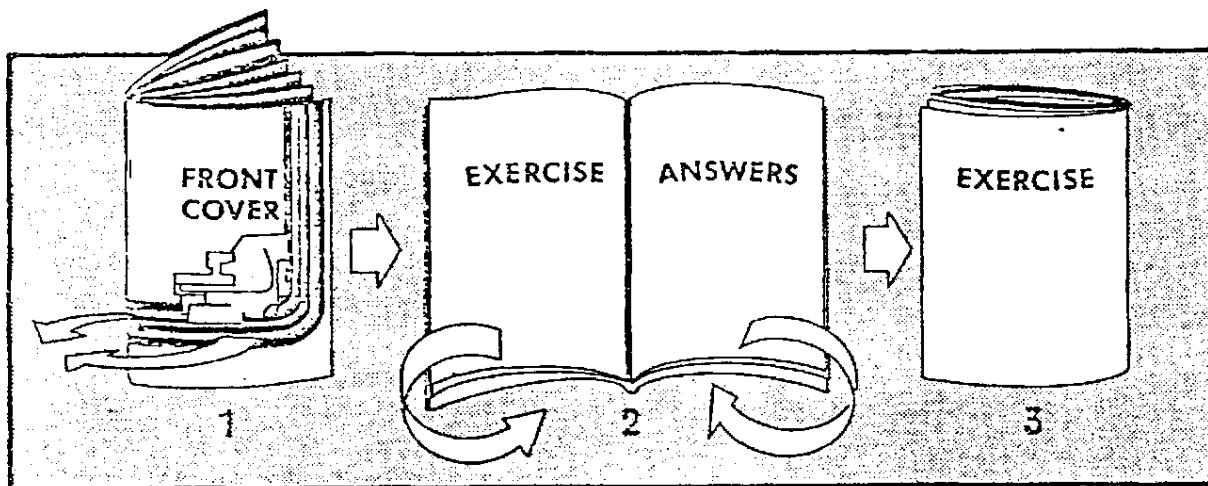
This slide-tape-workbook program is divided into several viewing segments. Each segment is followed by a review in the workbook. A segment lasts about five minutes. After you see the first program segment, you will be asked to turn to a certain exercise in this workbook. Turn to that page and work the exercise beginning on that page. Continue working until you reach these instructions:

When you have checked your answers, stop working in your workbook and start the tape.

When you reach these instructions, stop working and start the slide-tape again. Repeat the procedure for each workbook period.

Read each exercise question thoroughly. Then write your answer in the workbook, check off the correct answer, or whatever is required.

In order to work the exercises, turn your book like this:



Turn the front and back covers together as in Figure 1. The exercise will always be on a left-hand page of the book. Place the book on your table or desk so that the left-hand page is facing you.

The right-hand pages will contain the answers to the questions on the left-hand page as in Figure 2. After completing all the questions on the left-hand page, check your answers on the 'answer' page. Unless instructed otherwise, continue to the next series of questions in the same exercise, Figure 3.

When you have completed this program, take this workbook home with you and use it as a reference for information about benzene.

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Close your workbook, start
the tape, and view the first
program segment.

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Workbook Exercise Section

MCD 000010855

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Workbook Exercise 1

Check off the correct answers to these questions. They review what you learned in the program.

1. What is OSHA (Occupational Safety and Health Administration)?

- ☐ A trade organization for the petroleum industry.
- ☐ A labor union.
- ☐ A government agency that sets standards describing safe working conditions in various kinds of jobs.
- ☐ A private organization that researches job health hazards.

2. The program you are watching describes specific regulations OSHA has developed about:

- ☐ fire protection in places where benzene is produced or used.
- ☐ tank construction for benzene storage tanks.
- ☐ how pipelines should be labeled.
- ☐ how much on-the-job benzene exposure a person may receive.

3. Liquid benzene is:

- ☐ colorless and clear.
- ☐ brown.
- ☐ gummy and black.
- ☐ yellow.

4. Benzene is found in paraffinic crude petroleum.

- ☐ True
- ☐ False

5. Which of these is the chemical symbol for benzene?

- | | | |
|---------------------------------|-----------------------------------|--|
| ☐ H_2S | ☐ C_6H_6 | ☒ H_6C_6 |
| ☐ B_6 | ☐ B_{12} | ☐ H_2O |

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Workbook Exercise 1

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1. What is OSHA (Occupational Safety and Health Administration)?

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- ☐ A labor union.
- ☒ A government agency that sets standards describing safe working conditions in various kinds of jobs.
- ☐ A private organization that researches job health hazards.

2. The program you are watching describes specific regulations OSHA has developed about:

- ☐ fire protection in places where benzene is produced or used.
- ☐ tank construction for benzene storage tanks.
- ☐ how pipelines should be labeled.
- ☒ how much on-the-job benzene exposure a person may receive.

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- ☐ brown.
- ☐ gummy and black.
- ☐ yellow.

4. Benzene is found in ~~paraffinic~~ crude petroleum.

- ☒ True
- ☐ False

5. Which of these is the chemical symbol for benzene?

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|---------------------------------|--|-----------------------------------|
| ☐ H_2S | ☒ C_6H_6 | ☐ H_2C_6 |
| ☐ B_6 | ☐ B_{12} | ☐ H_2O |

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6. How can benzene enter your body? Name 3 ways.

7. Benzene is primarily obtained through what process?

_____ Catalytic reforming

_____ Alkylation

_____ Distillation

_____ Separation

_____ ~~Cracking~~ ^{Direct cracking}

8. Read the following descriptions of work situations. Decide which ones could involve benzene exposure, based on what you learned in the program. Put a check mark by each description that could expose a worker to benzene liquid or vapors.

_____ A technician takes a quality control sample from a pipeline containing benzene.

_____ Some maintenance people scrape old paint off a pump and put on a new coat of paint in the benzene production area of a refinery.

_____ A lease operator drops a tape into a crude petroleum storage tank to see how much oil is in the tank.

_____ A tank truck driver at a gasoline loading rack couples up the hoses so he can fill his tank trailer with product.

MCD 000010858

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6. How can benzene enter your body? Name 3 ways.

You can inhale it.

You can swallow it.

It can be absorbed through skin contact.

7. Benzene is primarily obtained through what process?

☒ Catalytic reforming

☐ Alkynylation

☐ Distillation

☐ Separation

☐ Cracking *Hydrocracking*

8. Read the following descriptions of work situations. Decide which ones could involve benzene exposure, based on what you learned in the program. Put a check mark by each description that could expose a worker to benzene liquid or vapors.

☒ A technician takes a quality control sample from a pipeline containing benzene.

☒ Some maintenance people scrape old paint off a pump and put on a new coat of paint in the benzene production area of a refinery.

☒ A lease operator drops a tape into a crude petroleum storage tank to see how much oil is in the tank.

☒ A tank truck driver at a gasoline loading rack couples up the hoses so he can fill his tank trailer with product.

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9. Check off the things that are examples of engineering controls that can reduce benzene exposure.

☐ Fume hoods in places where benzene is tested

☐ Ventilating and exhaust fans

☐ Sphere-shaped storage tanks

☐ Vapor recovery lines on tank trailers

☐ ~~Faster waste water treatment~~

☐ Flare stacks

☐ Level gages on storage tanks

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9. Check off the things that are examples of engineering controls that can reduce benzene exposure.

☒ Fume hoods in places where benzene is tested
☒ Ventilating and exhaust fans
☐ Sphere-shaped storage tanks
☒ Vapor recovery lines on tank trailers
☐ ~~Paster waste water treatment~~
☐ Flare stacks
☒ Level gages on storage tanks

When you have checked your answers, stop
working in the workbook, and view the
next program segment.

MCD 000010861

SAL 000019695

Workbook Exercise 2

Check off the correct answers to these questions. They review what you learned in the program.

1. What is the main serious health problem that continued, excessive exposure to benzene can cause?

☐ High blood pressure

☐ Bronchitis or asthma

☒ ~~The depression~~^{chronic} of white and red blood cell production

☐ Shaking of the hands or feet

2. Medical evidence indicates that ^{chronic} benzene exposure may eventually lead to the development of what disease?

☐ Emphysema

☐ Leukemia

☐ Complete paralysis

☐ Skin cancer

3. What do we mean by chronic benzene exposure?

☐ You are suddenly exposed to a large amount of benzene.

☒ ^{A single} Any benzene exposure above 1 ppm (parts per million).

☐ You are continually exposed to benzene over a long period of time.

☐ Any benzene exposure that makes you feel ill.

4. What do we mean by acute benzene exposure?

☐ You are suddenly exposed to a large amount of benzene.

☐ Any benzene exposure above 1 ppm.

☐ You are continually exposed to benzene over a long period of time.

☐ Any benzene exposure that makes you feel ill.

MCD 000010862

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Workbook Exercise 2

Check off the correct answers to these questions. They review what you learned in the program.

1. What is the main serious health problem that continued, excessive exposure to benzene can cause?

☐ High blood pressure
☐ Bronchitis or asthma
☒ ~~The depression~~ of white and red blood cell production
☐ Shaking of the hands or feet

2. Medical evidence indicates that chronic benzene exposure may eventually lead to the development of what disease?

☐ Emphysema
☒ Leukemia
☐ Complete paralysis
☐ Skin cancer

3. What do we mean by chronic benzene exposure?

☐ You are suddenly exposed to a large amount of benzene.
☐ Any benzene exposure above 1 ppm (parts per million).
☒ You are continually exposed to benzene over a long period of time.
☐ Any benzene exposure that makes you feel ill.

4. What do we mean by acute benzene exposure?

☒ You are suddenly exposed to a large amount of benzene.
☐ Any benzene exposure above 1 ppm.
☐ You are continually exposed to benzene over a long period of time.
☐ Any benzene exposure that makes you feel ill.

5. What might happen if you ^{spill} benzene on your skin?

_____ Nothing.

_____ Your skin will itch, blister and dry out.

_____ Acid brown spots will form on your skin.

6. Skin exposure to benzene is also called:

_____ fatty layer exposure.

_____ fatigue exposure.

_____ dermal exposure.

_____ chronic exposure.

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5. What might happen if you spill benzene on your skin?

☐ Nothing.

☒ Your skin will itch, blister and dry out.

☐ Acid brown spots will form on your skin.

6. Skin exposure to benzene is also called:

☐ fatty layer exposure.

☐ fatigue exposure.

☒ dermal exposure.

☐ chronic exposure.

When you have checked your answers, stop
working in the workbook, and view the
next program segment.

MCD 000010865

Workbook Exercise 3

1. During an 8-hour work period, you must not be exposed to an average airborne benzene level greater than:

_____ 10 ppm (parts per million).
_____ 100 ppm.
_____ 1 ppm.
_____ .05 ppm.

2. During any one 15-minute period during your work day, you must not be exposed to a benzene concentration greater than:

_____ 0.5 ppm.
_____ .05 ppm.
_____ 1 ppm.
_____ 5 ppm.

3. A work area is designated as "regulated" if the benzene exposure in that area exceeds:

_____ 0.5 ppm.
_____ 100 ppm.
_____ ~~1 ppm TWA, or 5 ppm ceiling~~
_____ 1 ppm.
_____ 10 ppm.

MCD 000010866

Workbook Exercise 3

1. During an 8-hour work period, you must not be exposed to an average airborne benzene level greater than:

☐ 10 ppm (parts per million).

☐ 100 ppm.

☒ 1 ppm.

☐ .05 ppm.

2. During any one 15-minute period during your work day, you must not be exposed to a benzene concentration greater than:

☐ 0.5 ppm.

☐ .05 ppm.

☐ 1 ppm.

☒ 5 ppm.

3. A work area is designated as "regulated" if the benzene exposure in that area exceeds:

☐ 0.5 ppm.

☐ 100 ppm.

☒ ~~1 ppm TWA, or 5 ppm ceiling.~~

☐ 1 ppm.

☐ 10 ppm.

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4. Which of these signs indicates a regulated area? Check the correct drawing.

A _____ B _____ C _____

5. When air sampling takes place in your work area, you or a representative of you and your co-workers:

_____ must leave the area for safety reasons.
_____ may observe the air sampling procedures.

6. You must wear a respirator in a regulated area:

_____ every time you enter the area.
_____ only when a warning light is on.
_____ if your supervisor tells you to do so.
_____ if the wind is blowing in the direction of your work area.

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4. Which of these signs indicates a regulated area? Check the correct drawing.

A _____ B _____ C _____

5. When air sampling takes place in your work area, you or a representative of you and your co-workers:

_____ must leave the area for safety reasons.

☒ may observe the air sampling procedures.

*Delete
this item*

6. You must wear a respirator in a regulated area:

☒ every time you enter the area.

_____ only when a warning light is on.

_____ if your supervisor tells you to do so.

_____ if the wind is blowing in the direction of your work area.

MCD 000010869

7. What is this device?

- ☐ It takes a urine sample.
- ☐ It holds a blood sample until the sample is taken to a laboratory for tests.
- ☐ It is a portable air pump which is clipped onto a person's clothing and ~~worn for 8 hours~~ so the air in his work area can be sampled for benzene.
- ☐ It is an analyzer that detects the concentration of benzene in a liquid such as waste water.

8. Check off the equipment that you might need to wear when working around benzene.

- | | |
|--|---|
| ☐ Respirator | ☐ Laboratory cloth coat |
| ☐ Protective gloves | ☐ Eye goggles |
| ☐ Impermeable boots | ☐ Grounding protection |
| ☒ Ear protectors | ☐ Splash-proof face shield |
| ☐ Petroleum jelly | ☐ Neoprene apron |

MCD 000010870

SAL 000019694

7. What is this device?

☐ It takes a urine sample.

☐ It holds a blood sample until the sample is taken to a laboratory for tests.

☒ It is a portable air pump which is clipped onto a person's clothing and ~~worn for 8~~ ^{several} hours so the air in his work area can be sampled for benzene.

☐ It is an analyzer that detects the concentration of benzene in a liquid such as waste water.

8. Check off the equipment that you might need to wear when working around benzene.

☒ Respirator

☒ Protective gloves

☒ Impermeable boots

☐ Ear protectors

☐ Petroleum jelly

☐ Laboratory cloth coat

☒ Eye goggles

☐ Grounding protection

☒ Splash-proof face shield

☒ Neoprene apron

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9. When your employer samples the air in your workplace, he will notify you of your benzene exposure, if any:

_____ within 5 working days after he receives the results.
_____ within 6 weeks of taking the samples.
_____ Your employer does not have to report the results to you.

10. If the benzene exposure in your workplace is above 0.5 ppm, your employer will:

_____ monitor the air again if an employee requests it.
_____ monitor the air periodically, as specified in OSHA's benzene standard.
_____ monitor the air every month.
_____ monitor the air again only if OSHA specifically requests this.

MCD 000010872

SAL 000019696

9. When your employer samples the air in your workplace, he will notify you of your benzene exposure, if any:
- ☒ within 5 working days after he receives the results.
 - ☐ within 6 weeks of taking the samples.
 - ☐ Your employer does not have to report the results to you.
10. If the benzene exposure in your workplace is above 0.5 ppm, your employer will:
- ☐ monitor the air again if an employee requests it.
 - ☒ monitor the air periodically, as specified in OSHA's benzene standard.
 - ☐ monitor the air every month.
 - ☐ monitor the air again only if OSHA specifically requests this.

When you have checked your answers, turn to the next page, review the drawings, and read the material on respiratory protection.

MCD 000010873

RESPIRATORS THAT CAN BE USED FOR BENZENE ENVIRONMENTS

MCD 000010874

Respiratory Protection

The illustrations on the opposite page show five kinds of respirators commonly used in benzene environments. The kind of respirator you use will depend on the concentration of benzene in the air.

Like other protective equipment, respirators have limitations. A respirator designed to protect you when the airborne concentration is 10 ppm may not offer much protection if the concentration of benzene in the air is 50 ppm. The correct respirator must be worn for the work situation.

The fit of a respirator mask is very important. If the mask is loose on the face, or if a beard or your clothing get in the way of a tight fit, the respirator will not offer much protection.

Your company will show you how to use the respirators and other protective equipment that may be required for your particular job at your particular company. All protective equipment is available at no cost to you.

The chart below shows what kind of respirator should be used for which kind of benzene environment.

RESPIRATORY PROTECTION FOR BENZENE

Airborne Concentration of Benzene or Condition of Use	Respirator Type
Less than or equal to 10 parts per million	(1) any chemical cartridge respirator with organic vapor cartridge, or: (2) any supplied air respirator
Less than or equal to 50 parts per million	(1) any chemical cartridge respirator with organic vapor cartridge and full facepiece (2) any supplied air respirator with full facepiece (3) any organic vapor gas mask (4) any self-contained breathing apparatus with full facepiece
Less than or equal to 1,000 parts per million	Supplied air respirator with half mask in positive pressure mode
Less than or equal to 2,000 parts per million	Supplied air respirator with full facepiece, helmet or hood in positive pressure mode
Less than or equal to 10,000 parts per million	(1) Supplied air respirator and auxiliary self-contained facepiece in positive pressure mode, or: (2) Open circuit self-contained breathing apparatus with full facepiece in positive pressure mode
Escape	(1) Any organic vapor gas mask, or: (2) Any self-contained breathing apparatus with full facepiece

Review the respirator illustrations,
and the respirator chart. When you
have finished, close your workbook,
and view the next program segment.

MCD 000010875

Workbook Exercise 4

Answer the following review questions.

1. If a person swallows benzene, you should:
_____ induce vomiting.
_____ not induce vomiting.
2. If you splash benzene on your skin or in your eyes, what should you do first? Put a check mark by the correct drawing.

A _____

B _____

C _____

MCD 000010876

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Workbook Exercise 4

Answer the following review questions.

1. If a person swallows benzene, you should:

 induce vomiting.

✓ not induce vomiting.

2. If you splash benzene on your skin or in your eyes, what should you do first? Put a check mark by the correct drawing.

A

B

C

MCD 000010877

3. In each of these drawings, a man has suffered acute benzene exposure, and another man is removing him from the exposure area. In which drawing is the rescuer wearing the correct equipment?

A _____ B _____ C _____

4. When rescuing a person who has suffered acute benzene exposure, what should you do first?

- _____ Apply mouth-to-mouth resuscitation.
- _____ Remove the person from exposure, and get him to fresh air.
- _____ Call medical aid and wait for them to assist the affected person.

5. If you work around benzene above a ^{the action level}~~specified exposure~~ level, your employer will periodically make available to you:

- _____ a personal air sampling device.
- _____ a new respirator.
- _____ medical testing.
- _____ a poster describing the exposure in your work area.

MCD 000010878

3. In each of these drawings, a man has suffered acute benzene exposure, and another man is removing him from the exposure area. In which drawing is the rescuer wearing the correct equipment?

A _____ B _____ C _____

4. When rescuing a person who has suffered acute benzene exposure, what should you do first?

- ☐ Apply mouth-to-mouth resuscitation.
- ☒ Remove the person from exposure, and get him to fresh air.
- ☐ Call medical aid and wait for them to assist the affected person.

5. If you work around benzene above a specified exposure level, your employer will periodically make available to you:

- ☐ a personal air sampling device.
- ☐ a new respirator.
- ☒ medical testing.
- ☐ a poster describing the exposure in your work area.

MCD 000010879

6. What are the main medical tests involved in periodic medical surveillance of benzene workers?

☐ Urinalysis and glucose tolerance tests
☐ Chest X-rays
☐ Two EKGs
☐ Blood tests

7. Suppose you are working on a pump and a mechanical failure causes a large amount of benzene to spill on the ground. You get to fresh air immediately, clean up the spill, and don't feel sick. Still, at the end of your shift, you should:

☒ remove your clothing, shower, and put on fresh clothing.
☒ write out a report about the spill.
☒ report to your company's health unit for a urinary phenol test.
☒ have a blood sample taken for blood testing.

8. Any time you are tested as part of a benzene medical surveillance program, the test results will be:

☐ kept secret from you.
☐ described to you ~~by your health unit.~~

9. ~~What is the best way to reduce benzene exposure?~~

☐ ~~By wearing a respirator all the time.~~
☐ ~~By developing engineering controls.~~
☐ ~~By developing better air sampling methods.~~
☐ By taking more frequent medical surveillance tests of benzene area employees.

MCD 000010880

6. What are the main medical tests involved in periodic medical surveillance of benzene workers?

☐ Urinalysis and glucose tolerance tests
☐ Chest X-rays
☐ Two EKGs
☒ Blood tests

7. Suppose you are working on a pump and a mechanical failure causes a large amount of benzene to spill on the ground. You get to fresh air immediately, clean up the spill, and don't feel sick. Still, at the end of your shift, you should:

☐ remove your clothing, shower, and put on fresh clothing.
☐ write out a report about the spill.
☒ report to your company's health unit for a urinary phenol test.
☐ have a blood sample taken for blood testing.

8. Any time you are tested as part of a benzene medical surveillance program, the test results will be:

☐ kept secret from you.
☒ described to you by your health unit.

9. What is the best way to reduce benzene exposure?

☐ By wearing a respirator all the time.
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☐ By developing better air sampling methods.
☐ By taking more frequent medical surveillance tests of benzene area employees.

When you have checked your answers, stop working in the workbook, and view the next program segment.

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Reference Section

MCD 000010882

SAL 000019706

Substance Safety Data Sheet
Benzene

MCD 000010883

Substance Technical Guidelines
Benzene

MCD 000010884

Medical Surveillance Guidelines
for Benzene

MCD 000010885

Signs and Labels

This wording is to be posted in regulated areas:

This wording is to appear on labels of all closed containers of benzene and packaged products containing benzene:

MCD 000010886

SAL 000019710

