

Chemical Hazards and Hazard Communication

Module at a Glance

Activity	Time	Materials & Resources
A. Introduction The instructor reviews the OSHA disclosure statement and the workshop objectives. The class brainstorms a list of chemicals they use on the job.	10 minutes	<ul style="list-style-type: none"> Slide #2, Training Objectives Slide #3, OSHA disclosure statement Slide #4, <i>What Chemicals Do You Work With?</i>
B. What Makes a Chemical Likely to Cause Harm? The instructor reviews the factors that make a chemical likely to cause harm.	10 minutes	<ul style="list-style-type: none"> Factsheet A, pages 1- 4, <i>Chemical Hazards</i>
C. How Do Chemicals Affect the Body? Pairs discuss the different ways chemicals can affect the body and then the class learns about acute and chronic and local and systemic health effects.	15 minutes	<ul style="list-style-type: none"> Slide #5, Local Health Effects Slide #6, Systemic Health Effects
D. How Can Chemical Hazards Be Controlled? The class learns about Cal/OSHA exposure limits and how to control chemical hazards.	15 minutes	<ul style="list-style-type: none"> Factsheet A, pages 5-7, <i>Controlling Chemical Hazards</i> Slide #7, How Can Chemical Hazards Be Controlled?

Activity	Time	Materials & Resources
<p>E. CAL/OSHA's Hazard Communication Standard.</p> <p>The following information is reviewed:</p> <ul style="list-style-type: none"> -Cal/OSHA's Hazard Communication Standard -Globally Harmonized System (GHS) -Old chemical label -New GHS label -Pictograms -Safety Data Sheet (SDS) 	20 minutes	<ul style="list-style-type: none"> ▪ Factsheet A, page 14 & 15, <i>Evaluating Your Workplace Hazard Communication Program</i> ▪ Factsheet A, pages 8 - 10, <i>Chemical Labels</i>. Factsheet A, pages 10-13, <i>Safety Data Sheets</i> ▪ Slide #8, GHS ▪ Slide #9, Old label ▪ Slide #10, New GHS label ▪ Slide #11, Pictograms ▪ Slide #12, SDS sections
<p>F. Evaluating An SDS</p> <p>Small groups study a sample SDS, answer questions on a worksheet, identify target organs on a T-shirt and report back to the class.</p>	20 minutes	<ul style="list-style-type: none"> ▪ Colored dots ▪ Sample SDS ▪ Worksheet #1, <i>SDS Worksheet</i> ▪ Toxic T-Shirts
<p>G. What To Do If Exposed To A Chemical</p> <p>The instructor explains what to do if a worker is exposed to chemicals at work.</p>	5 minutes	

Total time: 1 hour and 30 minutes

Preparing to Teach This Module

Before you present this Supplemental Module:

1. Obtain Factsheets A and Worksheet #1, one for each participant. Insert these into the course manuals in advance.
2. Collect an SDS of a chemical participants work with on the job. Make copies for everyone in the class.
3. Obtain 20-30 colored dots (stickers) in any color.
4. Obtain 4 “Toxic T-shirts” (white T-shirt with body organs drawn on it) for the class.

Detailed Instructor's Notes

A. Introduction to This Module

(10 minutes)

1. Show Slide #2, and tell the class that we are going to learn about chemical hazards and Cal/OSHA's Hazard Communication standard. Review the objectives for this class. By the end of this session you will be able to:
 - List factors that can influence the likelihood a person will develop health effects from a chemical exposure.
 - Identify three ways chemicals can enter the body.
 - Explain how chemicals can affect the body.
 - Describe and evaluate three ways to eliminate or reduce chemical hazards.
 - Describe five requirements of Cal/OSHA's Hazard Communication standard.
 - Describe the new Globally Harmonized System.
 - Get information from a Safety Data Sheet (SDS).
2. Show Slide #3 and explain the OSHA disclosure statement.
3. Show Slide #4 and ask the class what chemicals they work with?

Write the names of the chemicals people mention on a flipchart page. If necessary, ask for names of other chemicals that participants are familiar with, so your list includes many different forms of chemicals. Save this list for later use. Your completed flipchart may include:

- Solvents such as methyl ethyl ketone, toluene, and benzene
- Cleaning products
- Paints
- Wood dust

- Asbestos
- Pesticides
- Heavy metals such as cadmium, lead, and mercury
- Gasoline

Ask if anyone has ever been injured or made sick by a chemical they used. Ask for at least two or three stories. After participants have explained what happened, tell the class:

It is very important for workers to be trained about the chemicals they use. They need to know how these chemicals can harm them and how to work safely with them.

Training about specific chemicals used on your job is required by Cal/OSHA's Hazard Communication standard. Today's class will provide a basic overview of chemical hazards. It is not intended to substitute for training required by the Hazard Communication standard.

B. What Makes a Chemical Likely to Cause Harm?

(10 minutes)

The instructor explains all chemicals have the potential to cause harm. But, some are more likely to cause harm than others. There are five factors that make a chemical more likely to cause harm: (list on flipchart as each is presented)

Toxicity

Toxicity is the ability of a chemical to cause harm. If the chemical can cause harm only if the person is exposed to a very large amount of it, that chemical would be considered relatively non-toxic. If only a small amount of exposure to a chemical can cause harm, the chemical is considered highly toxic. An example of a highly toxic chemical is Cyanide (and other substances called poisons). It takes very little of this substance to cause significant harm.

Route of Exposure and Chemical Forms

A second factor that determines if a chemical will cause harm is whether it is in a form that can easily enter the body. Chemicals get into the body through:

- Breathing (also called *inhalation*). This is the main way workers are exposed to chemicals on the job.
- Skin and eye contact. A chemical can damage your skin or eyes. Some can also pass through the skin and get into your bloodstream.
- Swallowing (also called *ingestion*). Although you don't usually swallow chemicals deliberately, they can be carried on cigarettes, food, or unwashed hands. Also, some chemicals may get swallowed when you cough up dust.

How chemicals get into the body is related to the **form** the chemical is in. Chemicals come in the form of liquids, solids, dusts, mists, vapors, fumes, gases, and fibers. Sometimes you can see or smell them, sometimes you can't.

The form a chemical is in can determine whether it will cause harm. For example, although some things are absorbed through the skin, lead paint is not absorbed through the skin and so it won't get into your body if you get it on your hands. However, if you sandblast lead paint and then breathe the dust, it can enter your body to affect your central nervous system and other organs.

Sometimes chemicals change forms. For example, liquid cleaning products can be put into a bottle and then sprayed. In this case they are turned into **mists**. Liquid solutions, when they evaporate, give off **vapors** that can be inhaled.

Dose and Duration

Dose is how much of the chemical a person is exposed to. Generally, the greater the dose, the greater the harm. For example, breathing a lot of organic solvents will affect the central nervous system but breathing just a little may just give you a headache.

Duration is how long a person is exposed to the chemical. Generally, the longer the exposure, the greater the harm.

Reaction and Interaction

Reaction and interaction is what other chemicals a person is exposed to. Some chemicals, in combination, can create a different chemical. This is called **reaction**. For example, bleach and ammonia mixed together produce a different, more toxic gas.

Some chemicals, in combination, increase the likelihood the person will get sick. For example, being exposed to asbestos and also being a cigarette smoker will increase the likelihood of getting cancer. This is called **interaction**.

Individual Differences

A final factor is individual differences. Some people are more susceptible to getting sick from chemicals. Examples of individual differences that put some people at increased risk include family history, age, pregnancy, previous exposures, and whether the worker is a smoker, has sensitivities, or uses certain medications.

Refer the class to Factsheet A, *Chemical Hazards*, and tell them that this resource provides more information about chemicals.

C. How Do Chemicals Affect the Body?

(15 minutes)

1. Ask participants to take two minutes to talk with the person next to them about the different health effects chemicals may cause. Suggest that they think about the chemicals they listed at the beginning of the class, or other chemicals they are familiar with that aren't on the list. If you wish, display the flipchart page you made earlier that has the list of chemicals.

After about two minutes, ask people to share examples of chemicals they talked about and health effects they identified. Write these health effects on a flipchart page. Examples may include:

- A rash from getting a solvent on the skin
- Difficulty breathing or dizziness from exposure to solvent vapors
- Burns to the skin or eyes from a harsh chemical like drain cleaners

- Lung problems from inhaling asbestos or cement dust.

Say to the class

Notice that some of these health effects occur right away and others take a long time to develop. When they occur right away, we call them **acute effects**. What are some examples of acute effects?

Examples include a chemical burn to the skin or eyes, or a skin rash from handling a solvent. Some acute effects take a few hours to develop (like nausea from pesticide exposure).

When health effects occur a long time after exposure, we call them **chronic effects**. What are some examples of chronic effects?

Examples include lung disease or cancer after many years of exposure to asbestos or neurological problems caused by long-term exposure to lead dust.

Some chemicals can cause both acute and chronic effects. For example, breathing solvent vapors could give you a headache or make you dizzy right away. Breathing those vapors for years may also cause liver damage.

What are clues that might tell a worker that a health effect he or she is experiencing is related to exposures at work?

- Symptoms go away after time off from work, like weekends or vacations.
- Other workers doing the same job have similar symptoms.

Since chronic health effects develop a long time after exposure, it may be harder to recognize when they are work-related. Workers need to be aware when a chemical can cause a long-term health effect, so they can protect themselves and prevent future disease.

2. Show Slide #5 and say to the class:

Some chemicals cause health effects right at the point of exposure. We call these **local effects**. For example, if ammonia gas is inhaled, it quickly irritates the lining of the respiratory tract. Almost no ammonia passes from the lungs into the blood. So ammonia only causes local effects.

3. Show Slide #6 and tell the class:

Other chemicals can enter the body and travel in the bloodstream to affect internal organs. We call these **systemic effects**.

The organs most often affected by chemicals are the lungs, liver, kidneys, heart, nervous system (including the brain), and reproductive system.

Ask participants what chemicals they've heard of or worked with that could affect a particular organ, (either as a local effect or systemic effect). Examples may include:

- Asbestos targets the lungs.
- Solvents can affect the liver, the central nervous system, and the reproductive system.
- Metal fumes can affect the stomach and intestines.
- Lead dust and lead fumes can affect the reproductive systems in both men and women.
- Detergents, cleaners, and solvents can affect the skin by drying it out or causing rashes, sores, or other skin ailments.

4. Tell the class about chemicals and cancer.

Can all chemicals cause cancer? No. Cancer is the uncontrolled growth and spread of abnormal cells in the body, and is caused by some chemicals but not others. It is not true that all chemicals cause cancer in large enough doses. It is important to know when a particular chemical is believed to cause cancer so you can protect yourself.

5. Tell the class about the reproductive effects of chemicals.

As we have mentioned, some chemicals affect the reproductive systems of men and women. Examples of the reproductive effects of chemicals on men and women include the inability to conceive children, lowered sex drive, disturbances in menstruation, miscarriages, stillbirths, and defects in children that are apparent at birth or later in the child's development.

6. Summarize the information just presented:

We've learned that:

- Chemicals can cause **acute** (short-term) and/or **chronic** (long-term) health effects. Some chemicals can cause both.
- Symptoms can be a clue that you are experiencing acute health effects but chronic effects don't show up right away.
- Chemicals can cause **local effects** where they first contact your body or **systemic effects** if they get into your bloodstream.
- Not all chemicals cause cancer, no matter how much you are exposed to.

D. How Can Chemical Hazards Be Controlled?

(15 minutes)

1. Brainstorm a list of the main ways to control exposure to hazardous chemicals:

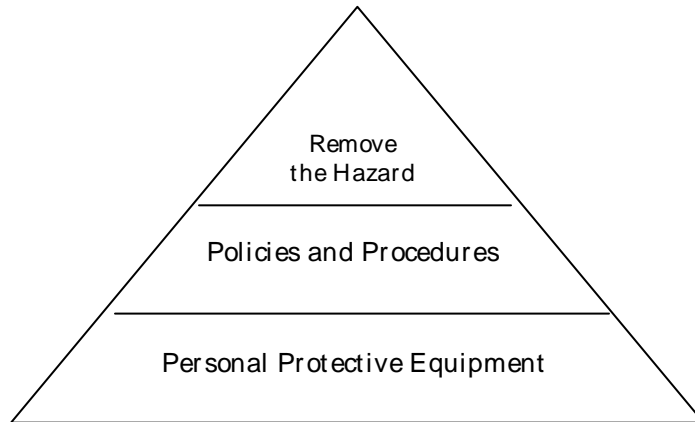
Let's make a list of some ways to reduce or eliminate exposure to chemicals at work.

As participants respond, list their ideas on a flipchart page. Answers may include:

- Substitute a safer chemical product in place of a toxic one.
- Enclose a process that uses toxic chemicals so no one is exposed.
- Use good ventilation so workers don't breathe in a chemical.
- Limit how much time a worker is exposed to a chemical.
- Train workers in how to use chemicals safely.
- Use personal protective equipment such as gloves, goggles, respirators, etc.

There are many ways to protect workers from hazards. But not all solutions are equally effective.

2. Show Slide #7 and tell the class the best way to protect workers is to remove the hazard from the workplace altogether, or at least keep the hazard away from workers.



Refer to the list of solutions on the flipchart you just created. Ask the class:

Which of the solutions on the flipchart is an example of “removing the hazard?”

- Substituting safer chemical products, such as water-based cleaners instead of organic solvents. However, remember that “water-based” doesn’t always mean it’s non-toxic or safe.
- Enclosing or isolating a process that uses toxic chemicals.
- Installing ventilation to reduce the amount of chemicals from the air workers breathe.

These are called **engineering controls**. They are considered the most effective kind of solutions because they get rid of the hazard at the source. They don’t rely on workers to follow correct procedures and they don’t allow for workers to take shortcuts that might be dangerous.

Explain:

Another way to protect workers is to set up work policies and procedures that cut down exposure to hazards by changing how the job is done.

Which of the solutions on the flipchart is an example of “policies and procedures?”

- Providing breaks.
- Training workers in using chemicals safely.

These are called **administrative controls**.

Explain:

Personal protective equipment, or PPE, is worn on the body and protects you from exposure to a hazard. What are some examples of PPE used for chemicals?

- Respirators
- Goggles
- Gloves
- Coveralls or other protective clothing

Ask the class:

Why is PPE usually considered less effective than the other methods?

Possible answers include:

- It doesn't get rid of the hazard itself.
- Workers may not want to wear it because it can be uncomfortable, hot, and may make it hard to communicate.
- It has to fit properly to work.
- In many cases it must be cleaned and inspected often.

- It has to be the right type for the particular hazard, such as the right respirator cartridge or glove for the chemical being used.
 - Workers must know and remember how to use it properly.
 - Some PPE creates its own hazards, such as heat, heavy weight, reduced visibility, reduced hearing, restricted movement, and discomfort.
3. Refer the class to Factsheet A, pages 5-7, *Controlling Chemical Hazards*. Tell them that this provides more information about controlling chemical hazards.

E. Cal/OSHA's Hazard Communication Standard

(20 minutes)

1. Explain to the class that you will next discuss how to find information about specific chemicals.
2. Ask people to call out what things they would like to know about the chemicals they work with.

Write their answers on a flipchart page, and then add any they may not have mentioned. The list may include the following:

- How toxic is it?
- Who makes it?
- How do you handle it safely?
- What should you do in an emergency?
- How do you dispose of it safely?
- What health effects does it cause?
- How flammable is it?
- Is there a safe level of exposure?

- Do you need a respirator or other PPE when you work with it?
3. Explain to the class that they have the right to get information from their employer about chemicals under **Cal/OSHA's Hazard Communication standard**.

The standard has five major requirements that employers must follow:

- Develop a written hazard communication program.
- Prepare an inventory of all hazardous substances in the workplace.
- Make sure all chemical products in the workplace have labels.
- Obtain Safety Data Sheets (SDSs), once known as Material Safety Data Sheets (MSDSs), for all chemicals in the workplace and make them available to employees.
- Train employees about the hazards of the specific chemicals they work with or work around, how to protect themselves against chemical exposure, and how to read SDSs and labels.

Refer the class to Factsheet A, pages 14 & 15, *Evaluating Your Workplace's Hazard Communication Program*. It has more information on what should be in an employer's hazard communication program.

4. Show Slide #8 and tell the class:

The Hazard Communication standard has been revised to come into compliance with the new **Globally Harmonized System** which has been adopted by many countries around the world. The changes involve:

- **Hazard classification:** Provides specific criteria for classification of health and physical hazards, as well as classification of mixtures.
- **Labels:** Chemical manufacturers and importers will be required to provide a label that includes a harmonized signal word, pictogram, and hazard statement for each hazard class and category. Precautionary statements must also be provided.
- **Material Safety Data Sheets, now called Safety Data Sheets:** Will now have a specified 16-section format.
- **Information and training:** Employers are required to train workers by December 1, 2013 on the new labels elements and safety data sheets format to facilitate recognition and understanding.

5. Show Slide #9 and tell the class:

Old labels currently were only required to have the following information on them:

- Product identity
- Hazard warnings
- Name and address of the manufacturer

6. Show Slide #10 and tell the class:

Under the new GHS, labels must include signal words, pictograms and hazard statements.

For each hazard class and category of chemical, labels must now include:

- Product identifier
- Supplier information
- A signal word
- Pictogram
- A hazard statement and a precautionary statement

One very confusing thing about the GHS system of doing things is that the categorization scheme for the severity of physical hazards will be the opposite of what you currently see on National Fire Protection Association placards or the *Hazardous Materials Identification System* where “1” under NFPA or HMIS is least severe and a “4” is most severe. Under GHS it is the opposite – category “1”, under GHS, is most severe.)

7. Show Slide #11 and tell the class:

As of June 1, 2015, the OSHA Hazard Communication Standard (HCS) requires pictograms on labels to alert workers of the chemical hazards they could be exposed to. The pictogram on the label is determined by the chemical hazard classification.

8. Show Slide #12 and tell the class:

Material Safety Data Sheets are now called Safety Data Sheets and the information provided on them must now be in a standard, set order and format, making it easier to find needed information about health effects and emergency procedures.

Employers are now required to train employees about these new changes to the Haz Com standard.

9. Explain Cal/OSHA's legal exposure limits. Tell the class:

Cal/OSHA requires employers who use certain chemicals to keep worker exposure below set limits, called Permissible Exposure Limits (PELs). The PEL for a chemical is the maximum amount of that chemical that a worker may be exposed to over a period of time. For most regulated chemicals there is a limit to exposures averaged over an 8-hour day. Some chemicals also have shorter limits (usually 15 or 30 minutes) or maximum (ceiling) concentrations.

The idea is that the employer must control exposures so that workers aren't breathing enough of the chemical to cause harm. Workers should be told by their employer about the exposure limits for any chemicals they use. Not all chemicals have PELs.

F. Evaluating An SDS

(20 minutes)

1. Introduce the small group activity. Explain that in this activity the class will be divided into small groups to learn how to read and understand the health effects section of a SDS.

Explain that each group will be given a SDS for a particular chemical, a Toxic T-shirt with the outline of a body draw on it with organs, and several colored dots. Each group will answer some questions about the chemical, using the health effects section of the SDS. A volunteer will put on the Toxic T-shirt and will explain what target organs the chemical affects in the body.

Note to Instructor: Remember, you will need a SDS for this session. Be sure to collect it in advance and have copies available (see Preparing to Teach this Module, p.4).

2. Divide the class into 3 - 4 small groups, with no more than six people in each group.

Pass out Worksheet #1, *SDS Worksheet*. Also give each group a copy of the SDS. Also distribute a Toxic T-shirt and several colored dots to each group.

3. Before the groups begin working, read aloud the questions on Worksheet #1. Explain that they should use their SDS to answer Questions #1 - 4. Point out that when answering Question #4, they should mark the target organs affected by the chemical on the Toxic T-shirt using the colored dots. Question #5 asks for their opinion about what health effects concern them most.

Ask each group to have a volunteer take notes. Each group should also select another two people to report back to the whole class: one to hold up the Toxic T-shirt and one to report on their worksheet answers.

Give the groups 10-15 minutes to answer the questions on the worksheet. As they work, check in to see if there are any questions.

Bring the whole class back together after 10-15 minutes. Have each small group report back on a different question on the worksheet. Ask for a volunteer to explain the target organs the chemical affects in the body on the Toxic T-shirt. Ask if any of the small groups have a different answer.

G. What To Do If Exposed To A Chemical

(5 minutes)

Tell the class:

If you get exposed to a chemical on the job, do the following:

- Let your supervisor and union know
- Identify the chemical(s) involved
- Follow SDS first aid directions
- Get medical attention as needed.

Ask a couple of volunteers to share one or two actions related to chemical hazards and the Hazard Communication standard that they would like to take back at their workplace.

Tell people that this ends the session on chemicals at the workplace.