

Chapter 5

Notes

HEALTH EFFECTS OF HAZARDOUS MATERIALS

Objectives

After completing this module, participants will be able to:

- _ Recognize how chemicals can get into the body.
- _ Recognize the key terms used to describe health effects.
- _ Locate health effect information on a Materials Safety Data Sheet (MSDS).
- _ Understand that the hierarchy of controls can be used to prevent exposure to hazardous materials.

Introduction

One of the most important concepts is understanding how you can be harmed by hazardous materials. In this chapter, you will discuss key terms of health effects. Then you will practice finding the health effects on an MSDS. Finally, you will be introduced to the hierarchy of controls. Exposure to hazardous materials can be controlled to *prevent* bad effects to your health.

Routes of Entry

Notes

Until hazardous materials get into the body, they aren't harming people. The ways that chemicals get into your body are called the Routes of Entry.

There are four ways chemicals get into our bodies:

Inhalation 8

Breathing

Easiest way for chemicals to get into our bodies.

We can breath in:

- Solids (dusts or fibers)
- Liquids (mists) or
- Gases and vapor forms

Absorption 8

Absorbed through skin or eyes

Second easiest route of entry.

Chemicals pass through skin or eyes, to the tiny blood vessels near the surface.

Once in the body, transported quickly to the heart, lungs, kidneys, brain, and other major organs.

(Continued)

Ingestion 8Through mouth**Notes**

You can ingest chemicals in these ways:

- Eating or drinking in contaminated area
- Not washing hands before eating
- Use of cosmetics, Chap-Stick
- Smoking

Injection 8Forced through skin / broken skin

Examples of injection:

- Stuck by needles, medical waste
- Glass, nails, other sharp objects
- Pressurized hoses (blowing off with air hose, ruptured hydraulic or pneumatic lines).

Dangerous because the material goes directly into the blood-stream.

Health Effects: The Short And The Long Of It

Notes

Acute and Chronic Health Effects

Once hazardous materials have entered your body, they may harm you immediately or it may take decades for you to suffer from the effects. You will see two of these two terms on MSDSs that tell you the dangers and when the effects can happen:

- _ **Acute** means short term
- _ **Chronic** means long term

Acute effects

- Acute effects can occur immediately, for example acid burning your skin, or the effects may appear up to 72 hours later.
- Acute effects are sometimes called symptoms; they let us know that we have been exposed to something.
- Acute chemical effects are often caused by exposure to a high concentration of the material.
- Often these effects will go away.

Notes**For example,**

let's take a look at the acute effects of a common chemical: ethyl alcohol, found in beer, wine, or liquor:

- ? What symptoms, or acute effects, do people show when they have had too much alcohol in a short time, such as 4 - 10 drinks on a Saturday night?

Many chemicals, especially solvents, produce similar acute effects. You should find the acute health effects listed on Material Safety Data Sheets. If you feel effects from exposure during a HazMat emergency report them when you call for help and seek medical attention.

Chronic Effects

- Chronic effects do not occur soon after the initial exposure. For example, asbestosis and cancer can take up to 30 years to develop.
- Chronic health effects are often overlooked because there may be no signs that you are getting a disease. (The period from exposure to illness is called the latency period.)
- Chronic effects often result from exposure to low levels of a toxic substance over a long period of time.
- Chronic effects are long lasting and usually irreversible, though there may be treatment.

Returning to our example,

Let's look at the chronic effects of ethyl alcohol:

- ? What chronic health effects would you expect to see in a person who had those 4 - 10 drinks almost every night for thirty years?

You should be aware that signs and placards on vehicles and containers emphasize acute effects over chronic effects. For example, DOT placards don't give you the information that a chemical could cause cancer. Often, your best source of chronic effects will be found in the Material Safety Data Sheet. In some cases, the chronic health effects of a chemical may not even be known.

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Health Effects: Where Does It Hurt You?

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Local Effects and Target Organs

A chemical can cause damage to the part of the body that comes in contact with. For example, burning of the eyes, nose, throat, and lungs by an irritating gas such as chlorine is a local effect.

Or the chemical may travel within your body to damage other areas. Inhaling solvent vapors might not hurt your lungs, but it may cause harm to organs the liver or kidneys. You can look for these terms on an MSDS:

- **Local Effects** -chemicals cause damage at the point of contact.
- **Target Organs** -chemicals travel through your body (in your blood) and damage the body somewhere besides the point of contact. Critical target organs include the brain, lungs, liver, kidney, immune system and circulatory system.
 - A doctor might refer to the effects of chemicals that travel as a systemic effect, and would refer to the damaged part of your body as the target organ. That is right, but you're likely to see "target organs" on an MSDSs or label.

Returning to our example again,
that is, drinking too much beer, wine, or liquor:

? What are the target organs of ethyl alcohol?

Chronic Effects: 3 Examples

Notes

In this section we will cover:

- _ Cancer
- _ Reproductive effects
- _ Sensitizers

Cancer and Carcinogens

A carcinogen is something that causes cancer. The term cancer is used for different diseases that affect many parts of the body. In all of its forms, abnormal cells grow rapidly out of control. These cells may form a tumor and remain in one location. Or the cancer can spread to other parts of the body.

Some cancers develop due to genetic makeup; others are caused by outside, or environmental, sources. Some cancers have more than one cause. It has been estimated that 38% of all cancers are caused by workplace exposures.

Sometimes exposure to two or more substances creates a much higher health risk than simply adding the effects together. This is called a synergistic effect. For example, asbestos workers who don't smoke cigarettes develop lung cancer 5 to 10 times more often than the general population. But asbestos workers who do smoke are 50 to 90 times more likely to get lung cancer! Most studies of chemicals look at one at a time, so synergistic effects aren't well known.

Scientists have not found level of exposure to carcinogens that is totally safe. However, the risk does go down with lower exposures.

Notes

Any material containing an ingredient that is a known carcinogen MUST note that on the Material Safety Data Sheet. Also, a hazard warning should be listed on the manufacturer's label.

Reproductive Hazards

Workplace hazards, such as radiation, certain chemicals, and infectious diseases, can affect your ability to have children. The idea that reproductive hazards affect only women is a myth. A policy that bars women from jobs with reproductive hazards is discriminatory and illegal. Both men and women can be affected by reproductive hazards, and both should be equally protected in the workplace.

Sensitizers

You are all familiar with allergies. Some people have severe or even life threatening reactions to bee stings. There are chemicals that can also produce a reaction like an allergic response. Chemicals that have this type of effect are called sensitizers. The target organ of a sensitizer is the immune system.

Just like allergies, one worker could have symptoms, while others in the area show no symptoms. At first, the reaction may be small and may come after some time working around the chemical. But as a person becomes sensitized the reactions get worse and may become so bad that the person can't even come to their workplace without a severe reaction. This could be job ending and life threatening.

For example,

one common chemical that is a known sensitizer is formaldehyde. Formaldehyde is a preservative, and is used extensively in lab and hospital work, in carpet manufacturing and fabrics, even in shampoo. Formaldehyde can be particularly bad because it affects the respiratory system. Tightness in the chest, difficulty breathing, and bronchial spasms may occur in workers who have become sensitized to formaldehyde.

Notes

Preventing Exposure To Hazards

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The Hierarchy of Controls

There are hazards in the workplace, but something *can* be done to reduce or prevent exposure to hazards. The hierarchy of controls is one system that can reduce your chance of getting sick from chemicals. (It's called a hierarchy because there is an order of effectiveness, represented here from top to bottom.)

Hierarchy of Controls

CONTROL	Most Effective
	DEFINITION, EXAMPLES
Elimination / Substitution	Eliminate the hazard - change the way the job is done
	Substitution – replacing a hazardous substance with a non-hazardous one
	Substitute solvents with a vegetable-based degreaser like Simple Green
	Reduces hazardous chemicals that can be involved in an emergency situation
	(Not always possible)

Second Most Effective, then continuing down to least effective		<u>Notes</u>
CONTROL	DEFINITION, EXAMPLES	
Engineering Controls	Design/use mechanical means to control the hazards	
	Local exhaust to control Fumes – may be the best way to reduce breathing hazards	
	Enclosing noisy machines with noise dampening materials	
Administrative Controls	Policies, work practices that reduce exposure to hazards	
	Clean place for workers to eat, change clothes – reducing contamination of food, clothing	
	Rotating workers through heat, or changing work to cooler hours	
Personal Protective Equipment (PPE)	Protection is on the worker , not the hazard	
	Respirators, gloves, work boots, hard hats safety glasses, and hearing protection	
	Least effective control	

Exercise: Using an MSDS to Find Health Effects**Notes**

As noted several times throughout this chapter, information about health effects is most commonly found off of material safety data sheets. In the following exercise, you will get some practice locating health information from MSDS sheets. Please get into your groups, selecting reader and reporter.

Alan and Jeff have been using a new product on their job for the last month. Alan has been complaining about having a lot of headaches and trouble breathing lately. Jeff tells him he's just getting soft. Alan decides to find out more about this new product.

Using the Material Safety Data Sheet that the instructor gives you, discuss the following questions in your group. Please note where you find the answers, too.

- 1) Could working with this chemical be the cause of Alan's headaches?

- 2) What long-term (chronic) health effects could this product cause?

- 3) Alan and Jeff usually use leather work gloves and regular work uniforms on the job. Will these be enough to protect them from this product?

- 4) What should Alan do now that he has noticed these problems?

Health Effects

Key Points **5**

- 1) Chemicals can get into you body in the following ways:
 - Inhalation--breathing
 - Absorption--absorbed through your skin
 - Ingestion--by mouth
 - Injection--forced through skin / broken skin
- 2) **Acute** means short term health effects, **chronic** means long term health effects, such as cancer.
- 3) Often the chronic effects of chemicals are overlooked because there may be no symptoms until it's too late.
- 4) Scientists have not found a "safe" level of exposure to cancer-causing substances (carcinogens). Risks do go down with lower exposure.
- 5) The hierarchy of controls can reduce or prevent exposure to hazards.
- 6) Exposure to hazards can be prevented. Suffering from bad effects of chemicals isn't just "a part of the job."