HEALTH EFFECTS 2

In Chapter 2 you will learn about:

- How lead enters and affects the body.
- Lead poisoning and children.
- How lead levels in the body are measured.
- How lead poisoning can be prevented.

Lead Poisoning Affects You

Lead is poisoning many children and adults around the country. You can prevent lead poisoning by working safely and carefully with lead-based paint. Your job is very important. But lead can also poison you. Lead can make you very sick and can cause death. At low levels of exposure, you can feel fine but lead is still harming you. You are in this class to learn how to protect yourself, others, and the environment from lead poisoning.

As a construction worker, especially if you do remodeling, demolition, or lead-based paint abatement work, you are exposed to lead. Without proper protection, lead in the workplace can make you sick. You will wear a respirator and protective clothing when you work with lead. You will clean up, hopefully shower, and put on clean street clothes before going home. If you fail to shower before leaving the job site or you wear dirty work clothes home, you could expose your family to lead.

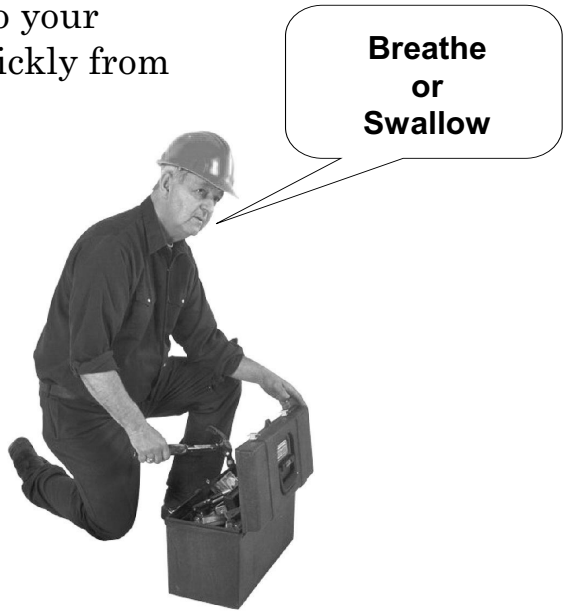
How Much Lead is Dangerous?

Even a small amount of lead can make you sick or damage you. Lead can stay in the body for a long time. Lead stays in the blood for several months and it can be stored in the bones for 30 years or more.

The more lead you are exposed to, the more likely you are to get lead poisoned. Many small doses of lead over a long time (chronic exposure) can make you lead poisoned. One large dose of lead in less than a day can also leave you lead poisoned. A low dose of lead can make you feel tired and irritable. A high dose of lead can cause permanent damage to your brain, nervous system, and kidneys. A very high dose of lead can cause death.

How Does Lead Get Into Your Body?

Breathing Lead. When lead is in the air, you breathe tiny lead particles into your lungs. The lead particles travel quickly from your lungs as they are absorbed into your bloodstream.

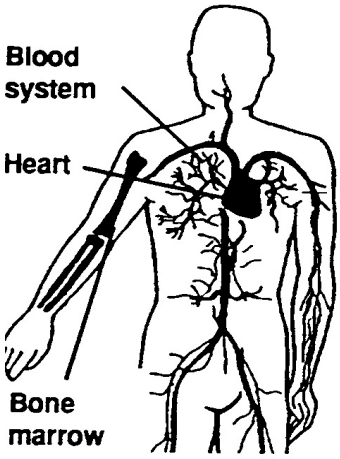


Swallowing Lead. If you swallow lead particles, the lead eventually goes through your digestive system and then slowly gets into your blood. You can swallow lead particles if you eat, drink, smoke, or chew your fingernails without washing your hands after working with lead.

Up to 50% of the lead that children and pregnant women swallow is absorbed into their bodies. About 10 to 15% of the lead that adults swallow is absorbed into their bodies. Your body will hold more lead if you don't have enough calcium or iron in your diet.

How Can Lead Harm Your Body?

Heart and Blood System

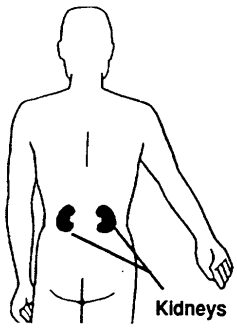


When lead reaches your blood, it attaches to red blood cells in the area where iron and oxygen are. If your body does not get enough iron, lead will attach to the red blood cells more quickly. Then, the red blood cells cannot carry oxygen. You cannot get enough oxygen to the rest of your body. When there is not enough iron or red blood cells in your blood, you have anemia. Anemia is a condition that makes you very tired.

Lead damages red blood cells. It makes red blood cells die earlier than they are supposed to. Lead also reduces your body's ability to make more red blood cells in the bone marrow.

Lead poisoning may cause high blood pressure. When you have high blood pressure, your heart muscles cannot relax. This increases your risk of heart attack, stroke, and kidney disease.

Kidneys



Your blood is cleaned and filtered in your kidneys. Some of the lead that is in the blood gets filtered in the kidneys, where it can cause damage. Kidney damage can be very serious. Often this damage cannot be detected until much of the kidney's function is lost. This damage requires serious medical treatment. Lead poisoning can make your kidneys fail. Kidney failure can cause death.

Female Reproductive Health and Pregnancy

Lead poisoning is very dangerous to the female reproductive system. It can make women less fertile. It can cause abnormal menstrual cycles and affect menopause.

When a woman is pregnant, her body must take in nutrients for herself and for the developing fetus. If she is exposed to lead, her body will take it in very quickly. A pregnant woman's body absorbs 50% of the lead that she takes in. (A non-pregnant woman's body absorbs only 10%.) This lead will stay in her body (in her bones) and will be released into her blood. Even if her exposure to lead was 20 years before this pregnancy, that lead could be released from her bones into her blood now. Very small amounts of lead can make a pregnant woman sick.

The fetus gets blood and calcium to make bone from the mother. If the mother has lead in her blood or bones, it will go to the fetus. Very small amounts of lead can hurt the fetus. The cells of the fetus are developing rapidly. Lead can cause brain damage and even death to the fetus. It can cause miscarriages and premature (early) births.

Male Reproductive System

Lead is very dangerous to the male reproductive system. Lead can make men lose interest in sex. It can cause men to have problems having an erection.

Lead can cause infertility. It damages sperm. Lead causes the sperm to have an odd shape. It makes sperm move slowly. Wives of lead-poisoned workers have more miscarriages and premature births. Their children have more birth defects.

Bone Tissue

As blood travels through the bones, lead from the blood is deposited into the bone tissue. Lead blocks your body's natural process of making new blood cells.

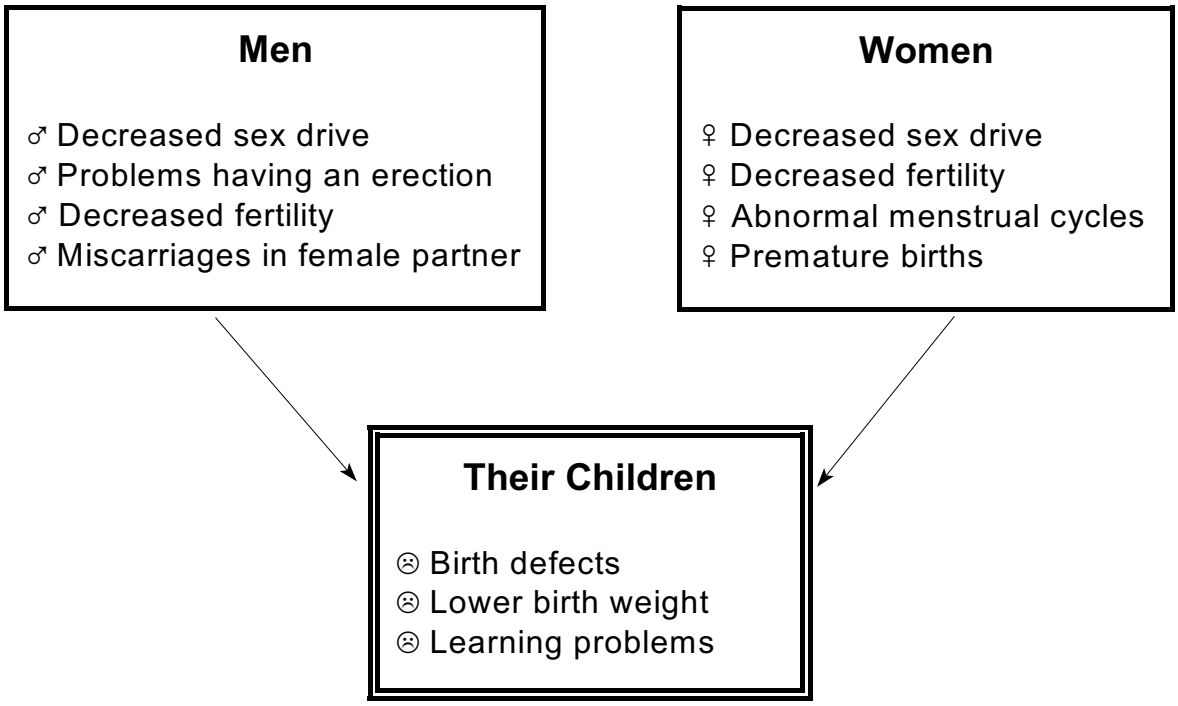
Lead also competes with calcium in the bone. Calcium is released from bone tissue as our bodies need it. If lead is there instead of calcium, then lead is released into the blood.

The bones and teeth store 95% of the lead in the body. **Lead can be stored in bone tissue for more than 30 years.** When the body is under stress, lead is released from the bone tissue into the blood. Your body is under stress whenever you get sick, are overactive, become pregnant, or are under a lot of pressure. **If the lead goes from the bone back into the blood, it causes problems all over again.**

Lead that stays in your body is called a **"body burden."** The more lead you are exposed to, the higher your lead body burden is. The lead body burden is not easy to measure because it is mostly found in your bone tissue. Samples of bone tissue are difficult to get. A child's tooth can be tested for lead when it falls out. The tested tooth can tell you how much lead is in the child's bones; that is, the child's lead body burden. A special X-ray machine can measure body burden. But, there are very few of these machines available.

This X-ray fluorescence machine measures lead in bone, where up to 95% of the body's lead is stored. A number of union construction workers who attended a 1990 national health & safety conference participated in a bone lead screening. The screening showed that these workers, who are often exposed to lead paint during renovation, have much higher bone leads than people who have no occupational exposure.

Reproductive Health Effects of Lead



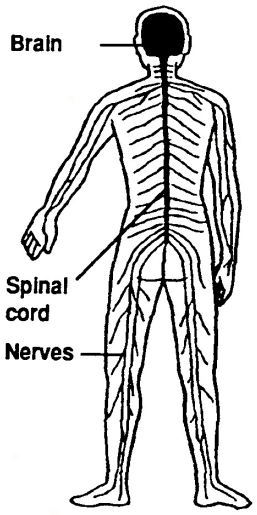
Fetal Protection Policies

In the past, many companies developed policies with the stated purpose of protecting the fetus. They were called **fetal protection policies.** Fetal protection policies may really have been developed to protect the companies against lawsuits.

Women were forced to prove they could not have children to keep their jobs. Women who wanted to have children in their lifetime were fired. In some cases, women had to be sterilized to keep their jobs.

In 1991, the Supreme Court decided fetal protection policies discriminated against women. Fetal protection policies are now illegal. Lead affects both male and female reproductive systems. Both men and women need to be protected from harmful levels of lead to have healthy babies. The employer must provide a safe workplace for both male and female workers.

Nervous System



The nervous system is the system in your body most affected by lead. The nervous system includes your brain, spinal cord, and nerves. The damage lead causes to the nervous system can be permanent. Lead damages the brain. It can even kill brain cells. Lead damage to your brain can make you depressed, irritable, forgetful, clumsy, and even less smart. At very high doses, lead poisoning can cause hallucinations, swelling of the brain, coma, and even death.

Lead damages the ability of your nerves to give and take messages. Lead can damage the nerves that go to your hands and feet. This nerve damage can cause your hands to shake. It can also cause your hand or foot to drop. If you get wrist drop or foot drop, you may never have full use of your hand or foot again.

The nervous system of a fetus, infant, or child is affected by even small amounts of lead. Lead poisoning can decrease the intelligence of children. Lead can cause behavior problems in children.

Children are at High Risk

Children can get lead poisoned very quickly. Even a small dose of lead can poison a young child. A child's rapidly developing brain, nervous system, and entire body are affected by lead. Toddlers (age 1 to 3) are at a very high risk of lead poisoning. Toddlers are always crawling on the floor and putting everything in their mouths. Therefore, they can swallow a lot of lead dust. Children absorb up to 50% of the lead that they take in.

Recent medical research shows that lead may affect a child's intelligence even at blood lead levels as low as 10 to 15 micrograms per deciliter. Lead poisoned children have a higher high school dropout rate than non-poisoned children. Lead poisoning can cause children to underachieve academically in school. It can also cause:

- Poor muscle and bone growth;
- Poor hearing;
- Speech and language problems; and
- Coordination problems.

Lead is the most significant environmental health hazard for children in the United States. Lead interferes with the development of a child's nervous system. It can make a child hyperactive. Lead can also make a child react very slowly and/or clumsily. Lead can make it hard for a child to pay attention. Lead kills brain and blood cells. In the U.S., about **900,000 children** ages 1 to 5 have a blood-lead level above the level of concern.

Health Effects of Lead Poisoning

Lead poisoning can affect you in many different ways. A large amount of lead can make you sick right away. A small amount of lead day after day can make you sick over a long period of time.

The health effects of lead poisoning are often difficult to recognize. There are many different signs and symptoms of lead poisoning. Signs and symptoms are things you see and feel when you are sick. The signs and symptoms for lead poisoning can also be caused by a number of other things, like the flu or a cold. Lead poisoning can easily be mistaken for a cold or the flu.

Protect Yourself and Your Family From Lead Poisoning!

Julia's husband Mike is an auto mechanic and machinist. He is exposed to lead on the job. Julia was exposed to lead on the job for three months while she worked in a battery recycling plant. Two years later, Julia became pregnant with their first son. The parents' lead exposure may have affected their son's health.

"As my son grew up," says Julia, "he developed learning disabilities. He had a lot of trouble paying attention and following directions. He has really poor organization skills. We had to send him to a special education program for several years. My son is 12 years old now. He's doing better, but he still needs help organizing. He still needs special care."

Signs and Symptoms of Lead Poisoning

- Tiredness (fatigue)
- Sleep problems
- Dizziness
- Irritability
- Nervousness
- Headaches
- Difficulty concentrating
- Depression
- Forgetfulness
- Hyperactivity (children)
- Numbness
- Wrist or foot drop
- Weakness
- Clumsiness
- Joint and muscle pain
- Vomiting
- Loss of appetite
- Stomach aches
- Constipation
- Metal taste in the mouth
- Problems having healthy children

Sometimes the signs of lead poisoning come and go. You have them one day and then they disappear. Then the signs come back again. This can happen for several months.

Lead can cause damage without symptoms. You may not know you have lead poisoning, it often goes unnoticed. A child with lead poisoning may seem healthy while damage is being done to their bodies. Signs and symptoms of the damage usually don't develop until the condition is serious.

Some Health Effects of Lead Poisoning

- Anemia
- High blood pressure
- Damage to blood cell formation
- Kidney disease
- Brain damage
- Nerve damage
- Decreased fertility
- Premature births
- Miscarriages

Short-term or Long-term Effects

Sometimes the effects of lead poisoning are **short term** or **acute.** This means they don't last a long time – maybe a few weeks

or months. Sometimes the symptoms of lead poisoning are long **term** or **chronic.** This means the symptoms stay with you a long time, sometimes for years or even permanently. Long-term effects can be caused by repeated small doses of lead, or by a very high dose at one time.

Reversible or Permanent Damage

Some effects of lead poisoning can be **reversed.** This means the effects may go away. High blood pressure is an effect of lead poisoning that is reversible. High blood pressure can return to normal when the lead in your body decreases.

Lead poisoning can cause **permanent damage**. This means that the damage is always there. An example of permanent damage caused by lead is wrist drop. Wrist drop is when your wrist hangs limp at the end of your arm. You may never be able to use that hand again. Wrist drop is caused when lead damages your nervous system.

Lead can Cause Permanent Damage to Your...

- Brain
- Learning ability
- Coordination
- Hearing
- Nerves
- Digestive system
- Heart
- Blood cell formation
- Kidneys
- Reproductive system

Testing for Lead in Your Body

The only way to tell for sure that you are lead poisoned is to get a blood test. When lead enters your body, it gets into your blood. A blood test is the only way to find out how much lead is in your blood. The amount of lead in your blood is called your **blood lead level**.

There are two kinds of tests to monitor blood lead levels. Both

tests can be done from blood taken from either your arm or your finger. Both can be taken from the same sample of blood.

1. **Blood Lead Level Test.** This test measures the amount of lead in your blood. It shows how much lead you have been exposed to in the last 6 to 8 weeks. The blood lead test is the most accurate test. Your blood lead level is measured in micrograms of lead per deciliter of blood.

2. **ZPP test (Zinc Protoporphyrin).** ZPP is a chemical in your body. Your ZPP level becomes abnormal when a lot of lead has entered your body over the last **few months**. It tells how much lead your body has absorbed by looking at some of your body proteins. It does not measure the amount of lead in your blood. Results are measured in **micrograms per deciliter**. Normal results for the ZPP test are 35-50 ug/dl. The ZPP test is not as accurate as the blood lead level test for early or low level lead exposures. ZPP results can vary because of diet, anemia, and other factors.

Blood Lead Levels

Lead is a poison to your body. Imagine that penny broken up into 2 million pieces again. Now picture 10 – 15 of those pieces dissolved in a half cup of liquid. That tiny amount of lead in your blood can cause health problems!

Lead is dangerous because it builds up in your body. It can stay there for years. It is difficult to say exactly what happens to your body with specific lead levels because we are all so different. Different people have different reactions to lead in their bodies. Some people do not even know that they are having problems with lead poisoning when their blood levels are 60 ug/dl. You may not know that lead is harming your body. Other people suffer obvious signs of lead poisoning at 30 ug/dl. This box is a very rough estimate of an adult's reaction to different levels of lead.

Adult Reactions to Lead

Blood Lead Level	Possible Health Effects
15 ug/dl	Increase in blood pressure; harmful effects on fetus; joint and muscle aches
25 ug/dl	Reproductive problems
40 ug/dl	Kidney damage; damage to blood formation
60 ug/dl	Anemia; nerve damage; constipation; stomach pains; irritability and fatigue; memory and concentration problems; clumsiness; drowsiness and sleep problems
80 ug/dl and above	Blue line on gums; uncontrollable shaking of hands; wrist and foot drop; hallucinations; brain damage; coma; death

ATSDR 1989; California Health Department 1993

Every child is also different in his or her reaction to lead. The following chart is a very rough scale of children's reactions to different levels of lead. A lead poisoned child may not look or act sick, but his or her body is being damaged. The health effects of lead sometimes may not be seen. Scientists have discovered that even very low exposures to lead can cause serious health effects in children.

In 1991, the Centers for Disease Control and Prevention lowered the level of concern for children's blood lead levels from 25 ug/dl to 10 ug/dl. Then, 10 to 15% of all preschool children (3 to 4 million children) were estimated to have BLLS above 10 ug/dl. **For 1999-2000, 2.2% (434,000 with a range of 189,000-846,000) of children from ages 1-5 had BLLs >=10 ug/dl.** State data varies

from CDC national data. The major source of lead exposure for children is lead-based paint and lead dust in their homes.

Child Reactions to Lead

Blood Lead Level	Possible Health Effects
10 ug/dl	Slight loss in IQ; (not as smart they should be); hearing and growth problems
20 ug/dl	Moderate loss in IQ; hyperactivity; poor attention span; difficulty learning, language and speech problems; slower reflexes
40 ug/dl	Poor bone and muscle development; clumsiness; lack of coordination; early anemia, fewer red blood cells to carry oxygen and iron; tiredness; drowsiness
50 ug/dl	Stomach aches and cramps; anemia, destruction of red blood cells; brain damage
100 ug/dl and above	Swelling of the brain; seizures; coma; death

A microgram is a measure of weight. There are one million micrograms in a gram. The abbreviation for microgram is **ug.**

A penny weighs about two grams. Imagine cutting a penny into 2 million pieces. A microgram would weigh the same as one of those 2 million pieces.

A **deciliter** is a measure of volume. It is equal to a little less than half a cup. A person weighing 165 pounds has about 60 deciliters of blood. The abbreviation for deciliter is **dl**.

Preventing Lead Poisoning

Lead-based paint in the homes of lead poisoned children should be abated. Lead-based paint **abatement** is any set of actions that removes the lead hazard permanently. Abatement often cannot happen right away. While the family waits, you can use **interim controls** to control the lead hazard until it is abated. Interim means **in between time.** Interim controls are actions that lessen the amount of lead dust. When lead dust is reduced, the source of lead poisoning is reduced. Interim controls do not take the place of abatement. By doing lead abatement and using interim controls, you are helping prevent lead poisoning.

When you work with lead, you have a higher risk of getting lead poisoned. You need to do as much as possible to reduce that risk. Here are some things that you can do:

- Make sure your employer provides a safe workplace.
- Know your rights as a worker.
- Wear protective gear.
- Use safe work practices.
- Use good personal hygiene.
- Don't take lead home on your clothes or in your car.
- Get the medical exams that your employer provides.
- Inform your employer if you develop any signs of lead poisoning.
- Do non-lead work if your blood lead level is too high.
- Eat a balanced diet.

In this class, you will learn how to make your workplace safer. You will learn what your rights are as a lead abatement worker. You will learn about the protective gear that you need to wear and the safe work practices that you will need to use. You will learn how important good personal hygiene is. The OSHA Lead Standard says your employer must provide this training for you. The standard also says your employer must make special medical exams available to you.

Good Nutrition

Good nutrition is important. A diet with enough iron and calcium prevents worse lead poisoning. When you eat a diet high in iron and calcium, you can reduce lead absorption. People with low amounts of iron and calcium have increased lead absorption. If you have enough iron and calcium in your body, lead will be absorbed less quickly. Vitamin C, zinc, and protein, found in a well-balanced diet, appear to decrease lead absorption as well. Stay away from foods high in fat. Foods with a lot of fat, such as fried foods, appear to increase lead absorption.

Eat foods high in iron. Cheese, fish, seafood, meat (especially liver), eggs, spinach, beans, raisins, apricots, seeds (pumpkin, squash, sunflower), black walnuts, almonds, barley, and wheat germ.

Eat foods high in calcium. Milk, cheese, ice cream, yogurt, bread, fish, seafood, meat, beans, broccoli, leafy green vegetables (spinach, etc.), cherries, blackberries, raisins, fruit juice (orange, prune, grapefruit, pineapple), peaches, apricots, dates, sunflower seeds, almonds, hazelnuts, and pecans.

Blood Test Results for Children and Follow-up Activities.

The Centers for Disease Control and Prevention (CDC) published a statement on lead called, *Preventing Lead Poisoning in Young Children* (October 1991). In that document, the CDC published a chart of what kind of intervention is necessary for children at different blood lead levels. The following chart is adapted from this publication.

Blood Lead Concentration (ug/dl)	Action
≤ **9**	Children are not considered to be lead-poisoned.
10 -14	Retest child's blood lead level for accuracy. If many children in the community have blood lead levels ≥ 10. Community intervention should be considered. Health effects shown in studies of children.
15-19	Retest blood lead levels every 3-4 months. Take an exposure history to assess possible high-dose sources of lead. Educate parents about diet, cleaning, etc. Test for iron deficiency. Consider environmental investigation and lead hazard abatement if levels persist.
20-44*	Conduct a complete medical evaluation. Identify and eliminate environmental lead sources.
45-69*	Begin medical treatment and environmental assessment and remediation within 48 hours.
≥ **70***	Begin medical treatment and environmental assessment and remediation IMMEDIATELY. This is a medical emergency.

***Based on confirmatory blood lead level of second test.**

Activity #1: Myths About Lead

Discuss the following statements and decide in your small groups if they are true or just myths. Explain why you think so.

1.	Workers who work with lead often suffer injuries or illness because of the lead they are exposed to.	**T**	**F**
2.	Most lead workers know how to avoid hazardous exposure to lead.	**T**	**F**
3.	You can tell by smell if there are dangerous levels of lead in the air.	**T**	**F**
4.	Lead affects the reproductive systems of women, but does not affect the reproductive systems of men.	**T**	**F**
5.	If you are not feeling sick right away after lead exposure it is safe to continue to work with it.	**T**	**F**
6.	OSHA regulations will protect you from hazardous exposures to lead.	**T**	**F**
7.	Lead can never enter the body through the skin.	**T**	**F**
8.	Most doctors know how to recognize the effects of lead exposure.	**T**	**F**
9.	It's my life. If I want to take risks by being exposed to lead it's not going to hurt anyone else.	**T**	**F**
10.	A few months after you've been exposed to lead, all of it has been excreted from the body.	**T**	**F**

Key Facts for Chapter 2

Lead can poison you and make you very sick.
Even a small amount of lead can make you sick.
Lead is dangerous when you breathe or swallow it.
Lead can cause permanent damage.
Children's developing brains and bodies are easily damaged by lead.
Even low levels of lead can cause permanent damage to a child.
Pregnant women and children are most easily lead poisoned.

Lead in your body –
Lead can damage your body without your feeling any symptoms.
Lead poisoning can easily be mistaken for the flu.
Lead attaches to your red blood cells and travels through your body.
Lead can be stored in your body for more than 30 years.
Body burden is the amount of lead stored in your body.
Lead can be released from your bones and poison you.
Lead can harm many parts of your body – blood cells, heart, kidneys, nervous system, bone tissue, and reproductive organs.
Lead can cause men to have problems having an erection.
Lead can cause women to have stillbirths or miscarriages.

Blood tests –
Blood tests find out how much lead is in your blood.
The tests used are: blood lead level test and zinc protoporphyrin (ZPP) test. The blood lead level test is the more accurate test.
Blood lead levels are measured in micrograms of lead per

deciliter (ug/dl) of blood.
People can have different reactions to the same blood lead level.

Lead poisoning can be prevented.
Your work as a lead abatement worker will prevent future lead poisoning.

You can protect yourself against lead poisoning.
Make sure your employer provides a safe workplace.
Wash your hands and face carefully when you leave the work area.
Use safe work practices that you will learn in this class.
Eat a balanced diet that has enough iron and calcium.

For More Information

The publications at the end of Chapter 1 and the ones below have more information on the health effects topics covered in this chapter.

CDC. *Blood Lead Levels in Young Children – United States and Selected States, 1996 – 1999.* http://www.cdc.gov/mmwr/preview/mmwrhtm/mm4950a3.htm. (12/22/2000).
CDC. *Children's Blood Lead Levels in the United States.* http://www.cdc.gov/nech/lead/research/kidsBLL.htm.
EPA. *Lead In Your Home: A Parent's Reference Guide.* EPA 747-B-98-002.June, 1998. 67 pp.
National Lead Information Center. *Lead Poisoning and Your Children.* (October, 1991).