Toxics In Construction

Training Curriculum

PROTECT
PROACTIVE RESPONSE TO OCCUPATIONAL TOXIC EXPOSURES IN THE CONSTRUCTION TRADES

State Building and Construction Trades Council of California
and the
Labor Occupational Health Program,
University of California, Berkeley
2014
Training Objectives

By the end of this training, participants will be able to:

1. Explain what makes a toxic substance likely to cause harm.

2. Discuss how toxic substances can affect your health.

3. Define terms used in OSHA exposure limits.

4. Review the hierarchy of controls and identify ways to eliminate toxic substances in construction.

5. List the key components of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

6. Discuss the hazards of silica, asbestos and lead dust.
# At a Glance

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<tr>
<th>Activity</th>
<th>Time</th>
<th>Materials &amp; Resources</th>
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| **Introduction**                                              | 10 minutes | - PPTs #1-8.  
- Refer to objectives in the course binder.                                    |
| Review OSHA funding, acknowledgements and course objectives.  |       | The class brainstorms a list of toxic substances they use in construction work.     |
| The class brainstorms a list of toxic substances they use in  |       | construction work.                                                                   |
| **1. What Makes a Toxic Substance Likely to Cause Harm?**     | 30 minutes | - PPTs #9-26  
- Handout: *Chemical Hazards* (course binder, tab 4)  
- Additional factsheets in course binder, tab 4, *Health Effects of Toxic Substances* |
| Small groups explore the factors that make a chemical likely |       | to cause harm and report back to the class about one factor.                         |
| **2. Health Hazards**                                         | 15 minutes | - PPTs #27-37  
- Additional factsheets in course binder, tab 4, *Health Effects of Toxic Substances* |
| The class learns about acute and chronic health effects, latency period, and common health hazards. |       |                                                                                      |
| **3. OSHA Exposure Limits**                                   | 10 minutes | - PPT #38-40  
- Handout: *Health Hazards in Construction, Units of Concentration* (course binder, tab 4) |
<p>| Review terms used in OSHA and Cal/OSHA exposure limits.      |       |                                                                                      |</p>
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| 4. How Toxic Substances Can be Controlled           | 30 minutes | - PPTs #41-49  
- Handout: *Controlling Chemical Hazards* (course binder, tab 5)  
- Additional factsheets in course binder, tab 5, *Controlling Hazards*  
- Pyramid Game prizes |
| The class learns about the hierarchy of controls and identifies specific ways to control toxic substances. Students play the Pyramid Game. |
| 5. Globally Harmonized System of Classification and Labeling of Chemicals (GHS) | 45 minutes | - PPTs #50-61  
- Handouts: OSHA Factsheet: *Hazard Communication Standard Final Rule*, and  
- 3 OSHA Quick Cards for HCS: *Labels, Pictograms, and SDSs* (course binder, tab 6)  
- Drawing of upper torso on a flipchart  
- Colored dots  
- SDS Worksheet (course binder, tab 7)  
- Sample Safety Data Sheets (SDSs) (course binder, tab 7) |
| Review key requirements of the GHS. Small groups review a sample SDS, answer questions on a worksheet, identify target organs on a flipchart, and report back to the class. |
| 6. Hazardous Dusts                                  | 40 minutes | - PPT #62-94  
- Factsheets on Silica, course binder, tab 8. Factsheets on Asbestos, course binder, tab 9. Factsheets on Lead, course binder, tab 10  
- Worksafe BC video: *How Silica Harms Your Lungs* (course DVD)  
- SBCTC video: *Eliminate the Hazard* (course DVD) |
| Additional information is provided on Silica, Asbestos and Lead hazards in construction. |
| Total Time                                          | 3 hours  |                                                                                      |

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Introduction to the Training (10 minutes)

Show PPT #1: Toxics In Construction

Show PPT #2: Funded by OSHA

Explain that this training is funded by federal OSHA.

Show PPT #3: Acknowledgements

Review the information on the slide.

Show PPT #4: Photo Credit and Duplication

Review the information on the slide.

Show PPT #5: SBCTC

Review the information on the slide.

Show PPT #6: World Trade Center

Ask: What health hazards do you see in this photo of the World Trade Center clean-up? Let students respond.

Tell the class: This OSHA photo of the World Trade Center (WTC) shows toxic exposures that building trades workers and other first responders were exposed to in the clean-up efforts. While this was obviously a major event that drew attention to toxic exposures, construction workers are exposed to toxics on a daily basis that they may or may not know about. Understanding these hazards is critical for maintaining the long-term health of members of all trades and that's what this training is all about.

Show PPT #7: Course Objectives, review the course objectives.

Tell the class, by the end of this training participants will be able to:

1. Explain what makes a toxic substance likely to cause harm.
2. Discuss how toxic substances can affect your health.
3. Define terms used in OSHA exposure limits.
4. Review the hierarchy of controls and identify ways to eliminate toxic hazards in construction.
5. List the key components of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).
6. Discuss the hazards of silica, asbestos and lead dust.

Show PPT #8: Occupational Illness and Disease

Say: *It is difficult to get accurate numbers of occupational disease and illnesses because workplace exposures are not directly linked to diseases which occur years later.*

Review the information on the slide:

- In 2008, OSHA estimated that over 1 million workers in construction and general industry face significant asbestos exposure on the job.
- OSHA estimates that more than 2 million workers are exposed to crystalline silica dust in the general, maritime, and construction industries.

Ask: *How many of you currently work with toxic substances? What are some toxics you work with?*

Write the names of the toxic substances people mention on a flipchart page. *Save this list for later use in Section 2, Health Effects of Toxic Substances.*

Your completed flipchart may include:
- asbestos
- paints and adhesives
- solvents
- hexavalent chromium
- lead
- silica
- welding fumes

Ask: *Has anyone ever been injured or made sick by a toxic substance used on the job?*

Ask for a couple of stories. After participants have explained what happened, tell the class that we will discuss how toxics can harm them and how to work with them safely.
1. What Makes a Toxic Substance Likely To Cause Harm? (30 minutes)

[Handout: Chemical Hazards, located in tab four of the course binder: Health Effects of Toxic Substances.]

Show PPT #9: Factors That Determine if a Substance Causes Harm

Explain to the class factors that determine if a substance causes harm include:

1) **Toxicity**, does the substance harm the body
2) **Route of exposure**, how the substance enters your body
3) **Physical forms**, the different physical forms of toxic substances
4) **Dose and duration**, how much of the substance enters your body and for how long
5) **Reaction and interaction**, other substances you are exposed to at the same time
6) **Individual characteristics** of the person exposed

Tell the class: *In this next activity we will explore the factors that make a chemical more likely to harm the body.*

Show PPT #10: Small Group Activity

Tell the class that we will now do a small group activity. Break the class into six small groups to examine each of these factors in more depth. Point out the flipchart pages posted around the room and say:

Notice that each flipchart page has a different factor listed on it that can influence whether a person will be harmed by a chemical. Each small group will be assigned one of these flipchart pages and will have 10 minutes to plan how to explain the term or terms listed on their sheet to the rest of the class. Your group should be able to say how this factor contributes to a chemical causing harm. Give examples from your work in construction.
Assign each small group a flipchart page and give them 10 minutes to work. Tell the groups to review the handout in tab 4 of their course binder, *Chemical Hazards*, for information about the factor they are studying.

After 10 minutes, reconvene the small groups and ask each group to report back on the term(s) they studied. After each small group presents, show the PPT slides that correspond to that term and make sure the following information is covered by the groups:

**Group 1: Toxicity**

Show PPT #11: What Makes a Substance Toxic?

Toxicity is the ability of a chemical to cause harm when it gets into the body. 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 tiny amount of exposure to a chemical can cause harm, the chemical is considered highly toxic. An example of a highly toxic substance is Cyanide (and other substances called poisons). It takes very little of this substance to cause significant harm.

**Group 2: Routes of Exposure**

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

Show PPT #12: Routes of Entry

The way toxic substances get into the body are often called the routes of entry. They include:

1. Breathing
2. Skin and eye contact
3. Swallowing
4. Puncture

Show PPT #13: Breathing

Breathing or inhaling is the most common way toxic substances get into the body. You can inhale toxic substances through your mouth, nose and lungs.
Information for Instructor

Air enters the body through the nose or mouth, passes through the larynx, down the trachea, and into our lungs. Once it is in your lungs, air goes through a maze of smaller and smaller bronchial tubes until it reaches clusters of tiny sacs, called the alveoli (pronounced al-vee-oh-lie.) Your lungs have about three hundred million of these tiny air sacs per lung. All are required to ensure that your body gets the oxygen it needs. This is called your respiratory tract. We breathe about 20-25 thousand breaths in one day.

Show PPT #14: Skin and Eye Contact

Toxic substances can also get in your body through your skin and eyes, and go into your bloodstream. The skin is the largest organ of your body. This slide shows irritant contact dermatitis from working with fiberglass. Toxic substances can get directly into the bloodstream through the open sores in the worker’s hands.

Eye Contact. Some toxic substances may be absorbed through the eyes and enter the bloodstream. The eyes are easily harmed by toxic substances, so any eye contact with them should be taken seriously.

Show PPT #15: Swallowing

Toxic substances swallowed accidentally through your mouth can get absorbed in your digestive tract. Substances can be swallowed if they are left on dirty hands or clothing. Dusts can also land on your uncovered food and drinks at work. Dust on your work clothes can be taken home to family members. Asbestos dust was taken home on dirty work clothes. Some family members who got exposed to asbestos this way developed a particular type of asbestos-related cancer years later called mesothelioma.

Show PPT #16: Puncture

Injecting or puncturing your skin with a dirty sharp object is the fourth way toxic substances can enter the body. While uncommon in construction, it could happen from a dirty nail or rebar puncturing the skin, putting a toxic substance directly into the bloodstream.
Information for Instructor

Toxic substances can take different forms. How a substance gets into the body, and what damage it causes depends on the physical form of the substance. It is important to know what form a substance is in when you use it so you know how it gets in your body and how to protect yourself. For example, stainless steel in solid form isn't likely to enter the body and cause harm. However, welding on stainless steel can be extremely hazardous. Chromium is a component in stainless steel. Chromium is converted to its hexavalent state, Cr(VI), during the welding process. Hexavalent Chromium (Cr(VI) fume is highly toxic and can damage the eyes, skin, nose, throat, and lungs and cause cancer. (OSHA has a standard on Hexavalent ChromiumCR(VI). (See course, binder tab 12, for factsheets on hexavalent chromium.)

Group 3: Physical Forms of Substances

Show PPT #17: Physical Forms of Substances

The slide shows three main physical forms of substances: solid liquid and gas.

Note to Instructor: You many continue with slides 17-19 and give more information on dusts, fibers and fumes or you can skip to slide 20, liquids.

Show PPT #18: Solids

A solid is a material that keeps its form, like stone. Solids can be present as small particles in dust, fumes, and fibers.

Dusts are small particles in the air. They are formed when solids like rock, metal or wood are crushed, sanded, grinded, or blasted. Dust can be hazardous when inhaled in the respiratory tract. Dusts in construction include:
- Crystalline silica dust
- Wood dust
- Lead paint dust

A fiber is a solid particle whose length is at least three times its width. The degree of the hazard depends on the size of the fiber.
Fibers found in construction include:
- Asbestos
- Fiberglass

Information for Instructor

Scientists have made over 400 studies of fiberglass to determine if it is hazardous like asbestos. The conclusion is that it is not, because its properties are very different from asbestos. OSHA confirmed these findings in 1991 when it decided to regulate fiberglass as a nuisance dust, and not as a cancer-causing agent. Precautions should still be taken while working with fiberglass. Personal protective equipment includes: hard hat, safety goggles, respirator, disposable suit & gloves.

**Fumes** are created when solid particles are heated to a very high temperature. Fumes are made by burning, welding, cutting or heating metal. At a certain temperature the solid metal is vaporized. As it cools, it forms small particles which can be inhaled into the lungs. Examples of fumes found in construction:

- Welding Fumes (The primary components are oxides of the metals involved, such as zinc, iron, chromium, aluminum, or nickel.)
- Asphalt fumes
- Naphtha – “Coal Tar” a brown or black thick liquid that comes from coal; it’s a skin irritant known to cause cancer.
- Lead Fumes

Health effects from certain fumes may include metal fume fever, stomach ulcers, kidney damage and nervous system damage.

**Show PPT #19: Respirable Particles**

Coarse dust is caught in the nose and throat before reaching the lungs. Smaller dust, fibers, fumes and other particles that can go past the nose and mouth and enter deep into the respiratory system are called respirable. These tiny particles are less than 10 microns (µm) in diameter. (Respirable particles are referred to in the OSHA and Cal/OSHA silica standard.)
Show PPT #20: Respirable Particles in Construction

A micron is 1 millionth of a meter (1/96,000 of an inch). A single human hair is between 80 – 120 microns (µm) in diameter.

Some exposures in construction, such as toxic fumes, dusts and mists occur from particles that are less than 10 microns (µm) in diameter; these particles are invisible. Construction examples include asbestos fibers, silica dust and welding fumes.

Show PPT #21: Liquids

A liquid is a material that flows freely, like water. Many hazardous substances are in liquid form. Some liquids like solvents can enter the body through the skin and can damage the organs. For example, paints and coatings can contain solvents (like toluene and xylene), which cause liver and kidney damage.

Information for Instructor

Mists — are tiny droplets of liquid suspended in air. Examples of mists in construction: spray paint, oil mist from lubricants, and aerosol (solvent) degreasers.

Vapors. Liquids may also evaporate (give off vapors), forming gases which can be inhaled.

Show PPT #22: Gases and Vapors

Gas

A gas is a material that exists as individual molecules (particles) in the air, like oxygen, at normal room temperature and air pressure. Toxic gases can irritate the skin, throat, eyes or lungs (called a local effect) or they can pass from the lungs into the blood stream (called a systemic effect).

Vapor

A vapor is the gas form of a substance that is usually a liquid at room temperature and normal pressure. It is formed by evaporation. Vapors can be inhaled into the lungs and can irritate the eyes, skin or respiratory tract. Most vapors produced on
construction sites come from solvents like paint thinners (e.g., toluene and turpentine), glues, paints and adhesives.

Information for Instructor

Welders and people who work in confined or enclosed spaces (plumbers, pipefitter, electricians, heating and air conditioning workers) are most at risk from toxic gases in construction. All welding processes produce hazardous gases. Gases are invisible to the eye, and may or may not have an odor. The heat in both the flame and the arc, and the ultraviolet radiation from the arc, produce gases such as carbon monoxide, carbon dioxide, oxides of nitrogen and ozone. Other gases and vapors may be produced as by-products from the breakdown of solvents or coatings on the metal. Gases used for arc shielding, or as a fuel, are also given off during welding.

Examples include:
- Oxygen – used for welding and cutting
- Acetylene – used for welding and cutting
- Carbon dioxide – used as an inert gas and can be found naturally in sewers
- Welding gases – welding process can produce ozone, phosgene and carbon monoxide gases
- Carbon monoxide from exhaust

Group 4: Dose and Duration

Show PPT #23: Dose Response Relationship

In general, the greater the amount of a toxic substance that enters your body, the greater the effect will be. This connection between amount and effect is called the dose-response relationship. It is best to keep exposures to toxic substances as low as possible.

Show PPT #24: Dose Response Relationship: Alcohol

This slide shows the dose-response relationship using alcohol as the example. The higher your dose (the more you drink), the greater is the effect on your body.
Duration

In general, the longer you are exposed to a toxic substance, the more likely you are to be affected by it. Exposure to toxic substances over a long period of time are often harmful because they can accumulate in the body or because the body does not have a chance to repair itself.

Group 5: Reaction and Interaction

Show PPT #25: Reaction and Interaction

If you are exposed to more than one toxic substance at a time you need to be aware of possible reactions and interactions between them. Some substances, in combination, can produce a new toxic substance. This is called reaction. For example, when bleach and ammonia are mixed together dangerous toxics are formed: chlorine gas and hydrochloric acid.

Some toxic substances, in combination, increase the likelihood the person will get sick. For example, being exposed to high levels of asbestos and also being a cigarette smoker can greatly increase the likelihood of getting cancer. This is called interaction.

Group 6: Individual Differences

Show PPT #26: Individual Differences

People vary widely in their sensitivity to the effects of toxic substances at home and the workplace. Individual differences include age, sex, inherited traits, diet, pregnancy, state of health (e.g., asthma), and use of medications, drugs, tobacco or alcohol. Depending on these individual differences, some people will experience the effects of toxics differently.
2. Health Hazards (15 minutes)

[Handout: *Understanding Toxic Substances*, located in tab four of the course binder: Health Effects of Toxic Substances.]

Ask participants to take a few minutes to talk with the person next to them about the different health effects toxic substances may cause. Suggest that they think about the toxic substances they listed at the beginning of the class, or other toxics they are familiar with that aren't on the list. Display the flipchart page you made earlier that has the list of toxic substances.

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

- silicosis among sand blasters, tunnel builders and rock drill operators
- asbestosis (and other diseases caused by asbestos) among asbestos insulation workers, steam pipe fitters, building demolition workers and others
- bronchitis among welders
- skin conditions among masons and others who work with wet cement
- neurological conditions (the nervous system and disorders affecting it) among painters and others exposed to organic solvents and lead.

The effects of toxic substances may appear immediately or they can take years to show up.

**Acute and Chronic Health Effects and Latency Period**

**Show PPT #27: Acute Health Effects**

Acute health effects occur immediately, hours or days after exposure. Usually the effect will disappear when you are no longer exposed to the toxic substance. Symptoms can include skin irritation, coughing, and nausea.
Ask: What are examples of substances that can cause acute health effects in construction?

Show PPT #28: Acute Health Effects From Solvents

Exposure to paint strippers and paint thinners can cause acute health effects. Symptoms can include headaches, dizziness, nausea, drowsiness; eye, nose, throat, & lung irritation. Skin irritation includes redness, dryness, flaking and cracking skin.

Show PPT #29: Chronic Health Effects

Chronic effects develop slowly over a long period of time, usually over months and years. Chronic effects are always delayed, making it difficult to determine the source of the exposure.

Ask: What are examples of substances that can cause chronic health effects in construction?

Show PPT #30: Examples of Chronic Health Effects

Toxic substances in construction that can cause chronic health effects:

- Asbestos
- Silica
- Lead

The Latency Period is the time between getting exposed to a toxic substance and getting a disease.

Show PPT #31: Latency Period for Mesothelioma

As the slide shows, Mesothelioma can take anywhere from 20 to 50 years after exposure to asbestos before someone shows symptoms. At some point in the future we will see the incidence of mesothelioma decline.
Common Health Hazards and Their Health Effects

We are now going to talk about some of the common health hazards and health effects associated with the toxic substances OSHA considers hazardous.

Irritants
Irritants are materials that irritate the eyes, nose, throat, or lungs. This includes fiberglass dust, hydrogen chloride gas and ozone (produced in welding), and solvent vapors.

Sensitizers
Sensitizers may cause little or no reaction upon first exposure. Repeated exposures may result in severe allergic reactions.

A skin sensitizer is a substance that will cause an allergic reaction in some workers following repeated skin contact. Skin sensitizers can cause an allergic reaction, with redness, rash, itching, swelling or blisters at the point of contact on the body.

Ask: What are examples of skin sensitizers in construction?

Show PPT #32: Sensitizers

Examples of skin sensitizers in construction include:
- wet cement
- some cement dusts
- lime
- some paints
- epoxy resins
- adhesives
- isocyanates – (these are the raw materials that make up all polyurethane products. Construction jobs that may involve exposure to isocyanates include painting and foam-blowing insulation. The main organs affected are the respiratory system, the eyes and the skin. Long-term effects can include chronic bronchitis and asthma.)

These materials can cause contact dermatitis which includes red, itchy, scaly skin or painful blisters, ulcers, and rashes like acne.
**Simple Asphyxiants**
A simple asphyxiant is a gas that displaces oxygen, so there is less oxygen in the air to breath. They can be very dangerous if used improperly in a confined space. They can cause unconsciousness or death by suffocation (asphyxiation). In the new OSHA Globally Harmonized System of Classification and Labeling of Chemicals (GHS), simple asphyxiants must be labeled where appropriate and be addressed on Safety Data Sheets (SDSs), previously known as Material Safety Data Sheets or MSDSs. (We will be discussing the GHS in section 5 of this training.)

Ask: *Can someone give me an example of simple asphyxiants that might be present during construction work?*

**Show PPT #33: Simple asphyxiants**

Simple asphyxiants commonly found on construction include: carbon dioxide, nitrogen, argon and methane.

**Corrosives**
Corrosives are materials that can attack and chemically destroy exposed body tissues. Corrosives can also damage or even destroy metal. They begin to cause damage as soon as they touch the skin, eyes, respiratory tract, digestive tract, or metal. The extent of damage depends on how long the corrosive is on the skin and how concentrated it is.

Ask: *Can someone give an example of a corrosive?*

**Show PPT #34: Corrosives**

- Hydrofluoric acid used to etch concrete
- Hazardous materials in wet concrete and mortar include: Alkaline compounds such as lime (calcium oxide) found in wet concrete and mortar

**Carcinogens, Mutagens and Teratogens**
A carcinogen is a toxic substance that can cause cancer in humans and animals. Safety Data Sheets (SDSs) must list a substance if it is a known carcinogen or suspected carcinogen. Cancer-causing
chemicals must be listed on an SDS even if the amount is only 0.1 percent of the product.

Ask: What are examples of known carcinogens found in construction?

Show PPT #35: Known and Suspected Carcinogens

Common carcinogens in construction include asbestos, benzene, beryllium, cadmium, asphalt fumes, and silica.

Show PPT #36: Mutagens

Mutagens are substances that change the genetic information of an organism, the DNA. Mutagens are usually also carcinogens and often cause cancer. Common mutagens in construction include benzene, lead, and vinyl chloride.

Show PPT #37: Teratogens

Teratogens are substances that cause harm to the fetus or embryo during pregnancy, causing birth defects. Common teratogens in construction include heavy metals, particularly lead and mercury.
3. OSHA Exposure Limits (10 minutes)

[Handout: Health Hazards In Construction, Units of Concentration, located in tab four of the course binder: Health Effects of Toxic Substances.]

OSHA has standards to limit the amount or concentration of a toxic substance (gas, liquid, dust, etc.) that can be present in the workplace. We are going to briefly discuss some of OSHA’s exposure limits commonly used in construction standards.

Ask: What are PELs?

Show PPT #38

A PEL is the Permissible Exposure Limit (PEL) set by OSHA to protect workers against exposure to toxic substances. A PEL is the legal limit a worker can be exposed to a toxic substance in an 8 hour day. PELs have been set for about 500 chemicals in California.

In California, Permissible Exposure Limits (PELs) are set by Cal/OSHA. In California, PELs are periodically revised when new information on toxicity becomes available.

Background Information for Instructor

An independent professional organization, the American Conference of Governmental Industrial Hygienists (ACGIH), recommends exposure limits. These are called Threshold Limit Values (TLVs). TLVs are reviewed and updated each year as new information becomes available. Suggested changes are first published as proposals and are given two years for review before being adopted by ACGIH.

NIOSH, the National Institute for Occupational Safety and Health, publishes Recommended Exposure Limits (RELs) for some chemicals. RELs are usually highly protective to health and are often used as best practices in industry. Neither RELs nor TLVs are enforceable by OSHA or Cal/OSHA.
Let's look at some common exposure limits you will see on the Safety Data Sheet (SDS):

1. **Time Weighted Average or TWA**. Most exposure limits are based on the average for an 8-hour day.
2. **Short Term Exposure Limit or STEL**. A few toxic substances are so irritating that they have a STEL of 15 minutes or less.
3. **Ceiling Limit or C**. Ceiling limit refers to the concentration of a toxic substance that no worker should be exposed to for any period of time, even for a few minutes.
4. **Skin or S**. This symbol is to remind you that the toxic substance can be absorbed through the skin. It's a warning to avoid any skin exposure by wearing proper personal protective equipment (PPE).

These units of measurement are established in OSHA standards to describe the amount of a toxic substance workers can be exposed to. You will also see these on the Safety Data Sheets (SDS) that we will use in Section 4.

- **Parts Per Million** – used to measure the amount of gas or vapor in air. For example, the OSHA PEL for benzene is 1 ppm. This means that a worker cannot breathe more than 1 molecule of benzene out of every million molecules of air.

- **Milligrams per Cubic Meter (mg/m³)** - used to measure solids or liquids in the air. A milligram is a very small weight. (1 milligram equals .001 gram). A cubic meter (m³) is a measure of volume. A cubic meter is about the same size as a cubic yard. The PEL for iron oxide fume is 5 mg/m³.

- **Micrograms per Cubic Meter (µg/m³)** - used to measure highly toxic dusts, mists, or fumes in air. (1 microgram equals .000001 gram). The OSHA PEL for Lead is 50 µg/m³.

- **Fibers per Cubic Centimeter of Air (f/cc)** - The number of particles measured in a cubic centimeter of air. The PEL for asbestos is 0.1 f/cc.
4. How Can Toxic Substances Be Controlled? (30 minutes)

[Handout: Controlling Chemical Hazards, located in tab five of the course binder: Controlling Hazards.]

Controlling exposures to occupational hazards is the best way to protect workers. Traditionally, a hierarchy of controls has been used to control hazards at the workplace.

Brainstorm a list of the main ways to control exposure to toxic substances.

Say: *Let’s make a list of some ways to reduce or eliminate exposure to toxic substances in construction.*

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

- Substitute safer chemical products, such as water-based paints instead of lead-based paints.
- Use wet methods or mechanical dust collection systems to control dust.
- Install ventilation to reduce the amount of toxic substances from the air workers breathe.
- Rotate workers through different job assignments.
- Isolate the work to a few workers.
- Train workers in using toxic substances 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. There is something called the hierarchy of controls, a pyramid of possible solutions with the most effective kind of solutions at the top of the pyramid.

Show PPT #41: Hierarchy of Controls

Tell the class that 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 page you just created.
Ask: Which of the solutions on the flipchart is an example of “removing the hazard?”

- Substitute safer chemical products, such as water-based paints instead of lead based paints. However, remember that “water-based” doesn’t always mean it’s non-toxic.
- Use wet methods or mechanical dust collection systems to control dust.
- Install ventilation to reduce the amount of toxic substances 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 or to have to wear PPE.

Show PPT 42: Engineering Controls

This slide is from a CPWR (The Center for Construction Research and Training) test of ventilation systems for tuck pointers. This is a very dusty process, as the upper photo on the right demonstrates. Tuckpointing without a vacuum in the top photo required a full-face powered air purifying respirator (PAPR), while the respirator worn in the bottom picture is a half-face respirator.

The PAPR class of respirator features a battery powered, portable fan which draws air through a particulate or chemical filter and blows it to the facepiece. The fan and filter unit is usually mounted on the wearer’s back or belt. Full and half-mask facepieces are available as well as a variety of helmets and hoods.

Air purifying, half mask respirators have a rubber face seal which fits over the nose and under the chin. The respirator is fitted with cartridges which purify the air as the wearer breathes. Different types of cartridges are available for different types of air contaminants.

Administrative Controls

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. These are called administrative controls.

Ask: Which of the solutions on the flipchart is an example of “policies and procedures”?
• Rotate workers through different job assignments
• Isolate the work to a few workers
• Train workers in using toxic substances safely.

Show PPT #43: Administrative Controls
This slide shows examples of administrative controls.

Personal Protective Equipment (PPE)
The purpose of personal protective clothing and equipment is to protect or isolate workers from the chemical, physical, and biological hazards they may encounter.

Ask: What are some examples of PPE used to work with toxic substances?
• Respirators
• Goggles
• Gloves
• Coveralls or other protective clothing

Respirators
Say to the class: Workers should use respirators for protection only if other hazard control methods are not practical or possible under the circumstances. Respirators should be the last choice for respiratory protection. If your employer assigns you a respirator, it is your employer’s responsibility to implement Cal/OSHA’s respiratory regulation.

Show PPT #44: Cal/OSHA Respiratory Regulation (Title 8, CCR, Section 5144)
Tell the class that an employer’s written respirator program describes the proper procedures for selecting and operating respiratory protective equipment. The correct use of a respirator is just as important as selecting the proper respirator. Parts of the respirator program deal with finding out what hazards are present and how much protection workers will need. Other parts describe how to wear and care for a respirator.

Cal/OSHA requires a filter change out schedule for respirators that use cartridges. A change schedule should be part of the employer’s written respirator program which says how often cartridges should
be replaced and what information was used to make the decision. In workplace inspections Cal/OSHA often discovers that cartridges are not changed often enough and are not protecting workers. This is especially true for chemical cartridges which are used to remove gases and organic vapors, like solvents.

Ask: *What are the 4 basic types of respirators?*

**Show PPT #45: NIOSH Approved Respirators**

The respirator you choose should provide protection against the hazard for which it was designed, in addition to being NIOSH-approved.

Here is a brief description of the respirators on the slide:

**Powered Air-Purifying Respirators** (PAPR) uses a motorized air source to filter and clean ambient air before it is delivered to the worker. PAPR systems can filter dusts, mists, fumes, vapors or gases.

**Air-purifying Respirators** have filters, cartridges, or canisters that remove toxics from the air by purifying the air through the cartridge before it reaches the worker. They can be full-face or half-face.

**N95 respirators** are manufactured for use in construction jobs that expose workers to dust and small particles. They cannot be used for chemical exposure.

Ask the class: *Why is PPE usually considered less effective than the other methods?*

**Show PPT #46: Why Is PPE Less Effective?**

Possible answers include:

- It doesn’t get rid of the hazard itself.
- Workers may not want to wear it because it can be uncomfortable and hot.
- It may be hard to communicate while wearing it.
- 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.

Refer the class to the handout, Controlling Chemical Hazards. Tell them that this provides more information about controlling chemical hazards.

$25,000 Safety Pyramid Game (15 minutes)

1. Draw a pyramid on the flipchart like the one on slide 41. Make sure it is taped to the wall at the front of the classroom.

2. Introduce the game. Tell participants:
We are now going to play the $25,000 Safety Pyramid game. You will work in teams to practice finding solutions for hazards.

During each round of the game, I will read aloud a story about someone who got hurt, killed, or sick on the job. Each team will have one minute to come up with ways this injury or illness could have been prevented.

For each story, your team may propose as many solutions as you can think of. Each team will have a pad of Post-it notes on which to write its solutions. Each different solution should be written on a separate Post-it sheet. Your team will pick one person to be the writer for your team.

When the time is up, someone from your team should come up and post all your Post-it notes in the appropriate categories on the chart—in the “Remove the Hazard” category, the “Policies and Procedures” category, or the “PPE” category.

3. Explain how points are calculated:

At the end of each round, I will look over the solutions and decide whether they will count. To be valid, a solution must:

- Relate to the story
- Be realistic
- Be specific (for example, not just PPE, but what kind of PPE)
Each valid “Remove the Hazard” solution is worth $2,000. Each valid “Policies and Procedures” solution is worth $1,000. And each valid “Personal Protective Equipment” solution is worth $500.

If a team puts a good solution in the wrong category, I will move it to the correct category and give the team the appropriate number of points for that category. However, remember that sometimes a solution may fall in more than one category.

The team (or teams) that reaches $25,000 first, wins the game. (You can also decide to limit the game to 3-4 rounds and award prizes to the team with the highest score at the end of the last round.)

4. Divide the class into 3-5 teams.

Distribute a different colored Post-it note pad to each team. Have teams come up with team names. Write the team names across the top of a sheet of flipchart paper, where you will record the points. Have a timer available to keep track of the one-minute time limit for teams to write down their solutions.

5. Tell each team to select one person to record the solutions the team comes up with on the Post-it notes. Also tell each team to select one person who will go up to the game board to post the team’s solutions in the appropriate categories on the board.

6. You may want to conduct a practice round first, using the first story. Or, you can play right away, without first practicing.

7. Begin the game. Select stories from those presented in Slides #47-49. Or, you may create your own stories and solutions. Play at least three rounds. If you have time, play as many rounds as it takes for a team to reach $25,000. If a team wins in fewer than three rounds, consider raising the goal to $30,000.

8. At the end of each round, review the solutions the teams have posted and total the points for valid answers. It’s a good idea to review all the solutions from one team before going to another team’s solutions so you can catch any duplicate answers. You can identify a team’s solutions by the color of its Post-it notes. Enter each team’s points on the flipchart page where you write the team names.
You may want to have another instructor help you judge the solutions and/or keep track of points. Remember that sometimes a solution may fall in more than one category. You can decide which category is most appropriate.

Mention any solutions the teams missed once the round has ended.

When a team wins, award prizes to all its members. Or award everyone in class prizes for playing the game.

**Round 1**

**Show PPT #47, Paint Stripper Dies Using Methylene Chloride, and read the story aloud:**

A paint stripper died while cleaning the inside of a tank. The victim was working by himself using a paint stripper to remove dried paint from the inside of a tank. The stripper contained methylene chloride, methanol, and mineral spirits. The tank was a permit-required confined space. The space was not adequately ventilated and the victim was not trained in confined space entry. There was no attendant at the tank opening to monitor the work process while the victim was in the tank. The victim was wearing a cartridge respirator that did not adequately protect against inhaling methylene chloride vapors.

Ask the groups: *What might have prevented this fatality?*

**Possible Solutions**

**Remove the Hazard**

- Substitute a safer cleaning product.
- Use abrasive removal methods such as orbital or belt sanders.
- Use thermal methods such as an electric heat plate or heat gun.

**Policies and Procedures**

Follow proper confined space rules:
- Air testing, monitoring, and documentation.
- Proper ventilation.
- Proper personal protective equipment.
- Communications protocols.
• Proper rescue and retrieval procedures. Training.

Personal Protective Equipment

Air supplied respirator. Proper gloves, chemical protective clothing.

Round 2

Show PPT #48, Exposure to Silica Dust, and read the story aloud:

A worker is using a stationary masonry saw. He is getting exposed to high levels of silica dust. He has not received any information about working with silica. He is a hard worker and works many hours a day cutting bricks.

Ask the groups: What would prevent this exposure?

Possible Solutions

Remove the Hazard

• Eliminate the silica exposure by using bricks that do not contain silica, substitute with a safer product.
• Use a saw equipped with an integrated water delivery system.

Policies and Procedures

• Regularly monitor the amount of silica in the air to make sure it is below the PEL. If a worker is above the action level then proper controls must be followed (see Silica presentation in Section 6.)
• Limit other workers’ access to the area where they could be exposed above the PEL.
• Offer medical exams-including chest X-rays and lung function tests-every three years for workers exposed above the PEL for 30 or more days per year.
• Train workers on work operations that result in silica exposure and ways to limit exposure.
• Keep records of workers’ silica exposure and medical exams.
Personal Protective Equipment

- Coveralls
- Full Face Cartridge Respirator Once the project is under way, verify that this is the appropriate respirator with air monitoring for your project, tool, and site conditions.
- If you wear a respirator:
  - Make sure the respirator has a NIOSH approval label
  - Have a medical review to make sure you can perform the work while wearing a respirator
  - Have a fit-test of the respirator annually
  - Inspect, clean and store the respirator with each use

Round 3

Show PPT #49, Exposure to Valley Fever Spores, and read the story aloud:

A construction crew excavated a trench for a new water pipe. Within three weeks, 10 of 12 crew members developed Valley Fever. Seven of the 10 had abnormal chest x-rays, four had rashes, and one had an infection that had spread beyond his lungs and affected his skin. Over the next few months, the 10 sick crew members missed at least 1660 hours of work and two workers were on disability for five months.

Ask the group: What might have prevented these illnesses?

Possible Solutions

Remove the Hazard – Engineering controls

Heavy equipment, trucks, and other vehicles generate heavy dust that could contain the Valley Fever spores. Provide vehicles with enclosed, air-conditioned cabs and make sure workers keep the windows closed. Heavy equipment cabs should be equipped with high efficiency particulate air (HEPA) filters.

Policies and Procedures

1. Determine if the worksite is in an area where Valley Fever is endemic (consistently present). Check with your local health department to determine whether cases have been known to occur in the proximity of your work area.
2. Train workers and supervisors on the location of Valley Fever endemic areas, how to recognize symptoms of illness, and ways to minimize exposure. Encourage workers to report respiratory symptoms that last more than a week to a crew leader, foreman, or supervisor.

3. Limit workers’ exposure to outdoor dust in disease-endemic areas. For example, suspend work during heavy wind or dust storms and minimize the amount of soil disturbed. When soil will be disturbed by heavy equipment or vehicles, wet the soil before disturbing it and continuously wet it while digging to keep dust levels down.

4. Use two-way radios for communication so that the heavy equipment vehicle windows can remain closed but allow for communication with other workers.

5. When digging a trench or performing other soil-disturbing tasks, position workers upwind when possible.

**PPE**

Use NIOSH-approved respiratory protection with particulate filters rated as N95, N99, N100, P100, or HEPA.
5. Globally Harmonized System (GHS) and Safety Data Sheet (SDS) Activity (45 total minutes)

[Handouts: Handouts: OSHA Factsheet: Hazard Communication Standard Final Rule, and 3 OSHA Quick Cards for HCS: Labels, Pictograms, and SDSs (course binder, tab 6). Sample SDSs are located in tab seven of the course binder.]

Explain to the class that OSHA’s Hazard Communication Standard (HCS) was developed in the 1980s to give workers information about chemical hazards. It has been referred to as the “Right to Know Law” because it gives workers the right to know the hazards they work with and how to protect themselves. In 2012, OSHA revised the HCS to align with the new Globally Harmonized System or GHS. OSHA still requires training on the other requirements of the HCS that haven’t changed: chemicals used at the workplace, steps workers can take to protect themselves, and the employer’s required written Hazard Communication Program.

Show PPT #50: Globally Harmonized System (GHS)

The GHS is an international approach to hazard communication, defining and classifying chemical hazards, and standardizing information on labels and safety data sheets around the world.

Ask: Why do we need the GHS?

Show PPT #51: Why We Need the GHS

Countries use different symbols for toxic substances on labels and MSDSs. For example, a product considered flammable or toxic in one country may not be in another country.

Show PPT #52: A Worldwide System

Toxic substances will have a standard label and Safety Data Sheet format that will be followed worldwide.

Ask: When does this new GHS regulation take effect?
Show PPT #53: OSHA’s GHS (HCS) Timeline

Review the implementation dates on the slide. Tell the class that these are the dates for compliance with the Hazard Communication Standard (HCS) provisions of the GHS. There are deadlines related to other aspects of the GHS that are not listed.

Ask: What are the main changes in the GHS?

Show PPT #54: Major GHS Changes

The three major changes in the GHS are in hazard classification, labels, and Safety Data Sheets (SDS):

**Hazard classification**: The definitions of hazard have been changed to provide specific criteria for classification of health and physical hazards, as well as classification of mixtures. These specific criteria will help ensure that evaluations of hazardous effects are consistent with all manufacturers, and that labels and Safety Data Sheets are more accurate.

**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.

**Safety Data Sheets**: SDSs will now have a specified 16-section format that must be used for all SDSs.

Say: We will review each of these changes in greater detail.

Hazard Classifications

Show PPT #55: Health Hazard Classification

The relevant health hazard classifications on this slide must be provided on labels, SDSs, and in training.

Show PPT #56: Physical Hazard Classification

The relevant physical hazard classifications on this slide must be included on an SDS.
Labels

Show PPT #57: GHS Label Requirements

Chemical manufacturers and importers will be required to provide a label that includes the 6 elements listed on the slide. Labels must be in English. It is OK if additional languages are also used. Manufacturers must use the new labels by June 1, 2015. We will review the new GHS label a little later. The items highlighted in red are the new GHS requirements.

Pictograms

Show PPT #58: Chart of 9 OSHA Pictograms

A pictogram is a symbol plus other graphic elements. Nine pictograms are used in the GHS. OSHA only requires eight pictograms.

Ask: *Which pictogram do you think OSHA is not requiring, why not?*

OSHA is not requiring use of the environment pictogram. OSHA does not have jurisdiction over the environment.

Show PPT #59: Sample GHS Label

Say: *We are now going to go over the 6 required sections of the new GHS label*. Review the sections on the slide.

Safety Data Sheet (SDS)

We will now discuss the new Safety Data Sheets (SDSs) that will replace the old Material Safety Data Sheets or MSDSs.

Say: *As of June 1, 2015, the Hazard Communication standard will require the new Safety Data Sheets (SDSs) to be in a uniform format that includes 16 sections listed in a specific order.*

Show PPT #60: New Safety Data Sheet (SDS) Format

This slide lists the 16 section headings of the SDS. To be consistent with the GHS, the revised standard requires that the
highlighted red sections, #12 through #15, be listed on the SDS. However, OSHA will not enforce these sections since much of the information is not regulated by OSHA.

Activity: Evaluating a Safety Data Sheet (SDS) (30 minutes)

[Handouts: 1) SDS worksheet 2) Sample SDSs, located in tab seven of the course binder.]

Show PPT #61 and introduce the small group activity. Explain that the class will be divided into small groups to learn how to read and understand the health effects section of an SDS.

1. Explain that each group will be given an SDS for a particular chemical, a flipchart with the outline of an upper torso on it with organs, and several colored sticker dots. Each group will answer the questions on the worksheet about their particular chemical, using the information in the SDS.

Instructions for Instructor

Draw an outline of the upper torso (head to top of legs) of a human body on a large sheet of flipchart paper. Add in the body organs. See sample below.
2. Divide the class into 4-5 small groups, with no more than five to six people in each group.

Ask people to take out the SDS Worksheet. Also give each group an SDS. Try to provide a different SDS to each group. Also distribute a flipchart with the outline of a body drawn on it (prepared in advance) or have the small groups draw their own upper body torso. Distribute several colored sticker dots to each group.

3. Explain that they should use their SDS to answer Questions 1-4 on the worksheet. Point out that when answering Question #3, they should mark the target organs affected by their particular chemical on the drawing of the upper torso using the colored dots. Question #4 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 upper torso body outline and one to report on their worksheet answers.

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

4. Bring the whole class back together after 15 minutes. Have the groups report back on the SDS they studied and their worksheet answers. If more than one group has been given the same SDS, rotate the worksheet questions among the groups with that SDS. After finishing a question, ask the other group(s) if they have anything to add to what the other group reported.

Tell the class that you will now briefly discuss some toxic dusts in construction.
6. Hazardous Dusts: Silica, Asbestos and Lead (40 minutes)

[Handouts: Select factsheets on these topics from the course binder: tab 8 is Silica, tab 9 is Asbestos, and tab 10 is Lead.]

Show PPT #62: Hazardous Dusts

Say: Next we are going to briefly discuss information about some specific hazardous dusts -- silica, asbestos and lead.

Silica Hazards

Ask: How many people are exposed to silica at work in the U.S.?

Show PPT #63, Silica

- 2 million U.S. workers are exposed to silica.
- Crystalline silica is a human lung carcinogen.
- 300 U.S. workers die each year from silicosis
- Silicosis is frequently misdiagnosed, so actual numbers may be quite higher.

Ask: What is silica?

Show PPT #64, What Is Silica?

Crystalline silica is a basic component of soil, sand, granite, and many other minerals. Quartz is the most common form of crystalline silica. (Cristobalite and tridymite are two other forms of crystalline silica and are listed in Cal/OSHA’s silica standard. All three forms may become respirable-sized particles when workers chip, cut, drill, or grind objects that contain crystalline silica.)

Ask: What construction jobs can expose workers to silica?

Show PPT #65: Jobs That Expose Workers To Silica

- Demolition or concrete and masonry structures.
- Crushing, loading, hauling, and dumping of rock.
- Chipping, hammering, and drilling of rock.
• Abrasive blasting using silica sand as the abrasive.
• Abrasive blasting of concrete (regardless of abrasive used).
• Sawing, hammering, drilling, grinding, and chipping of concrete or masonry.
• Dry sweeping or pressurized air blowing of concrete, rock, or sand dust.

**Show PPT #66: What’s Your Chance of Getting Overexposed to Silica Dust?**

Review the Cal/OSHA chart on the slide. Note that the work operations involving grinding, drilling, sanding and cutting materials containing crystalline silica are extremely hazardous and create a lot of dust.

**Ask: What Is Silicosis?**

**Show PPT #67: How Silica Harms Your Lungs**

Silicosis is a disease of the lungs from breathing crystalline silica respirable dust particles. The silica dust particles become trapped deep in the lungs and form scar tissue. You can see the scar tissue on the left slide, the x-ray shows the light scarred areas on the lung. There is no cure for this disease: prevention is the only answer.

Show the Worksafe BC video: *Silica Exposure*. It is about 2 minutes long. It shows how silica damages the lungs.

**Background Information for Instructor**

There are three types of silicosis, depending upon the airborne concentration of crystalline silica to which a worker has been exposed:

- **Chronic silicosis** usually occurs after 10 or more years of overexposure.
- **Accelerated silicosis** results from higher exposures and develops over 5-10 years.
- **Acute silicosis** occurs where exposures are the highest and can cause symptoms to develop within a few weeks or up to 5 years.

**Show PPT #68, Cal/OSHA PELs for Silica Dust**

Review the information on the slide.
Ask: *How do you control silica dust? (Ask students to think about the hierarchy of controls.)*

**Show PPT #69, How To Control Silica Hazards**

The following solutions are listed in order of preference:
- Most Preferred: Use a silica substitute
- Use engineering controls
- Improve work practices
- Use personal protective equipment

**Show PPT #70, Silica Dust Controls**

Review photos on slide.

**Show PPT #71: SBCTC Video**

Show the SBCTC video: *Eliminate the Hazard*. It is 7 minutes long. It shows how silica hazards can be eliminated with engineering controls.

**Show PPT #72, Cal/OSHA Silica Hazards In Construction e-Tool**

Refer students to Cal/OSHA eTool on silica for more information.

**Show PPT #73, CPWR Silica Website**

Review slide about the CPWR silica website. It is the single best source for information on silica in the U.S. It provides information for workers and contractors.

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**Asbestos Hazards**

Ask: *How many workers are affected by asbestos today in the U.S.?*

**Show PPT #74**

Review information on the slide.

Ask: *What is asbestos?*

**Show PPT #75 What Is Asbestos?**
Asbestos refers to a set of six naturally occurring fibrous minerals. (These are chrysotile, crocidolite, amosite, anthophyllite, tremolite, and actinolite.) Chrysotile and amosite asbestos are the most common. Because of its fiber strength and heat resistance it has been used in a variety of building construction materials for insulation and as a fire-retardant. (Asbestos has been used in a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings.)

Ask: *Who can get exposed to asbestos in the trades?*

**Show PPT #76, Asbestos in Construction**

The construction trades most at risk from asbestos are insulators, plumbers, pipefitters, electricians, sheet metal workers, roofers, bricklayers, painters, and steel workers. Any construction worker may be exposed during maintenance, remodeling, renovation or demolition of older buildings.

**Show PPT #77 & #78: Asbestos Uses**

Review photos on the slides. They illustrate ways asbestos has been used in construction.

Ask: *Why is asbestos hazardous?*

**Show PPT #79: Asbestos - Inhalation Hazard**

Because asbestos fibers are microscopic (roughly .02 the diameter of a single human hair), they are easily inhaled. Once inhaled, these respirable fibers go deep in the respiratory system, including the lining of the lungs and inner cavity tissue. Once they are trapped in the body, they can cause health problems.

Symptoms include shortness of breath, a dry crackling sound in the lungs while inhaling, coughing, and chest pain. This condition is permanent and there is no effective treatment.

Asbestos is currently the single largest cause of occupational cancer.

Ask: *What are the diseases caused by asbestos?*
There are three primary diseases associated with asbestos exposure:

**Asbestosis** – is a scarring of the lungs. The scarring affects the lungs so they can’t work properly. Asbestosis is a slowly progressive disease, taking 15 to 30 years to fully develop.

**Lung Cancer** – is a malignant tumor in the lungs. The tumor grows through the surrounding tissues, invading and blocking the air passages of the lungs. The time between exposure to asbestos and the occurrence of lung cancer may take 20 to 30 years.

**Mesothelioma** – is a type of cancer. This disease attacks the lining of the chest that holds the lungs. Mesothelioma is considered to be exclusively related to asbestos exposure. Mesothelioma may take 30 to 50 years to develop.

(The illustration on this slide shows how asbestos fibers can affect the body once inhaled or ingested. After fibers enter the body, they can become lodged in organs and body cavities, causing inflammation or infection. Over time, this can lead to the development of serious asbestos-related illnesses such as mesothelioma. In this image, fibers affect the lining of the lungs, known as the pleural membrane, and the membranes that line the abdomen and heart.)

**Show PPT #81: Worker with Asbestosis (Joe Darabant)**

Ask: *Does anyone know of someone who has an asbestos-related disease?*

Let a couple of students tell their stories.

Ask: *What is the PEL for asbestos?*

**Show PPT #82: PEL for Asbestos**

Review information on the slide.

**Show PPT #83: OSHA Asbestos Standard for Construction**

Review the points on the slide.
Ask: What can be done to control asbestos hazards?

Show PPT #84, Asbestos Control Methods

Review the control methods on the slide:

- Local exhaust ventilation with HEPA filter system
- HEPA-filtered vacuums
- Enclosure or isolation
- Wet methods of handling
- Prompt disposal
- Regular housekeeping

Show PPT #85, Mesorfa

The Mesothelioma Research Foundation of America’s (Mesorfa) mission is to fund research that will lead to the quickest cure for mesothelioma. Mesothelioma, a cancer of the lining of the lungs caused by asbestos exposure, has very few treatment options at this time. The Mesothelioma Research Foundation of America and its board members have a long history of sharing concerns for labor unions that help get the best workplace and working conditions for union members. The SBCTC sponsors a benefit golf tournament for Mesorfa every year and has raised over $1 million for research.

Lead Hazards

Ask: What is lead?

Show PPT #86: Lead

Lead is a soft gray metal element that occurs naturally in the earth. It has been used for many centuries. It’s a chronic and acute poison. Lead poisoning has been documented from ancient Rome, ancient Greece, and ancient China.

Ask: How can construction workers get exposed to lead?

Show PPT #87: Construction Jobs and Lead Exposure

- Steel bridge painting or repair.
- Removing lead-based paint on old buildings or houses.
Grinding or sandblasting lead paint on metal structures.
Cutting or removing lead pipe in old buildings.
Using solder that contains lead.

**Show PPT #88, Bridge Repair**

Bridge work frequently results in lead overexposure since they are almost all covered with lead paint. This photo is from an actual bridge repair job. It shows a worker cutting on lead coated bridgework. He was later found to have high lead levels in his blood.

Ask: *How does lead get into your body?*

**Show PPT #89: How Lead Gets Into the Body**

Lead can enter the body in two ways:

- It can be inhaled (breathed in) by breathing in dusts or fumes.
- It can be ingested (swallowed) by getting it on the hands, clothes, or hair, or in food, drinks or cigarettes.

**Information for Instructor**

Lead dust is produced from the following work activities:

- Grinding, cutting, drilling, sanding, scraping or blasting surfaces that are coated with lead paint (e.g., bridges)
- Tearing down structures that have been painted with lead-based paints
- Working on leaded cables or wires
- Pouring powders containing lead pigments

Lead fumes are created from the following work activities:

- Using heat guns to remove paint from doors, windows, and other painted surfaces.
- Welding or soldering lead-containing materials.
- Torch cutting painted and uncoated metal.

Ask: *What are the health effects from lead exposure?*
Show PPT #90: Health Effects of Lead Exposure

- Headaches, tiredness and insomnia
- Loss of appetite and stomach pain
- Pain, weakness or twitching in your muscles
- Reproductive and birth defects
- Kidney damage
- Permanent brain and nerve damage
- Lead is especially harmful to the fetus in a pregnant woman.
- Lead is also harmful to men and women trying to have children. Lead can affect men by causing impotence, reduced sperm count or even sterility.

Ask: How does lead affect children?

Show PPT #91: Lead and Children

Just a little bit of dust on clothing can get spread around your house where children can get exposed. Children exposed to too much lead will suffer brain damage and permanent mental retardation. Even low exposures to lead can lead to learning and behavior problems. Lead was taken out of household paint and gasoline several years ago because of the concern about children’s exposure.

Ask: What is the Cal/OSHA PEL for lead?

Show PPT #92: Lead PEL

The Cal/OSHA permissible exposure limit (PEL) for lead in the air is 50 µg/m³ (micrograms per cubic meter). Also, a worker cannot have more than 40 micrograms per deciliter of lead in their blood. Both of these limits are in the Cal/OSHA regulation on lead.

Show PPT #93: Lead Action Level

When the amount of lead in the air is above the “action level” of 30 µg/m³ (30 micrograms per cubic meter) Cal/OSHA requires employers to do the following:

1) Conduct air monitoring
   - Employers must assume that workers are exposed above the PEL until air monitoring results prove otherwise.
   - Exposure is determined by performing personal air monitoring for each worker.
• Exposure is determined as if the workers were not using a respirator.

2) Provide medical surveillance
Employers must provide free medical exams (including blood tests) to see if a worker has too much lead in their body, if the level of lead in the air exceeds the action level for more than 30 days in a year.

3) Provide protective measures for employees during air monitoring, including:
• Appropriate personal protective equipment
• Appropriate respiratory protection
• Change areas with separate storage facilities for work and street clothes
• Hand washing facilities
• Training

Cal/OSHA Trigger Tasks
For certain highly hazardous tasks, called trigger tasks, Cal/OSHA requires that special protective measures must be followed—including specified respirators—until the employer determines that worker airborne exposures to lead are below the PEL.

Ask: What safe work practices can workers follow to protect themselves and their families from exposure to lead?

Show PPT #94: Safe Lead Work Practices
• Wash your hands and face before you eat, drink or smoke.
• Eat, drink and smoke only in areas free of lead dust and fumes.
• Work with your employer to ensure that you are not overexposed to lead in your workplace. Sometimes this may include special ventilation equipment or the use of a properly-fitted respirator.
• Avoid stirring up lead-containing dust with dry sweeping or blowing. Wet cleaning and vacuuming are generally safer.
• Don't wear your work clothes and shoes/boots home.
• If possible, shower at work before going home.
• Wash and dry your work clothes separately at home.

Tell the class the Cal/OSHA lead standards are based on toxicity information that is over 30 years old. The California Department of Public Health, Occupational Lead Poisoning Prevention Program, reviewed recent scientific information and made health-based recommendations to Cal/OSHA to revise the General Industry and Construction Lead Standards. In response, Cal/OSHA will convene an Advisory Committee in 2014 to look at revising the lead standards.

**Conclusion**

Ask: *What are the key issues we discussed today?*

Tell the class we explained what makes a toxic substance harmful and how toxics affect your health. We defined common terms used to measure toxic substances, described OSHA’s exposure limits, discussed the Globally Harmonized System (GHS) and reviewed health effects on a Safety Data Sheet (SDS). We also discussed the hierarchy of controls and identified ways to reduce toxic exposures on the job. We ended the session with an overview of three dusts that are extremely toxic for construction workers: silica, asbestos and lead.

Say: *This ends our training on toxic substances in construction. Thank you for taking the time to attend this training. We hope you find this information useful in preventing exposures to toxic substances.*
TOXICS IN CONSTRUCTION

State Building and Construction Trades Council of California, AFL-CIO
Funded by OSHA

This material was produced under grant number SH-24900-13-60-F-6 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.
Acknowledgements

The following organizations provided information for this training:
- Cal/OSHA
- Construction Safety Council, Illinois
- Center for Construction Research & Training (CPWR)
- Canadian Centre for Occupational Health and Safety (CCOHS)
- Department of Industrial Relations, Commission on Health and Safety and Workers’ Compensation
- Federal OSHA
- International Brotherhood of Teamsters
- Labor Occupational Health Program (LOHP)
- New York Department of Public Health
- Occupational Health Branch (OHB), California Department of Public Health
- State Compensation Insurance Fund (SCIF)
- U.S. Bureau of Labor Statistics (BLS)
- WISHA (Washington Industrial Safety and Health Act)
- Worksafe (Canada)
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State Building and Construction Trades Council of California (SBCTC), AFL-CIO

- Umbrella organization for 160 unions
- Represents 350,000 skilled construction workers in California
- Developed and presented six OSHA funded health & safety programs since 2000
World Trade Center

Photo Source: OSHA
Course Objectives

1) Explain what makes a toxic substance likely to cause harm.
2) Discuss how toxic substances can affect your health.
3) Define terms used in OSHA exposure limits.
4) Review the hierarchy of controls and identify ways to eliminate toxic hazards in construction.
5) List the key components of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).
6) Discuss the hazards of silica, asbestos and lead dust.
Occupational Illness & Disease

- 1 million workers in construction and general industry face significant asbestos exposure
- 2 million workers are exposed to crystalline silica dust in the general, maritime, and construction industries

Photo Source: Lawrence Berkeley National Laboratory
Factors That Determine If a Substance Causes Harm

- Toxicity
- Routes of exposure and chemical forms
- Dose-response
- Duration
- Reaction & interaction
- Individual differences

Photo Source: etcosh
Small Group Activity

- Divide class into small groups
- Assign each small group a different factor to work on
- Groups have 10 minutes to work
- Groups report their answers back to the class
What Makes A Substance Toxic?

- Toxicity is the ability of a substance to cause harm when it gets into the body.
- If only a tiny amount of a substance can cause harm, it is considered highly toxic.
Routes of Entry

1. Breathing
2. Skin & Eyes
3. Swallowing
4. Puncture

Illustration source: CPWR
Breathing
Toxics can enter through the nose and mouth and go into the respiratory tract.

Illustration source: NIH
Skin & Eye Contact

- Toxic substances can get in your skin through cuts, sores, or skin rashes
- Some chemicals can pass through the skin and eyes and into your body

Illustration source: Lehigh University

Contact dermatitis from working with fiberglass

Photo source: CDC

State Building & Construction Trades Council of California • safety.sbctc.org
Swallowing

- You can swallow toxic substances if you eat, drink, or smoke on the job and do not wash your hands
- Toxic substances can also land on your uncovered food or drinks at work
- Family members can get exposed to toxic substances brought home on dirty work clothes and unwashed hands
Puncture

A sharp object can puncture the skin, letting a toxic substance enter the body

![Image of a sharp object](image1.png)  
Photo source: CPWR

![Image of a hand with a nail penetrated through the shoe](image2.png)  
A 30-year-old construction worker sustained this traumatic puncture wound with a high-pressure nail gun. The nail penetrated through the shoe.

Photo source: Podiatrytoday.com
Physical Forms of Substances

**Phases of Matter**

- **Solid**
  - Holds Shape
  - Fixed Volume

- **Liquid**
  - Shape of Container
  - Free Surface
  - Fixed Volume

- **Gas**
  - Shape of Container
  - Volume of Container
Solids

Asbestos fibers

Crystalline Silica
Photo source: CDC

Fumes are created when solid particles are heated to very high temperature.

Note that this welder is protected by a respirator.

Photo source: elcosh
Respirable Particles

Respirable dust is less than 10 microns (μm) in diameter

A single human hair is between 80 – 120 microns (μm) in diameter

Slide courtesy of Construction Safety Council, Illinois
Respirable Particles in Construction

Respirable Dust, e.g., Lead, Silica & Asbestos (<10 μm)

Human Hair (80 – 120 μm)

A lower case 'o' when printed in Times New Roman size 10 (1mm).

Large Dog

0.00001
0.001
0.01
0
1

Micron (μm) Millimeter (mm) Centimeter (cm) Meter (m)

Slide courtesy of Construction Safety Council, Illinois
Liquids

Construction workers use epoxy resin systems in many different trades.

Photo source: elcoash
Gases and Vapors

Carbon monoxide (forklift exhaust)

Many gases are produced in welding
Photo source: Wikimedia.commons

Photo source: CPWR

State Building & Construction Trades Council of California • safety.sbctc.org
Dose Response Relationship

Illustration source: CPWR
Dose Response Relationship: Alcohol

Illustration source: CPWR
Reaction and Interaction

Reaction

Mixing cleaning supplies can cause a chemical reaction.

Photo source: Orange County Safe Apartments

Interaction

Increased risk of developing lung cancer if a person smokes and has been exposed to asbestos.

Illustration source: asbestos.com
Individual Differences

Photo source: elcosh
Acute Health Effects

- Symptoms occur within minutes or hours
- Effects are usually reversible
- Symptoms include skin irritation, coughing, & nausea

Illustration source: Occupational Health Branch, CDPH
Acute Health Effects From Solvents

Brain (Central Nervous System)
- headache, dizziness, nausea, drowsiness (feeling drunk)

Eyes, Nose, Throat, & Lungs
- Irritation - stinging & burning; hoarseness; coughing

Skin
- Irritation - redness; dryness; flaking; cracking
Chronic Health Effects

- Develop slowly over a long period of time, usually over months and years
- Chronic effects are always delayed, making it difficult to determine the source of the exposure

Illustration source: elcosh
Examples of Chronic Health Effects

- Lung cancer
- Skin cancer
- Asbestosis
- Mesothelioma
- Silicosis
- Occupational Hearing Loss
- Cumulative Trauma Disorder

Illustration source: Mesothelium.com
Latency Period for Mesothelioma

Illustration source: asbestos.com
Sensitizers

- Wet cement
- Cement dusts
- Lime
- Some paints
- Epoxy resins
- Adhesives
- Isocyanates

Photo source: elcosh
Simple Asphyxiants

Photo Source: CPWR
Corrosives

Alkaline burns from working with Portland cement

Photo source: alcosh
Known and Suspected Carcinogens

- Asbestos
- Benzene
- Beryllium
- Cadmium
- Asphalt fume
- Silica

Photography: Neil Lippy for eLCOSH

Photo source: Wikimedia
Mutagens

- Substances that change the genetic information, the DNA

Photo source: CPWR
Teratogens

- Toxic substances that can harm the developing fetus causing birth defects or death
What Is A PEL?

- Set by OSHA & Cal/OSHA
- Legal limit a worker can be exposed to in an 8 hour day
- PELs cover about 500 chemicals in California
- Cal/OSHA PELs are updated on a regular basis
Exposure Limits

- **Time Weighted Average or TWA.** Based on the average exposure in an 8-hour day
- **Short Term Exposure Limit or STEL.** Highest average concentration allowed during 15 minutes
- **Ceiling Limit or C.** Highest concentration allowed
- **Skin or S.** Toxic substances can be absorbed through the skin. Use gloves and protective clothing to prevent skin absorption
Measurements Used In PELs

- Parts per million (ppm) – PEL for benzene is 1 ppm
- Milligrams per cubic meter of air (mg/m³) – iron oxide fume PEL is 5 mg/m³
- Micrograms per cubic meter of air (µg/m³) - PEL for Lead is 50 µg/m³
- Fibers per cubic centimeter of air (f/cc) – PEL for asbestos is 0.1 f/cc

Slide courtesy of CPWR
Hierarchy Of Controls

1. Remove the Hazard
2. Work Policies and Procedures
3. Personal Protective Equipment
Engineering Controls

Slide courtesy of CPWR
Administrative Controls

- Standard Operating Procedures (SOPs)
- Schedule jobs when toxic substance use is low
- Job rotation
- Train workers how to use toxic substances safely
- Proper signage
- Good job hazard analysis before work starts
Cal/OSHA Respiratory Regulation (Title 8, CCR, Section 5144)

Required elements of Cal/OSHA’s respiratory regulation:

- Respirator selection - based on exposure assessment
- Change out schedule
- Medical evaluations
- Fit testing
- Use of respirators
- Maintenance and care of respirators
- Breathing air quality and use (when atmosphere-supplying respirators are used)
- Training and information
- Program evaluation
NIOSH-Approved Respirators

PAPR

Full Face APR

½ face APR

N 95

Slide Courtesy of CPWR
Why Is PPE Less Effective?

- Doesn’t get rid of the hazard
- Can be uncomfortable and hot
- Hard to communicate
- Limited vision and movement and hand dexterity
- Workers must know and remember how to use it properly
- Difficult to maintain—it can break

Photo source: elcosh
Paint Stripper Dies Using Methylene Chloride

Paint tank

Photo source: CA FACE Report
Exposure To Silica Dust

Photo source: OSHA
Exposure To Valley Fever Spores

Photo source: California Department of Public Health
Globally Harmonized System (GHS)

- The Globally Harmonized System of Classification and Labeling of Chemicals (GHS)
Why We Need The GHS

Why is the GHS Important?
A Worldwide System

Why is the GHS Important – The Vision
## OSHA’s GHS (HCS) Timeline

<table>
<thead>
<tr>
<th>Effective Completion Date</th>
<th>Requirement(s)</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 1, 2013</td>
<td>Train employees on the new label requirements and SDS format.</td>
<td>Employers</td>
</tr>
<tr>
<td>June 1, 2015</td>
<td>June 1, 2015 Compliance with all modified provisions of this final rule, except distributors have an additional six months to ship product without GHS labels.</td>
<td>Chemical manufacturers, importers, distributors and employers</td>
</tr>
<tr>
<td>December 1, 2015</td>
<td>Must not ship containers without a GHS label.</td>
<td>Distributors</td>
</tr>
<tr>
<td>June 1, 2016</td>
<td>Update alternative workplace labeling and hazard communication program as necessary, and provide additional employee training for newly identified physical or health hazards. Comply with Title 8, CCR, Section 5194, of the Cal/OSHA standard.</td>
<td>Employers</td>
</tr>
</tbody>
</table>
Major GHS Changes

- **Hazard classification**: Health and physical hazards must be identified
- **Labels**: Must include a signal word, pictogram, hazard statement, and precautionary statement
- **Safety Data Sheets**: The new format requires 16 specific sections
- **Information and training**: Workers should be trained by December 1, 2013 on the new GHS label and safety data sheet format
Health Hazard Classification

- Acute toxicity
- Skin irritation/corrosion
- Eye damage/irritation
- Respiratory/skin sensitization
- Germ cell mutagenicity
- Carcinogenicity
- Reproductive toxicity
- Specific target organ toxicity – single exposure
- Specific target organ toxicity – repeated/prolonged exposure
- Aspiration hazard
Physical Hazard Classification

- Explosive
- Flammable gases
- Flammable aerosols
- Oxidizing gases
- Gases under pressure
- Flammable liquids
- Flammable solids
- Self-reactive chemicals

- Pyrophoric solids
- Self-heating chemicals
- Water-contact flammable
- Oxidizing liquids
- Oxidizing solids
- Organic peroxides
- Corrosive to metals
GHS Label Requirements

- Product identifier
- **Signal words**
- **Hazard statements**
- **Pictograms**
- **Precautionary statements**
  - Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party
# Pictograms

<table>
<thead>
<tr>
<th>Flame over circle</th>
<th>Flame</th>
<th>Exploding bomb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidizers</td>
<td>Flammables</td>
<td>Explosives</td>
</tr>
<tr>
<td></td>
<td>Pyrophorics</td>
<td>Self Reactives</td>
</tr>
<tr>
<td></td>
<td>Self-Heating</td>
<td>Organic Peroxides</td>
</tr>
<tr>
<td></td>
<td>Emits Flammable Gas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self Reactives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organic Peroxides</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skull and crossbones</th>
<th>Corrosion</th>
<th>Gas cylinder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity (severe)</td>
<td>Corrosives</td>
<td>Gases under pressure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health Hazard</th>
<th>Environment</th>
<th>Exclamation mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinogen</td>
<td>Aquatic Toxicity</td>
<td>Irritant</td>
</tr>
<tr>
<td>Mutagenicity</td>
<td></td>
<td>Skin Sensitizer</td>
</tr>
<tr>
<td>Reproductive Toxicity</td>
<td></td>
<td>Acute Toxicity (harmful)</td>
</tr>
<tr>
<td>Respiratory Sensitizer</td>
<td></td>
<td>Narcotic effects</td>
</tr>
<tr>
<td>Target Organ Toxicity</td>
<td></td>
<td>Respiratory Tract Irritation</td>
</tr>
<tr>
<td>Aspiration Toxicity</td>
<td></td>
<td>Hazardous to Ozone Layer</td>
</tr>
</tbody>
</table>
Sample GHS Label

Product J (abc chemical)

Pictogram - acute toxicity

Signal Word

Hazard Statement

Precautionary Statement

Manufacturer, importer, or other responsible party

Precautions:
- Wear protective gloves.
- Take off contaminated clothing and wash before reuse.
- Wash hands thoroughly after handling.
- Do not eat, drink or smoke when using this product.
- Store locked up.
- Dispose of contents/container in accordance with local regulations.

IF ON SKIN: Rinse skin with water/shower.
IF IN EYES: Rinse cautiously with water.
IF SWALLOWED: Immediately call a Poison Center or doctor/physician. Do not induce vomiting.

ABC Chemical Co., 123 Anywhere St., (123) 456-7890
See the SDS for more information
New Safety Data Sheet (SDS) Format

1. Identification of the substance or mixture and of the supplier
2. Hazards identification
3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection.
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information (non-mandatory)
13. Disposal considerations (non-mandatory)
14. Transport information (non-mandatory)
15. Regulatory information (non-mandatory)
16. Other information, including date of preparation or last revision
Small Group SDS Activity

- Divide class into small groups
- Answer questions on the SDS Worksheet
- Put dots on the target organs affected on the drawing of the upper body torso
- Two people report your group’s answers back to the class
Hazardous Dusts

- Silica
- Asbestos
- Lead Dust

Photos courtesy of elcosh
Silica

- 2 million U.S. workers are exposed to silica
- Crystalline silica is a human lung carcinogen
- 300 U.S. workers die each year from silicosis
- Silicosis is frequently misdiagnosed, so actual numbers may be quite higher
What Is Silica?

- Quartz is the most common form of crystalline silica.
- Is a basic component of soil, sand, granite

Photo source: Construction Safety Council, Illinois
Jobs That Expose Workers To Silica

Top photos: Cal/OSHA

Photo source: elcosh

Photo: OSHA
What’s Your Chance of Getting Overexposed to Silica Dust?

What are your chances of being overexposed?
(Based on a Summary of University of Washington Studies)

The probability (in %) of being overexposed
(based on the Cal/OSHA PEL of 0.1 mg/m³ of air for respirable quartz silicas)
How Silica Harms Your Lungs

- Show *Silica Exposure* by Worksafe BC
  [http://www.youtube.com/watch?v=R_sC2wX9Uwc](http://www.youtube.com/watch?v=R_sC2wX9Uwc)
- This video shows how breathing in silica dust can cause permanent damage to the lungs. (2 min 01s in length)
Cal/OSHA PELs For Silica Dust

- Cal/OSHA PELs for silica vary depending on the form of silica (quartz, fused, tripoli, tridymite and cristobolite) and particle size
- Cal/OSHA's Permissible Exposure Limits over an 8-hour average:
  - Respirable crystalline silica (quartz, fused, tripoli), 0.1 mg/m³
    (0.1 milligrams of Silica in 1 cubic meter of air) most common
  - Total crystalline silica (quartz), 0.3 mg/m³
  - Respirable cristobolite and tridymite, 0.05 mg/m³

**Rule-of-thumb:** if dust containing silica is visible in the air, it’s probably over the PEL.
How To Control Silica Hazards

The following solutions are listed in order of preference.

- Most Preferred: Use a silica substitute
- Use engineering controls
- Improve work practices
- Use personal protective equipment

Photo source: elcosh
Silica Dust Controls

Right-Angle Grinder without Control
Right-Angle Grinder with Vacuum Control
Walk-Behind Concrete Saw without Control
Walk-Behind Concrete Saw with Water Control

Photos courtesy of the NJ Department of Health and Senior Services' NIOSH-funded Silicosis Surveillance Project
SBCTC Video

- Show SBCTC video: Eliminate the Hazard
- SBCTC members show ways to control silica dust
Cal/OSHA Silica Hazards In Construction e-Tool

What are the possible exposure sources?
What’s the hazard?
How do you control the hazard?
Who needs to be trained and what should you cover?
What are some of the related Cal/OSHA requirements?

Cal/OSHA etool Website: [http://www.dir.ca.gov/dosh/etools/08-019/index.htm](http://www.dir.ca.gov/dosh/etools/08-019/index.htm)
CPWR Silica Website

- CPWR Website Provides Easy Access to Tools and Information to Control Silica Dust: [http://www.silica-safe.org/](http://www.silica-safe.org/)
- Create-A-Plan is a tool designed to help contractors and others responsible for job-site safety develop a plan to protect workers engaged in work that produces respirable silica dust.
- Best single source of information available for information on silica and construction.
Asbestos

- 1.3 million workers are exposed in the U.S. – primarily in the construction industry
- Asbestos removal and building renovation & demolition have the greatest exposures today

Photo source, asbestos.com
What Is Asbestos?

• Asbestos is a naturally occurring mineral
• Properties of asbestos:
  • Strong
  • Flexible
  • Heat resistant
  • Electrical resistance
  • Good insulation

Photo courtesy of Wikimedia Commons
Asbestos In Construction

- Pipe insulation
- Floor tiles
- Roof shingles
- Fireproofing
- Acoustic and decorative plaster
- Fire resistant drywall

Slide courtesy of WiSHA
Asbestos Uses

Sprayed-on fireproofing material

Sheet vinyl containing asbestos

Vinyl asbestos flooring

These products may be found in homes and buildings constructed before 1981

Slide courtesy of WISHA
Asbestos Uses

Asbestos fabric in HVAC system

Asbestos gaskets—may be round, flat or impregnated with waterproof sealant

Damaged asbestos gasket

Slide courtesy of WISHA
Asbestos - Inhalation Hazard

- Asbestos fibers are inhaled deep in the lungs
- The body’s defense mechanisms cannot break down the fibers
- The fibers cause damage to the lungs
- The fibers may also damage the pleura, the membrane lining the outside of the lungs

Slide courtesy of WISHA
Asbestos-related Diseases

Asbestosis
Mesothelioma
Lung Cancer
Other cancers

Illustration courtesy of asbestos.com
Joe Darabant, 1949, covered with chrysotile asbestos fibers. Worked for 30+ years at the Johns-Manville Plant in New Jersey, cutting asbestos shingles and making asbestos block and pipe-covering materials.

Joe, 1989. Forced to retire in 1974 at age 50 from poor health; he died from asbestosis in 1990 at age 66.

Asbestosis is a disease that involves scarring of lung tissue as a result of breathing in asbestos fibers. The scarring makes it hard to breathe and for oxygen to get into the blood. The disease worsens slowly over time.

Slide courtesy of asbestos.com
PEL for Asbestos

**Asbestos Permissible Exposure Limits (PEL)**

- 0.1 fibers per cubic centimeter of air (0.1 f/cc) 8-hour time weighted average
- 1.0 f/cc 30-minute excursion limit (similar to a STEL)
OSHA Asbestos Standard for Construction (Title 8, CCR, Section 1529)

If there is potential asbestos exposure OSHA requires that employers do the following:

- exposure assessment
- medical surveillance
- recordkeeping
- have a competent person
- specify regulated work areas, and
- follow hazard communication standard regulations
- use engineering and work practice controls
Asbestos Control Methods

- Local exhaust ventilation with HEPA filter system
- HEPA-filtered vacuums
- Enclosure or isolation
- Wet methods of handling
- Prompt clean up and disposal
- Regular housekeeping

HEPA filter = high efficiency particulate air filter
Mesorfa

- Excellent source of information on mesothelioma
- Annual golf fundraiser with SBCTC
- Go to website for additional information: www.mesorfa.org
Lead

- Lead is a soft gray metal element
- Occurs naturally in the earth
- Used for many centuries
- Is a chronic and acute poison


Photo of lead ore which is 85% lead
Construction Jobs and Lead

1. Steel bridge painting or repair
2. Removing lead-based paint on old buildings or houses
3. Grinding or sandblasting lead paint on metal structures
4. Cutting or removing lead pipe
5. Using solder that contains lead

Slide courtesy of WISHA
Lead Paint on Bridges

Slide courtesy of WISHA
How Does Lead Get Into Your Body?

Inhaling lead dust or lead spray paint

Inhaling lead fumes from welding or burning lead paint

Swallowing lead dust on your hands from eating, drinking or smoking

Slide courtesy of WISHA
Health Hazards of Lead Exposure

- Headaches, tiredness and insomnia
- Loss of appetite and stomach pain
- Pain, weakness or twitching in your muscles
- Reduced sex drive and birth defects
- Kidney damage
- Permanent brain and nerve damage

Slide courtesy of WISHA
Lead and Children

- Children are very susceptible to the effects of lead
- They can be harmed by smaller amounts than adults
- Do not take lead dust home on your clothes or shoes

Photo source: EPA

Slide courtesy of WISHA
Lead PEL

Lead “permissible exposure limit” or PEL

In your blood: no more than 40 micrograms of lead per deciliter (µg/dL)

In the air: no more than 50 micrograms of lead per cubic meter (µg/m³) for an 8-hour day.

Both of these limits are in the Cal/OSHA regulations on lead.

Red Blood Cell

Slide courtesy of WIISHA
Lead Action Level

When the amount of lead in the air is above the “action level” of 30 micrograms per cubic meter of air (30 μg/m³), employers are required to:

- Conduct air monitoring
- Provide medical surveillance
- Provide training

The Action Level is 60% of the permissible exposure limit (PEL)

Slide courtesy of WISHA
Safe Lead Work Practices

- Wash your hands and face before you eat, drink or smoke
- Eat, drink and smoke in areas free of lead dust and fumes
- Make sure your employer uses proper controls to limit lead exposure (special ventilation equipment, properly-fitted respirators, etc.)
- Avoid dry sweeping or blowing, use wet cleaning and wet vacuuming
- Don't wear your work clothes and shoes/boots home
- Wash and dry your work clothes separately at home
- Separate change areas, showers and eating areas if exposed above the lead PEL