EXCAVATION & TRENCHING HAZARDS

2019 Train-the-Trainer Course

Presented by:
State Building and Construction Trades Council of California, AFL-CIO

Train-the-Trainer Course 2019

OSHA Funding Disclaimer

This material was produced under grant SH05030SH8 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 State Building and Construction Trades Council of California, AFL-CIO (SBCTC) acknowledges the following organizations and individuals (listed alphabetically) for providing information, training material, and technical support for this course:

- Cal/OSHA
- California Department of Public Health
- Commission on Health and Safety and Workers' Compensation, California, Department of Industrial Relations, Worker Occupational Safety and Health (WOSH) Specialist Training Program
- Elaine Nazima El-Askari, MPH, Consultant
- Elcosh Images
- Federal OSHA
- Labor Occupational Health Program (LOHP), University of California, Berkeley
- McGuire and Hester
- Oregon OSHA
- OSHA Training Institute Education Center—Chabot-Las Positas College
- Rudy Schroeder, Safety Consultant
- Swinerton Builders
- The Center for Construction Research and Training (CPWR)

OSHA Harwood Grant training materials previously produced by:

- Construction Advancement Foundation of Northwest Indiana, Inc.
- Maryland Fire and Rescue Institute
- University of Texas at Arlington

Binder cover photo courtesy of McGuire and Hester, used with permission.

This page is intentionally blank
Redacted contact information

Train-the-Trainer Course Objectives

After completing this course, participants will be able to:

1. Teach the SBCTC Excavation and Trenching Hazards curriculum:
    - Excavation fatality trends in construction
        - Define excavation and trench
        - Dangers of excavation work
        - Identify main causes of fatalities
    - Excavation risks and hazards
        - Discuss variables affecting excavation safety
        - Describe ten most common excavation hazards and risk factors for each
        - Explain how trench cave-ins happen
        - Identify signs of soil stress that may lead to trench failure
        - Discuss injuries likely to occur in a cave-in
        - Lead discussions of actual case studies
    - Hazard controls and protective systems
        - Identify OSHA Excavation Standards
        - Explain what employers must do to comply with OSHA requirements
        - Discuss the role of a competent person for excavation work
        - Describe when protective systems are required for trenching
        - Explain how soil type relates to proper use of protective systems
        - Explain basics of sloping, benching, shoring, shielding controls
        - Discuss requirements for controlling ten different excavation hazards
        - Discuss rescue operations for trench cave-ins and importance of pre-planning
        - Use various activities and props to illustrate excavation safety concepts
    - Hazard Identification Practice
        - Guide students in applying hazard identification skills using photos
        - Discuss control strategies for various hazard situations
        - Discuss best practices for workers and employers

2. Practice best teaching methods and understand adult learning styles

3. Use resources provided through the training

4. Find additional training resources

5. Train workers about excavation and trenching hazards

How Training Materials Are Organized

The purpose of this training is to raise awareness of construction excavation and trenching hazards. It is intended to be delivered by trainers who have completed the SBCTC 2-day train-the-trainer course. This training program consists of this course binder, a flash drive and laminated slides. All electronic files needed to present this training are included on the flash drive. Hard copies of the Curriculum and handouts are included in the binder.

Curriculum and PowerPoint: The complete program consists of an introduction plus 3 sections designed for a multi-craft, worker audience. It can be presented at one time in its entirety in approximately 3.5 hours. An "At-A-Glance" page describing each section and approximate teaching times is included in the Instructor's Guide. The curriculum is formatted as a table with a left column that displays thumbnail images of the PowerPoint slides and a right column with key talking points, teaching notes, and information associated with each slide as well as prompts for activities. Each section begins with an overview of key points and what you will need to teach the section. The PowerPoint presentation includes a total of 141 slides.

Videos:
The video referenced in the presentation:

- Slide 25 Oregon OSHA video of real-time trench collapse at a job site. Run time 1.30 minutes. Access this video on YouTube https://www.youtube.com/watch?v=0wmcD3aM8X4

Handouts/Evaluation Forms: Handouts may be used to aid workers in retaining information or to guide activities. The curriculum notes prompt trainers when to use these materials for activities. All required material is included in the course binder. The course binder "Table of Contents" indicates where to find individual handouts in the binder. Some optional material (Tab 5-Bonus Materials) is included in the binder that is not discussed in the curriculum; this material may be used at the trainer's discretion. The SBCTC is not responsible for the accuracy of this material or for changes that may have occurred after the original publication date. Any reliance you place on such information is therefore strictly at your own risk. We suggest you contact OSHA for current regulatory compliance information.

Evaluation forms are provided for trainers to use at their 2nd-tier training (binder Tab 4). Trainers are encouraged to use these at each of their training sessions. OSHA requires that all training performed as part of Harwood Grant programs be evaluated for both "Training Reaction Assessment" and "Learning Assessment." Trainers can accomplish this by having their trainees complete the one-page "Training Evaluation Form" and the "Excavation Hazards Pre- and Post-Tests" provided.

Training Tips: The binder (Tab 6) includes information on training techniques and best practices that you may find helpful when presenting this program to others. These factsheets are from the Worker Occupational Safety and Health Training and Education Program (WOSHTEP) funded by the CA Commission on Health and Safety and Workers' Compensation.

Resources: There is a resource list provided in the binder (Tab 7). You can find useful references and website links related to construction excavation and trenching hazards.

INSTRUCTOR'S GUIDE

Information to review before training

- Ø Teaching Materials Provided For This Training
- Ø Overall Training Objectives
- Ø At-A-Glance
- Ø Preparing To Teach This Training
- Ø What You Need To Present This Training
- Ø Instructions For Setting-Up Fun Activities And Props
- Ø Props To Make Training More Lively
- Ø Case Study Activity
- Ø Mock Trench (Optional Role Play)
- Ø Rescue Planning Small Group Activity
- Ø Rescue Planning Activity Template

Teaching Materials Provided For This Training

- Instructor preparation tools (in course binder Tab 2)
  - ü Overall training objectives
  - ü At-A-Glance
  - ü Preparing to teach this training
  - ü What you need to present this training

- Curriculum (in course binder Tab 2 and on flash drive)
  Includes all teaching notes and background information to teach the course. Pairs with Excavation and Trenching Hazards PowerPoint presentation and Laminated slides

- PowerPoint presentations (on flash drive)
  - ü Excavation and Trenching Hazards (141 slides) matches Curriculum
  - ü Excavation Hazards Jeopardy Review Game (42 slides)

- PowerPoint slides reference hardcopy
  - ü Excavation and Trenching Hazards handout with space for notes (in course binder Tab 2)
  - ü Excavation Hazards Jeopardy Answer Key and Game Board (back pocket of course binder)

- Videos (on flash drive)
  - ü Slide 25 Oregon OSHA—real time trench collapse Run time 1:30 minutes.
  - ü Slide 110 News Media Montage—Trench Rescue Run time 1:24 minutes.

  Optional:
  - ü OSHA V-Tool "Excavations in Construction—Trenching"
    English: Run time 9:02 minutes; Spanish: Run time 11:58 minutes.
  - ü News Clip KCRA—San Francisco Gas Line Strike Run time 00:47 minutes.

- 8 Laminated Slides (front pocket of course binder)

Overall Training Objectives

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

1. Understand excavation risk factors
2. Identify excavation and trenching hazards
3. Recognize employer requirements for excavation safety
4. Understand the role of a "competent person" for excavation
5. Describe trench protective systems and other excavation hazard controls
6. Apply best practices for excavation safety
7. Understand challenges of trench rescue operations

AT-A-GLANCE

Module	Slide #s	Time	Training Goal
Introduction Activities: *-Discussion* *-Brainstorm*	1-19	30 minutes	-Excavation Hazards pre-test -Acknowledge source -Introduce topic -Why excavations are dangerous -Trends in trench fatalities -Intro to OSHA standards -Define course objectives -Provoke discussion/class engagement -Create active learner environment
Part 1. Risks and Hazards Activities: *-Buzz Group* *-Prop/Demonstration* *-Small Group-Case Study*	20-69	50-75 minutes	-Discuss excavation safety variables -Learn 10 common excavation hazards -Explain why cave-ins are greatest risk -Discover how much soil weighs -Discover how fast soil can collapse -Learn how cave-ins affect the body -Identify risk factors for all 10 hazards -Explain that hazards are controllable -Practice assessing risk factors -Build relationships through team work
Part 2. Hazard Controls and Protective Systems Activities: *-Prop/Demonstration* *- Role Play Scenario* *-Small Group-Rescue Plan*	70-114	45-75 minutes	-Learn excavation hazard controls -Cover controls for 10 common hazards -Discuss OSHA Standard requirements -Explain role of competent person -Discuss why soil type is important -Describe common protective systems -Explain sloping/shoring/shielding -Learn challenges of trench rescue -Understand elements of rescue plans -Build relationships through team work -Reach multiple learning styles
Part 3. Practice What You Learned	115-141	25-30 minutes	-Practice spotting excavation hazards -Actively involve trainees -Assess ability to apply knowledge -Review best practices -Excavation hazards post-test -Course evaluation

Total time: Approximately 2.5—3.5 hours depending on which activities you use.

Preparing To Teach This Training

The curriculum is designed to guide you through the entire training with key talking points, background information, activities, and prompting questions to engage the class. The goal of the training is to educate workers about excavation and trenching hazards. Excavations are known to be among the most hazardous construction operations. It is important that workers know how to identify hazardous situations and risk factors that can result in severe injury and death. They must also know the importance of the competent person and the safe practices and required controls that keep them safe on-the-job.

Specialized technical knowledge is not necessary to teach this course. With proper preparation, foremen, union staff, apprenticeship instructors, and others can present the material. The Train-the-Trainer (TOT) class is designed to prepare participants to teach the curriculum by experiencing the training first-hand as well as receiving supplemental technical information from expert guest speakers and teaching tips and adult learning information.

The course is flexible and can be presented in different ways. Feel free to adapt it to your own situation. The minimum recommended training session is 30 minutes. You can use specific modules that are most relevant to your training needs, or present the entire course in 2.5 to 3.5 hours.

Laminated Slides: We have provided 8 laminated double-sided slides that can be useful for presenting training at a job site where it is not feasible to use PowerPoint or video. We condensed material from the course curriculum and PowerPoint that cover essential information from each training module. Use the curriculum talking points with these slides to present a shorter, basic training or refresher class. They also work well in conjunction with a tailgate training or toolbox talk.

PRACTICE! However you decide to present this training, it is always essential to study the curriculum and rehearse your presentation before holding a class. The curriculum provides a level of detail designed to provide the information you need to competently teach the material. Some of this information is intended to enhance the trainer's understanding of the concepts. You may choose to target only key points in your training as outlined at the beginning of each section and as shown on the PowerPoint slides.

If you have any questions or need help using this material, please contact the SBCTC Project Coordinator whose contact information is listed in Tab 1 of your binder.

What You Need To Present This Training

- Flash drive provided at the TOT class—(PowerPoint files with video files)
- Computer and LCD projector for PowerPoint presentation
- Audio system or portable speakers for videos
- Extension cord and power strip
- Course curriculum (binder Tab 2)
- Class sign-in sheet (binder Tab 8)
- Pre/Post tests (binder Tab 4)
- Class evaluation forms (binder Tab 4 & 8)
- Copies of handouts (binder and flash drive)
- Flip chart pads and easel or white board
- Multi-colored markers (7 sets)
- Painter's tape for posting flip charts
- (Optional) Samples of Type A, B, C soils
- (Optional) Samples of hydraulic shoring components
- Props such as: cubic foot and cubic yard models; bags of soil; hard hats and safety vests; slope angle display
- Materials for playing Review Games (Back binder pocket & flash drive)
- (Optional) Prizes for playing Review Games

Instructions For Setting-Up Fun Activities and Props

The following activities are mentioned in the Excavation and Trenching Curriculum:

Buzz Groups

Curriculum: Slide 21 "Every excavation is different"

Training Goal: Actively involve learners and build relationships among trainees; stimulate thinking about conditions that make every excavation different.

Time and Set-up:

- Quick 3-5 minute activity; use a timer to keep it short
- Minimal set-up; pen and paper for each team; flip chart/pens

What to do:

ü Ask trainees to pair with the person next to them

ü Challenge teams to use their knowledge and experience of job sites to quickly create a list of fixed and changeable variables that affect excavation sites.

ü Set a timer for 3 minutes

ü Teams work together to write down variables

ü Class reconvenes; instructor calls on each team to share one item from their list; instructor records answers on flip chart; continue until all teams have shared answers.

Reaction Time Test

Curriculum: Slide 30 "From six feet"

Training Goal: Create active interest; add fun to training; demonstrate why workers cannot react fast enough to run to safety from a trench cave-in.

Time and Set-up:

- Quick 1-2 minute activity
- In advance, create simple reaction timer stick (see instructions on following pages)

What to do:

ü Ask for 2 volunteers (or the Instructor and a volunteer)

ü Volunteer #1 holds reaction timer at the top; volunteer #2 lines-up their fingers with bottom edge of timer

ü Volunteer #1 drops the reaction timer at any time without warning

ü Volunteer #2 tries to catch the timer between their fingers and hold it.

ü Instructor reads reaction time score from the timer at the point volunteer #2 grabbed it

ü Compare this time with those just covered in the PowerPoint slides

(From Reaction time)

Make Your Own Reaction Timer

Here is a simple method for making your own reaction timer. It is basic, and probably not the most accurate test of reaction time, but it is interesting activity to do, and lots of fun will be had.

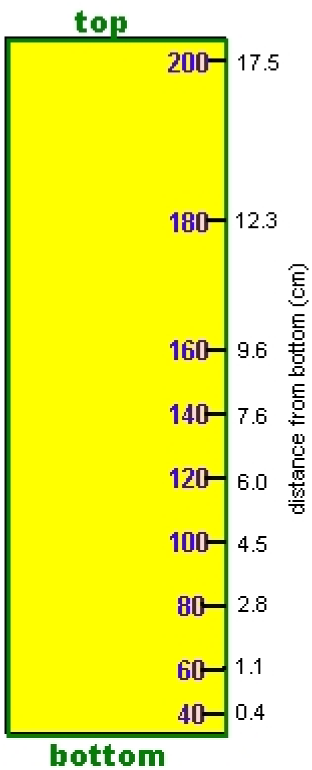
Equipment Required

- a piece of thick paper or cardboard, approximately 20 cm long and 5 cm wide.
- a ruler
- a pen or pencil

Construction Method

1. Cut the card to at least 20cm long and 5 cm wide.
2. Mark the piece of paper or cardboard as illustrated (use the figure below as a guide).
3. The numbers 40 to 200 (time in milliseconds) are to be written on the card at the specified distances (in centimeters) from the bottom of the card.

Note: all measurements are approximate



Test Method

- Have a friend hold the reaction timer at the top
- line up your fingers with the bottom edge of the reaction timer
- have the friend drop the reaction timer at any time, without warning, and try and grab it between your fingers. Don't chase it, that's cheating!
- read off your score from the side of the card at the point you grabbed it, and rate your score using the table below.

Scoring

Speed (milliseconds)	Rating
40	pretty good
60	a little below average
80	slow
100	very slow
120	have another go
140	I wouldn't get into a car with you
160	what drugs are you on?
180	hello?
200	wake up!

Props To Make Training More Lively

Cubic foot and cubic yard models
(Slide 32 "How much does soil weigh?")
These are easy to measure and build using PVC pipe and 3-way fittings. They are effective training tools to provide a visual representation of volume. You can then discuss possible weights of each of those volumes of soil. These props can be referred to throughout the training and used in group role play activities.

Bags of soil
(Slide 34 "That's equivalent to a vehicle")
Bags of gardening soil readily available for purchase from nurseries and hardware stores are great props for demonstrating soil weight. Typically these bags will come in 1-3 cubic foot quantities. It is important to note that these are prepared mixes of different materials, therefore the cubic foot weight will be considerably less than the 114 pound average for excavated soil. Multiple bags can be used to simulate the weight of a small amount of soil that may fall on a victim of a trench collapse. Ask if anyone would volunteer to have the bags stacked on their chest, face, arms, or legs for several hours. Don't actually ever do this! This would be a small glimpse into what it might be like to be trapped in a trench cave-in.

Soil Samples
(Slide79 "Soil classification is critical")
Collect samples of soil representing each of the three classifications (Type A,B,C) and put them in clear jars that can be passed around the class. Either label them or make it into an activity by having trainees guess which type each is and why. Alternatively, you can purchase cans of "Play-Doh" and have trainees try different manual soil tests (thumb penetration, ribbon) that a competent person must perform.

Slope Angle Measure
(Slide 84 "Slope angles by soil type")
Construct a simple tool to create a better visual and interactive way to discuss the slope angles required to stabilize different soil types. This can be accomplished using PVC pipe, bolt/washer/wing nut, and a protractor. Cut two sections of PVC pipe and drill holes at one end of each. Using a protractor, create a template out of heavy cardboard marking the four angle positions that will be demonstrated—90

Case Study Activity

Curriculum: Slide 69 "Case Studies—Small Group Activity"

Training Goal: Trainees practice using information provided to analyze actual fatality cases; creates participation and shared ownership; team problem solving; exchange of ideas

Time and Set-up:

- Longer 30-40 minute activity depending on class size
- In advance, print out 6 different case studies (provided in binder Tab 3, use your own, or find more online from NIOSH FACE Reports—see Tab 7)
- Flip chart paper and pens for each team

What to Do:

ü Introduce the activity and explain the goals
ü Break class into small groups of 3-5 trainees
ü Give each group a case study, flip chart page and pens
ü Tell the groups to work as a team, read their case and determine what went wrong in the situation and how could the incident have been prevented.
ü Groups write their answers on the flip chart and choose a team member to report their findings to the class.
ü Set timer for 15 minutes and check on progress of groups
ü Reconvene the class and begin report-backs
ü Discuss any questions or feedback

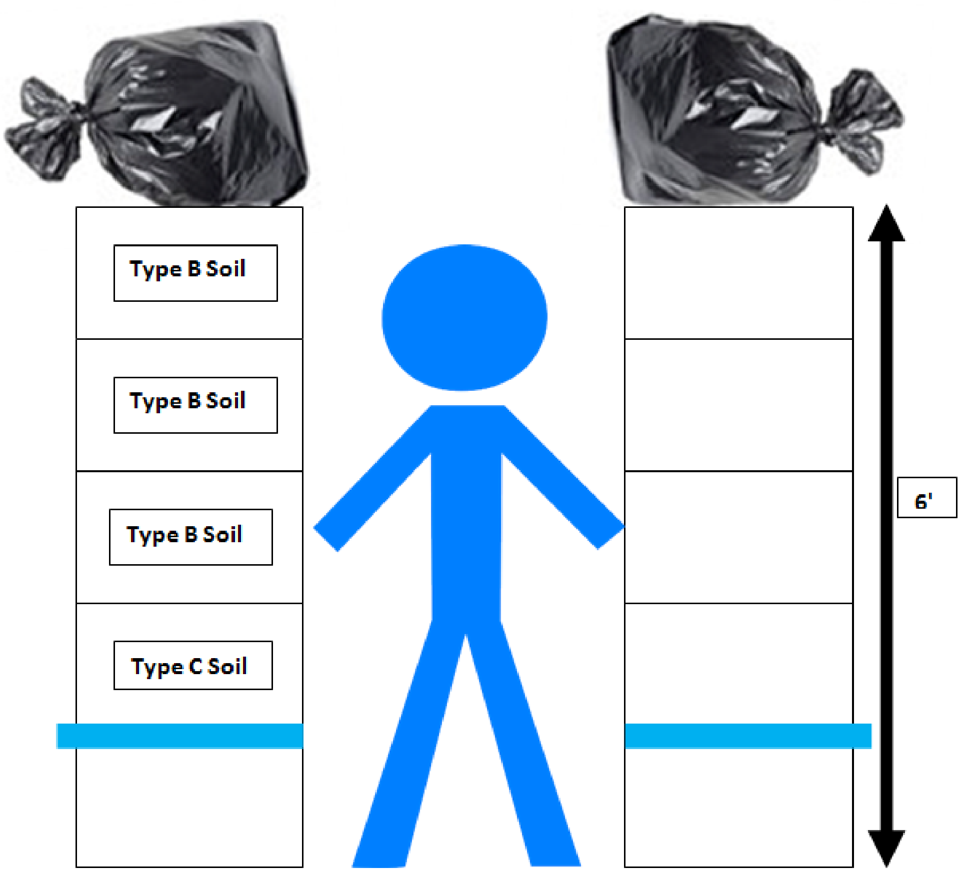
An excerpt from the WOSHTEP "Construction Case Study Guide" is included on the following pages to provide further information on effectively using this technique in your training.

Mock Trench (Optional Role Play)

Curriculum: Slide 97 "Safely entering and leaving a trench"

Training Goal: Create active interest; add fun to training; encourages participation; uses a simulated trench scenario to review key points and demonstrate knowledge learned at the training; consolidates key concepts.

Time and Set-up:
- Variable 5-25 minute activity, or ongoing depending on how you use it
- In advance, gather parts to build walls of a mock trench. These can be stackable storage bins, empty boxes, or other light-weight materials of your choice. Have enough on hand to go 6 feet high on both sides. (See diagram below)
- Label your stackable layers as different soil types.
- Add layer to simulate water.
- Use garbage bags filled with light-weight filler to simulate spoils pile.
- Have a tape measure or a pre-measured 5-foot stick to mark depth at which protective systems are mandatory. Mark other trigger depths on the stick such as 4-feet for ingress/egress ladders and testing for hazardous atmospheres, 2-feet for maximum distance allowed from bottom of trench to bottom of trench box.



What to Do:

- ü Once your mock trench is set-up, it can be used to engage the class in discussing many different aspects of excavation and trench safety:
  Soil types, soil weight, trigger depths, spoils piles, different types of cave-ins, changing conditions, water accumulation, falling objects, protective systems, etc.
- ü Encourage volunteers to interact with the materials and talk about potential hazards and what they would do to make the trench safe.
- ü Incorporate other props such as cubic foot models, slope angle, soil samples, etc.

Adding Optional Role Play
Time and Set-up:

- Longer, 30+ minutes
- Follow previous set-up steps
- Create a scenario that involves 3-4 characters (e.g. laborer, equipment operator, competent person, OSHA inspector, foreman, union steward) tailor this to your trade and type of work.
- Scenario must include a precise conflict and resolution that can easily be played-out by the actors. Improvisation of a scene could quickly get out of control.
- Prepare a simple script for each character to read.
- Provide props such as hard hats and safety vests marked to identify each character.

What to Do:

- ü Ask for volunteers to act out the scenario
- ü Give each volunteer their script and appropriate props
- ü Set the scene, put each character in place
- ü Direct the scene; help volunteers to act out their roles
- ü Freeze the scene at key points and engage the class in discussion of what's happening
- ü Finish the role play and give each volunteer actor a prize
- ü Follow activity with discussion and summary

Rescue Planning Small Group Activity

Curriculum: Slide 112 "Will it be rescue or recovery"

Training Goal: Encourage participation and teamwork; create shared ownership of outcome; engage trainees in organizing a excavation rescue plan.

Time and Set-up:

- Moderate 20 minutes; depends on class size
- Break the class into teams of 3-4 people
- Give each group a flip chart page and pens
- Give each group a template of categories (sample on next page)

What to Do:

ü Ask each group to discuss what needs to be included in an excavation rescue plan and fill-in their ideas on the template provided (or use your own company rescue plan and have teams find the information)

ü Encourage teams to consider everything they learned about excavation and trenching hazards throughout the training

ü If there is time, have each team transfer their list to a flip chart and be prepared to discuss their ideas with the class.

ü Reconvene the class, ask for volunteers to report their team's ideas back to the class

Rescue Planning Activity Template

Contacts—Who needs to be notified and when?
Information Needed—What information needs to be available?
Personnel—Who should be on the scene and what are their responsibilities?
Equipment—What special tools or equipment needs to be available at the scene?
Site Control—What will be needed to manage access, traffic flow, crowd control at the scene?

Before presenting this training

This curriculum is designed for delivery by experienced instructors who have completed training on Excavation and Trenching Hazards. Instructors who have not completed this course should not attempt to deliver this training.

The curriculum is to be used in tandem with the accompanying PowerPoint presentation. It guides trainers through the entire presentation providing directions, key talking points, background information, activities, and prompting questions to engage the class.

Using this training package requires planning, preparation and practice.

Refer to the "At-A-Glance" in the Instructor's Guide section of your course binder for approximate teaching times for each section.

Instructors should do the following before presenting:

- ü Study directions in the *Instructor's Guide* provided in the TOT course binder.
- ü Thoroughly review the curriculum and PowerPoint slides
- ü Assemble all necessary equipment, supplies, props, and handouts in advance
- ü Practice using the slides with the curriculum
- ü Test the PowerPoint presentation to assure all features are working properly (especially text animation and embedded videos)

Equipment Needed:

- ü LCD Projector and cables
- ü Computer
- ü TOT Course flash drive
- ü Power source and extension cords
- ü Flip chart easel
- ü Timer/clock

Supplies:

- ü Training sign-in roster
- ü Participant nametags (optional)
- ü Pens/pencils/notepaper
- ü Flip chart pad and multicolor pens
- ü Painters tape

Introduction

Slides 1-19

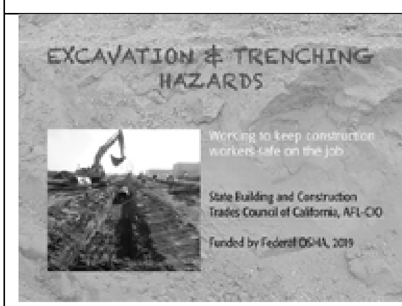
Key points in this section:

- Acknowledge source and OSHA grant funding of program
- How material may be used
- Introduce training topic—define "excavation" and "trench"
- Why excavations are dangerous
- Trends in excavation/trench fatalities
- Identify OSHA standards and jurisdictions
- Review course goals

Handouts: Excavation and Trenching Hazards Pre-Test

Activities:

- Circulate training sign-in roster
- Participant introductions—Name one thing you want out of this training (create list and save for use later)
- Participants take the excavation hazards pre-test
- Class Brainstorm:
  What construction projects require excavation?
  Which trades are exposed to excavation hazards?
- Discussion of why excavations are dangerous
  (create list and save for use later)
- Read aloud and discuss "Buried Alive: Joe's Story"



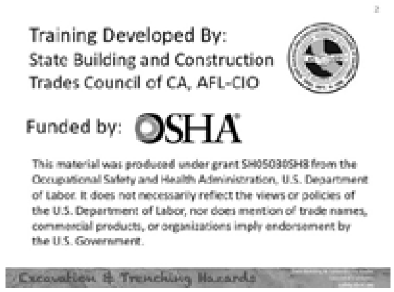
Slide 1—Title Slide

Before starting your training presentation:

Welcome the class:
Introduce yourself and explain that this training will cover Excavation and trenching hazards and controls.

Ask each participant to introduce themselves, and state one thing they would like to get out of the training session. Record responses on a flip chart and post in the classroom.

Administer the pre-test to each participant. Allow 5 minutes for completion, then collect tests and save for grading.



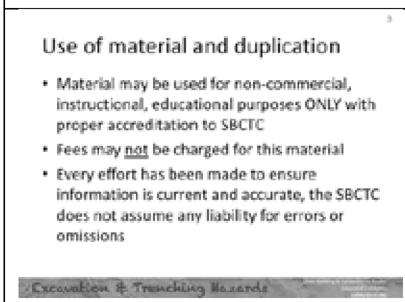
Slide 2—Training developed by:
State Building and Construction Trades Council of CA, AFL-CIO

Identify that this training program was developed in 2018-19 by the State Building and Construction Trades Council of California, AFL-CIO (SBCTC).

Explain that the SBCTC is a statewide non-profit council of building trades unions representing over 400,000 union construction workers throughout California. In existence for more than a hundred years, the SBCTC has been a strong advocate for worker health and safety.

Explain that this program was funded by a grant from federal OSHA; refer to the disclaimer shown on the slide.

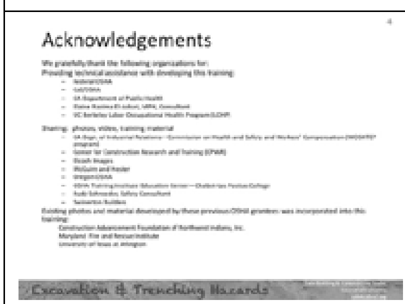
For more information about the SBCTC, visit our website at www.sbctc.org.



Slide 3—Use of Material and Duplication

Emphasize that this training was specifically designed to educate workers about excavation and trenching hazards in construction. It cannot be used for commercial purposes, nor may any fees be charged for the materials or training.

We have made every effort to give proper credit to photo sources used in the PowerPoint presentation. A full list of image credits by slide is included at the end of this curriculum. Some credits may also appear on the slide or in the notes section below the slide.

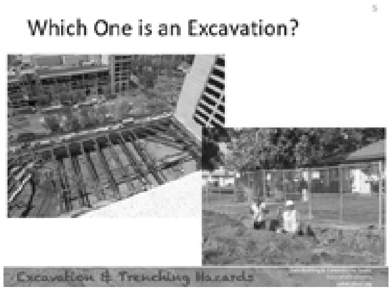


Slide 4—Acknowledgements

Whenever possible, we use existing sources of information to compile our training.

The SBCTC expresses appreciation to the organizations, companies and individuals listed on this slide for their cooperation in sharing their resources and expertise for the benefit of our training.

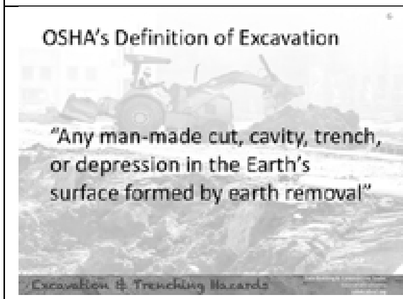
When using this training, acknowledge the SBCTC as the source of this training package.

<table>
<tr>
<td>


</td>
<td>
Slide 5—Which one is an excavation?
Ask the class to examine each photo and decide which is an excavation.

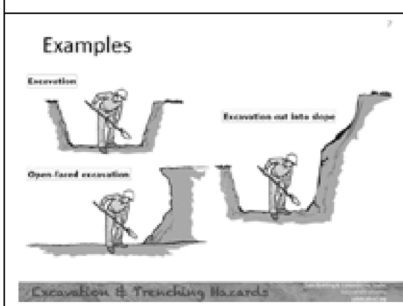
The answer is Both! It's a trick question.
Dig a hole in the ground and you have made an excavation.

Although the photos depict two very different scales of work, they are both considered excavations and the same set of rules apply to each.

How does OSHA define excavation?
</td>
</tr>
<tr>
<td>


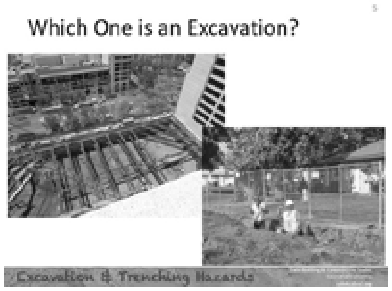
</td>
<td>
Slide 6—OSHA's definition of excavation
Ask the class: Does everyone know what "OSHA" stands for and understand what they do?
Review basics if needed.
OSHA stands for "Occupational Safety and Health Administration." Created by Congress in 1970, OSHA is the federal agency formed to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance. It is part of the United States Department of Labor.

Read aloud how OSHA defines excavation as: "Any man-made cut, cavity, trench, or depression in the Earth's surface formed by earth removal."

Excavations can be any size: wide, narrow, deep, or shallow. Either mechanically or hand dug.
</td>
</tr>
<tr>
<td>


</td>
<td>
Slide 7—Examples
The diagrams on the slide illustrate three different excavation scenarios.

Ask the class: Raise your hand if you've worked in or around an excavation?
Follow-up: What did you do?
</td>
</tr>
</table>

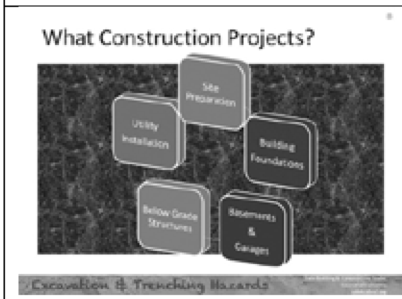


Slide 5—Which one is an excavation?
Ask the class to examine each photo and decide which is an excavation.

The answer is Both! It's a trick question.
Dig a hole in the ground and you have made an excavation.

Although the photos depict two very different scales of work, they are both considered excavations and the same set of rules apply to each.

How does OSHA define excavation?



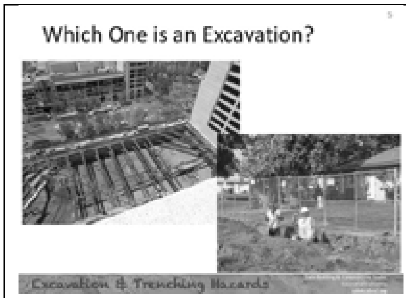
Slide 8—What construction projects?
Ask the class: What type of construction projects would require excavation operations?
Allow the class to brainstorm answers, then click the slide to reveal a few answers.

Possible answers include:

- Site preparation--grading
- Building foundations
- Basement construction
- Below grade garage structures
- Underground mass transit systems
- Placement or repair of underground utilities (water, electrical, gas, phone/fiber optics)
- Removal of old underground utilities
- Placement of underground storage tanks
- Sewer and septic systems
- Waterproofing
- Walls
- Road building

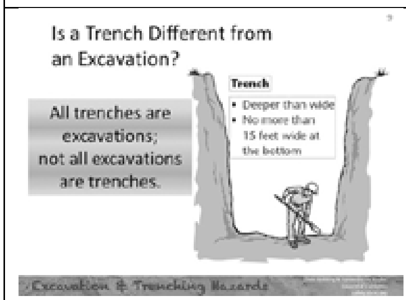
Ask the class: Which trades are involved with excavations?
Operating Engineers and Laborers work together to perform excavation and trenching work.
But Carpenters, Cement Masons, Electricians, Plumbers/Pipefitters, Waterproofers may also work in excavations and trenches. Any trades working at a jobsite where excavation/trenching work is active could be exposed to hazards.

It's important for all workers to receive basic hazard awareness training, even if they aren't performing excavation work.

<table>
<tr>
<td>
</td>
<td>Slide 5—Which one is an excavation?
Ask the class to examine each photo and decide which is an excavation.

The answer is Both! It's a trick question.
Dig a hole in the ground and you have made an excavation.

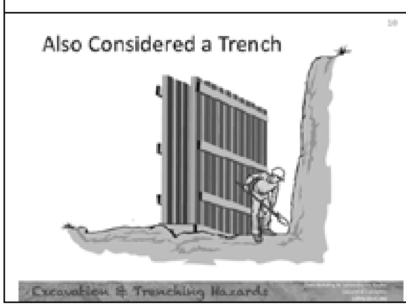
Although the photos depict two very different scales of work, they are both considered excavations and the same set of rules apply to each.

How does OSHA define excavation?</td>
</tr>
<tr>
<td>
</td>
<td>Slide 9—Is a trench different from an excavation?
Discuss this with the class so everyone understands the difference.

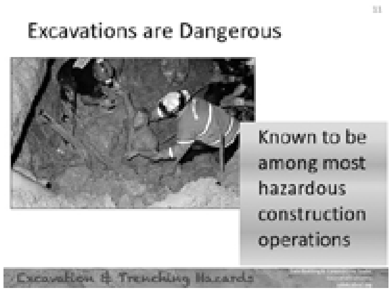
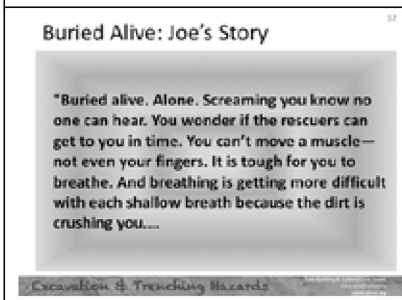
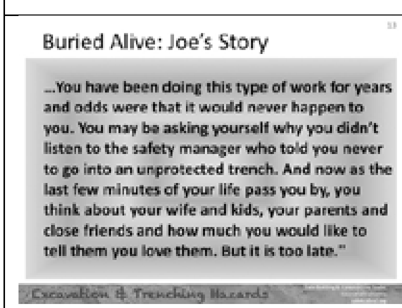
All trenches are excavations, but not all excavations are trenches.

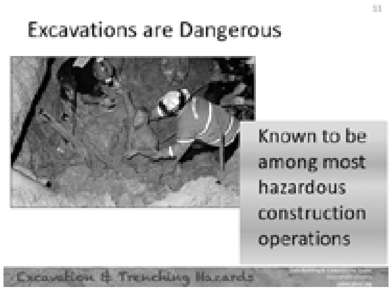
As shown in the diagram, a trench is defined as a narrow excavation, deeper than it is wide, and not greater than 15 feet wide at the bottom.

In this training we'll learn that all trenches can be dangerous and can potentially expose workers to multiple hazards, even if they are only 4 feet deep!

Trenches and other excavations can also include confined spaces.</td>
</tr>
<tr>
<td>
</td>
<td>Slide 10—Also considered a trench
If forms or other structures are installed in an excavation that reduce its width to less than 15 feet at the bottom, as shown in this illustration, the excavation is considered a trench.

OSHA standards for trenches would apply here.</td>
</tr>
</table>

	**Slide 11—Excavations are dangerous** Excavations are known to be among the most hazardous construction operations. Ask the class: Why do you think they are so dangerous? Create a list of class responses on a flip chart. All excavations are hazardous because they are inherently unstable. In an undisturbed state, vertical and horizontal forces are in balance, keeping soil masses stable. By cutting into and removing layers of soil, moving earth, creating depressions where water can accumulate, changing the slope we are creating a potentially unstable soil situation that, if not properly managed, can end in tragic accidents like the one in this photo.
	**Slide 12—Buried Alive: Joe's Story** The quote shown on the next 2 slides comes from an article by George Kennedy in *Utility Contractor* magazine published by the National Utility Contractor's Association (NUCA) in March 2018. Joe's Story It depicts what it might be like to experience a trench accident. Ask for a volunteer from the class to read the story from the slide. If no one is comfortable doing this, read it to the class yourself. "Buried alive. Alone. Screaming you know no one can hear. You wonder if the rescuers can get to you in time. You can't move a muscle—not even your fingers. It is tough for you to breathe. And breathing is getting more difficult with each shallow breath because the dirt is crushing you..."
	**Slide 13—Buried Alive: Joe's Story (continued)** Ask for the volunteer to keep reading or have someone else take over. "... You have been doing this type of work for years and odds were that it would never happen to you. You may be asking yourself why you didn't listen to the safety manager who told you never to go into an unprotected trench. And now as the last few minutes of your life pass you by, you think about your

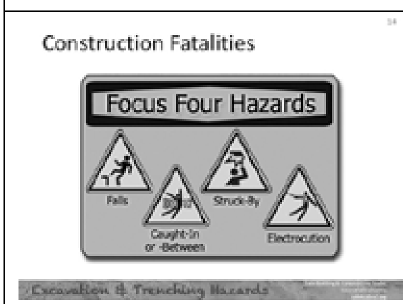
<table>
<tr>
<td>


</td>
<td>
Slide 11—Excavations are dangerous
Excavations are known to be among the most hazardous construction operations.

Ask the class: Why do you think they are so dangerous?
Create a list of class responses on a flip chart.

All excavations are hazardous because they are inherently unstable.
In an undisturbed state, vertical and horizontal forces are in balance, keeping soil masses stable.

By cutting into and removing layers of soil, moving earth, creating depressions where water can accumulate, changing the slope we are creating a potentially unstable soil situation that, if not properly managed, can end in tragic accidents like the one in this photo.
</td>
</tr>
<tr>
<td></td>
<td>
wife and kids, your parents and close friends and how much you would like to tell them you love them. But it is too late."

Ask the class: What is your reaction to this story?
Has anyone or someone you know experienced an excavation accident?
Ask them if they are comfortable sharing what happened with the class.
Discuss how excavation accidents impact construction workers.
</td>
</tr>
<tr>
<td>


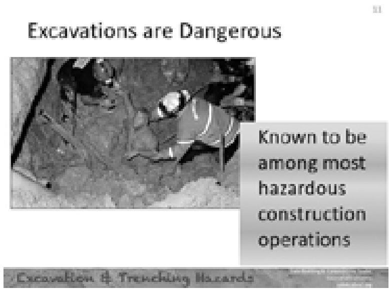
</td>
<td>
Slide 14—Construction fatalities
Ask the class: Can anyone identify the leading causes of fatalities in construction?
Answer: Falls, struck-by, electrocutions, caught-in/between.

Click on the slide to reveal Focus Four graphic

OSHA has identified the four leading causes of construction fatalities and calls them "The Focus Four."

Caught-In includes trenching and excavation accidents where workers are trapped by collapsing soil or pinned between equipment or materials and the wall of an excavation.

Explain that all the other 3 hazards can also be found at excavation sites as we'll learn throughout this training.
</td>
</tr>
</table>



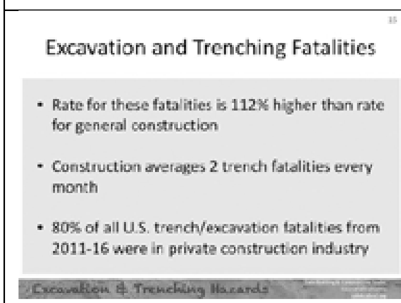
Slide 11—Excavations are dangerous
Excavations are known to be among the most hazardous construction operations.

Ask the class: Why do you think they are so dangerous? Create a list of class responses on a flip chart.

All excavations are hazardous because they are inherently unstable.
In an undisturbed state, vertical and horizontal forces are in balance, keeping soil masses stable.

By cutting into and removing layers of soil, moving earth, creating depressions where water can accumulate, changing the slope we are creating a potentially unstable soil situation that, if not properly managed, can end in tragic accidents like the one in this photo.

Despite OSHA standards and readily available protective systems, workers continue to die on-the-job in unprotected trenches and excavations.



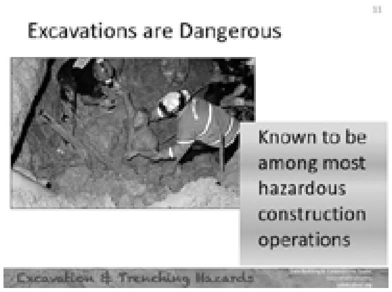
Slide 15—Excavation and trenching fatalities
Review the data shown on the slide from the federal Bureau of Labor Statistics (BLS).

According to OSHA, the fatality rate for excavations is 112% higher than the rate for general construction, with on average 2 trenching fatalities every month.

Injuries from this type of work tend to be very serious and these types of accidents often result in worker fatalities.

According to BLS data for the years 2011-2016 there were 130 fatalities recorded in trenching and excavation and 80% of these fatalities occurred in the private construction industry.

That's 104 construction worker excavation fatalities that could have been prevented.



Slide 11—Excavations are dangerous
Excavations are known to be among the most hazardous construction operations.

Ask the class: Why do you think they are so dangerous? Create a list of class responses on a flip chart.

All excavations are hazardous because they are inherently unstable.
In an undisturbed state, vertical and horizontal forces are in balance, keeping soil masses stable.

By cutting into and removing layers of soil, moving earth, creating depressions where water can accumulate, changing the slope we are creating a potentially unstable soil situation that, if not properly managed, can end in tragic accidents like the one in this photo.

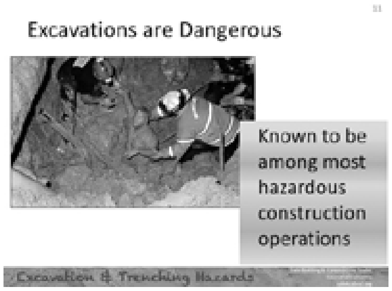
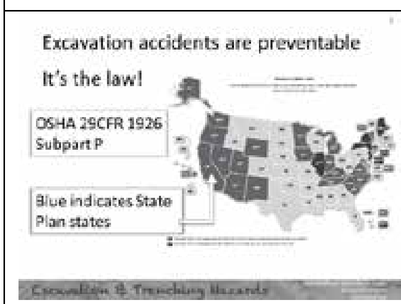
Slide 16—Trench fatalities 2011-16
The bar graph on this slide depicts numbers of fatalities that occurred in trenches.
The blue bars represent all trench fatalities in the U.S.
The red bars represent the number of those that were in construction.
Actual numbers of deaths are shown at the top of each bar.

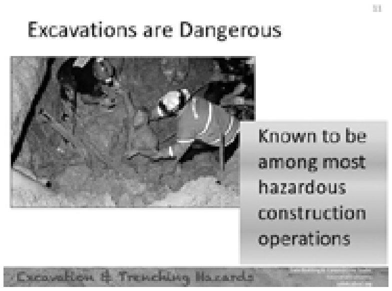
Ask the class: What stands out to you about this chart? Discuss their answers.

There was a big uptick in trench fatalities in 2016.
All but 3 of these deaths were construction workers.
The few non-construction industry deaths occurred among workers employed in agriculture or government agency jobs.

This alarming spike in fatalities prompted OSHA to revive their National Emphasis Program on Trenching and Excavation Safety beginning October 1, 2018. The agency stated that:
"OSHA will concentrate the full force of enforcement and compliance assistance resources to help ensure that employers are addressing these serious hazards."

The Center for Construction Research and Training (CPWR) funded a study in 2018 to analyze causes of recent trenching accidents. The findings of this study are expected to be published in spring of 2019.

	**Slide 11—Excavations are dangerous** Excavations are known to be among the most hazardous construction operations. Ask the class: Why do you think they are so dangerous? Create a list of class responses on a flip chart. All excavations are hazardous because they are inherently unstable. In an undisturbed state, vertical and horizontal forces are in balance, keeping soil masses stable. By cutting into and removing layers of soil, moving earth, creating depressions where water can accumulate, changing the slope we are creating a potentially unstable soil situation that, if not properly managed, can end in tragic accidents like the one in this photo.
	**Slide 17—Trench fatality facts 2011-14** These are some preliminary findings of the CPWR study. This information helps us better understand what is happening in the industry. Most fatalities happen in smaller construction companies with less than 50 employees. Many union contractors are small companies. Two-thirds of workers dying in trenching accidents are Hispanic, about one-third of which are born outside of the U.S., mostly in Mexico.
	**Slide 18—Excavation accidents are preventable—It's the law!** We know what needs to be done to protect workers in and around excavation operations. OSHA enforces standards for excavation and trenching operations. All workers, regardless of citizenship, are covered by OSHA laws in our country. The federal standard is found in: 29 Code of Federal Regulations (CFR) 1926 Subpart P. Depending on where you work in the U.S. you will either be working under federal OSHA or state OSHA regulations. State



Slide 11—Excavations are dangerous
Excavations are known to be among the most hazardous construction operations.

Ask the class: Why do you think they are so dangerous? Create a list of class responses on a flip chart.

All excavations are hazardous because they are inherently unstable.
In an undisturbed state, vertical and horizontal forces are in balance, keeping soil masses stable.

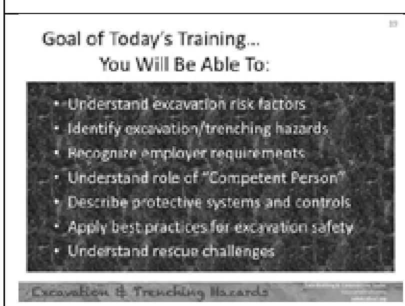
By cutting into and removing layers of soil, moving earth, creating depressions where water can accumulate, changing the slope we are creating a potentially unstable soil situation that, if not properly managed, can end in tragic accidents like the one in this photo.

Plans are OSHA-approved job safety and health programs operated by individual states rather than federal OSHA.

Twenty-two states have their own plans. State-run programs must enforce standards at least as effective as the federal OSHA program. Often state programs are more stringent.

The map shows which states have their own plans and which are covered by federal OSHA. The light blue is federal OSHA, the medium blue have State Plans and the 6 dark blue have State Plans that cover state and local government workers only.

It is critical that construction workers from all crafts receive training to be aware of excavation and trenching hazards and the protections required to work safely.



Slide 19—Goal of today's training...you will be able to:

- ü Understand how excavations pose a risk to workers
- ü Identify excavation and trenching hazards
- ü Recognize employer requirements to protect workers
- ü Understand role of the "competent person" at the job site
- ü Describe the protective systems used at excavations
- ü Apply best practices for excavation and trenching safety
- ü Understand the complexities of rescue operations
- ü Recognize warning signs of potential danger and what to do

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

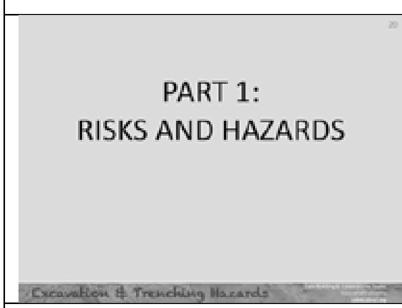
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

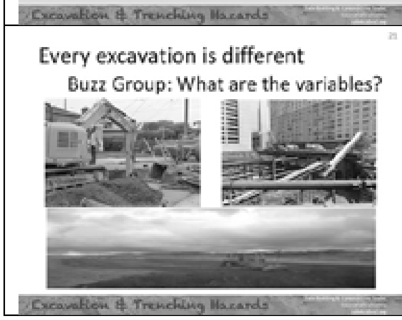
Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 20—Part 1: Risks and hazards

In this section we'll look at the main hazards associated with excavation work and how these pose a risk to you.



Slide 21—Every excavation is different—

Buzz Group: What are the variables?

No two excavations are alike; conditions may even vary at different locations on the same job site. This slide shows examples of excavation work in a residential neighborhood, an urban center, and a rural open space.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Many factors, some fixed and some variable, affect safety at an excavation site. Buzz Group: Ask trainees to team-up with their neighbor to write a list of factors they believe affect safety at an excavation site. Give the teams 5 minutes to create their lists then reconvene the class. Go around the room, have each team tell one factor on their list and record the responses on a flip chart in two columns, one for fixed and one for variable factors. Continue until all teams have shared their lists. Fixed factors might include:

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	· Environmental conditions in the surrounding area—vegetation, climate, urban/suburban/rural · Natural topography—slope, rivers and streams, rocky outcrops, springs · Type of soil · Existing infrastructure—buildings, roads, pavement, sidewalks, foundations, walls, surface and subsurface utilities. · Water table · Previous excavation activity in the area Things that change day-to-day or hour-to-hour might include: · Weather conditions · Progress of the excavation

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

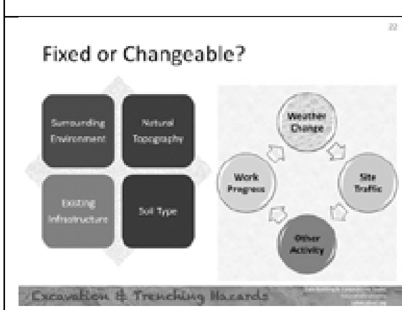
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

- Other construction activity near the excavation site
- Traffic



Slide 22—Fixed or changeable?
See how these match-up with what the class listed.

Every excavation must be assessed prior to the start of work and inspected often as work progresses or conditions change.

All these variables affect how individual job sites must be managed for worker safety.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity

Slide 23—Most common hazards

Go back to the flip chart list of dangers the class created earlier.

*****Click on the slide to reveal hazards—they appear automatically one at a time*****

See how the class list compares to the hazards shown on the slide.

These are the excavation hazards we will be addressing in this class:

- Cave-ins
- Contact with utility lines (gas, electrical)
- Falling loads from lifting or digging equipment

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	· Exposure to vehicular traffic · Bad air--Hazardous atmospheres · Unstable structures—buildings, walls, sidewalks, pavement · Water accumulation in the excavation · Falling objects: dirt, material, or equipment sliding, rolling · Valley Fever · Falls from unprotected edges

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

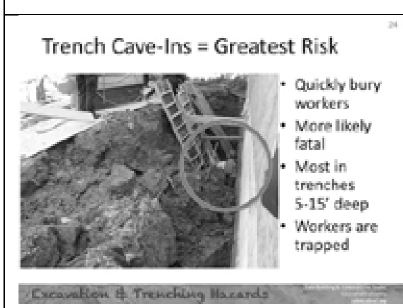
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity



Slide 24—Trench cave-ins = Greatest risk

Ask the class: What do you notice in the photo?
This is a photo of an actual trench collapse.
Can you locate the trapped worker?

*****Click on the slide to highlight the worker with a red circle*****

Cave-ins occur rapidly when a mass of soil or rock slides or falls from the unprotected side of an excavation and buries workers beneath the soil.

Trench cave-ins are more likely to result in worker fatalities than other excavation-related incidents.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Trenches are especially dangerous because they are narrow, and workers can get trapped. An unprotected trench can be an early grave. Most trench fatalities occur in excavations that are only 5-15 feet deep. Several factors make cave-ins dangerous.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

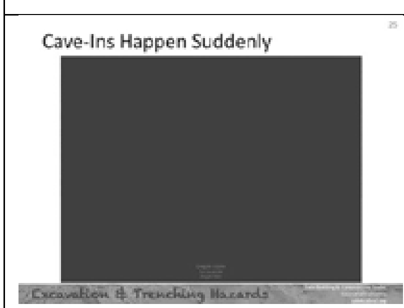
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 25—Cave-ins happen suddenly

Watch what happens in this video clip taken by an Oregon OSHA inspector at a job site.

*****Click on the blue box to play the video clip*****

Discuss what hazards students saw in this video.

- A worker was at risk in an unprotected trench as the crew was attempting to install shoring (we'll discuss what shoring is in Section 2 of our training).
- A section of the trench wall suddenly collapsed with no apparent warning.
- There appear to be cracks in the surface next to the trench edge that could indicate further collapse.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	· The worker is in imminent danger with no means of exiting the trench. · The crew seems to struggle to place a ladder where the worker can reach it. · The crew had been working for 3 hours. · The job site is close to a public roadway with traffic. · Lots of things went wrong with this excavation! This video shows how cave-ins can happen in a split second without any warning. This time they were very lucky the worker was not trapped.

<table>
<tr>
<td></td>
<td>

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

</td>
</tr>
<tr>
<td>

</td>
<td>

Slide 26—Myth "I can get out of the way"
Planning to outrun a cave-in is not a good strategy to protect yourself.

This may work in the movies, but it's just not possible in real life.
(Raiders of the Lost Ark)

You cannot move fast enough.

</td>
</tr>
</table>

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

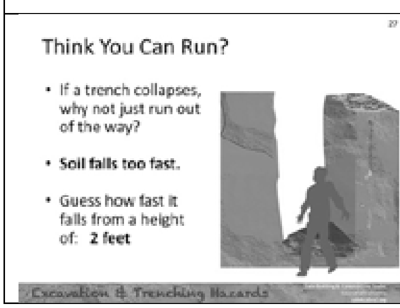
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 27—Think you can run?

Let's look at the speed at which soil moves in a collapse versus the average human reaction time.

The next 3 slides illustrate soil collapses from different heights.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

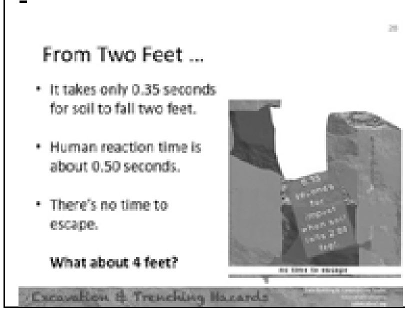
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

-



Slide 28—From two feet...

Even a reaction time of half a second is not fast enough to avoid the falling soil.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

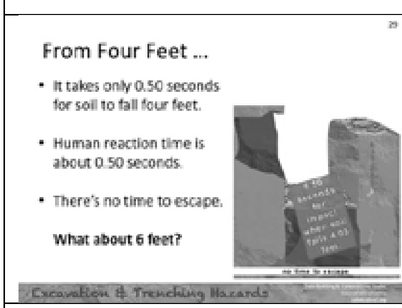
- Case studies
- Case study worksheet

Props:

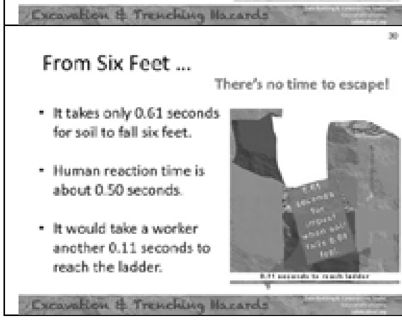
- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 29—From four feet...
Even when the soil has more distance to fall, you still can't move fast enough to escape it.



Slide 30—From six feet...
Even if you were anticipating something dropping on you, the split-second time difference would not be enough for you to react.

(You can try different fun experiments to test people's reaction times)

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

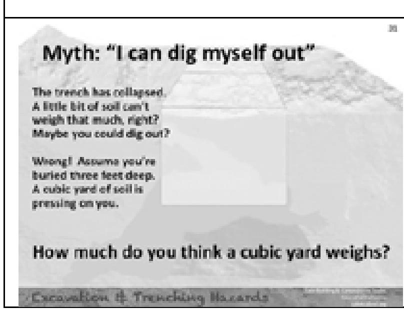
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity

Collapsing soil could reach a speed of 14 miles per hour when it strikes a worker. 14 MPH equals 20 feet per second. Imagine a car suddenly traveling at you from 10 feet away at that speed with no warning. You would not be able to escape the impact.



Slide 31—Myth: "I can dig myself out"

Another factor in addition to the speed of collapsing soil is its weight.

If you are buried three feet deep you have about a cubic yard of soil pressing down on you. No problem, that doesn't sound like much right?

<table>
<tr>
<td></td>
<td>

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

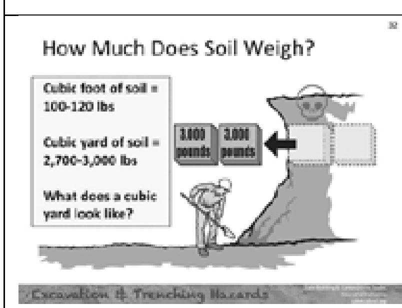
Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

</td>
</tr>
<tr>
<td></td>
<td>

Ask the class: How much do you think soil weighs?

</td>
</tr>
<tr>
<td>



</td>
<td>

Slide 32—How much does soil weigh?
The weight of a cubic foot of soil can range from 100--120 pounds. On average, a cubic foot weighs 114 pounds.

A cubic yard of soil weighs 2,700--3,000 pounds or more.

Imagine trying to move your body under a mass weighing more than a ton!

Use a prop to demonstrate the volume of a cubic yard—3'x3'x3'. This can be easily fabricated with PVC and fittings.

</td>
</tr>
</table>

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Imagine this space as a visual representation of the volume of soil that would be on top of you. (If you already have a cubic meter prop from our Silica in Construction class, that can work too. A cubic meter equals about 1.3 cubic yards. This volume of soil could weigh over 3,500 pounds.) Depending on the type of material and how wet it is, it could be much heavier.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

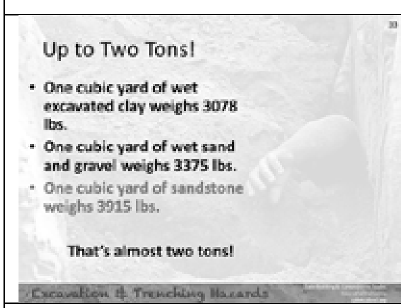
- Case studies
- Case study worksheet

Props:

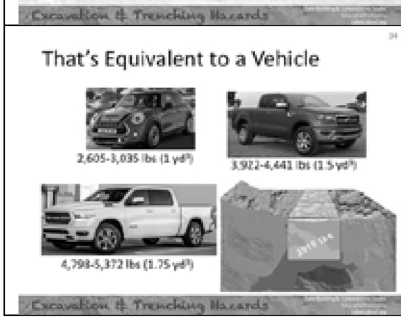
- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 33—Up to two tons!
Soil weight varies with the type and moisture content.
Here are examples of weights for different materials.



Slide 34—That's equivalent to a vehicle
Let's look at some other familiar objects that have comparable weight for perspective.

Here are the curb weights of some popular vehicles:
MINI Cooper 2,605—3,035 lbs.
Ford Ranger 3,922—4,441 lbs.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Dodge RAM 1500 4,798—5,372 lbs. You would not be able to move your arms and legs under this pressure and you would have great difficulty breathing. Does anyone want to volunteer to try it? Have some bags of soil for props; note the volume (in cubic feet) and weight of each bag. Ask if anyone is willing to lay on the floor and have these stacked on their chest, head, arms or legs.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

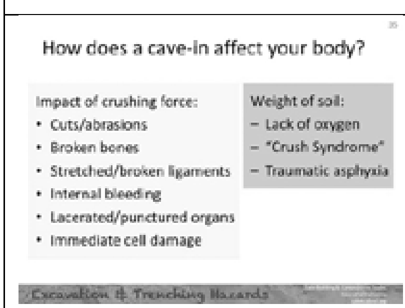
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 35—How does a cave-in affect your body?
Remember this weight is not being gently shoveled on you like kids burying each other in the sand at the beach. It is striking your body unexpectedly at great speed with great force.

Ask the class: What trauma would you expect from such an impact?
Damage resulting directly from the crushing force:

*****Click the slide to reveal answers*****

Broken bones, stretched or broken ligaments, internal bleeding, lacerated or punctured organs, cuts and abrasions, immediate damage to cells.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Immediately after the impact, soil surrounds you and traps you. **Asphyxiation** due to lack of oxygen in a confined space is often the cause of death in trench collapses. Even if you have air space to breathe, the weight of the soil may not allow you to expand your chest resulting in traumatic asphyxia. If you survive the initial trauma but are trapped in the cave-in for an extended time, the compressing force on your muscles causes loss of circulation to those body parts. The resulting decrease in oxygen causes your cells to function differently and begin to breakdown and generate toxins that

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	can leak out of the cells and cause other cells to die. Toxic substances are dumped into surrounding tissues. Our body's cellular response may allow us to survive for long periods of time in a trench collapse. But once rescued, and the weight of the compressing soil is removed, blood flow returns, and the toxic substances are spread throughout the body. This medical condition is referred to as "Crush Syndrome." A rescued trench collapse victim may initially be stable, alert and conscious but rapidly deteriorate and even suffer cardiac arrhythmias or cardiac arrest, kidney failure, or other body systems failures.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

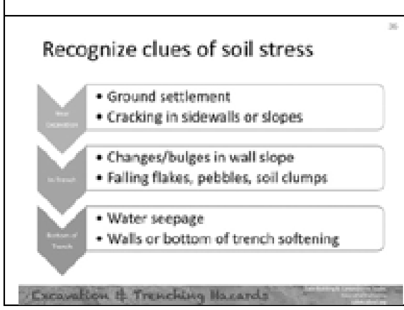
- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity

A victim may be successfully rescued but die hours later due to internal injuries or Crush Syndrome.

Some victims do survive; not all cave-ins end in fatalities. But it is a life-threatening, serious situation that no worker should have to experience.



Slide 36—Recognize clues of soil stress

Cave-ins may happen without warning, but there are clues you can look for at the excavation that may indicate a problem.

If you observe any of these signs of soil stress in or around the excavation notify your supervisor immediately:

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

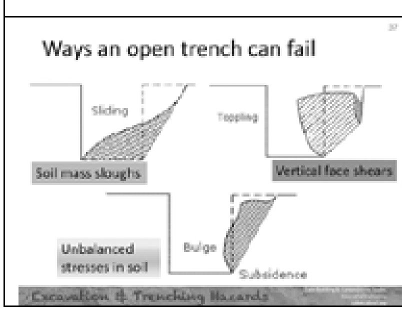
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

- Ground settlement or cracking in sidewalls, slopes or surfaces next to the excavation
- Changes or bulges in the wall slope
- Flakes, pebbles, or clumps of soil falling into excavation
- Water seepage
- Walls or bottom of trench softening



Slide 37—Ways an open trench can fail
Several things can happen when we remove soil and leave the cut unprotected.

Soil will eventually move downward into the excavation. The longer the side of the excavation is left unsupported, the more likely it is to cave-in.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	An increase or decrease in moisture content can affect soil stability. Tension cracks can form at a horizontal distance of 0.5 to 0.75 times the depth of the trench, measured from the top of the vertical face of the trench. These illustrations depict 3 common ways trenches fail: **Sliding:** a mass of soil slides or sloughs (pronounced "sluffs") into the trench

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

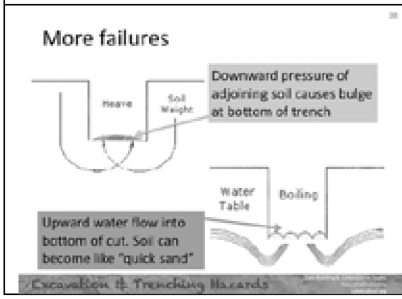
- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

Toppling: the trench's vertical face shears along the tension crack and falls into the excavation

Subsidence and Bulging: Unbalanced stress in the soil causes subsidence at the surface and bulging of the vertical face of the trench.



Slide 38—More failures

The next two conditions shown here can occur even when protective systems (such as shoring or shielding) have been properly installed.

Heaving or Squeezing: Downward pressure created by weigh of adjoining soil causes a bulge in the bottom of the cut.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity

Boiling: An upward water flow into the bottom of the cut; a high water table can be a cause of boiling. This condition can make the bottom of the trench like "quick sand"

Slide 39—Common trench hazards

In the following slides these different types of collapses will be illustrated.

- Spoil Pile Slide
- Shear Wall Collapse
- Lip Slide
- Belly Slough

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

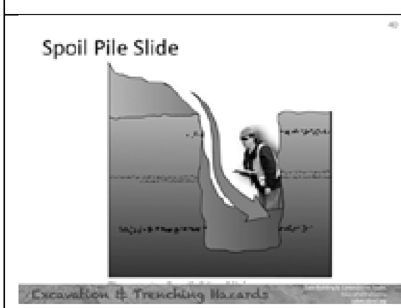
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 40—Spoil Pile Slide

These are very common and occur when excavated soil is piled too close to the edge of the trench.

Ask the class: What might cause the spoil pile to move?
Vibration caused by equipment working near the trench
Steep slope angle of pile
Additional weight on pile
Water from rain or other sources
Workers walking on pile…this is extremely dangerous and is prohibited!!

This may not cause serious injury initially, but there could be a more serious collapse of the trench wall during the rescue.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

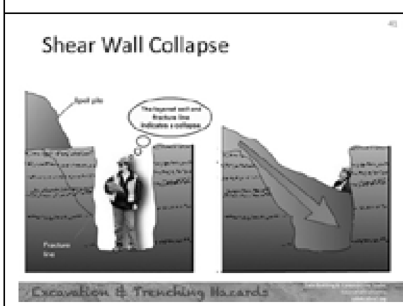
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 41—Shear Wall Collapse
Ask the class: What clues do you notice in this drawing that indicate a potential problem?
Layered soil; fracture line; spoil pile beyond fracture line

*****Click the slide to reveal the result of the collapse*****

These occur most frequently in clay or layered soil.

They happen very quickly and usually cause death or very serious injury to the victim.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

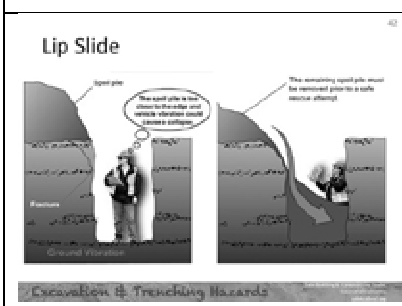
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

An average collapse is about 2-3 yards of soil which can weigh approximately 5,400—8,100 pounds.



Slide 42—Lip Slide
Ask the class: What stands out to you about this scenario? The spoil pile is right at the edge of the trench; there's a fracture line near the top of the trench wall; there is ground vibration indicated.

*****Click the slide to reveal the result of the collapse*****

Lip slides are similar to shear wall collapses but are usually smaller and less severe.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

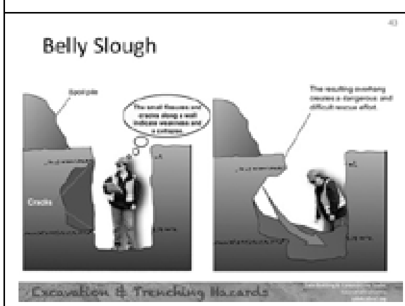
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity

These occur when the spoil pile is too close to the trench. Weight of the spoil pile along with vibration from nearby equipment and vehicles can cause the lip to fracture, allowing the spoil pile to slide into the trench, trapping the victim.



Slide 43—**Belly Slough** (slough is pronounced like "sluff")
These occur in areas near underground utilities or where running water is present in the trench.

Often, a fracture line will appear near the bottom wall of the trench signaling an impending collapse. This type of collapse is rapid and usually buries the victim deeply and is likely to suffocate them.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	*****Click the slide to reveal the result of the collapse***** The undercutting of the trench wall makes rescue very dangerous, difficult and time consuming. First responders must stabilize the trench before they can begin to free the victim. The longer a victim is trapped, the less likely they will survive.

<table>
<tr>
<td></td>
<td>

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

</td>
</tr>
<tr>
<td>

-

</td>
<td>

Slide 44—See any clues here?
Ask the class: Do you notice anything that would cause concern here?
Discuss

*****Click the slide to reveal arrows highlighting signs of weakness*****

- There appear to be several cracks and fissures that may indicate soil weakness.
- Loose rock/soil on the face.
- Possibly a different type of soil at bottom of trench, gray color.
- Undercutting of trench wall.

</td>
</tr>
</table>

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity

Slide 45—What's happening here?
Standing water in the bottom of the trench
Soil is obviously very softened due to the water, trench boiling could be happening
Base of the trench wall is undermined
Ladder is sitting in standing water

Ask the class: Would you enter this trench? Why or why not?

No, it is not safe. Never enter an excavation with standing water.
Water makes the soil unstable
The saturated soil may become like "quick sand"

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

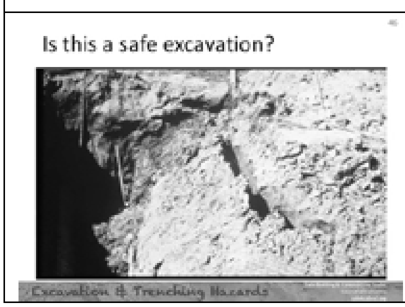
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

Very difficult to get out of a trench with these conditions!



Slide 46—Is this a safe excavation?

Ask the class: Which type of failure looks to be possible here?
Toppling and shear wall collapse.
This is a very unstable and unsafe situation.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

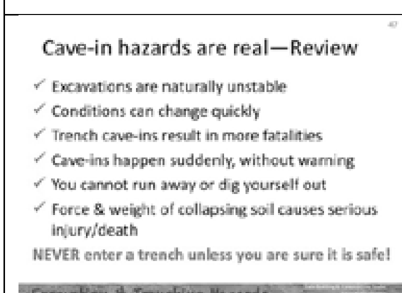
- Case studies
- Case study worksheet

Props:

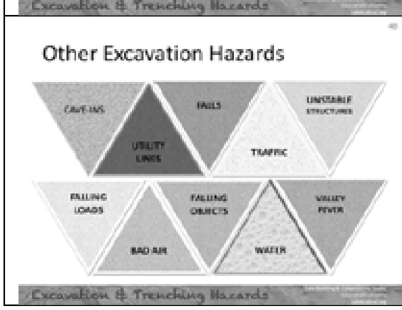
- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 47—Cave-in hazards are real—Review
Wrap up cave-in hazards with a quick review of key points before moving on to other hazards.
Discuss and answer any questions before moving forward to other hazards.



Slide 48—Other Excavation Hazards
Remind the class of the other common hazards to be covered.

Excavation sites are dynamic and busy. There is a combination of heavy equipment (backhoes, loaders, dump trucks, cement mixers) operating simultaneously in conjunction with workers

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

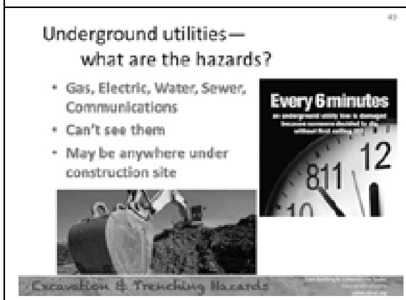
- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

on the ground. Communication between operators and other workers is critical.

In addition to the dangers of cave-ins, workers must also be aware of these potential hazards.



Slide 49—Underground utilities—what are the hazards?
Ask the class: What are underground utilities and why are they dangerous?

*****Click the slide to reveal a list*****

Utility lines and installations can be buried anywhere under a construction site with no indicators on the surface.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Digging without knowing the approximate location of underground utilities can result in damage to gas, electric, communications, water and sewer lines, which can lead to service disruptions, serious injuries and costly repairs. An underground utility line is damaged once every six minutes nationwide because someone decided to dig without first calling 811, according to data collected by Common Ground Alliance (CGA) (link is external).

Part 1—Risks and Hazards
Slides 20-69

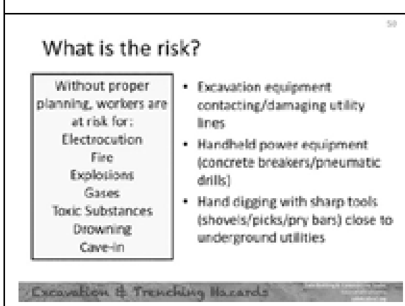
Key points in this section:
- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:
- Case studies
- Case study worksheet

Props:
- Cubic yard/cubic foot models
- Bags of soil

Activities:
- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity

Excavating equipment can also contact overhead power lines causing the ground around the equipment to become energized and electrocute workers in the energized zone.



Slide 50—What is the risk?
Ask the class: What can happen if you contact underground utilities while excavating?

*****Click the slide to reveal a list of dangers*****

Striking an underground line during excavation can expose workers to fire, explosions, electrocution, and inhalation of gases or other toxic substances.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

Even hand digging with power tools or shovels can result in a utility line strike and be deadly.

A broken water line can quickly flood a trench, putting workers at risk for drowning, electrocution, and cave-in.

Ask the class: Has anyone experienced this happening on a job?
Have them explain what happened.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

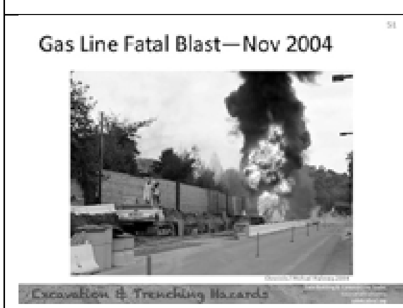
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity



Slide 51—Gas line fatal blast—Nov 2004

This is an actual photo from a tragic accident that occurred in the San Francisco Bay Area several years ago. 5 workers died.

Some of you may remember this excavation accident in Walnut Creek, CA. It all started with a backhoe puncturing a petroleum pipeline and ended in a deadly explosion that killed workers who were welding further down the trench.

The pipeline made a bend that was not indicated on original plans.

<table>
<tr>
<td></td>
<td>

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

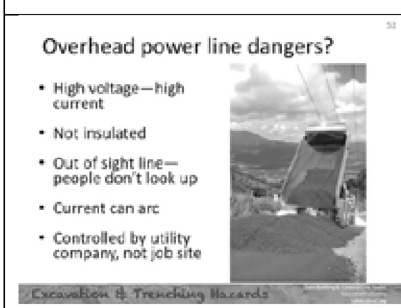
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity

</td>
</tr>
<tr>
<td>



</td>
<td>

Slide 52—Overhead power line dangers?
Ask the class: What are hazards of working around power lines?

*****Click the slide to reveal answers*****

Excavating equipment can also contact overhead power lines causing the ground around the equipment to become energized and electrocute workers on the ground in the energized zone.

The photo shows a dump truck accidentally contacting overhead power lines while spreading a load. You can see the bright white spark at the point of contact.

</td>
</tr>
</table>

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	The electrical energy flowing through the vehicle has caused it to catch on fire (look at the front tires and area under the front of the truck), making it unsafe for the operator to remain in the cab. This is an extremely dangerous situation, as both the equipment and the ground are energized. Often the operator may be safe if they can stay inside the equipment, but laborers working adjacent to the equipment as grade checkers, spotters or flaggers receive a fatal shock.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

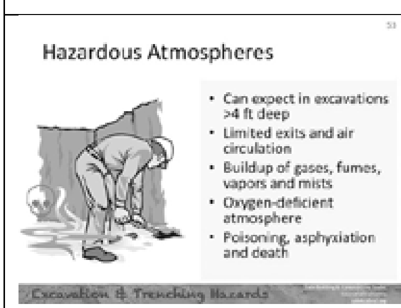
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 53—Hazardous Atmospheres

Even though trenches are open at the top, they have limited exits and air circulation.
Trenches more than 4 feet deep can be like confined spaces.

Heavier-than-air vapors, fumes, mists, or gases can build up in the trench and may travel along the ground resulting in an oxygen-deficient atmosphere. These materials are a breathing hazard and, in some cases, a fire and explosion hazard.

These toxic gases, fumes, vapors can enter and settle in a trench causing poisoning, asphyxiation, death of workers.

Part 1—Risks and Hazards
Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

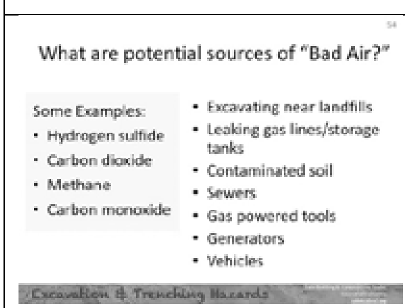
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 54—What are potential sources of "Bad Air?"
Ask the class: What could cause hazardous atmospheres in excavations?

*****Click the slide to reveal answers*****

Hazardous atmospheres could potentially exist in excavations near landfills, sites contaminated by leaking gas lines or storage tanks, in sewers and in other confined spaces.

For example, hazardous gases such as hydrogen sulfide, carbon dioxide and vapors from fuels are heavier than air and can accumulate at the bottom of a trench. Accumulations of gases like methane and carbon monoxide are also dangerous.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Sources may also be outside the trench from gas powered tools and equipment such as generators, vehicles and equipment operating adjacent to the excavation. Workers must also be aware of tools and materials they are using to do work in a trench that can create toxic atmospheres without adequate ventilation. An example is Waterproofers who commonly work below grade in trenches applying sprayed-on emulsions, rubberized asphalt, hot asphalt or coal tar.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

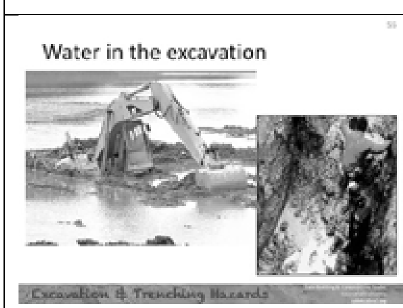
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity



Slide 55—Water in the excavation

Water accumulation in an excavation or trench is a major concern and requires immediate action.

Remember, conditions at an excavation site can change quickly, so workers must always be aware of their surroundings and notify their foreman or supervisor as soon as they recognize a potential hazard.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

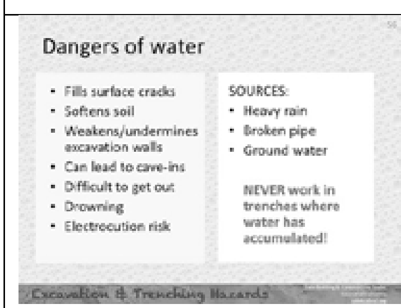
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 56—Dangers of water

Water can fill surface cracks, soften soil and weaken or undermine excavation walls, leading to instability and cave-ins. Additional risks include drowning and electrocution.

Soft soil conditions also make it more difficult to get out. Water allows dirt to move much easier and quicker than it would normally.

Sources may be heavy rain, a broken pipe, ground water. Workers must never work in trenches where water has accumulated.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

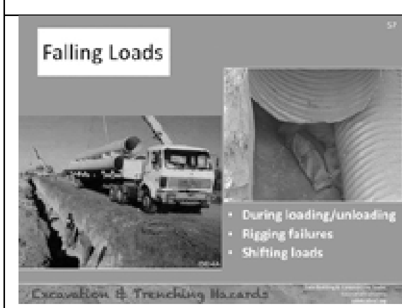
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity



Slide 57—Falling loads
Working under and around loads being handled by lifting or digging equipment is dangerous and must never be allowed.

There's a lot of constant activity around an excavation site. Multiple pieces of heavy equipment operating in the work zone as well as laborers on the ground and in trenches, everybody focused on their work tasks.

It may be easy for the operator to lose sight of workers around their equipment and for workers to be in the excavator's swing radius, under the boom, arm or bucket or in the operator's blind spot.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

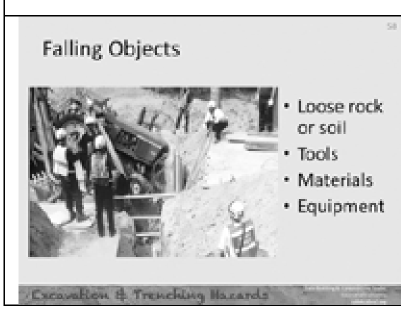
- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

Rigging failures or shifting loads can also result in workers being crushed under the falling material. A broken or improperly rigged sling can kill anyone in its path.

Remember "Struck-by" is one of OSHA's Focus Four Hazards and is a leading cause of worker fatalities.



Slide 58—Falling objects

Ask the class: What has happened in this photo?

Workers in trenches are at risk for being struck by falling objects such as equipment, tools, materials, spoil piles that are located too close to the edge of the excavation.

<table>
<tr>
<td></td>
<td>

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

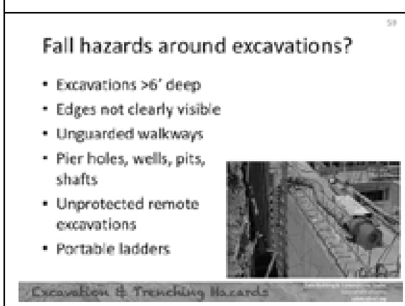
- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

</td>
</tr>
<tr>
<td></td>
<td>

Vehicles and heavy equipment can slide or roll into an un-barricaded excavation.

Loose rock or soil can also fall from excavation walls onto workers in the trench below.

</td>
</tr>
<tr>
<td>



</td>
<td>

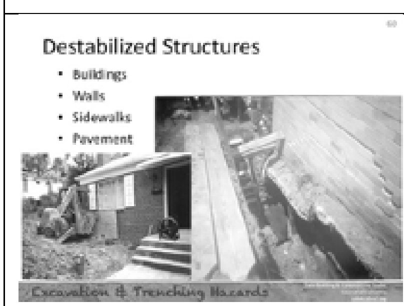
Slide 59—Fall hazards
Ask the class: Where might workers be at risk for falls at an excavation site?

*****Click slide to reveal answers*****

Unprotected walkways where workers and equipment are permitted to cross over excavations pose a risk for falls to a lower level.

</td>
</tr>
</table>

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Trench edges, wells, pits, shafts also create risk for falls. Ladders used to enter and leave a trench may also be a fall hazard if not used properly. Poor housekeeping at the site can lead to tools and materials in the work zone that create tripping hazards. Walkways or bridges where accumulation of water, oils, hydraulic fluid, or dirt are allowed may become a slip/trip/fall hazard.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	**Slide 60—Destabilized Structures** Ask the class: What do we mean by this? Excavation operations can undermine and destabilize adjacent buildings, walls, sidewalks, pavement and roads. If unsupported, these structures can collapse and trap, injure or kill workers. Ask the class: What do you notice in the photos? Is the house supporting the excavator or is the excavator supporting the house?

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	In the photo on the right, a worker has already become partially buried by soil cave-in and the undermined wall of the adjacent structure looks like it is ready to collapse. Notice the crack in the wall. These are very dangerous situations that should never be allowed to happen.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

Slide 61—Exposure to vehicular traffic

Ask the class: What can we say about this scene?
It appears to be on a residential street with no traffic control or barricades.

The individual is too close to the edge of the excavation and is standing in the street with his back to the traffic zone. He is not wearing any high visibility clothing.
Excavation work can expose you to public traffic as well as traffic within the work zone. This is a risk for struck-by accidents.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

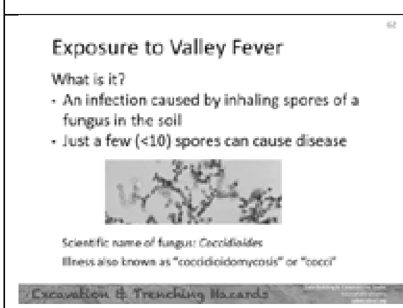
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- v Buzz Group—Identity fixed and variable factors that affect excavation safety
- v Video clip—Slide 25—Example of a trench cave-in
- v Case Study Small Group Activity



Slide 62—Exposure to Valley fever

Ask the class: Has anyone heard of Valley fever before?

So, what is Valley fever exactly?

Click the slide for answer

Valley fever is an infection caused by inhaling the spores of a fungus that lives in the soil. Shown here is the fungus as viewed under a microscope.

*****Click the slide to reveal scientific name for Valley fever*****

The scientific name of the fungus is:
Coccidioides, (pronounced "kok-sid-ee-oy-dees"}

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	And doctors will often refer to Valley fever as: coccidioidomycosis (pronounced "kok-sid-ee-oy-doh-mahy-koh-sis" or cocci (kok-see). We'll just refer to it as Valley fever! We know the fungus that causes Valley fever lives in the soil in certain parts of the Southwestern United States, and that people working outdoors in these areas are at risk. Valley fever is an occupational disease and workers performing dirt-disturbing activities are particularly at risk.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Cases have been increasing, and 2017 had the most cases ever recorded. Construction workers seem to be at particularly high risk, because they often perform tasks or work near tasks that disrupt soil, such as digging or grading. Research shows that the fungus has a spotty distribution in the soil, and currently there are no commercially available and reliable soil or air testing methods. Even if a soil sampling method were available, it would be very difficult to use sampling to determine that a work location is completely free the fungus.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

It's important to note that it doesn't take very much exposure to become infected with Valley fever – inhaling less than 10 of the tiny fungal spores can cause disease.

Slide 63—Region where fungus is found

The fungus that causes Valley fever is found mostly in the southwestern United States.

It thrives in desert-like areas with hot summers and mild winters.

It is especially common in Arizona and in parts of California, and Arizona and California are also the states with most of the cases of Valley fever.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

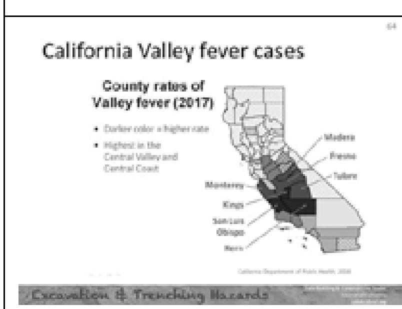
Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

The fungus is also found in Nevada, Utah, New Mexico, and Texas, as well as in Mexico. Recently, it was discovered in eastern Washington state, so public health officials are still learning more about where this fungus lives.



Slide 64—California Valley fever cases
This map from the California Department of Public Health shows the rates of Valley fever cases in California broken out county by county.

It's important to note when looking at this map that medical cases are recorded where patients live, so this map shows where the people diagnosed with Valley fever live, and that's not always the same as where the person became infected.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Because it's difficult to pinpoint precisely where a worker was exposed to the fungus, this is the best way for public health researchers to track and identify cases. For example, the fungus isn't found in San Francisco, but someone living in San Francisco could travel to the Central Valley to work and become infected…and that person would count as a San Francisco case because that is where the person lives. The darker the color, the higher the rate. The Central Valley and the Central coast have the highest rates in the state, and these also account for most of the cases in California.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

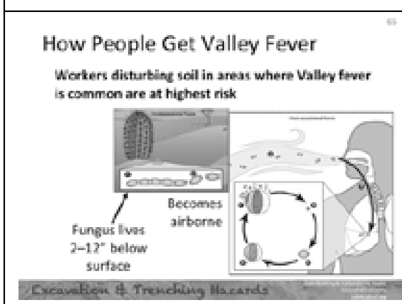
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 65—How people get Valley fever

The fungus that causes Valley fever lives in the soil, and is most commonly found in dry, desert-like environments. For example, it seems to thrive well in the foothills of California's Central Valley.

The fungus lives between about 2 – 12 inches below the surface.

Little strands of the fungus can break off when the soil is disturbed either by digging or by high winds.

*****Click the slide for the next graphic*****

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	These can become airborne, and inhaled by people, especially those near or immediately downwind of digging. It turns out our lungs are a great environment for the Valley fever fungus. The fungus acts like a parasite, dividing and growing in the lungs, sometimes creating nodules in the lungs. In rare cases, it can spread outside of the lungs to other parts of the body like the skin and the tissues that surround the brain and the spinal cord. In these rare cares, Valley fever is fatal without treatment.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	It's important to note that Valley fever doesn't spread from one person to another. Once it's in the lungs, it loses its ability to easily break off in little strands and become airborne. If you've already had Valley fever, your immune system will most likely protect you from getting it again. Some people can have the infection come back again (a relapse) after getting better the first time, but this is very rare.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

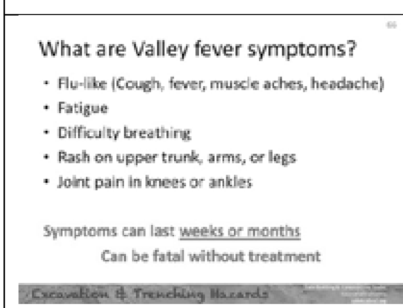
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 66—What are Valley fever symptoms?

How would you know if you had Valley fever?

*****Click slide to reveal symptoms*****

A doctor or other clinician is the only one who can make a Valley fever diagnosis. This diagnosis requires laboratory testing, usually a blood test. Sometimes, multiple blood tests are required—Valley fever is very often not diagnosed on the first visit to the doctor.

The symptoms can be like the flu, and can include a cough, fever, muscle aches, or headache.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	Fatigue is very common, as are respiratory symptoms such as a lingering cough, difficulty breathing, or chest pain. There may also be a rash, or joint pain in the knees or ankles. Unlike the flu, these symptoms can last for weeks or even months. If a worker who has recently been in an area where Valley fever is common becomes ill with symptoms that could be Valley fever, such as difficulty breathing, cough, fatigue, fever, etc., they should inform their supervisor, just like they would for any other work-related injury or illness.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	They should then seek an evaluation from a medical provider as directed by their employer. Remember, Valley fever can only be diagnosed by laboratory testing ordered by a medical provider. It's important for workers to tell the doctor what kind of work they do, what the symptoms are, and that they suspect Valley fever.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

Slide 67—Who is exposed here?

Ask the class: If the fungus that causes Valley fever is in the soil, which of these workers is potentially being exposed? Answer: All of them!

This photo helps show how workers from different trades can be exposed and become sick.

The installation of underground cabling for large solar projects requires digging trenches, and having people working in the trenches. You can see how laborers and electricians working in those trenches can be at face level with that first 2 – 12 inches of soil.

	Part 1—Risks and Hazards **Slides 20-69** Key points in this section: · Many variables affect excavation safety · There are a variety of different hazards at excavations · Trench cave-ins are the greatest risk · Cave-ins happen suddenly without warning · A cubic yard of soil can weigh over 2 tons · Soil collapse happens faster than human reaction time · Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness · Being able to identify risk factors will help workers stay safe on the job · Excavation hazards are controllable Handouts: · Case studies · Case study worksheet Props: · Cubic yard/cubic foot models · Bags of soil Activities: v Buzz Group—Identity fixed and variable factors that affect excavation safety v Video clip—Slide 25—Example of a trench cave-in v Case Study Small Group Activity
	The heavy equipment operators in unenclosed cabs are also exposed. You can also see the uncovered spoils piles and airborne dust. Anyone at this excavation worksite could be exposed to spores, even if they had no duties involving digging or working in trenches. For more information and great resources on Valley fever, search the California Dept. of Public Health website.

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

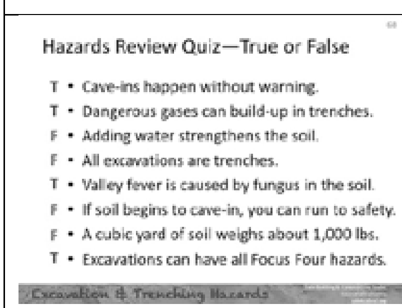
- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity



Slide 68—Hazards Review Quiz—True or False

Ask for volunteers to answer each question.

*****Click on the slide, the correct answers will appear to the left of each bullet point, one at a time with each click*****

Clarify any questions before moving on to the next section.

<table>
<tr>
<td></td>
<td>

Part 1—Risks and Hazards

Slides 20-69

Key points in this section:

- Many variables affect excavation safety
- There are a variety of different hazards at excavations
- Trench cave-ins are the greatest risk
- Cave-ins happen suddenly without warning
- A cubic yard of soil can weigh over 2 tons
- Soil collapse happens faster than human reaction time
- Construction workers may be exposed to other hazards at excavations such as: falls, struck-by, electrical, toxic gases/vapors, and respiratory illness
- Being able to identify risk factors will help workers stay safe on the job
- Excavation hazards are controllable

Handouts:

- Case studies
- Case study worksheet

Props:

- Cubic yard/cubic foot models
- Bags of soil

Activities:

- Buzz Group—Identity fixed and variable factors that affect excavation safety
- Video clip—Slide 25—Example of a trench cave-in
- Case Study Small Group Activity

</td>
</tr>
<tr>
<td>

</td>
<td>

Slide 69—Case Studies—Small Group Activity

This activity looks at real fatality cases and is a great tool to help workers apply what they just learned about excavation hazards to actual situations.

Refer to the directions for doing a Case Study Activity in the Instructor's Guide section of your binder.

Depending upon class size/small group size this activity will take approximately 30-40 minutes to complete.

</td>
</tr>
</table>

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

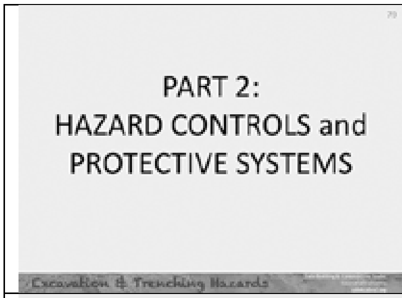
- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

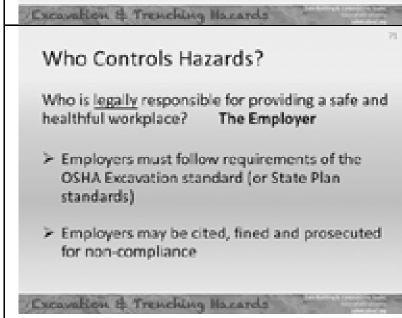
Activities:

- Pass jars of different soil samples around the class
- "Mock Trenching Activity" role play
- Video clip—Slide 110—Rescue media coverage
- Small Group Activity—Rescue Planning



Slide 70—Part 2: Hazard Controls and Protective Systems
Solutions and controls are known for all the hazards we just identified.

This section of our training we will learn what should be in place to keep you safe at excavation jobs.



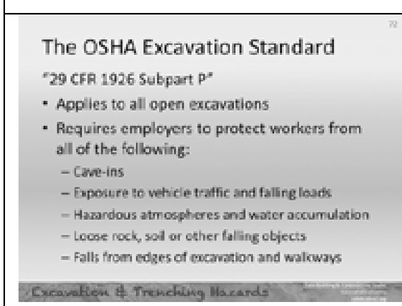
Slide 71—Who controls hazards?
Asks the class: Who is legally responsible for providing a safe and healthful workplace?
Answer: The employer.

We know everyone plays a role in safety on-the-job, but the employer has the responsibility to comply with health and safety laws.

We'll be looking at each of the excavation hazards we just covered and discuss the controls employers must implement to protect you.

OSHA standards have been put in place to protect your health and safety. Workers have a right to a healthy and safe workplace under the law. Controls specified in our federal and state standards are not optional, they are the law.
Employers can be cited and prosecuted for not complying with these standards.

If employers follow all the requirements, we can prevent workers from being injured or killed while doing excavation work.



Slide 72—The OSHA Excavation Standard
29CFR1926 Subpart P
The OSHA standard applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(Remember certain states may enforce their own standards that are more rigorous than OSHA)

Federal and state safety standards for excavations encompass a broad range of requirements and include very specific compliance rules for each requirement.

This class is not intended as compliance training but will cover essential information workers need to know to work safely at an excavation site.

<table>
<tr><td></td><td>

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

Activities:

v Pass jars of different soil samples around the class
v "Mock Trenching Activity" role play
v Video clip—Slide 110—Rescue media coverage
v Small Group Activity—Rescue Planning

</td></tr>
<tr><td></td><td>

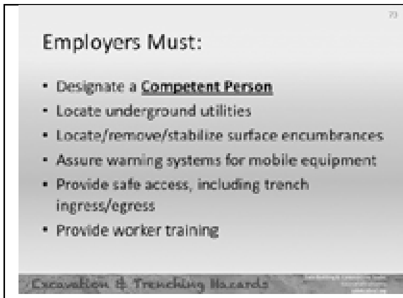
Construction employers MUST protect workers from all the following:

Cave-ins

</td></tr>
</table>

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Exposure to vehicle traffic and falling loads Hazardous atmospheres and water accumulation Loose rock, soil or other falling objects Falls from edges of excavation and walkways

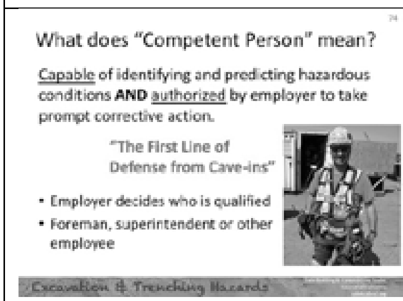
	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	We'll discuss the specific protective systems that are required for each of these hazards in this section of the training.



Slide 73—Employers must:

Employers are also required to:

- Designate a competent person who will fulfill the employer's responsibilities.
- Locate underground utilities before work begins
- Locate, remove or stabilize surface encumbrances and underground installations
- Assure there are warning systems for mobile equipment
- Provide safe means of access, including ingress and egress for trenches
- Provide worker training in how to recognize and avoid hazards.



Slide 74—What does "Competent Person" mean?

Ask the class: Does anyone know what is meant by competent person?

Is anyone a competent person for excavation?

*****Click slide to reveal answer*****

“Competent” means someone who “is capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate or control these hazards and conditions.”

Your employer decides who is qualified to be the competent person at your job site for excavation. This could be a foreman or superintendent or other employee who has sufficient experience and training to perform all the required duties.

Ask: Why is the competent person important to you?

The competent person plays a critical role and is responsible for monitoring the job site and assuring the safety of workers in and around excavation operations.

They are your first line of defense against cave-ins.

Workers must know who the designated competent person at the excavation site is.

This is the "go-to" person if workers recognize a potential hazard or question the safety of a situation.

The key is that the employer has given the competent person the authority to take immediate action. An employee who is

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	trained and can identify excavation hazards but doesn't have the <u>authority</u> to correct them is <u>NOT</u> a competent person.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	If the employer designates a competent person, and that person fails to act because they are not sure the employer will back their decisions, there really isn't a competent person at the site.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Ask the class: Has anyone worked with a competent person on the job? What have you seen them do?

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

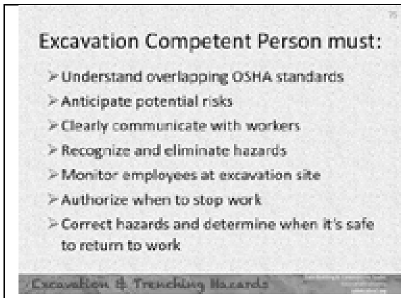
- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

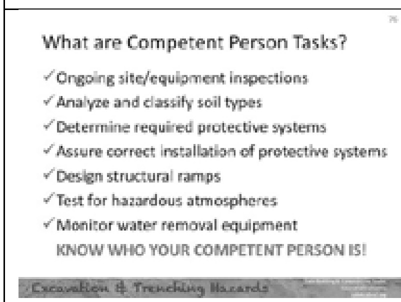
Activities:

- Pass jars of different soil samples around the class
- "Mock Trenching Activity" role play
- Video clip—Slide 110—Rescue media coverage
- Small Group Activity—Rescue Planning



Slide 75—Excavation competent person must:
Being an excavation competent person comes with big responsibility and demands accountability requiring extensive training and broad expertise beyond basic hazard awareness. The competent person must be able to do the following:

- Understand and execute requirements of multiple OSHA standards
- Be proactive and anticipate potential risks
- Clearly communicate with all persons involved in excavation operations
- Recognize and eliminate major hazards including cave-ins
- Monitor employees entering the excavation
- Authorize when to stop work and remove employees from an excavation
- Correct hazards and determine when it is safe for employees to return to work

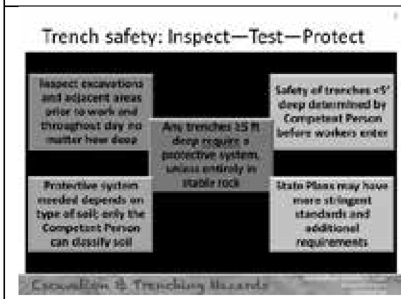


Slide 76—What are competent person tasks?
Ask the class: Can anyone tell us what tasks the excavation competent person performs?

*****Click the slide to reveal the answers*****

This is the person at your job site in control of which protective systems will be used and when and where they need to be implemented.
The competent person is responsible for performing all these tasks:

- Perform ongoing site/equipment inspections
- Analyze and classify soil types
- Determine required protective systems and ensure they are installed correctly
- Test for hazardous atmospheres
- Monitor water removal equipment



Slide 77—Trench safety: Inspect—Test—Protect
Excavation safety requires both pre-planning and ongoing monitoring of the site as work progresses and conditions change.

The excavation site and adjacent areas must be inspected before work even begins to identify potential hazards and locate surface structures or natural features like trees, waterways, rocks that may affect the excavation work.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Ask the class: Has anyone worked on a construction site in a busy urban area? Describe what it was like to work in that environment.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Imagine the amount of pre-planning and coordination required to run an excavation job site in downtown San Francisco!

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Excavations, no matter how deep, must be inspected prior to start of work and ongoing throughout the day, especially if any conditions change.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Special note for workers doing construction in California: there is an additional requirement that employers obtain a permit from Cal/OSHA for any excavation or trenching job 5 feet or deeper into which any person is required to descend. The

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	permit process notifies Cal/OSHA of the existence of high-hazard job sites and gives them the opportunity to promote compliance.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Ask: Who remembers what is the leading cause of excavation fatalities? Trench cave-ins.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Each worker in a trench must be protected from cave-ins according to these rules:

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	· Any trench that is **5 feet deep or deeper** MUST have a protective system unless it is entirely in stable rock.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	· Trenches **less than 5 feet deep** must be inspected by a competent person and they determine if conditions require use of a protective system or, if there is no

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

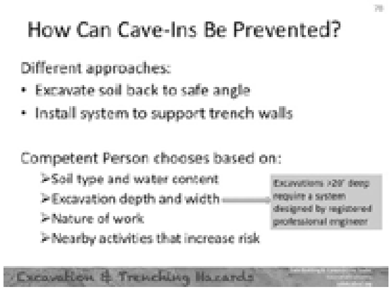
- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

Activities:

- Pass jars of different soil samples around the class
- "Mock Trenching Activity" role play
- Video clip—Slide 110—Rescue media coverage
- Small Group Activity—Rescue Planning

indication of a potential cave-in, it is safe for workers to enter without a protective system.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Remember the competent person is responsible for performing various tests to determine the stability and safety of the site and monitor for potential changes.



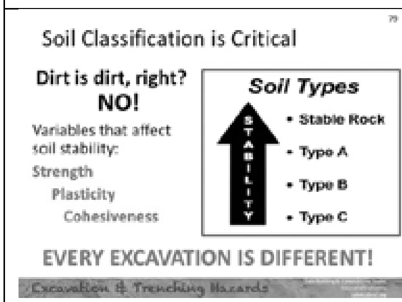
Slide 78—How can cave-ins be prevented?
There are two categories of systems that protect workers from cave-ins:

- Sloping and benching—soil is cut away to a safe angle or stepped back
- Support systems—structures that provide shoring or shielding

The competent person is responsible for determining the appropriate system to protect trenches up to 20 feet deep.

Choosing the proper type of protective system to use depends on factors such as:
Soil type and water content
Excavation depth and width
Nature of the work
Nearby activities that could increase risk

If an excavation is more than 20 feet deep, a registered professional engineer must design protective systems.



Slide 79—Soil classification is critical
Ask the class: Why do you think it is important to know the type of soil being excavated?

Activity: Consider having samples of different soil types in jars and pass them around the class.

Different types of soils vary in strength, plasticity and cohesiveness. These characteristics affect soil stability. The soil characteristics at every excavation, and from point to point at the same excavation, will be different and influence what type of protective system must be used.

The diagram on this slide shows four soil classifications used in the excavation standard and their relative stability.
Ask the class: According to this diagram, which soil type do you think is more stable, Type A or C?
Type A is rated as more stable. Type C is the least stable.

Soil strength is determined by a test that shows how much pressure it takes to collapse a soil sample. The results, referred to as "unconfined compressive strength," are expressed in tons per square foot ranging from 1.5 (high compressive strength) to 0.5 (low compressive strength).

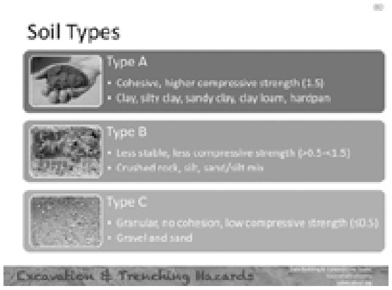
	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Plasticity is a property of soil which allows the soil to be deformed or molded without cracking. Cohesiveness refers to the ability of a soil to hold together.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	For example, clay, or soils with a high clay content are more cohesive and have a higher compressive strength; they don't

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	crumble, can be excavated with vertical side slopes, are plastic when moist and hard to break up when dry.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Whereas coarse grained soils, with little or no clay content, such as gravel, sand or silt have no cohesive strength, lower compressive strength, cannot be molded when moist, and crumble easily when dry.

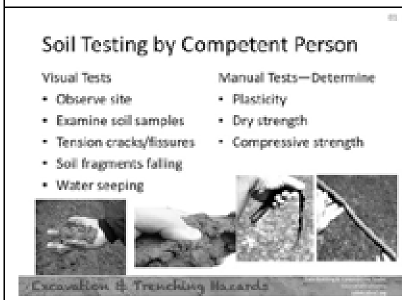
	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	The less cohesive the soil, the greater the protective measures needed to prevent cave-in.

<table>
<tr>
<td>
</td>
<td>Slide 80—Soil types
Here we see descriptions of the three soil types.

Type A is more cohesive and has a compressive strength of 1.5 tons per square foot. Examples of Type A soils are clay, silty clay, sandy clay, clay loam, and hardpan.

Type C soil is more granular, less cohesive and less stable, with a compressive strength of 0.5 or less tons per square foot. Examples of Type C soils are gravel and sand.

Type B soil is less stable than Type A and has a compressive strength greater than 0.5 but less than 1.5 tons per square foot. Crushed rock, silt, and soils that contain an equal mixture of sand and silt are examples of Type B soils.

Stable rock and Type A soils are not often found on construction sites.
Usually common soils at construction sites are Type B or C.</td>
</tr>
<tr>
<td>
</td>
<td>Slide 81—Soil testing by competent person
Performing visual and manual tests and classifying the soil at each excavation site are duties performed by the competent person.

But it is also good for workers to know what to watch for and report any observed changes to the competent person.

The visual tests involve observing the excavation site in general and examining samples of the soil being excavated and the soil forming the sides of the open excavation. They will be observing whether excavated soil clumps or not and look for signs of potential movement like tension cracks, fissures, fragments of soil falling off vertical sides, or water seeping from the sides.

The competent person must also perform a manual test in the field to determine the plasticity, dry strength and compressive strength of the soil being excavated in order to classify soil properly. These can be done using special equipment or by some simple tests shown here.

An excavation cut may pass through different layers of soil. For example, you may have a Type C soil overlaying a Type B or vice versa.</td>
</tr>
</table>

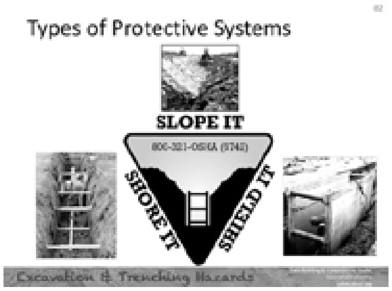
	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Layered soils must be classified and protected from cave-in in accordance with the weakest layer. Often the competent person will treat the excavation as Type C, the worst-case soil.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	By defaulting to protect for the worst-case conditions, they are not required to classify the soil type. Ask: What conditions might affect the soil classification?

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Weather change, rain, water from other sources onsite, heat, cold.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	A single rain shower can turn Type B into Type C soil by causing it to soften. It is critical to pay attention to current conditions.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	If properties, factors or conditions change in any way that may affect classification, the soil must be reclassified as necessary.



Slide 82—Types of protective systems
Ask the class: At what depth does OSHA require a protective system?
In excavations 5 feet deep or deeper.
Ask the class: Are there any exceptions?
Only if it's in stable rock.

Remember…Never enter or work in an unprotected trench that is 5 feet deep or deeper!

There are 3 basic types of protection systems required by OSHA:

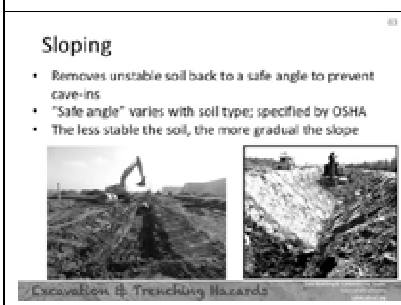
- § Sloping (and benching)
- § Shoring
- § Shielding

You may see any of these in use on the job and you may even be involved in installing them.

Employers choose the most practical design that best fits the site and the nature of the work, and meets the criteria required by the standard.

Factors such as soil type, water content, excavation width and depth, weather and climate, the adjacent area including structures, underground utilities, and other operations in the vicinity all must be considered when choosing the appropriate system.

And all systems have specifications that must be followed to assure proper use with each application.

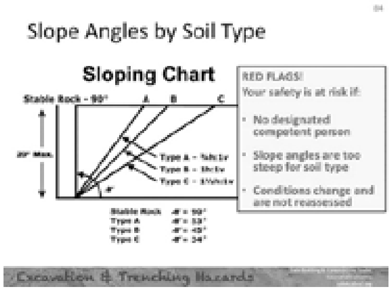


Slide 83—Sloping
Ask the class: Has anyone seen sloping used for excavations?

Sloping cuts back the excavation face/sidewalls on a relatively smooth incline to an angle where the soil is stable.

The angle of incline needed varies with different soil types and current conditions.

Ask the class: Why would soil type matter for sloping?
The less stable the soil, the more gradual the slope must be to prevent cave-ins.



Slide 84—Slope angles by soil type
Ask the class: Which soil type can have a steeper slope and why?
Type A soil because it is the most stable. Type C soil would require a more gradual slope because it is the least stable.

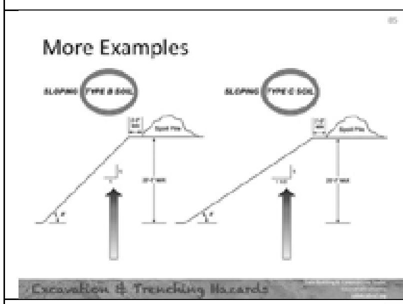
Each type of soil has a "maximum allowable slope" which is the steepest acceptable incline for an excavation face to protect against cave-in.

Angles are indicated by a ratio of the horizontal distance to vertical rise H:V.
The diagram shows the maximum allowable slope for different soil types.

Stable rock is vertical with a 90-degree angle

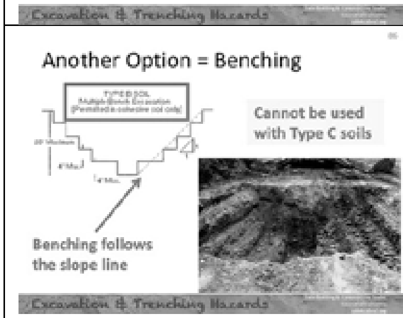
Ask the class: What is the allowable slope angle for Type C?
1-1/2 horizontal to 1 vertical, meaning for every 1 foot of rise there must be 1-1/2 feet of horizontal run.

This sloping chart is an example of the kind of information a competent person must have to assure that sloping is done properly to protect workers.



Slide 85—More examples
Here's another way of looking at slope angles.
This is the type of diagram that can be found in the Excavation standard.

It may seem dry, but it can save your life.

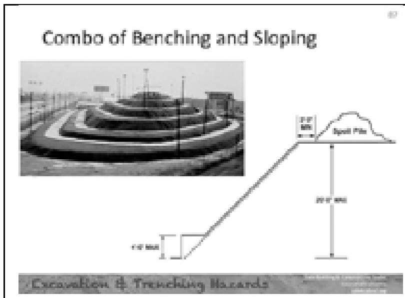


Slide 86—Another option = benching
Benching slants the excavation to a safe angle by cutting a series of steps into the face/sidewalls rather than a smooth slope.

As with sloping, the angles required vary with soil type.

Ask the class: Why do you think benching is not allowed with Type C soils?
They aren't cohesive enough to hold.

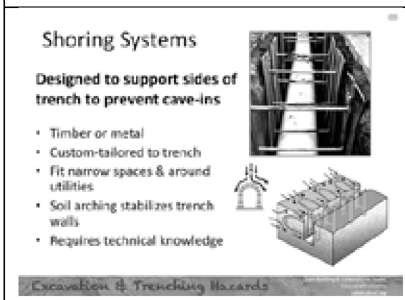
Notice how the slope line is applied to benching for it to be done properly.



Slide 87—Combo of benching and sloping
Using a combination of sloping and benching is allowed so long as it follows specifications in the standard.

Sloping and benching are effective when done properly to OSHA specifications, but they require a lot of open space around the excavation to reach the proper angle.

This may be impractical, especially in urban or residential locations with a lot of surface encumbrances. In these situations, a different protective system will be used.



Slide 88—Shoring systems
Ask the class: Has anyone ever installed a shoring system? What did you have to do?

Shoring systems are made of metal or timber designed to support the sides of a trench and prevent cave-ins.

Shoring is effective and can be custom-tailored to the trench. It can be used in narrow confines and is more easily installed around underground utilities.

But shoring requires a greater technical knowledge to be installed correctly, and these systems are usually not suitable for deeper excavations.

Shoring systems are engineered and rated to handle specific loads for certain soil types.

Shoring manufacturers provide tables and charts, referred to as "tabulated data," used to design and construct a protective system.

Ask the class: What do you think we mean by "soil arching" shown in the diagram on the slide?
When we excavate and remove masses of soil, we disrupt the balance of forces that keep the soil stable. Lateral forces will push toward the face of the cut. Engineers design shoring systems to apply an opposite force by pushing directly on the trench walls. The shoring counters (pushes back) the earth's lateral forces.

Like the way a keystone at the top of an arch transfers the load to the legs of the arch, the positioning of the shoring and crossbraces compresses the soil and the load is transferred to

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	the crossbraces and the gaps between the shores are stabilized.

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

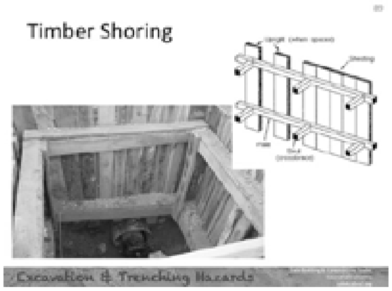
Activities:

- Pass jars of different soil samples around the class
- "Mock Trenching Activity" role play
- Video clip—Slide 110—Rescue media coverage
- Small Group Activity—Rescue Planning

Is it all starting to come together? A lot of thought, planning and technical know-how need to go into having the proper shoring available onsite when it is needed.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Cave-in protection can range from simple shoring installed by one or two workers, to complex engineered systems.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Most trench fatalities occur because employers do not take the time to select and provide protective systems.



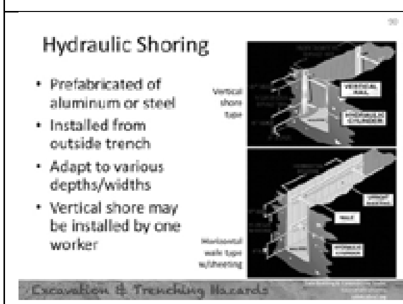
Slide 89—Timber shoring
This photo shows an excavation stabilized by wood timbers. This type of shoring is less common today than metal hydraulic systems.

The diagram shows the main components of a shoring system: uprights or sheeting, wales, and crossbraces (struts). These basic parts are referred to in the same way whether using wood or metal shoring systems.

Uprights or sheeting (commonly made of wood or metal) are placed vertically against the trench wall and distribute the compression force generated by the crossbraces to a wider area on the trench wall. The term "upright" implies that there are gaps between individual planks whereas "sheeting" is an upright system where there are no gaps between planks.

Crossbraces are the horizontal members, which extend perpendicularly to each trench wall. By tightening crossbraces, pressure is applied to the soil in the trench walls. Crossbraces may be wooden, hydraulic, pneumatic or a screw brace (trench jack).

Wales (or stringers) are horizontal members that press against the uprights and distribute the compressive force of a crossbrace to those uprights which do not have their own crossbraces.

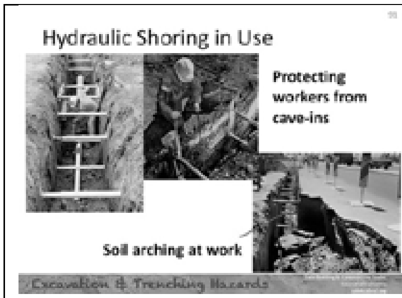


Slide 90—Hydraulic shoring
The trend today is toward the use of hydraulic shoring, a prefabricated strut and/or wale system manufactured of aluminum or steel.

Advantages of hydraulic shoring are that workers do not have to enter the trench to install or remove it. Other advantages of most hydraulic systems are that they:

- Are light enough to be installed by one worker;
- Can be adapted easily to various trench depths and widths.

In stable soils, vertical hydraulic shores may be used directly against the trench face.
In less stable soils they can be used in conjunction with sheeting.



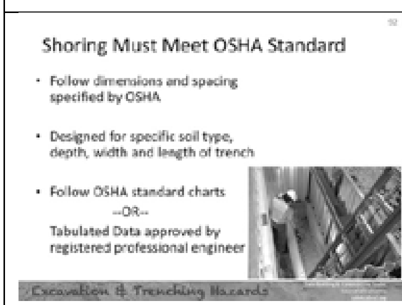
Slide 91—Hydraulic shoring in use
Ask the class: Has anyone helped install hydraulic shoring on the job?
What was it like?

This type of shoring system can be relatively inexpensive and easy for workers to use. The competent person still needs to assure it is being installed correctly.

Hydraulic shores are prefabricated with a hydraulic cylinder acting as the crossbrace. They are used with a gauge-regulated pump, a pump hose with quick connect couplings, and environmentally friendly shoring fluid.

The installer positions the shore at the edge of the trench, connects the pump hose, slides the shore into position in the trench, operates the pump to pressurize the cylinders to the manufacturer's specified level, and disconnects the pump hose from the shore.

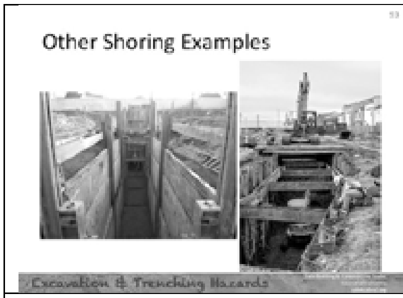
Hydraulic shoring should be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.
Here's an example of soil arching at work.
Notice where the hydraulic shoring system is in place, the trench walls are stable.
The unprotected trench wall has collapsed.



Slide 92—Shoring must meet OSHA standard
The OSHA Excavation standard provides specific guidance for using shoring.

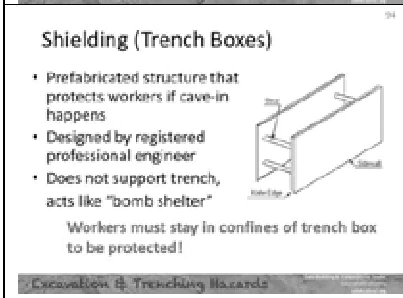
Selecting proper shoring is a duty of the competent person. They rely on OSHA charts and manufacturer's tabulated data to select the right shoring for the soil type, depth, width and length of the trench.

If shoring systems are not selected and installed properly, workers are at risk.



Slide 93—Other shoring examples
These are examples of bigger, engineered shoring systems being used for longer term excavation jobs.

The principles of shoring are still the same.



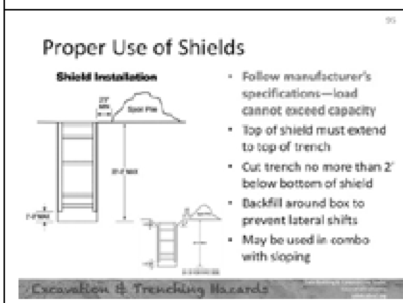
Slide 94—Shielding (trench boxes)
Ask the class: Who has worked inside one of these?
Did you feel safe inside the trench box?
How is shielding different from shoring?

Shields, or trench boxes are box-shaped structures used to protect workers in the event a cave-in happens. They are not intended to provide support for the trench to prevent cave-ins.

Shields must be designed by registered professional engineers.

Workers must stay in the confines of the trench box to be protected. If you move out of the safety of the shield for any reason, you are at risk of injury or death.

Trench shields can be easy to install, portable for use at different job sites, and can be pulled along a trench as an excavation proceeds.



Slide 95—Proper use of shields
Prefabricated shields are engineered and rated to withstand specific loads and stresses and must be used according to the tabulated data provided by the manufacturer. This data must be present at the work site.

The diagram shows what proper installation of a trench box looks like.

Ask the class: Why is it important that the box extends to the top level of the excavation?

To protect workers from soil falling into the trench box. This could occur from a lip slide type collapse or from loose rocks and dirt on the trench walls.

If used in combination with sloping, the shield must extend 18 inches, above trench walls for similar reasons.

The trench may only be dug 2 feet below the bottom of the shield, but the shield must be rated for the total depth. This is to prevent soil from caving out from under it.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	It is also important to backfill around the trench box to prevent lateral movement in the event of a cave-in. For example, lateral movement could pin workers between the shield and a fixed structure in the trench such as a pipe.

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

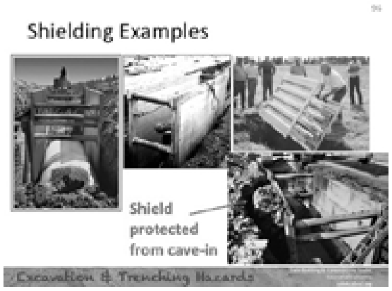
- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

Activities:

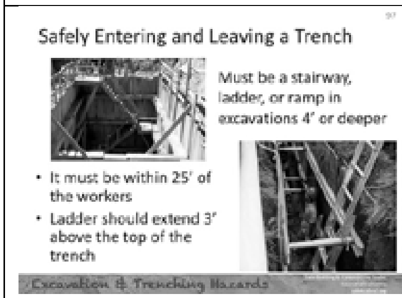
- Pass jars of different soil samples around the class
- "Mock Trenching Activity" role play
- Video clip—Slide 110—Rescue media coverage
- Small Group Activity—Rescue Planning



Slide 96—Shielding examples
Shields come in a big variety of sizes and configurations.
Some are even designed to be stacked for deeper excavations.

Shields are becoming the preferred means of providing worker protection.

Ask the class: Are there any questions about protective systems before we move on?



Slide 97—Safely entering and leaving a trench
A safe means of entering and leaving excavations must be provided for workers.

Ask the class: Is it OK to ride in a loader or backhoe bucket to get in and out of a trench?
NO! Lifting equipment and loaders, buckets and backhoe shovels are NOT safe means of entering/exiting a trench.

Trench excavations 4 feet or more in depth must have a stairway, ladder, ramp, or other means of egress located so that workers require no more than 25 feet of lateral travel to reach the exit.

Ask the class: If a worker can be no more than 25 feet lateral distance from a ladder, how far apart must ladders be spaced in the trench?
50 feet

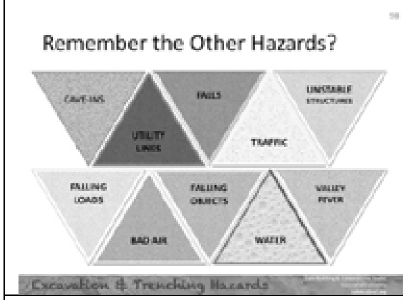
Ladders must also extend 3 feet above the landing surface.

Ramps used for ingress/egress must be designed by a competent person.

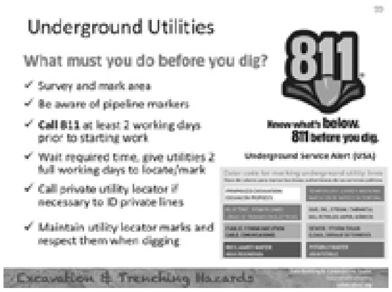
If you are working in a trench, you should never be more than 25 feet away from a ladder or other way out.

*****This point in the training would be a good place to do the optional "Mock Trenching Activity" to take a break from PowerPoint and engage the class in a fun role play. Refer to the directions in the Instructor's Guide section of your course binder for how to conduct this activity*****

-



Slide 98—Remember the other hazards
Review the list of hazards discussed earlier.



Slide 99—Underground utilities
Ask the class: What must you do before you dig?

*****Click slide to reveal answers*****

Prior to starting an excavation, employers must locate underground utility lines.

Look around the excavation site for physical evidence that would indicate the existence of underground utilities (e.g. manholes, valve covers, water meters, fire hydrants, sewer cleanouts, storm drains, vaults, utility maintenance boxes, pole risers, etc.).

Employers are required to mark the proposed excavation area and contact the utility locator service (811) <u>at least 2 days before starting work</u>.

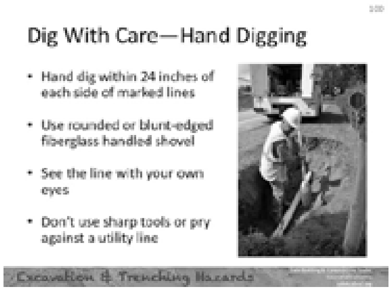
Workers should not begin digging unless this has been done.

USA North 811 accepts notifications for excavation work on public and private property, Military Bases, Indigenous People's Reservations and even waterways.

In some cases, contractors may also need to have a private locator company check for installations that are not covered by members of the 811 network.
Pre-planning for excavation work should include contacting owners, utility companies and public agencies to notify them of the proposed work.

Once the site has been marked with the color codes shown here, it is important to assure that the markings are protected and not damaged by other work at the site.

If you are in doubt about digging near utility lines, talk to your competent person.



Slide 100—Dig with care—hand digging

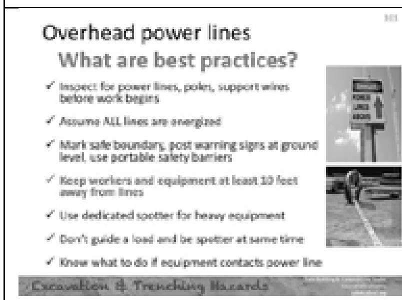
Even though utilities have been marked, the precise locations cannot be certain.

Contractors may do "pot holing" to locate the actual position.

Workers must hand excavate within 24 inches of each side of marked utilities.

Workers need to use extreme caution when digging near utility lines.

Even hand tools can break through insulation on electrical lines and the worker can be shocked. Or they can puncture gas or water lines.



Slide 101—Overhead power lines

Ask the class: What are best practices when working around power lines?

Click slide to reveal answers

Workers and equipment must stay at least 10 feet away from overhead power lines.

Before starting work, always check for power lines, poles and support wires and mark safe boundary areas and post warning signs at ground level where workers can see them easily.

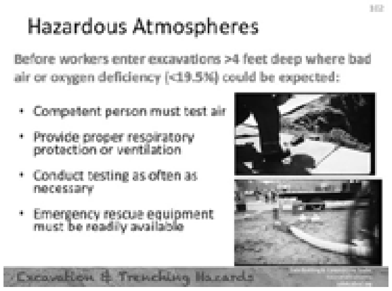
Assume that all lines are energized and potentially dangerous. Notify the utility that controls the line at least two days before beginning work.

The utility company may be able to help by temporarily raising, de-energizing or insulating the lines, or providing visual barriers.

It's important to have a dedicated spotter work with equipment operators to watch out for lines the operator may not be able to see. Dump trucks and excavating equipment can easily contact overhead lines in the swing radius or above where spoils are being dumped. Good coordination and communication with a spotter can avoid this type of accident.

The designated spotter should not also be performing other work (like guiding a load or grade checking) at the same time.

Workers should be trained about electrical hazards and what to do if equipment contacts a power line.



Slide 102—Hazardous atmospheres

Ask the class: Who remembers what we are looking for here?
Answer: Hydrogen sulfide, methane, carbon dioxide, carbon monoxide and other toxic vapors, mists, fumes.

Employees are not permitted to work in hazardous and/or toxic atmospheres.

Ask the class: What must employers do to protect you?

*****Click slide to reveal answers*****

Testing for atmospheric contaminants must be conducted before workers enter the trench and should be done regularly to ensure the trench remains safe.

Ask the class: Who is required to perform this testing?
The competent person.

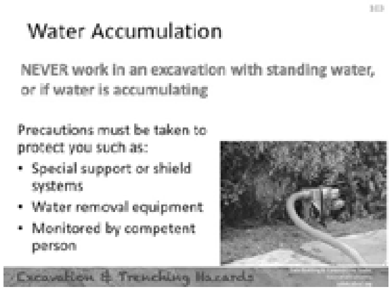
Testing is required where oxygen deficiency (less than 19.5% oxygen), or a hazardous atmosphere exists **or** could reasonably be expected to exist.

The frequency of testing should also be increased if welding, cutting, or burning is done in the trench.

Controls for hazardous atmospheres include ventilation and proper respiratory protection.

Multiple OSHA standards may apply to these situations.
Employees required to wear respiratory protection must be trained, fit-tested, and enrolled in a respiratory protection program.
Some trenches qualify as confined spaces. When this occurs, compliance with the Confined Space Standard is also required.

Emergency rescue equipment (breathing apparatus, safety harness and line or basket stretcher) must be readily available where hazardous atmospheric conditions exists **or** can reasonably be expected to develop.



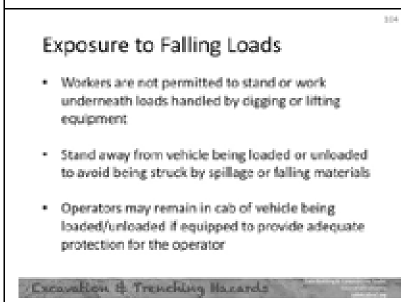
Slide 103—Water accumulation
OSHA standards prohibit employers from allowing workers to enter an excavation where water has accumulated or is accumulating unless adequate precautions are taken to protect workers.

Precautions can include support or shield systems to prevent cave-ins, water removal to control the water level, or a safety harness and lifeline.

The photo shows a trash pump being used to remove water. It's important to pay attention to where the water being pumped out of the excavation is going.

Every situation is different, and the competent person must carefully inspect trenches after each rain event before employees are permitted to re-enter the trench.

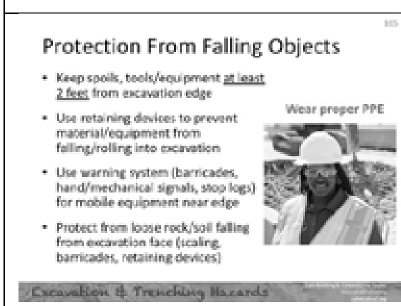
If water removal equipment is used, the competent person must monitor the equipment and operations to ensure proper use.



Slide 104—Exposure to falling loads
Ask the class: True or False It’s okay to stand under the excavator bucket so long as it's just for a few minutes.
FALSE! Employees are not allowed under loads handled by lifting or digging equipment.

Workers must stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials.

You also need to be aware of the excavator's swing area and blind spots.
Don't allow anyone to stand under the boom, arm, or bucket.
And always wear a hardhat.



Slide 105—Protection from falling objects
Workers must be protected from excavated or other materials or equipment falling or rolling inside the excavation.

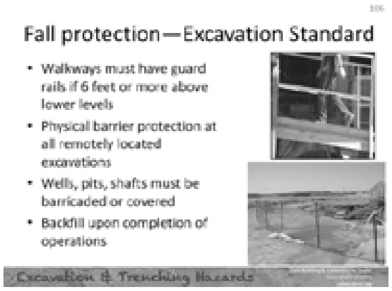
Materials, tools and equipment must be kept at least 2 feet back from the edge of the excavation. This includes the spoil pile.

Other protections include scaling the excavation face to remove loose rock or soil that could fall on workers or installing protective barricades at intervals.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Equipment operators may not have a clear view of the excavation edge. Warning systems like barricades, hand or mechanical signals, or stop logs should be provided.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Never work on faces of sloped or benched excavations at levels above other workers unless the workers at the lower level are protected.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Always wear hardhats, steel-toed boots and safety glasses when working in or around excavations.



Slide 106—Fall protection—Excavation Standard
Ask the class: What must your employer provide?

*****Click slide to reveal answers*****

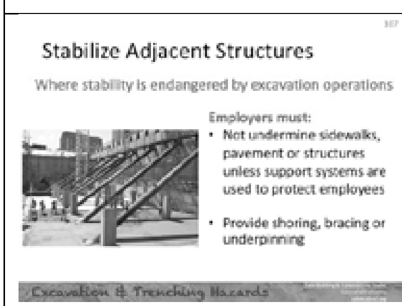
Walkways must be provided where employees or equipment are permitted to cross over excavations.

If the walkways are 6 feet or more above a lower level, they must have guardrails.
Fall protection standards apply at excavation sites.
The general federal OSHA requirement for fall protection involving employees working "around" excavations is actually addressed in OSHA Standard section 1926.501 paragraph (b)(7)(i)of Subpart M, which requires that each employee at the edge of an excavation six (6) feet or deeper be protected from falling by guardrail systems, fences, or barricades, but only when the excavations are not readily seen because of plant growth or other visual barrier.

Walkway surfaces should be kept oil and dirt free and slip resistant to avoid slips and falls.

Adequate physical barrier protection must be provided at all remotely located excavations.
Barricade or cover all wells, pits, shafts.
Backfill as soon as possible.

Portable ladders used to enter and exit the trench could pose a fall hazard. Workers in the excavation site should be trained in ladder safety. Side rails must extend 3 feet above the upper surface of the excavation.
Your employer may have a company policy regarding use of personal fall protection at excavation edges even if it is not required in the OSHA standards. This is something to ask your competent person about at the job site.



Slide 107—Stabilize adjacent structures
If the stability of adjacent buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning must be provided to ensure stability.

Excavation below the level of the base or footing that could pose a hazard is not permitted except when:

- The excavation is in stable rock, or

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

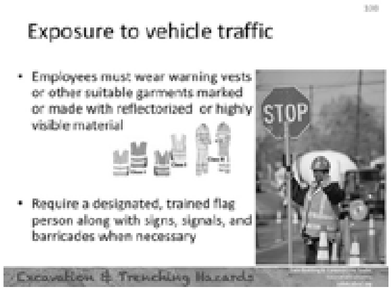
- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

Activities:

- v Pass jars of different soil samples around the class
- v "Mock Trenching Activity" role play
- v Video clip—Slide 110—Rescue media coverage
- v Small Group Activity—Rescue Planning

- Support system (underpinning) is provided, or
- A Registered Professional Engineer approves

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Sidewalks and pavements must not be undermined unless a support system or another method of protection is provided to protect employees from collapse.

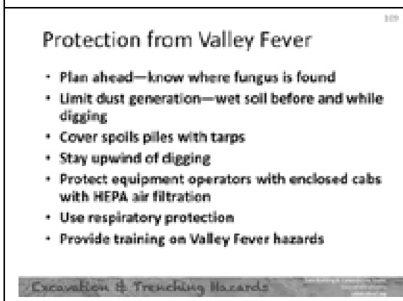


Slide 108—Exposure to vehicular traffic
Excavation sites are busy and have a lot of internal traffic. With excavators, dump trucks and vehicles all active around the site, workers must be as visible as possible to avoid being struck.

The employer must provide high visibility vests or other garments.

High visibility apparel must allow you to contrast from all surroundings.

Workers may also be exposed to public vehicle traffic where there is a need for traffic control including a designated, trained flag person along with signs, signals, and barricades when necessary.



Slide 109—Protection from Valley fever
*****Click the slide to reveal bullet points. There are 7 bullets, each new bullet reveals when you click*****

A key to Valley fever prevention is to plan for this hazard well ahead of the job. First, you need to know when you are working in an area where the fungus is known to live in the soil. Check the state map shown earlier based on where people have developed Valley fever.

You can also ask the property owner and the local health department whether they are aware of previous cases in the area you'll be working.

Valley fever is a hazard that employers should address in their Injury and Illness Prevention Program and have written policies on how they will protect workers from this hazard.

For jobs that involve multiple employers, everyone needs to be fully informed about Valley fever as a possible risk, and their role in Valley fever prevention. General contractors should use contract specifications to inform subcontractors about Valley fever risk and to clarify who will be responsible for doing which aspects of the Valley fever prevention plan. This will ensure that all subcontractors and their employees have been trained and consistently use the same prevention measures.

It's possible to reduce the risk of exposure to Valley fever by designing the job to be safer. Sometimes it's possible to avoid digging at all. One example is a solar farm under construction where wiring is being installed in above-ground trays rather

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

Activities:

- Pass jars of different soil samples around the class
- "Mock Trenching Activity" role play
- Video clip—Slide 110—Rescue media coverage
- Small Group Activity—Rescue Planning

than below-ground trenches that would require digging trenches in the soil with heavy equipment and having electricians working in trenches.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Another option may be to reduce the amount of grading done onsite. Vegetation should be maintained in place wherever possible.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Another way to prevent Valley fever is to use respiratory protection. Respirators can help block the spores that cause Valley fever, the same as they filter out other kinds of particles like silica dust.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	By respirators, we mean NIOSH-approved respirators that will provide a reliable level of protection if the user has been fit tested and properly trained.

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

Activities:

v Pass jars of different soil samples around the class
v "Mock Trenching Activity" role play
v Video clip—Slide 110—Rescue media coverage
v Small Group Activity—Rescue Planning

Bandanas will not protect against the spores that cause Valley fever.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	There are a few options for respirator types, from single-use filtering facepieces to half-mask to powered air purifying respirators, also known as PAPRs. Any of these would be used

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	with particulate filters rated as N95 or P100 (which are also referred to as HEPA filters). Disposable and half-mask respirators provide a similar expected level of protection. PAPRs, which have a motor that

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	brings filtered air into the headpiece, provide a higher level of protection and can also help to cool the wearer.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Since respirator use in hot locations can increase the heat burden on workers, particularly if they are physically active, be sure that workers are part of an effective heat illness prevention program.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	All supervisors and employees should be trained about the hazard posed by Valley fever and the measures that need to be taken to prevent it.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Make sure that any subcontractors are informed about Valley fever risk and are providing the same level of training as your employees get.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Steps should be taken to prevent employees from transporting spores into their trucks and off the jobsite through contaminated clothing and shoes. Provide workers with a clean

Part 2—Hazard Controls and Protective Systems

Slides 70-114

Key points in this section:

- OSHA has standards that specify controls for excavation hazards
- Employers are responsible for assuring compliance with the standards
- The designated Competent Person is responsible for implementing controls at the job site
- Trenches 5-feet or deeper require protective systems
- Soil type is critical to protective system selection
- Sloping/shoring/shielding are common protective systems
- All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard
- Rescue operations for trench cave-ins require advanced planning
- Rescues are extremely dangerous situations
- Rescues often become recoveries due to the amount of time it takes to safely reach the victim

Handouts:

- Sample tabulated data charts for shoring and shielding equipment
- If doing group activities, refer to instructions for each regarding handouts needed

Props:

- Soil samples
- Plastic bins or boxes to create a mock trench scenario
- Safety vests and hard hats for role play
- Sample hydraulic shoring if available from a job site

Activities:

- Pass jars of different soil samples around the class
- "Mock Trenching Activity" role play
- Video clip—Slide 110—Rescue media coverage
- Small Group Activity—Rescue Planning

place to wash up and require them to change out of work clothes at the end of the shift.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	—If showers can't be provided, train employees about the need to shower and wash hair as soon as they get home. —If workers will wear home their boots, provide boot cleaning stations.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	—Also, wet-clean tools and equipment when they’re ready to leave the site.

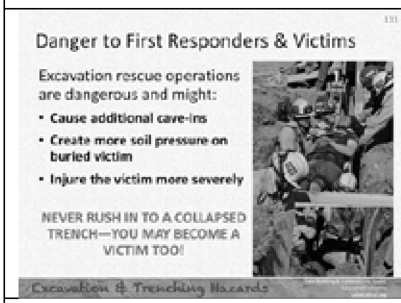
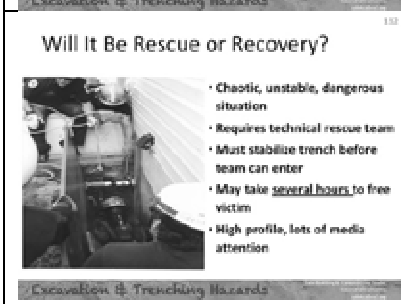
	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Ask the class: Does anyone have any questions about controlling hazards before we move to the next topic?

<table>
<tr>
<td>
</td>
<td>Slide 110—Excavation Rescue

Click the white box on the slide to start short video clip

After watching the video
Ask the class: What do you think the scene of a cave-in would be like? Has anybody been through this experience?

You know your co-worker is trapped, probably injured and unable to breathe.
Time is critical, a speedy rescue could be the difference between life and death for the victim.

The scene will most likely be chaotic and confusing and your first instinct may be to jump into the trench and dig your friend out.</td>
</tr>
<tr>
<td>
</td>
<td>Slide 111—Danger to first responders and victims
But, as we've learned, a collapsed trench is unstable and extremely dangerous.
That instinct to take action to immediately save the victim has tragically turned would-be rescuers into victims themselves.</td>
</tr>
<tr>
<td>
</td>
<td>Slide 112—Will it be rescue or recovery?
Stabilizing a collapsed trench is tricky, technical work and, depending on the type of cave-in, can take from minutes to many long hours to accomplish.

First responders will not enter an unprotected trench.

We learned about all the factors that must be considered in choosing the correct protection system for any given situation. Now imagine trying to do this under the stress of a rescue operation.

Many rescues turn into recoveries because of the time it took to safely access the victim.

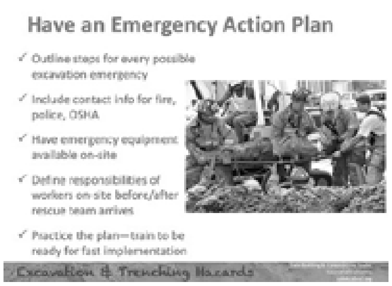
Not all emergency first responders are equipped to deal with this type of accident.
It requires an experienced technical rescue team with the right tools, equipment and training.

As we saw in the video clip, these types of workplace accidents draw a lot of media attention which may add to the pressure at the rescue scene.</td>
</tr>
</table>

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Ask the class: What would best prepare you for a cave-in situation? Have a plan!

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	It is easier to organize and anticipate what needs to be done when there is no panic and emergency.

	Part 2—Hazard Controls and Protective Systems **Slides 70-114** Key points in this section: · OSHA has standards that specify controls for excavation hazards · Employers are responsible for assuring compliance with the standards · The designated Competent Person is responsible for implementing controls at the job site · Trenches 5-feet or deeper require protective systems · Soil type is critical to protective system selection · Sloping/shoring/shielding are common protective systems · All other excavation hazards discussed in Part 1 are addressed specifically in the OSHA Excavation Standard · Rescue operations for trench cave-ins require advanced planning · Rescues are extremely dangerous situations · Rescues often become recoveries due to the amount of time it takes to safely reach the victim Handouts: · Sample tabulated data charts for shoring and shielding equipment · If doing group activities, refer to instructions for each regarding handouts needed Props: · Soil samples · Plastic bins or boxes to create a mock trench scenario · Safety vests and hard hats for role play · Sample hydraulic shoring if available from a job site Activities: v Pass jars of different soil samples around the class v "Mock Trenching Activity" role play v Video clip—Slide 110—Rescue media coverage v Small Group Activity—Rescue Planning
	Small Group Activity—Rescue Planning (Refer to complete directions in the Instructor's Guide section of your course binder)



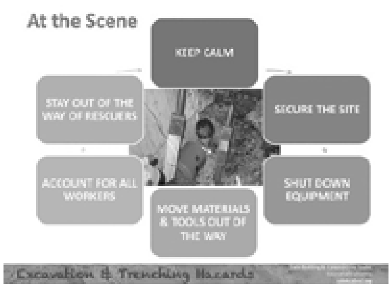
Slide 113—Have an emergency action plan

The best way to avoid panic and confusion is to have a plan in place, train everyone so they know the plan, and practice it to assure everyone knows what to do.

These are some basics that should be in every plan.

Compare this with what the teams came up with in the brainstorm exercise.

Some things to consider are:
What is your crew able to do immediately and what requires outside agencies?
What resources will be available at the site that could be used? (shoring, vacuum truck, barricades, etc.)



Slide 114—At the scene

Review each of the actions listed on the slide:

- Keep calm
- Secure the site
- Shut down equipment
- Move materials and tools out of the way
- Account for all workers
- Stay out of the way of rescuers

Discuss why these are important.

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

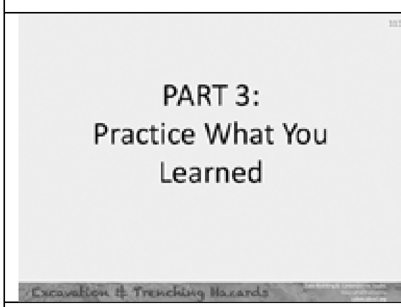
Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

Activities:

- v Small Group Activity—What's Wrong with These Pictures
- v Buzz Group—Name 3 things you learned in this training
- v Post –test answer review
- v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)



Slide 115—Part 3: Practice What You Learned
We've learned a lot about excavation and trenching hazards and controls to keep you safe. Now it's your turn to put the information into use.

Slide 116—What's wrong here?
Ask the class: Are there any safety red flags here?

The next slide points out the problems at this site.

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

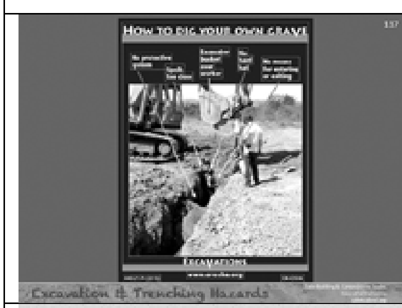
Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

Activities:

- v Small Group Activity—What's Wrong with These Pictures
- v Buzz Group—Name 3 things you learned in this training
- v Post –test answer review
- v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)

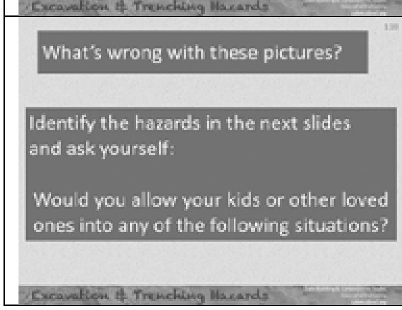


Slide 117—How to dig your own grave

There are 5 problems listed here.

Ask the class: Did you find more than five?

Discuss



Slide 118—What's wrong with these pictures?

In this section we'll be looking at a series of slides with photos of excavation sites. Your job is to assess each scene for hazards and describe what should be done to correct them.

We'll discuss each slide together as a group.

	Part 3—Practice What You Learned **Slides 115-141** Key points in this section: · Photos show several different excavation scenarios where hazards are present · Students apply the information they've learned about hazard identification and hazard controls · Review best practices for workers and employers · Answer any final questions about anything covered in this training · Excavation accidents are preventable Handouts: · (If doing Optional group activity) color hardcopies of slides · Excavation post-test · Training evaluation form Props: Activities: v Small Group Activity—What's Wrong with These Pictures v Buzz Group—Name 3 things you learned in this training v Post –test answer review v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)
	(Alternatively, you could make this section into a longer Small Group Exercise. Break the class into teams of 3-4 students. Give each group a set of color hardcopies made from Slides 119-137. You can break up the 19 slides into smaller sets so that each team is assessing 4-5 different scenes. Working together, each team will list all the hazards they identify for each numbered photo and come up with recommended controls. Allow approximately 20 minutes for the groups to do their assessments. Reconvene the class, resume the PowerPoint show and ask the groups to report back their findings for each slide by number.)

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

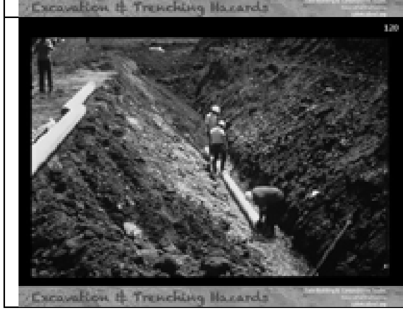
Activities:

- Small Group Activity—What's Wrong with These Pictures
- Buzz Group—Name 3 things you learned in this training
- Post –test answer review
- Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)

-

Slide 119— (no title)

An unsuccessful attempt at sloping a trench.
There are obvious cracks and fissures, the slope on the right side of the trench looks unstable.
Loose clumps of soil that can roll into trench.
Even though this may not be a deep excavation, the slope above the trench could collapse and trap a worker.



Slide 120— (no title)

Slope appears to be 45-degree angle, but possibly Type C soil.
Pipe on edge of trench is a falling object hazard.
Access (ingress/egress) is an issue.
Workers in trench are not protected from cave-in.

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

Activities:

- Small Group Activity—What's Wrong with These Pictures
- Buzz Group—Name 3 things you learned in this training
- Post –test answer review
- Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)

Slide 121— (no title)
Worker is under equipment
No trench protection
Weight of equipment could weaken trench
Public traffic—no barricades

Slide 122— (no title)
No cave-in protection
Water accumulation in bottom of trench
Potential fumes from equipment
No save ingress/egress

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

Activities:

- v Small Group Activity—What's Wrong with These Pictures
- v Buzz Group—Name 3 things you learned in this training
- v Post –test answer review
- v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)

Slide 123— (no title)
No protective system
Spoil pile too close to edge
No ingress/egress
Worker is not wearing PPE

Slide 124— (no title)
No cave-in protection
Water accumulation?
No ingress/egress
Potential hazardous atmosphere?

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

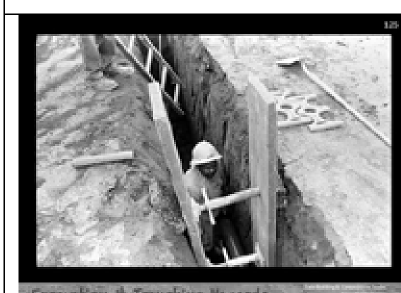
Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

Activities:

- Small Group Activity—What's Wrong with These Pictures
- Buzz Group—Name 3 things you learned in this training
- Post –test answer review
- Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)



Slide 125— (no title)

Not proper shoring, could be scaffolding legs?
Trench is unprotected
Not using tabulated data for proper shoring
Is there a competent person?

Slide 126— (no title)

Bucket riding is not safe access for a trench box
Fall hazard
Caught-in/between hazard

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

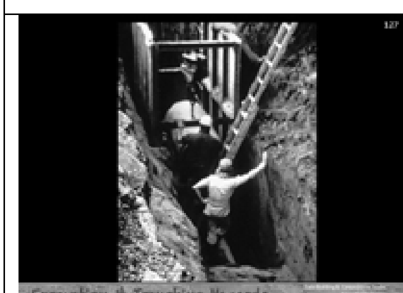
Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

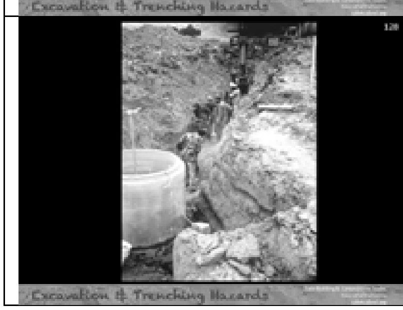
Props:

Activities:

- Small Group Activity—What's Wrong with These Pictures
- Buzz Group—Name 3 things you learned in this training
- Post –test answer review
- Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)



Slide 127— (no title)
Workers outside of trench box in unprotected trench
Ladder is outside of protection
Spoils are too close to edge
Possible overhead hazards?



Slide 128— (no title)
No cave-in protection
Spoils too close to edge
Falling object hazards
No safe ingress/egress
Fumes/vapors in trench?

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

Handouts:

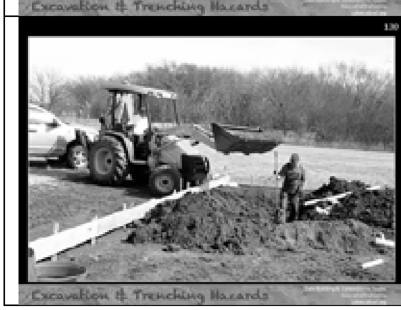
- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

Activities:

- v Small Group Activity—What's Wrong with These Pictures
- v Buzz Group—Name 3 things you learned in this training
- v Post –test answer review
- v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)

Slide 129— (no title)
Cave-in hazard
Too close to equipment, may be out of operator's line of sight
Spoils unsafe
No ingress/egress



Slide 130— (no title)
Worker under load
Out of operator's sight
Operator not wearing seatbelt

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

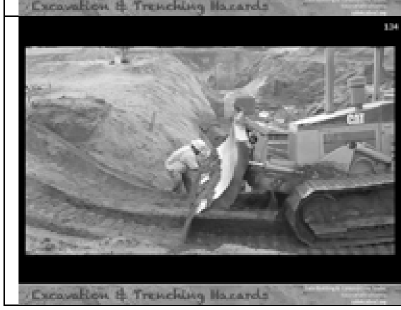
Props:

Activities:

- v Small Group Activity—What's Wrong with These Pictures
- v Buzz Group—Name 3 things you learned in this training
- v Post –test answer review
- v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)

Slide 131— (no title)
Improper use of trench box
Set too deep
Bottom of trench more than 2 feet below bottom of box
Need tabulated data to assure proper rating for trench box

Slide 132— (no title)
No protection on face of excavation
Spoils too close to edge
Equipment too close to edge? Vibration?
Outrigger set close to edge

	Part 3—Practice What You Learned **Slides 115-141** Key points in this section: · Photos show several different excavation scenarios where hazards are present · Students apply the information they've learned about hazard identification and hazard controls · Review best practices for workers and employers · Answer any final questions about anything covered in this training · Excavation accidents are preventable Handouts: · (If doing Optional group activity) color hardcopies of slides · Excavation post-test · Training evaluation form Props: Activities: v Small Group Activity—What's Wrong with These Pictures v Buzz Group—Name 3 things you learned in this training v Post –test answer review v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)
	**Slide 133— (no title)** Trench too deep for trench box Where's the tabulated data? No ladder Fall hazard from edge
	**Slide 134— (no title)** Struck-by hazard, too close to equipment Too close to edge of excavation Sandy, non-cohesive soil?

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

Handouts:

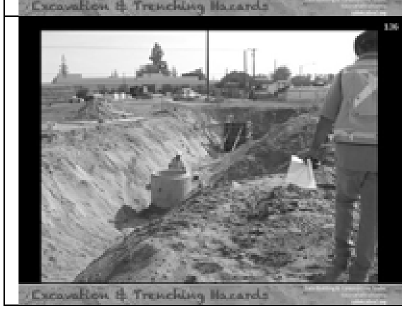
- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

Activities:

- v Small Group Activity—What's Wrong with These Pictures
- v Buzz Group—Name 3 things you learned in this training
- v Post –test answer review
- v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)

Slide 135— (no title)
Overloaded trench box
Mud, water accumulation
Unstable soil



Slide 136— (no title)
Potential confined space inside pipe
Steep slope in sandy soil?
Materials too close to edge
No ingress/egress

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

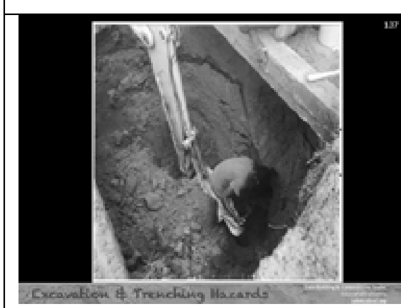
Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

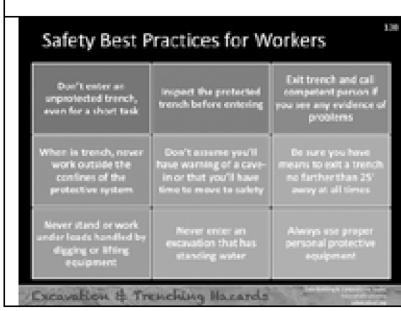
Props:

Activities:

- Small Group Activity—What's Wrong with These Pictures
- Buzz Group—Name 3 things you learned in this training
- Post –test answer review
- Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)



Slide 137— (no title)
No cave-in protection
Undercutting structure?
No PPE
Unsafe edge
Too close to equipment
Disaster!



Slide 138—Safety best practices for workers
Review the information in each box on the slide.
This will be a good place to reinforce the training, review information and clarify any
questions.

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

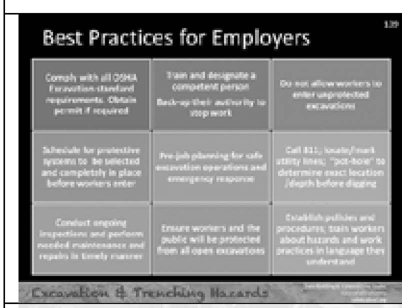
Handouts:

- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

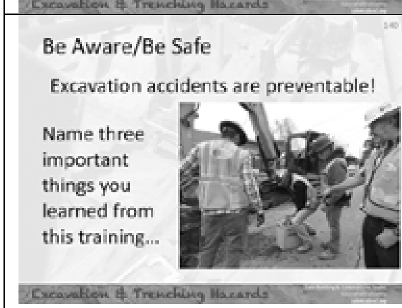
Activities:

- v Small Group Activity—What's Wrong with These Pictures
- v Buzz Group—Name 3 things you learned in this training
- v Post –test answer review
- v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)



Slide 139—Best practices for employers

Now review what employers must do to keep excavations safe.



Slide 140—Be aware/be safe

Ask the class to come up with 3 things they will remember most from this training.

This can even be done as a short 3-5-minute Buzz Group exercise to make it more fun.

Ask trainees to pair up with the person next to them and talk about what they got out of this training.

Part 3—Practice What You Learned

Slides 115-141

Key points in this section:

- Photos show several different excavation scenarios where hazards are present
- Students apply the information they've learned about hazard identification and hazard controls
- Review best practices for workers and employers
- Answer any final questions about anything covered in this training
- Excavation accidents are preventable

Handouts:

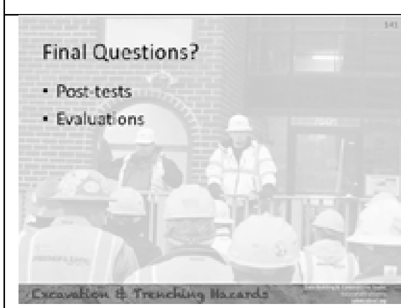
- (If doing Optional group activity) color hardcopies of slides
- Excavation post-test
- Training evaluation form

Props:

Activities:

- v Small Group Activity—What's Wrong with These Pictures
- v Buzz Group—Name 3 things you learned in this training
- v Post –test answer review
- v Complete written training evaluation (alternatively do this verbally with the group and write responses on flip chart)

Go around the room and have teams report back to the class.



Slide 141—Final questions?
Wrap-up the training and handle any final questions or concerns.

Administer Excavation post-test
Review answers to post-test

Students complete written training evaluation forms and give them to instructor.
Or conduct a verbal evaluation of the training with the group and note responses on a flip chart.

Photo Credits

Binder Cover and Curriculum Cover
Courtesy of McGuire and Hester, used with permission

Title Page
Top left—CPWR Construction Solutions
All other photos—Laura Boatman

PowerPoint Slides

Slide #	Credit
#1	Laura Boatman
#5	Left—Laura Boatman Right—OSHA Training Center-Chabot/Las Positas, used with permission
#7, 9, 10	Graphics—Oregon OSHA, used with permission
#11	From "Confined Space—Jordan Barab" credited as 2002 NYT
#18	Map—OSHA website
#21	Top two—Laura Boatman Bottom—CA Department of Public Health
#24	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#25	Video Clip—Oregon OSHA
#26	Google Images "Raiders of the Lost Ark"
#32	Graphic—Oregon OSHA, used with permission
#34	Online—MINI, Ford, Dodge
#37, 38	Graphics—OSHA Technical Manual
#40-43	Graphics—NIOSH
#44-46	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#49	"Every 6 Minutes" Infographic—https://usanorth811.org/
#51	Online—Chronicle
#52	You Tube—no source given
#53	Graphic—Oregon OSHA, used with permission
#55	Left—Oregon OSHA Right—Harwood Grant Material—Construction Advancement Foundation of Northwest Indiana
#57	Left—Oregon OSHA Right—Harwood Grant Material—University of Maryland Fire and Rescue Institute
#58	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#59	eLCOSH—Electronic Library of Construction Occupational Safety & Health
#60	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#61	eLCOSH—Electronic Library of Construction Occupational Safety & Health
#62-65, 67	CA Department of Public Health

Slide #	Credit
#74	eLCOSH—Electronic Library of Construction Occupational Safety & Health
#79	Graphic—Harwood Grant Material—University of Texas at Arlington
#81	Left to Right Washington FACE Report Google Images Harwood Grant Material—University of Maryland Fire and Rescue Institute
#82	Top & Right—Harwood Grant Material—University of Texas at Arlington Left—CPWR Construction Solutions
#83	Left—Laura Boatman Right—Harwood Grant Material—University of Texas at Arlington
#85	Graphic—Harwood Grant Material—University of Texas at Arlington
#86	Graphic—OSHA Technical Manual Photo—Harwood Grant Material—University of Texas at Arlington
#87-88	Harwood Grant Material—University of Texas at Arlington
#89	Graphic—OSHA Technical Manual Harwood Grant Material—University of Maryland Fire and Rescue Institute
#90	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#91	Left—CPWR Construction Solutions Center/Right— Harwood Grant Material—University of Texas at Arlington
#92	OSHA/Speed Shore
#93	McGuire and Hester, used with permission
#94-95	OSHA Technical Manual
#96	Top right—Harwood Grant Material—University of Maryland Fire and Rescue Institute All others— Harwood Grant Material—University of Texas at Arlington
#97	Left— eLCOSH—Electronic Library of Construction Occupational Safety & Health Right—NIOSH
#99	https://usanorth811.org/
#100-101	eLCOSH—Electronic Library of Construction Occupational Safety & Health
#102-103	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#105	CA Department of Public Health
#106	Top—Harwood Grant Material—Construction Advancement Foundation of Northwest Indiana Bottom— Harwood Grant Material—Associated General Contractors
#107-108	eLCOSH—Electronic Library of Construction Occupational Safety & Health
#111	SBCTC Focus Four Harwood Grant
#112	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#113	Online digdifferent.com
#114	Harwood Grant Material—University of Texas at Arlington
#116-117	Oregon OSHA, used with permission
#119	Harwood Grant Material—University of Maryland Fire and Rescue Institute

Slide #	Credit
#120	eLCOSH—Electronic Library of Construction Occupational Safety & Health
#121-122	Oregon OSHA, used with permission
#123-124	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#125	eLCOSH—Electronic Library of Construction Occupational Safety & Health
#126	Google Images
#127	Harwood Grant Material—University of Texas at Arlington
#128	Oregon OSHA, used with permission
#129	Harwood Grant Material—National Safety Council photo courtesy of Construction Safety Council
#130	eLCOSH—Electronic Library of Construction Occupational Safety & Health
#131-132	Harwood Grant Material—University of Maryland Fire and Rescue Institute
#133	Harwood Grant Material—University of Texas at Arlington
#134	OSHA Training Center-Chabot/Las Positas, used with permission
#135	Harwood Grant Material—University of Texas at Arlington
#136	OSHA Training Center-Chabot/Las Positas, used with permission
#137	Google Images
#140	Laura Boatman, courtesy of McGuire and Hester
#141	eLCOSH—Electronic Library of Construction Occupational Safety & Health

CASE STUDY: Day Laborer Buried in Trench Collapse at Private Residence

California FACE report #12CA004

A day laborer died when he was buried in a trench collapse at a private residence. The homeowner hired day laborers to do construction work at her residence, which included digging trenches along the perimeter of the home for drainage. The trench ranged in depth from 6- to 12-feet deep, and measured 2 feet wide and approximately 15 feet long. None of the permits required to excavate the trench had been obtained and the trench had not been inspected or shored. The employees were not given any training in trench safety and shoring procedures.

On the day of the incident, the victim was in the trench loosening the dirt with a pick and shovel. He would then hand the dirt up to another day laborer who moved it to a grassy area of the back yard approximately 20 feet away from the trench. According to the coworker of the victim, the soil appeared to be solid and well packed so they felt that it was safe and did not require any additional support. As the victim continued to dig, the soil side of the trench gave way and quickly engulfed him. The movement of the soil pinned the victim against the house foundation and buried him completely, leaving only part of his hand exposed. The co-worker yelled to the housekeeper to call 911 and then he and another co-worker tried in vain to rescue the victim. The housekeeper called for help and also called the homeowner to inform her of the incident. The fire and police departments arrived on the scene within minutes. The fire department requested the Urban Search and Rescue Unit to respond to the incident scene. The procedure to exhume the victim was extensive and took 12 hours before the victim's body was removed from the trench. The City Community Development Office stated that the homeowner did not file any construction permits or inspection reports for the work being performed at her residence. The firefighter report stated that the soil in the trench was water-saturated, making it less stable than if it were dry.

Cause of Death

The cause of death according to the death certificate was mechanical asphyxia with smothering and compression.

What went wrong in this situation?

How could this incident have been prevented?

This material was produced under grant SH05030SH8 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.

CASE STUDY: Construction Laborer Crushed Under Concrete Patio Foundation

California FACE report #09CA002

A 32-year-old Hispanic construction laborer died after being crushed under a concrete patio foundation. On the day of the incident, the victim and his co-worker were excavating soil around the perimeter of an apartment building to expose the foundation for waterproofing. The corner of the building had a patio deck with a foundation measuring approximately three feet by five feet. The patio foundation was separate from the apartment building foundation. The victim and his co-worker had been instructed that morning by their supervisor to continue excavating the soil around the perimeter of the building foundation. There was no competent person at the work site to evaluate the excavation being done by the victim and his co-worker. The workers had not received formal training on trenching and excavation. The concrete patio foundation was not part of the building foundation and was not supported to prevent it from falling.

At approximately 2:30 p.m., the victim was on his knees under the patio concrete deck using an electric chisel to break away compacted soil against the patio foundation. His co-worker was removing the loosened soil with a shovel. The depth of the excavation at this location was approximately six feet, and it was not shored or sloped. As the co-worker stepped back from the excavation, he witnessed the patio concrete fall on the victim and trap him underneath. A tenant in the building who heard the incident called emergency response. The area was excavated in order to reach the victim. The victim was declared dead at the incident scene.

Cause of Death

The cause of death according to the death certificate was mechanical asphyxia caused by compression of the torso from a large concrete block.

What went wrong in this situation?

How could this incident have been prevented?

This material was produced under grant SH05030SH8 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.

CASE STUDY: Plumber Dies When Trench Collapses

California FACE report #05CA002

A 35-year-old male plumber died when the trench he was working in caved-in around him. The victim was in the trench connecting a residential sewer line to a sewer main when the incident occurred. The site of the incident was a new housing tract where the utilities were being installed. The owner of the company hired the victim based on the backhoe operator's recommendation although he had never met the him. The victim was hired two days before the incident occurred and had not yet been to the company's orientation and safety training.

Their assignment was to install the sewer lines from the houses to the street and connect them to the main sewer line. On the day of the incident, the victim was working with the backhoe operator as a two man crew. The backhoe operator dug a trench from a house to the sewer connection in the street, placing the excavated soil at the edge of the trench. The trench was approximately seven feet deep and three feet wide and was not shored, benched, or sloped. The company had shoring, but it was not available at the job site. According to the company owner, the backhoe operators in his employment usually sloped out the trenches they dug instead of using shoring. The backhoe operator involved in this incident said they had made many connections in the previous two days and that most of the trenches he dug varied in depth from three to six feet and that the soil was hard and compacted. He did not slope or shore any of the trench walls he dug in this subdivision. The area where this particular trench met the main had been dug up before by other utilities, and the soil had not been re-compacted to the same density as the surrounding soil that had not been disturbed.

After the backhoe operator dug seven feet down and exposed the main sewer line, he swung his backhoe bucket out of the trench. While he was swinging the backhoe bucket out of the trench, the victim jumped into the trench to finish digging out the sewer line connection with a shovel. While the victim was in the trench, the walls of the trench collapsed around him and completely buried him. The backhoe operator jumped off the backhoe and tried to dig the victim out by hand while yelling for help. Several workers in the area responded and dug with him. The paramedics arrived and pronounced the victim dead while he was still entrapped.

Cause of Death

The cause of death, according to the death certificate, was asphyxia.

What went wrong in this situation?

How could this incident have been prevented?

This material was produced under grant SH05030SH8 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.

CASE STUDY: Laborer Dies in Trench Cave-In
California FACE report #95CA017

A 51-year old Hispanic male laborer (victim) died after being trapped in soil up to his neck as a result of a trench that caved-in. The specific job on the day of the fatality involved the digging of a trench to lay 6-inch pipe for a sub-drain system. The major portion of the sub-drain had been laid previously; the trench had originally been dug one month before for this job and refilled. The victim and another laborer were working in the trench, approximately four and one-half feet deep, digging out the bottom of the trench attempting to uncover the sub-drain pipe. Although the plan was to lay the sub-drain pipe over the top of a perpendicular water line, the laborers found it necessary to dig under the water line to install the sub-drain below the line. In the area where the sub-drain was to pass under the water line, the trench had been dug to approximately five and one-half feet deep.

There was water accumulated in the bottom of the trench. The trench wall suddenly began to collapse and the laborers yelled to each other to get out and ran in an attempt to get out of the trench. The cave-in trapped both laborers. The victim was trapped up to his neck. The other laborer was trapped up to his hip, but was able to free himself with the help of several men who were working nearby and escaped with minor injuries.

According to the survivor, about two hours prior to the cave-in, the victim went to the construction foreman and told him that the wall was caving in. Although the sides of the trench were dry, the bottom where the water was standing was beginning to erode. The foreman inspected the site and noted that a 6-inch square chunk of soil 2 feet long had sloughed off the bottom of the trench. The foreman stated that the situation was acceptable and the laborers went back to work.

Cause of Death
Bleeding from the large vein in the chest because of severe bone fractures.

What went wrong in this situation?

How could this incident have been prevented?

This material was produced under grant SH05030SH8 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.

CASE STUDY: 19 Year-Old Laborer Crushed in Trench Collapse

Kentucky FACE report #15KY031

A 19-year-old construction laborer (the victim), a construction foreman, and three other construction laborers were in a parking lot laying sewage pipe in a trench. The trench measured a depth of 12 feet 2 inches and covered an area of 5 feet by 48 feet. A trench box measuring 8 feet deep and covering an area of 2 feet 1 inch by 16 feet had been placed into the trench. The trench box walls were 4 feet 2 inches too short and left the construction laborers vulnerable to a large section of the spoil pile and concrete above.

The two construction laborers were laying sewage pipe in the trench for approximately 6 hours when an above section of the spoil pile and concrete gave way, dumping the majority of the spoil pile into the trench, burying the victim and trapping the other construction laborer from the waist down. Three construction laborers outside the trench witnessed the incident and immediately contacted Emergency Medical Services. While waiting for the EMS to arrive, a worker climbed into the trench and began clearing the debris in an attempt to free the construction laborers. EMS and a special trench rescue team arrived at the scene within eight minutes to begin the rescue and recovery process. The trapped second construction laborer was alert, calm, and responsive throughout the extraction process, while the victim showed no signs of verbal responsiveness and was entirely covered by debris. The trapped second construction laborer was extracted after four and a half hours and transported to a local hospital for treatment, while the victim required two additional hours of extraction and was pronounced dead at the scene.

Cause of Death

Traumatic asphyxia with blunt impact injuries of the head, neck and torso.

What went wrong in this situation?

How could this incident have been prevented?

This material was produced under grant SH05030SH8 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.

CASE STUDY:

23 Year-Old Hispanic Pipe Layer Struck By Bucket Teeth of Excavator

NIOSH In-house FACE report 2003-12

A 23-year-old male Hispanic pipe layer (the victim) died after being struck by the bucket teeth of an excavator (track hoe). The victim, and a crew of four other workers were installing concrete drain pipe alongside a public roadway. The excavator operator was reportedly in the process of extending the trench for the accommodation of another 8-foot section of the pipe. When making the cut, the bucket teeth struck the victim at the right-side chest and neck area, causing nearly immediate fatal injuries. Emergency medical service (EMS) and the local fire department were notified and responded within minutes. The victim was pronounced dead at the scene.

At the time of the incident, the spotter for the excavator was in a man-hole box approximately 80 feet away from the victim and excavator. (Note: The spotter was reportedly "mudding" the box and was not available to spot for the operator, and the foreman was across the road performing other duties). After the pipe was connected and aligned, the operator back filled the trench within two to three feet from the end. Just as this was completed, the victim apparently stepped-up on the pipe just as the operator was reversing the excavator to make the next cut into the soil. The victim was apparently between the bucket and the superstructure of the excavator and was struck during the process.

All of the employees on this five-man crew, except the excavator operator, were Hispanic. None of the Hispanic employees were able to speak, read, or understand English. The company has a safety manual written in English that includes a section/chapter related to trenching. None of the employees received formal safety and health training from this company, or specific training on the safety and health manual – all training was provided on-the-job.

Cause of Death

Blunt trauma to the right neck and chest region.

What went wrong in this situation?

How could this incident have been prevented?

This material was produced under grant SH05030SH8 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.

Training Pre-Test

Name: Date:

Instructor: Location:

1. All excavations are trenches.

6. Cave-ins happen without warning.

   True

   False

7. Soil classifications are:

   (a) Stable rock, A, B, C

   (b) 1, 2, 3, 4

   (c) Rocky or smooth

   (d) Hard or soft

8. What effects on the body can a cave-in have?

   (a) Respiratory distress

   (b) Crush syndrome

   (c) Total body impact

   (d) All of the above

9. Soil can weigh about _________ (fill in the blank) pounds per cubic foot.

   (a) 120

   (b) 400

   (c) 600

   (d) 50

10. No employee shall be permitted underneath loads handled by lifting or digging equipment.

    True

    False

11. According to the OSHA Excavation Standard, employers must do which of the following: (Check all that apply)

    (a) Locate underground utilities prior to starting excavation work

    (b) Designate a competent person

    (c) Locate/remove/stabilize surface encumbrances

    (d) Provide worker training

12. Sliding, toppling, bulging, boiling are all examples of what?

    Ways to stabilize an excavation

    Terms used with trench shoring

    Common ways trenches fail

    Trench collapse rescue techniques

This material was produced under grant SH05030SH8 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.

Training Post-Test

Name: Date:

Instructor: Location:

1. All excavations are trenches.

6. Cave-ins happen without warning.
   True
   False

7. Soil classifications are:
   (a) Stable rock, A, B, C
   (b) 1, 2, 3, 4
   (c) Rocky or smooth
   (d) Hard or soft

8. What effects on the body can a cave-in have?
   (a) Respiratory distress
   (b) Crush syndrome
   (c) Total body impact
   (d) All of the above

9. Soil can weigh about _________ (fill in the blank) pounds per cubic foot.
   (a) 120
   (b) 400
   (c) 600
   (d) 50

10. No employee shall be permitted underneath loads handled by lifting or digging equipment.
    True
    False

11. According to the OSHA Excavation Standard, employers must do which of the following: (Check all that apply)
    (a) Locate underground utilities prior to starting excavation work
    (b) Designate a competent person
    (c) Locate/remove/stabilize surface encumbrances
    (d) Provide worker training

12. Sliding, toppling, bulging, boiling are all examples of what?
    Ways to stabilize an excavation
    Terms used with trench shoring
    Common ways trenches fail
    Trench collapse rescue techniques

This material was produced under grant SH05030SH8 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.

Training Pre/Post-Test Answer Key

1. All excavations are trenches.

10. No employee shall be permitted underneath loads handled by lifting or digging equipment.

    True

11. According to the OSHA Excavation Standard, employers must do which of the following: (Check all that apply)

    (a) Locate underground utilities prior to starting excavation work

    (b) Designate a competent person

    (c) Locate/remove/stabilize surface encumbrances

    (d) Provide worker training

12. Sliding, toppling, bulging, boiling are all examples of what?

    Common ways trenches fail

This material was produced under grant SH05030SH8 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.

Training Evaluation Form

Type of Training: ____

Topic Covered Today: ____

Company/Apprenticeship/Union: ____

Instructor(s):____

Date: _________ **Time:**_________ **Location:** ________________________________

Name: (optional) ________________________________

1. What is one thing you will remember from this training?

2. How useful will this information be to you on-the-job? (Check one)

o Very Useful o Useful o Not Useful o I don't know

3. How would you rate this safety training? (Check one)

o Excellent o Good o Just OK o Boring o Waste of time

4. Will having this training change how you will work around excavation and trenching hazards in the future?

o Yes o Not likely o I'm not sure

If yes, what will you change? ____

5. Additional comments?

____

Thank you for taking the time to complete this evaluation. Your input will be used to improve this program. **Please hand this form back to your Instructor.**

This material was produced under grant SH05030SH8 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.

SELECTED TRENCHING AND EXCAVATION RESOURCES

WEBSITES/ORGANIZATIONS

OSHA

https://www.osha.gov/

OSHA has issued new compliance assistance resources on working safely in trenches, including an updated QuickCard in English and Spanish, and a video, "5 Things You Should Know to Stay Safe in a Trench," that highlights proven safety measures that can eliminate hazards and protect workers. In addition, OSHA has also issued an updated National Emphasis Program on trenching and excavation safety.

Trenching and Excavation page
https://www.osha.gov/SLTC/trenchingexcavation/
Includes tons of links to many OSHA and OSHA partner materials

Trenching and Excavation Safety
https://www.osha.gov/Publications/osha2226.pdf
This booklet highlights key elements of OSHA's excavation and trenching operations standards and describes safe work practices that can protect workers from cave-ins and other hazards.

Trenching and Excavation eTool (part of the OSHA Focus 4)
English
https://www.osha.gov/SLTC/etools/construction/trenching/mainpage.html
Spanish
https://www.osha.gov/SLTC/etools/construction_sp/trenching/mainpage.html
Information on the following hazards and ways to avoid them:

- No Protective System
- Failure to Inspect Trench and Protective Systems
- Unsafe Spoil-Pile Placement
- Unsafe Access/Egress

NIOSH

https://www.cdc.gov/niosh/

Trenching and Excavation
https://www.cdc.gov/niosh/topics/trenching/
Includes links to a number of NIOSH publications on trenching and excavation

NIOSH FACE Reports on fatalities due to confined space incidents
https://wwwn.cdc.gov/NIOSH-FACE/Default.cshtml?state=ALL&Incident_Year=ALL&Category2=0004&Submit=Submit

- State FACE Reports from Cooperative State partners on fatalities due to confined space incidents
  https://wwwn.cdc.gov/NIOSH-FACE/Default.cshtml?Category=0004&Category2=ALL&Submit=Submit

Cal/OSHA

https://www.dir.ca.gov/dosh/

Trenching Safety: Tailgate/Toolbox Topic
https://www.dir.ca.gov/dosh/dosh_publications/tb_trench.pdf

CPWR

https://www.cpwr.com/

The Center for Construction Research and Training (CPWR) is a non-profit organization created by the Building and Construction Trades Department, AFL-CIO. CPWR is an international leader in applied research, training, and service to the construction industry. CPWR also serves as the National Construction Center for the National Institute for Occupational Safety and Health (NIOSH).

Strategies to Prevent Trenching-Related Injuries and Deaths
https://www.cpwr.com/publications/strategies-prevent-trenching-related-injuries-and-deaths

Practice Trench Safety. It Saves Lives. Infographic. 2018.
English
https://www.cpwr.com/sites/default/files/publications_handouts-and-toolbox-talks_infographics_trench-safety-infographic.pdf
Spanish
https://www.cpwr.com/sites/default/files/publications_handouts-and-toolbox-talks_infographics_trench-safety-infographic-spanish.pdf

Trenches – Hazard Alert
https://www.cpwr.com/sites/default/files/publications/TrenchingPDFforweb.pdf

eLCOSH

http://www.elcosh.org/index.php

Trenches & Excavations search
http://elcosh.org/en/index.php?and_filters%5B%5D=24&module=Search&search_query=trench

The Electronic Library of Construction Occupational Safety and Health (eLCOSH.org) was developed to provide accurate, user-friendly information about safety and health for construction workers, employers, researchers and others from a wide range of sources worldwide. There are around 190 resources listed here. eLCOSH was developed and is maintained by CPWR.

Oregon OSHA

https://osha.oregon.gov/Pages/index.aspx

Excavation web page
https://osha.oregon.gov/Pages/topics/excavation.aspx
Includes links to publications and trainings.

OSHA Training Institute Education Centers – Chabot-Las Positas Community College District

https://osha4you.com/resources/excavation-and-trenching
An entire web page of free resources including links to OSHA excavation citations, Harwood grant presentations and materials, excavation hazard pictures, and more.

FACTSHEETS/CHECKLISTS/TOOLKITS

Excavation Assessment Form
-Virginia Tech
https://www.ehss.vt.edu/detail_pages/document_details.php?document_id=54

Excavation Safety
-Texas Department of Insurance, Division of Workers' Compensation Workplace Safety
English
https://www.tdi.texas.gov/pubs/videoresource/stpexcav.pdf
Spanish
https://www.tdi.texas.gov/pubs/videoresourcessp/spstpexcav.pdf

Excavation Safety Checklist
-Ohio State University Extension
https://agsafety.osu.edu/sites/agsafety/files/imce/CFAES%20Excavation%20checklist.pdf

Excavation, Trenching and Shoring Safety
-AFSCME
https://www.afscme.org/news/publications/workplace-health-and-safety/excavation-trenching-and-shoring-safety
Includes 7 chapters which could each be used individually as factsheets.

Keeping Workers Safe During Trenching and Excavation
- American Society of Safety Professionals (formerly ASSE)
https://www.assp.org/news-and-articles/2018/08/14/keeping-workers-safe-during-trenching-and-excavation

Preventing Worker Deaths from Trench Cave-ins
-NIOSH
English
https://www.cdc.gov/niosh/docs/wp-solutions/2011-208/default.html
Spanish
https://www.cdc.gov/spanish/niosh/docs/wp-solutions/2011-208_sp

Safety Checklist for Trenching and Excavation
- University of Arizona Risk Management Services
https://risk.arizona.edu/sites/risk/files/safetychecklist-trenching-excavation.doc

Trenches and Excavations
- LIUNA
https://www.lhsfna.org/index.cfm/occupational-safety-and-health/trenches-and-excavations/#tabs-1
Includes a description of the hazards as well as links to regulatory issues, resources, and articles.

Trenching and Excavation
-ASCME
https://www.afscme.org/news/publications/workplace-health-and-safety/fact-sheets/pdf/Trenching-Excavation-AFSCME-fact-sheet.pdf

Trenching and Excavation Safety
-OSHA
https://www.osha.gov/OshDoc/data_Hurricane_Facts/trench_excavation_fs.pdf

Trenching and Excavation Safety
- University of Arizona Risk Management Services
https://risk.arizona.edu/trenching-and-excavation-safety

Trenching & Excavation Safety Check List
-University of North Carolina at Chapel Hill
https://tinyurl.com/t-echeck

Trenching and Excavation Safety for Trainers and Supervisors
-Ohio State University Extension
https://ohioline.osu.edu/factsheet/aex-892284
Includes short quiz at bottom

Trenching and Excavation Toolkit
- National Association of Home Builders
https://www.nahb.org/en/research/safety/trenching-excavation-toolkit.aspx

Working Safely in Trenches: An OSHA QuickCard
-OSHA
https://www.osha.gov/Publications/trench/trench_safety_tips_card.pdf

VIDEOS

5 Things You Should Know to Stay Safe in a Trench
-OSHA
https://www.youtube.com/watch?v=lmqLTgKNVQo

Excavation and Trenching Safety (37 min)
-Marco Karr, 2005, OSHA Harwood Grant
https://www.youtube.com/watch?v=GmPSW2cx6n8

Excavation Inspection: Trench Cave In
-Oregon OSHA
https://youtu.be/0wmcD3aM8X4
An OR/OSHA compliance officer happened by this jobsite and caught this cave in on tape. The cave in measured roughly the size of a small car.

Excavations: A Guide to Safe Work Practices
-WorkSafe BC
https://www.worksafebc.com/en/resources/health-safety/videos/excavations/a-guide-to-safe-work-practices

Excavations in Construction/Trenching: Prevention Video (V-Tool)
-OSHA
https://www.osha.gov/dts/vtools/construction/trench_fnl_eng_web.html
In English and Spanish

Excavations, Trenching and Shoring Safety Training Video (20 Min)
-Safety Video Library
https://www.youtube.com/watch?v=gFmsVEsRv94

Trench Soil Classification Video
-Stephen Wright Rescue Manager, FEMA US&R Texas TF1 and Operating Engineers Local 825
https://www.youtube.com/watch?v=ovNJIkJgp4Q

Trenching and Excavation for Electric Utilities
-Video Learning Systems Inc.
https://vividlearningsystems.com/safety-toolbox/safety-tip-video-electric-utilities-trench-and-excavation

Trenching and Excavation Safety
-ETraining
https://www.youtube.com/watch?v=kFOPDH5NTWY

Trenching and Excavation Safety
-NAHB Construction Safety & Health Committee
https://www.youtube.com/watch?v=29lCiaj3OIk

Trench Boxes: Typical Installation Methodology
-Vp Groundforce
https://www.youtube.com/watch?v=O3bjzxULlG0

IMAGES

Excavation Hazard Pictures
-OSHA Training Institute Education Centers, Chabot-Las Positas Community College District
https://osha4you.com/resources/excavation-and-trenching/albumid/624-2
A collection of 67 photos.

Excavation Safety
-Oregon OSHA
Instructor Version
https://osha.oregon.gov/edu/Documents/workshop-materials/1-320i.pdf
Participant Version
https://osha.oregon.gov/edu/Documents/workshop-materials/1-320w.pdf
Includes a lot of diagrams and pictures to illustrate the information.

Excavations: Hazard Recognition in Trenching and Shoring
-Oregon OSHA
https://osha.oregon.gov/OSHARules/technical-manual/Section5-Chapter2.pdf
Includes soil mechanics, determination of soil type, shoring and shielding types, sloping, benching, spoil, competent person, ingress, egress, and other special considerations. Uses diagrams to illustrate these concepts.

Excavations: Safe Practices
-Oregon OSHA
https://osha.oregon.gov/OSHAPubs/2174.pdf
Includes lots of drawings. Has a checklist and a glossary.

REAL LIFE INCIDENTS

19 Year-Old Worker Killed in Baltimore Trench
Jordan Barab. Confined Space. June 6, 2018.
http://jordanbarab.com/confinedspace/2018/06/06/19-year-old-worker-killed-in-baltimore-trench/

Death in the Trench
Jim Morris. Center for Public Integrity. December 14, 2017.
https://apps.publicintegrity.org/the-trench/
Story of Jim Spencer, who died in a trenching accident in 2016. Incudes a brief history of OSHA regulations.

NIOSH FACE Reports on fatalities that occurred due to confined space incidents. Includes the NIOSH fatality investigation report, with detailed analysis of the event and recommendations on ways to prevent future similar occurrences.
https://wwwn.cdc.gov/NIOSH-FACE/Default.cshtml?state=ALL&Incident_Year=ALL&Category2=0004&Submit=Submit
State FACE Reports on confined space fatalities
HTTPS://WWWN.CDC.GOV/NIOSH-FACE/DEFAULT.CSHTML?CATEGORY=0004&CATEGORY2=ALL&SUBMIT=SUBMIT

OSHA EXCAVATION CITATIONS
-OSHA Training Institute Education Centers, Chabot-Las Positas Community College District
https://osha4you.com/resources/excavation-and-trenching/gallerytype/slideshow/itemid/62/albumid/2

CURRICULUM

Excavation and Trenching
-University of Maryland Fire and Rescue Institute
https://www.osha.gov/harwoodgrants/grantmaterials/bytopic/
(scroll down to find this title)
In English and Spanish. Includes checklist, awareness training, instructor's guide, pre and post tests.

Excavation, Trenching and Shoring
-Washington State Department of Labor & Industries
http://www.lni.wa.gov/safety/trainingprevention/online/courseinfo.asp?P_ID=121

Excavation Safety
-Construction Advancement Foundation of Northwest Indiana, Inc.
Presentation
https://www.osha.gov/sites/default/files/2018-12/fy15_sh-27662-sh5_Excavation_Safety.pptx
Pre- post test and answer key
https://www.osha.gov/sites/default/files/2018-12/fy15_sh-27662-sh5_Excavation_Safety_pre-_post-test_and_answer_key.pdf

Excavation Safety
-Oregon OSHA
Instructor Version
https://osha.oregon.gov/edu/Documents/workshop-materials/1-320i.pdf
Participant Version
https://osha.oregon.gov/edu/Documents/workshop-materials/1-320w.pdf
Includes a lot of diagrams and pictures to illustrate the information

Excavation Safety for the Construction Industry
-University of Texas at Arlington
https://www.osha.gov/harwoodgrants/grantmaterials/bytopic/
(scroll down to find this title)

Excavation Safety Workplace Program
-Texas Department of Insurance, Division of Workers' Compensation Workplace Safety
English
https://www.tdi.texas.gov/pubs/videoresource/wpexcav.pdf
Spanish
https://www.tdi.texas.gov/pubs/videoresourcessp/spwpexcav.pdf

Excavations: OSHA 10-Hour Construction Outreach
-OTIEC Outreach Resources Workgroup
https://www.osha.gov/dte/outreach/construction_generalindustry/Excavation.zip

ARTICLES

5 common trenching and excavation safety hazards
-Ferguson Enterprises, Inc. By Billy Stutz
https://www.ferguson.com/content/trade-talk/business-tips/5-common-trenching-excavation-safety-hazards

Excavation and the Competent Person: Training Is Vital For Hazard Prevention
Kenneth Lane. *Modern Contractor Solutions*. March 2010. 42-43.
https://osha4you.com/Portals/0/Excavation%20and%20the%20Competent%20Person%20-%20Modern%20Contractor%20Solutions.pdf

How Trenches Collapse
Joseph Hovanjec
National Projects Engineer (Australia)
https://www.linkedin.com/pulse/how-trenches-collapse-joseph-hovanjec/

OSHA Steps Up Oversight of Trenches and Excavations. January 2019.
LIUNA
HTTPS://WWW.LHSFNA.ORG/INDEX.CFM/LIFELINES/JANUARY-2019/OSHA-STEPS-UP-OVERSIGHT-OF-TRENCHES-AND-EXCAVATIONS/

Safety in the Trenches
Ashley Johnson. *Safety+Health*. August, 2011. 184(2): 32-35.
https://www.safetyandhealthmagazine.com/articles/print/safety-in-the-trenches-4

Shoring Best Practice Guide
Joseph Hovanjec
National Projects Engineer (Australia)
https://www.linkedin.com/pulse/shoring-best-practice-guide-joseph-hovanjec/

Trench Safety-Using a Qualitative Approach to Understand Barriers and Develop Strategies to Improve Trenching Practices.
Flynn MA, Sampson JM.
International Journal of Construction Education and Research. 2012 Jun;8(1):63-79.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4631709/

Trenching and Excavation Safety: Proper Protective Systems, Competent Person Key to Incident Prevention
Kevin Druley. *Safety+Health*. October 2018. 197(4): 114-116.
https://www.safetyandhealthmagazine.com/articles/17490-trenching-and-excavation-safety

"We mean nothing to no one" – Slaughter In the Trenches
Jordan Barab. Confined Space. October 3, 2018.
http://jordanbarab.com/confinedspace/2018/10/03/slaughter-trenches/
OSHA, immigrants, SBCTC, NEP, private construction industry statistics.

What to Expect When OSHA Comes to Call: Guidelines for Handling an Inspection of your Excavation Site.
Ken Lane. *Site Prep*. May/June 2010. 4(4): 16-18.
https://osha4you.com/Portals/0/Site_Prep_Mag_May_2010_Excavation.pdf

MANUALS

Excavations: Hazard Recognition in Trenching and Shoring
-Oregon OSHA
https://osha.oregon.gov/OSHARules/technical-manual/Section5-Chapter2.pdf
Includes soil mechanics, determination of soil type, shoring and shielding types, sloping, benching, spoil, competent person, ingress, egress, and other special considerations. Uses diagrams to illustrate many of these concepts.

Excavations: Safe Practices
-Oregon OSHA
https://osha.oregon.gov/OSHAPubs/2174.pdf
Includes lots of drawings. Has a checklist and a glossary.

Excavations: Hazard Recognition in Trenching and Shoring
-OSHA Technical Manual
https://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html

Excavation, Trenching and Shoring
-University of North Carolina at Chapel Hill
https://ehs.un.edu/manuals/imac/excavation-trenching-and-shoring/

This material was produced under grant SH05030SH8 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.

TRAINING ATTENDANCE SHEET

Training Date: ________________ **Time:** ________ **to** __________

Location: ______________________________ **Instructor:** _______________________ **Translator:** ____________________

Training modules/activities/topics covered in this session: ____

	Print Name	Signature	Company where you work	ü if Manager	ü if Worker	Contact Info: Phone/Email or mailing address
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						

I certify that the information on this page is accurate. ____

(Signature of trainer)

This material was produced under grant SH05030SH8 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.

	Print Name	Signature	Company where you work	ü if Manager	ü if Worker	Contact Info: Phone/Email or mailing address
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						

I certify that the information on this page is accurate. ______________________________

(Signature of trainer - Page 2)

This material was produced under grant SH05030SH8 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.