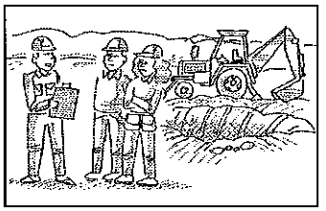


Excavations—An Overview

Overview Of Topic

One of the preventable hazards of construction work is the danger of trench cave-ins. Yet every year there are an estimated 75 to 200 deaths, and more than 1,000 lost work days from trenching accidents. Other hazards associated with trenches include: contact with numerous underground utilities, hazardous atmospheres, water accumulation, and the collapse of adjacent structures.

Causes of trench cave-ins

Several factors contribute to trench cave-ins, each of which should be addressed when considering proper precautions. Soil stability is related to soil type and may be affected by changes in weather. In the spring, unshored trench walls, heavy from rain, can become unstable. Also, when damp soil is exposed to air during excavation, it can dry out and lose the ability to stand on its own, increasing the risk that it will slide into the trench. Other factors, such as proximity to highways, large machinery, backfilled areas, or existing structures, can affect soil stability.

How can workers be protected?

To prevent *cave-ins,* excavations can be shored using timber or other materials. Sides can be sloped to reduce the "overburden" (weight and pressure exerted by large amounts of soil on the sides). Also, shield or trench box systems, manufactured or designed by a qualified engineer, can be used to protect workers.

OSHA requires employers to either slope the sides of excavation walls, use an adequate shoring system (as determined by a qualified engineer), or by equivalent means, such as engineer-designed sheeting or bracing.

OSHA regulations

OSHA completely updated the current standard in March 1990. The rule applies to all open excavations made in the earth's surface, which includes trenches. The regulation is in the construction standards at §1926.650-.652 and covers:

Scope and application—the rule applies to all open excavations made in the earth's surface including trenches.

Specific excavation requirements—including surface hazards, underground utilities, getting in and out of the excavation, traffic hazards, hazardous atmospheres, emergency rescue, inspections, and fall protection.

Requirements for protective systems—each employee in an excavation must be protected from cave-ins by an adequate protective system designed in accordance with either: (1) sloping and benching requirements, or (2) support, shield, or other protective systems. Exceptions would be when:

- Excavations are made entirely in stable rock; or
- Excavations are less than five feet deep and examination of the ground by a competent person provides no indication of a potential cave-in.

The OSHA regulation has five very helpful appendices. They help in: (1) classifying soil types, (2) proper sloping and benching, (3) timber shoring, (4) aluminum hydraulic shoring, and (5) selection of protective systems.

Employee Training

No specific employee training is mentioned in the excavation standard. There are, however, a number of places where "implied" training is required for competent persons and engineers.

However, you must always instruct employees in the recognition and avoidance of unsafe conditions and the regulations applicable to their work environment to control or eliminate any hazards or other exposure to illness or injury.

Training Tips

Situations at excavation sites change rapidly. Use this Toolbox Talk as a reminder of the importance of always being alert to changing conditions, just like a sentry on duty.

Where To Go For More Information

Construction regulatory text: §1926, Subpart P—Excavations

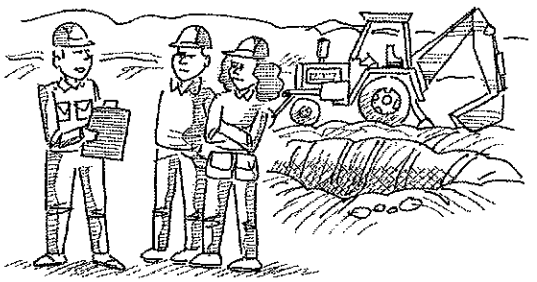
Construction regulatory text: §1926.21(b)(2)—Safety training and education, employer responsibility

KELLER'S CONSTRUCTION TOOLBOX TALKS

Excavations—An Overview

Trench cave-ins can be prevented. Yet every year there are an estimated 75 to 200 deaths and more than 1,000 lost work days per year from trenching accidents.

According to OSHA, your company competent person must inspect all excavations each day for evidence of a situation that could result in: (1) possible cave-ins, (2) indications of failure of protective systems, (3) hazardous atmospheres, and (4) other hazardous conditions. However, if you work in trenches/excavations you should know much of the same information your competent person does. Why? A sudden change could mean disaster for you and fellow workers. Some of the things that could cause an immediate change at an excavation site are:



- A bulldozer or excavator coming too close to your trench could cause a surcharge (overloading) and stress cracks at or near the edge of the trench.
- A sudden downpour could fill the trench or cause rain-soaked soil to give way.
- Accidently striking an underground utility line with a tool could present an immediate electrocution or hazardous atmosphere hazard.

These are just a few of the sudden incidents that need immediate attention and decision-making. That's why the OSHA rules require your company to train you in the recognition and avoidance of unsafe conditions, the regulations applicable to your work environment, and to control or eliminate any hazards or other exposure to illness or injury.

OSHA's excavation rules apply to all open excavations made in the earth's surface including trenches. The regulation is in the construction standards at §1926.650-.652 and covers:

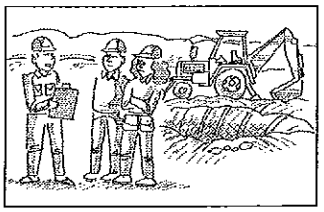
Scope and application—The rule applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

Specific excavation requirements—to include surface hazards, underground utilities, getting in and out of the excavation, traffic hazards, hazardous atmospheres, emergency rescue, inspections, and fall protection.

Requirements for protective systems—The rule says each employee in an excavation must be protected from cave-ins by an adequate protective system designed in accordance with the OSHA regulations for: (1) sloping and benching systems, or (2) support, shield, and other protective systems. Exceptions would be when:

- Excavations are made entirely in stable rock; or
- Excavations are less than five feet deep and examination of the ground by a competent person provides no indication of a potential cave-in.

Excavations are one of the most dangerous places in construction work. Your knowledge of the hazards and a constant vigil could make a life or death difference.



Excavations—An Overview Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Excavations—An Overview at _____ .
(company name)

The session covered:

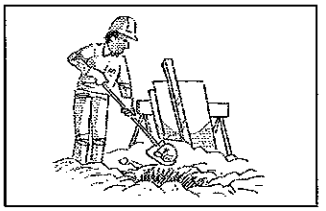
- The causes of trench cave-ins.
- The OSHA provisions to prevent excavation collapses by either sloping or benching the sides of excavation walls, or using an adequate shoring or shield system as determined by a qualified engineer.
- Contents of the OSHA rules.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

_____
Supervisor's Signature



Excavations — Confined Space

Overview Of Topic

The OSHA definition of a confined or enclosed space for construction activities is: (1) limited means of getting out, and (2) is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere [(1926.21(b)(6)].

Normally excavations are not considered confined spaces, they are enclosed areas but are usually subject to natural ventilation. You do not find reference to confined spaces in the excavation rule.

Hazardous atmospheres

However, you do find reference to hazardous atmospheres. Under this provision, a competent person must test excavations where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen), or a hazardous atmosphere:

- Exists, or
- Could reasonably be expected to exist.

The atmospheres in the excavation must be tested before employees enter excavations greater than four feet deep.

Adequate precaution must be taken to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of its lower flammable limit.

Excavations that could raise a red flag as "could reasonably be expected to exist" are excavations in landfill areas, areas where hazardous substances are stored nearby, hazardous waste cleanup sites, trenches next to roads on which traffic is flowing (exhaust may allow carbon monoxide build-up), and underground storage tank digs.

Engineering controls

If hazardous conditions exist, controls such as proper respiratory protection or ventilation must be provided. Ventilation is probably the best and most effective method of abating a hazardous atmosphere. In numerous places throughout the OSHA regulations it says you must engineer or administrate out hazardous atmospheres before resorting to respiratory protection.

Excavations — Confined Space

When controls such as ventilation are used to reduce atmospheric contaminants to acceptable levels, the atmosphere must be tested as necessary to ensure it remains safe.

Rescue operations

Where adverse atmospheric conditions may exist or develop in an excavation, the employer must provide and ensure that emergency rescue equipment (e.g., breathing apparatus, a safety harness and line, basket stretcher, etc.) is readily available. This equipment must be attended when used.

Employee Training

No specific training is mentioned in the Excavation Standard for employees. There is, however, a number of places where "implied" training is required for competent persons and engineers.

Of course, in accordance with the "general" training reference for all construction workers, 1926.21(b)(2), employees must be trained to recognize and avoid unsafe conditions and the regulations applicable to his work environment to control or eliminate the hazards. This is especially true for trenching and shoring activities.

Training Tips

Dwell on what makes an excavation a confined space—hazardous atmospheres. Most excavations do not have a limited means of egress. Evaluate your excavation sites. Are they are subject to adverse atmospheric conditions existing or developing?

Where To Go For More Information

Regulatory text: 29 CFR 1926.650-.652

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility

KELLER'S CONSTRUCTION TOOLBOX TALKS

Excavations — Confined Space

The OSHA definition of a confined or enclosed space for construction activities is: (1) limited means of getting out, and (2) is subject to the accumulation of toxic or flammable gases or has an oxygen deficient atmosphere.

Normally excavations are not considered confined spaces because they are usually subject to natural ventilation. Sometimes, however, excavations qualify as confined spaces if natural ventilation does not occur.

Hazardous atmospheres

Sometimes, you do find hazardous atmospheres in excavations. If so, a competent person must test excavations where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen), or a hazardous atmosphere exists or there is a chance it could exist. If that is the case, the air in the excavation must be tested before you enter any excavation more than four feet deep.

Also, adequate precaution must be taken to prevent your exposure to air containing a concentration of a flammable gas greater than 20 percent of its lower flammable limit.

Excavations that could raise a red flag as "could reasonably be expected to exist" are excavations in landfill areas, areas where hazardous substances are stored nearby, hazardous waste cleanup sites, and underground storage tank digs.

Engineering controls

If hazardous conditions exist, controls such as proper respiratory protection or ventilation must be provided.

Ventilation is probably the best and most effective method of controlling a hazardous atmosphere. In numerous places throughout the OSHA regulations it says you must engineer or administrate out hazardous atmospheres before resorting to respiratory protection.

When controls, such as ventilation, are used to reduce atmospheric contaminants to acceptable levels, the atmosphere must be tested as necessary to ensure it remains safe.

Rescue operations

Where adverse atmospheric conditions may exist or develop in an excavation, the employer must provide and ensure that emergency rescue equipment (e.g., breathing apparatus, a safety harness and line, basket stretcher, etc.) is readily available. This equipment must be attended when used.

Excavations — Confined Space Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Excavations — Confined Space at _____.
(company name)

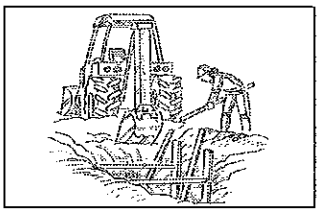
The session covered the following:

- Definition of confined space
- Characteristics of hazardous atmospheres.
- Engineering controls for hazardous atmospheres.
- Rescue operations information.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**



Excavations — Protective Systems

Overview Of Topic

Excavation workers are exposed to many hazards, the chief one being danger of cave-ins. OSHA requires that all excavations, where employees are exposed to potential cave-ins, must be protected by sloping, or benching; timber or aluminum hydraulic shoring of or placing a shield between the side of the excavation and the work area. Employers are free to choose the most practical design approach for a particular circumstance. Once an approach is selected, the required performance criteria for that system must be met.

The standard does not require protective systems when an excavation: (1) is made entirely in stable rock, or (2) is less than 5 feet deep and a competent person has examined the ground and found no indication of a potential cave-in.

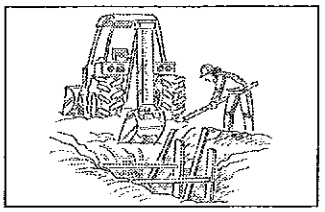
Protective systems

Designing a protective system is complex because of the number of factors involved — soil classification, depth of cut, water content of soil, changes due to weather and climate, or other operations in the vicinity. The OSHA regulations, however, provides several different methods and approaches. Protective systems must be able to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

One method is to slope the sides to an angle not steeper than one and one-half horizontal to one vertical. **A slope of this gradation (for Type C soil) or less is considered safe for any type of soil.**

A second design method, which can be applied for both sloping and shoring, involves using tabulated data, such as tables and charts, approved by a registered professional engineer (RPE).

Contractors may also use a trench box or shield that is either designed or approved, or is based on tabulated data prepared or approved by a RPE. Timber, aluminum, or other suitable materials may also be used. OSHA standards permit the use of a trench shield (also known as a welder's hut) as long as the protection provided is equal to or greater than the protection that would be provided by the appropriate shoring system.



Excavations — Protective Systems

Installation and removal of protective systems

The standard requires the following steps for protecting employees when installing support systems: (1) securely connect, (2) safely install, (3) never overload members, and (4) install other structural members to carry loads imposed on the support system when temporary removal of individual members is necessary.

As soon as work is completed, the excavation should be backfilled as the protective system is dismantled. After the excavation is cleared, workers should slowly remove the protective system from the bottom up, taking care to release members slowly.

Materials and equipment

Employers are responsible for the safe condition of materials and equipment used for protective systems. Defective and damaged materials and equipment can result in the failure of a protective system and cause excavation hazards. If materials and equipment are not safe for use, they must be removed from service. These materials cannot be returned to service without the evaluation and approval of a registered professional engineer.

Employee Training

No specific training is mentioned in the Excavation Standard for employees. There is, however, a number of places where "implied" training is required for competent persons and engineers.

Of course, in accordance with the "general" training reference for all construction workers, 1926.21(b)(2), employees must be trained to recognize and avoid unsafe conditions and the regulations applicable to his work environment to control or eliminate the hazards.

Training Tips

Each time you use this Toolbox Talk demonstrate one of the methods your company uses to protect employees in excavations.

Where To Go For More Information

Regulatory text: 29 CFR 1926.650-.652

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility

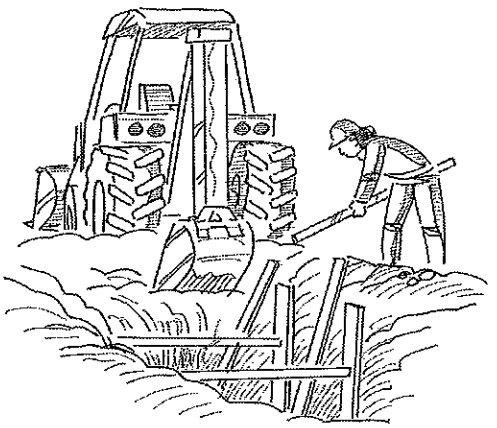
KELLER'S CONSTRUCTION TOOLBOX TALKS

Excavations — Protective Systems

You are exposed to many hazards during a construction work day. If you work in excavations, the chief hazard is the danger of cave-ins.

OSHA requires that all excavations, where employees are exposed to potential cave-ins, must be protected by:

- Proper sloping and/or benching of the sides of the excavation.
- Supporting the sides of the excavation with timber or aluminum hydraulic shoring.
- Placing a shield between the side of the excavation and your work area.



- Employers are free to choose the most practical design approach for a particular circumstance. Once an approach is selected, the required performance criteria for that system must be met.

The standard does not require protective systems when an excavation is:

- Made entirely in stable rock, or
- less than 5 feet deep and a competent person has examined the ground and found no indication of a potential cave-in.

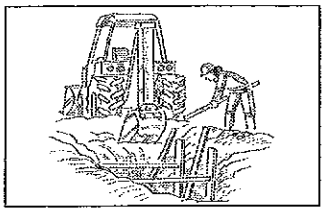
Protective systems—There are many factors involved in designing a protective system. Some of them are: soil classification, depth of cut, water content of the soil, changes due to weather and climate, or other operations at the work site. The OSHA rules provide several different methods and approaches.

Protective systems must be able to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

Installation and removal of protective systems—The following steps are required for protecting employees when installing support systems: (1) securely connect, (2) safely install, (3) never overload members, and (4) install other structural members to carry loads imposed on the support system when temporary removal of individual members is necessary.

As soon as work is completed, the excavation should be backfilled as the protective system is dismantled. After the excavation is cleared, workers should slowly remove the protective system from the bottom up, taking care to release members slowly.

Materials and equipment—Employers are responsible for the safe condition of materials and equipment used for protective systems. Defective and damaged materials and equipment can result in the failure of a protective system and cause excavation hazards.



Excavations — Protective Systems Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Excavations — Protective Systems at _____.
(company name)

The session covered the following:

- Selecting protective systems.
- Types of protective systems.
- Installing and removing protective systems.
- Materials and equipment maintenance.

The space below is for each individual who has been trained on this topic to sign their names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**

Excavations—Rescue Operations

Overview of Topic

Over 50% of the workers who die in confined spaces are attempting to rescue other workers. Unplanned rescue, such as when someone instinctively rushes in to help a downed coworker, can easily result in a double fatality, or even multiple fatalities if there is more than one would-be rescuer.

Construction regulations (1926.651(g)(2)(1)

When your "excavation" competent person determines that hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation, and that excavation is greater than four feet deep, emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, is required to be readily available. This determination is based on the conditions at each jobsite.

Standby person(s) must attend emergency equipment when the determination is made that it is necessary. Constant visual or auditory communication with the person on the inside must be maintained.

In an OSHA Letter of Explanation it was determined that a contractor **cannot** rely on a local rescue squad instead of providing rescue equipment. Many emergency situations associated with the hazards involved with hazardous atmospheres in trenches would normally require an immediate response within a few minutes or even seconds. A rescue squad would be unable to provide the necessary response.

General industry—Permit Required Confined Spaces

Although not a part of the construction regulations you can get some good ideas for your excavation rescue procedures from the OSHA general industry rule at 1910.146-Permit Required Confined Spaces.

Attendants—A confined space attendant must: (1) know the hazards of confined spaces, (2) be aware of behavioral effects of potential exposures, (3) maintain continuous count and identification of authorized entrants, (4) remain outside the space until relieved, and (5) should communicate with entrants as necessary to monitor entrant status.

Attendants also must: (1) monitor activities inside and outside the permit space and order exit if required, (2) summon rescuers if necessary, (3) prevent unauthorized entry into the confined space, and (4) perform non-entry rescues if required.

Attendants may not perform other duties that interfere with their primary duty to monitor and protect the safety of authorized entrants.

An attendant should be assigned to remain on the outside of the confined space and be in constant contact (visual or speech) with the workers inside. The attendant should not have any other duties but to serve as standby and know who should be notified in case of emergency. Attendants should not enter a confined space until help arrives, and then only with proper protective equipment, life lines, and respirators.

Employee Training

No specific training is mentioned in the Excavation Standard for employees. There is, however, a number of places where "implied" training is required for competent persons and engineers.

Of course, in accordance with the "general" training reference for all construction workers, 1926.21(b)(2), employees must be trained to recognize and avoid unsafe conditions and the regulations applicable to his work environment to control or eliminate the hazards. This is especially true for trenching and shoring activities.

Training Tips

Practice is the key with this issue. Everything from psychological aspects (only fools rush in), to using the equipment properly, needs to be gone over and over. In this toolbox talk, stress the importance of training to rescue people.

Where To Go For More Information

Regulatory text: 29 CFR 1926.650-.652.

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility.

Regulatory text 29 CFR 1910.146.

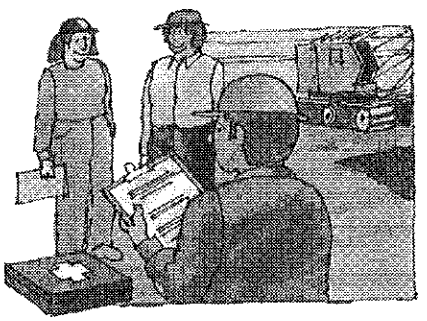
KELLER'S CONSTRUCTION TOOLBOX TALKS

Excavations—Rescue Operations

Over 50% of the workers who die in confined spaces are attempting to rescue other workers. Unplanned rescue, such as when you would instinctively rush in to help a downed coworker, can easily result in a double fatality, or even multiple fatalities if there are more than one would-be rescuers.

OSHA Construction regulations (1926.651(g)(2)(1)

When your "excavation" competent person determines that hazardous atmospheres exist or could reasonably be expected to develop during work in an excavation, emergency rescue equipment must be readily available. This determination is based on the conditions at each jobsite.



Standby person(s) must attend emergency equipment when the determination is made that it is necessary. The standby person must have constant visual or auditory contact with the person in the excavation?

Good work practices for confined spaces

Although not a part of the construction regulations, construction companies can get some good ideas for excavation rescue operations from the following confined space attendant guidelines.

Attendants—A confined space attendant should: (1) know the hazards of confined spaces, (2) be aware of behavioral effects of potential exposures, (3) maintain continuous count and identification of workers that come and go from the excavation, (4) remain outside the space until relieved, and (5) should communicate with workers in the confined space as necessary to monitor their status.

Attendants also should: (1) monitor activities inside and outside the confined space and order exit if required, (2) summon rescuers if necessary, (3) prevent unauthorized entry into the excavation, and (4) perform non-entry rescues if required.

The attendant should not perform other duties that interfere with their primary duty to monitor and protect the safety of authorized workers.

An attendant should be assigned to remain on the outside of the confined space and be in constant contact (visual or speech) with the workers inside. The attendant should not have any other duties but to serve as standby and know who should be notified in case of emergency. Attendants should not enter a confined space until help arrives, and then only with proper protective equipment, life lines, and respirators.

Increase your chances of surviving a "hazardous atmosphere" situation whether working inside an excavation or being an attendant. Don't become a dead hero when you can be a live one. Memorize the procedures.

Excavations — Rescue Operations, Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Excavations—Rescue Operations at _____.
(company name)

The session covered:

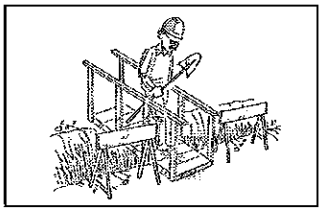
- The construction rules on rescue operations.
- The general industry rule "Permit required confined spaces."
- The duties of an attendant.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

_____
Supervisor's Signature



Excavations—Site Safety

Overview of Topic

Many excavation accidents are a direct result of inadequate initial planning. It is important, before beginning an excavation job, to establish and maintain a safety and health plan for the worksite. This plan should provide adequate policies, procedures, and practices to protect employees from, and allow them to recognize, job-related safety and health hazards. The plan should reflect the unique characteristics of the jobsite.

To be sure safety policies are implemented effectively, there must be cooperation among supervisors, employee groups, including unions, and individual employees. Each supervisor must understand the degree of responsibility and authority he or she holds in a particular area. It is a good idea for contractors to develop safety checklists to make certain there is adequate information about the jobsite and all needed items are on hand.

When preparing checklists, specific site conditions should be taken into account. Some of those are: (1) traffic, (2) nearness of structures and their condition, (3) soil, (4) surface and ground water, (5) the water table, (5) overhead and underground utilities, and (6) weather. Checklists should also incorporate elements of relevant OSHA standards as well as other information necessary for safe operations.

These and other conditions can be determined by a jobsite safety analysis to identify potential hazards, observations, test borings for soil type or conditions, and consultations with local officials and utility companies. It is also important, before beginning work, to provide employees exposed to public vehicular traffic with warning vests or other suitable garments marked with or made of reflectorized or high-visibility material. You must ensure that they wear the safety equipment.

Workers must also be instructed to remove or neutralize surface encumbrances that may create a hazard. In addition, no employee should operate a piece of equipment without first being properly trained to handle it, and fully alerted to its potential hazards.

Equipment inventory

When all the necessary specific information about the job site is assembled, the contractor is ready to determine the amount, kind,

and cost of the safety equipment needed. No matter how many trenching, shoring and backfilling jobs have been done in the past, each job should be approached with the utmost care and preparation.

Competent person

The standard requires that a competent person inspect, on a daily basis, excavations and the adjacent areas for possible cave-ins, failures of protective systems and equipment, hazardous atmospheres, or other hazardous conditions. If these conditions are encountered, exposed employees must be removed from the hazardous area until the necessary safety precautions have been taken. Inspections are also required after natural or man-made events, such as blasting, or heavy rains, that may increase the potential for hazards.

Employee Training

No specific training is mentioned in the excavation standard for employees. There is, however, a number of places where "implied" training is required for competent persons and engineers.

Of course, in accordance with the "general" training reference for all construction workers, 1926.21(b)(2), employees must be trained to recognize and avoid unsafe conditions and the regulations applicable to his work environment to control or eliminate the hazards. This is especially true for trenching and shoring activities.

Training Tips

If this Toolbox Talk is being presented to employees working in excavations, show them your plan for this jobsite. Go over the checklists your competent person uses to inspect excavation safety.

Where To Go For More Information

Regulatory text: 29 CFR 1926.650-.652.

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility.

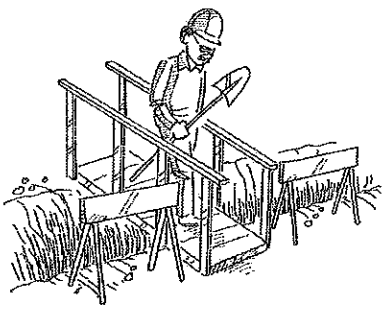
KELLER'S CONSTRUCTION TOOLBOX TALKS

Excavations—Site Safety

All the while your company competent person and site supervisor are planning an excavation, you can just sit back under some shade tree and wait, right? Wrong! Participating in a planned dig, by being a part of the process, can prevent accidents and possibly save your life.

It is a good idea for contractors to develop safety checklists to make certain there is adequate information about the jobsite, and all needed items are on hand. It is also a good idea for you to know and understand the key issues on a trench safety checklist.

Some of those issues are: (1) traffic, (2) nearness of structures and their conditions, (3) soil, (4) surface and ground water, (5) the water table, (5) overhead and underground utilities, and (6) weather.



Checklists should also incorporate elements of relevant OSHA standards as well as other information necessary for safe operations. In fact, it is your employers responsibility to instruct you in the recognition and avoidance of unsafe conditions and the regulations applicable to your work environment.

Your company competent person is responsible for inspecting all excavations, adjacent areas, and protective systems each day for evidence of a situation that could result in: (1) possible cave-ins, (2) indications of failure of protective systems, (3) hazardous atmospheres, and (4) other hazardous conditions.

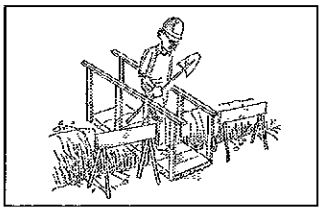
Competent persons are also required to perform these inspections as needed and after every rainstorm or other hazard-increasing occurrence such as blasting.

The thing is, chances are your competent person is not going to be at your excavation the entire work shift. Who does that leave to ensure the jobsite remains safe? If anything goes wrong, you must have the ability to act instantly. That takes training, practice, and most of all alertness. Some other things you should recognize as threats before you even get into a trench are:

- When exposed to public vehicular traffic you must wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.
- Remove or neutralize all surface encumbrances (spoil piles, equipment, etc.) that may create a falling object hazard.
- In addition, no employee should operate a piece of equipment without first being properly trained to handle it, and fully alerted to its potential hazards.

You should also look around for: tension cracks in walls of, slopes of, or ground near the excavation; ground settlement or sinking; changes in wall slope or bulging; increase in strut loads; spalling (breaking off in slabs), or sloughing (crumbling or falling away) of soils; excessive seepage and piping of fine soils; softening of sidewalls; boiling of trench bottom; creaking or popping sounds; and visual deformation of bracing system or trench.

Any of these signs indicates you should not enter a trench, or immediately leave a trench, and report the problem to your supervisor or competent person.



Excavations—Site Safety, Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Excavations—Site Safety at _____.
(company name)

The session covered:

- The purpose for prior planning and site safety checklists.
- Suggestions for things to look for before beginning work and entering an excavation.
- Competent person and employee responsibilities.

The space below is for employee's to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

_____
Supervisor's Signature

Excavations—Soil Classifications

Overview of Topic

Soil classification must be a part of the initial planning stage of an excavation. Mistakes in soil classification can be costly by requiring changes in shoring and/or sloping decisions and even excavation failure. Excavation failure can mean extra costs and possibly injury and death to employees.

Designing a protective system can be complex because of the number of factors involved-soil classification, depth of cut, water content of soil, changes due to weather and climate, or other operations in the vicinity.

It is the responsibility of your excavations "competent person" to classify the soil at the excavation site and then select a proper sloping, or benching system to protect workers.

Soil classification

Each soil and rock deposit at an excavation site must be classified by your competent person as stable rock, Type A, Type B, or Type C soil. Examples of the different soil types are:

Stable rock—Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed.

Type A—Examples include clay, silty clay, sand clay, clay loam, and sometimes silty clay loam and sandy clay loam.

Type B—Examples include silt, silt loam, sandy loam and sometime silty clay loam and sandy clay loam.

Type C—Examples include granular soils like gravel, sand, loamy sand, submerged soil, and soil from which water is freely seeping, and submerged rock that is not stable.

Soil classification is not necessary if the excavation will be sloped to an angle of one and one-half horizontal to one vertical.

Appendix A to the excavation rules describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

The appendix can be used to design a method of protection for employees from cave-ins when: (1) sloping or benching, (2) timber shoring, or (3) aluminum hydraulic shoring, is used.

The soil classification must be made based on the results of at least one visual and one manual analysis. The visual and manual analysis must be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification.

In a layered system, the system must be classified by its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes must be evaluated by your competent person and the deposit reclassified as necessary.

Employee Training

No specific training is mentioned in the Excavation Standard for employees. There is, however, a number of places where "implied" training is required for competent persons and engineers.

Of course, in accordance with the "general" training reference for all construction workers, 1926.21(b)(2), employees must be trained to recognize and avoid unsafe conditions and the regulations applicable to his work environment to control or eliminate the hazards.

Training Tips

Bring some samples of different classifications of soils. Explain the reason the particular classification was given to the soil. If you have time you may want to demonstrate a few soil sampling tests.

Where To Go For More Information

Regulatory text: 29 CFR 1926.650-.652.

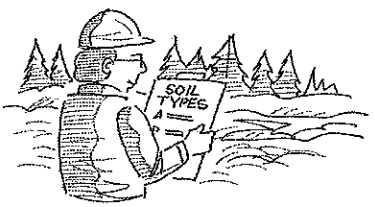
Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Excavations — Soil Classification

Although soil classification may not be your job, unless you are the company competent person, information on this topic can still help you understand excavations, the reasons a particular protective support system was chosen, and why you should always be alert to changing situations. It would be nice to know if the particular system chosen to protect you and your fellow workers is the correct one.

Before you can work in an excavation you must be protected by a protective support system. Soil classification is one factor in the decision to select the system that is protecting you. Your company "excavation" competent person must know how to conduct various tests to determine the classification of soil at a potential dig.



Soil classification

The different soils fall into one of the following four categories:

Stable rock—Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed.

Type A—Examples include clay, silty clay, sand clay, clay loam, and sometimes silty clay loam and sandy clay loam.

Type B—Examples include silt, silt loam, sandy loam and sometime silty clay loam and sandy clay loam.

Type C—Examples include granular soils like gravel, sand, loamy sand, submerged soil, and soil from which water is freely seeping, and submerged rock that is not stable.

Soil classification is not necessary if the excavation will be sloped to an angle of one and one-half horizontal to one vertical.

Appendix A to the excavation regulations

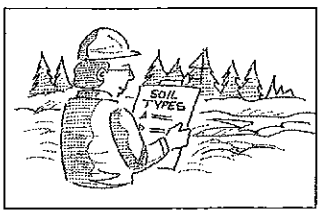
Appendix A to the excavation rules describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

The appendix can be used to design a method of protection for employees from cave-ins when: (1) sloping or benching, (2) timber shoring, or (3) aluminum hydraulic shoring, is used.

Ask your "excavation" competent person to explain the difference between a cohesive and granular material, or how to do a ribbon test.

You may also want to know how to spot tension cracks, or fissured materials in an excavation. These could be indications of potentially hazardous situations.

Your competent person will not always be at an excavation, when he/she is, pick their brain about some situation that is bothering you or just doesn't look right.



Excavations — Soil Classifications Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Excavations — Soil Classification at _____.
(company name)

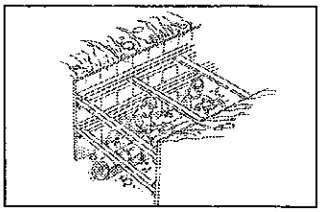
The session covered the following:

- Why there is a need to classify soil.
- The different types of soil classifications.
- How Appendix A to the excavation rules is used.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**



Excavations—Trench Safety

Overview of Topic

Trenches/excavations can either be death traps or safe places for employees to work. Do you let employees enter an unsafe trench for just a minute? Do you follow OSHA and company rules for excavation work? It all adds up. Before allowing employees to enter a trench do you:

- ❑ Clear all surface hazards and move the spoil pile back the required two feet?
- ❑ Locate and protect, support, or remove all underground utilities and other hazards?
- ❑ Provide a safe means of entry and exit from excavations that are more than four feet deep, that meets OSHA requirements?
- ❑ Test for and abate hazardous atmospheres if they exist, or could reasonably be expected to exist?
- ❑ Provide emergency rescue equipment where hazardous atmospheres exist or could reasonably be expected to develop during work in the excavation?
- ❑ Provide adequate protection for employees working in excavations where water is accumulating or could accumulate?
- ❑ Provide protection for employees from loose rock or soil that could pose a hazard by falling or rolling from the excavation face?
- ❑ Require your company competent person to:
  - Inspect the excavation, adjacent area, and protective systems daily for evidence of situations that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions?
  - Inspect the excavation after every rainstorm or other hazard increasing occurrence?
  - Remove employees from the trench/excavation if any of the above hazards exist?
- ❑ Provide walkways where employees and/or equipment are required or permitted to cross over excavations?

- ❑ Protect employees in an excavation from a cave-in by an adequate protective system designed in accordance with the OSHA regulations? This could include sloping and benching, support, or shield systems?

If you can answer yes to all of the previous questions, then you can be reasonably sure your employees are safe while working on your excavation project.

Employee requirements

Make sure employees are aware of and know:

- ❑ The previous listed requirements.
- ❑ When to leave an excavation, and how to respond to an emergency.
- ❑ How to properly use the equipment and protective gear you have provided.
- ❑ Safe work practices when you or the company competent person is not around.
- ❑ How to report unsafe situations immediately to their supervisor/competent person.

Trenches are nothing to monkey around with. Your employees need to know you are sincere about following the rules and you expect them to do the same.

Employee Training

No specific training is mentioned in the excavation standard for employees. There is, however, a number of places where "implied" training is required for competent persons and engineers.

Of course, in accordance with the "general" training reference for all construction workers, 1926.21(b)(2), employees must be trained to recognize and avoid unsafe conditions and the regulations applicable to his/her work environment to control or eliminate the hazards.

Training Tips

Go over this checklist with your employees and ensure they understand every point.

Where To Go For More Information

Regulatory text: 29 CFR 1926.650-.652.

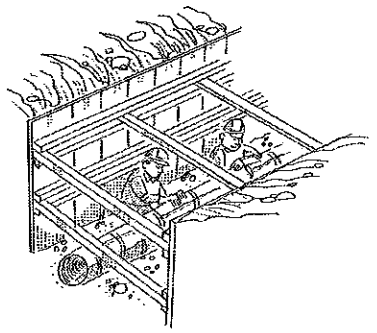
Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Excavations—Trench Safety

Your employer has a tremendous amount of responsibility to make excavations and trenches safe for you to work in. You also have a lot, the first of which is to question any unsafe conditions at your excavation site and report it to your supervisor/competent person.

The following list, generated from OSHA requirements, is worth committing to memory if you work in trenches or excavations, it could someday save your life.

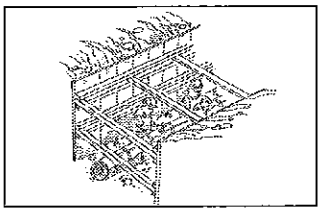


- Are all surface hazards and the spoil pile moved back the required two feet?
- Are all underground utilities located and protected, supported, or removed?
- Is a safe means of entry and exit provided for excavations more than four feet deep?
- Are hazardous atmospheres, that exist or could exist, tested for and eliminated prior to entry?
- Is rescue equipment provided where hazardous atmospheres exist or could reasonably be expected to develop during work in the excavation?
- Is adequate protection provided when working in excavations where water is or could accumulate?
- Is protection from loose rock or soil, that could pose a hazard by falling or rolling from the excavation face, provided?
- Does your company competent person: (1) inspect the excavation, adjacent area, and protective systems daily for evidence of situations that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, (2) inspect the after every rainstorm or other hazard increasing occurrence, and (3) remove employees from the trench/excavation if any of the above hazards exist?
- Are employees protected from cave-ins by adequate protective systems? This could include sloping and benching, support, or shield systems?

The above points are your employer's responsibility. Report any discrepancies to your supervisor if any of these is not correct.

You also have a responsibility to conduct yourself in a manner that promotes safety for yourself and your fellow employees. Do you:

- Follow the above requirements (that apply) when your supervisor is not around?
- Know when to leave an excavation and how to respond to an emergency?
- Properly use the equipment and protective gear your company has provided?
- Use safe work practices when your supervisor/competent person is not around?
- Report unsafe situations immediately to your supervisor/competent person?



Excavations—Trench Safety, Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Excavations—Trench Safety at _____.
(company name)

The session covered the following:

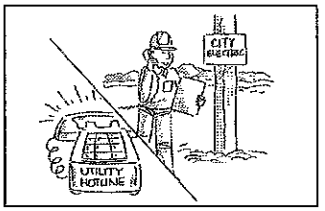
- Employer's responsibility for trench safety.
- Employee's responsibility for trench safety.
- Safety requirements for occupying trenches.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

_____
Supervisor's Signature



Excavations — Underground Utilities

Overview Of Topic

Accidental contact with underground utilities can be both deadly and costly. It is a routine event for local radio stations to announce that a gas, electric transmission, or sewer line, etc., was damaged by construction workers. This should not be the accepted norm.

Locating underground utilities

Before excavation work begins, OSHA rules require contractors doing the work to determine the estimated location of utility installations—sewer, telephone, fuel, electric, water lines, or any other underground installations—that may be encountered during digging.

Contractors must contact the utility companies or owners and inform them, within established or customary local response times, of the proposed work. In some areas, this could also be accomplished by calling diggers hotline or a one-call system.

Contractors must also ask the utility companies or land/building owners to find the exact location of the underground installations. If they cannot respond within 24 hours (unless the period required by state or local law is longer), or if they cannot find the exact location of the utility installations, contractors may proceed with caution.

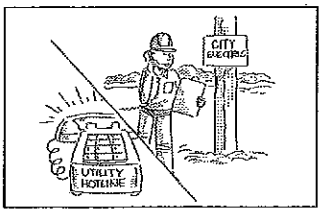
Construction companies need not contact utility companies or owners when the excavation work is to be done in a remote location where:

- No underground installations are likely to be hit, or
- There are no features which would indicate the presence of underground installations.

However, it may be a good idea to make a phone call to the utility companies or land/building owners just to verify the possibility of underground utilities, however remote.

Detection equipment and encountering the installations

If contractors proceed on their own, detection equipment or other acceptable means to locate utility installations must be used.



Excavations — Underground Utilities

When the operation approaches the estimated location of underground installations, the exact location must be determined by a safe and acceptable means. The underground utility must be located and totally exposed before machine digging begins.

Hazardous atmospheres

You must remember that where there are utilities, there is the possibility of hazardous atmospheres. If there is the potential that hazardous atmospheres exist or could reasonably be expected to exist, atmospheric testing and control is required.

After utility discovery, and while the excavation is open, underground installations must be protected, supported, or removed as necessary to safeguard employees.

Employee Training

No specific training is mentioned in the Excavation Standard for employees. There is, however, a number of places where "implied" training is required for competent persons and engineers.

Of course, in accordance with the "general" training reference for all construction workers, 1926.21(b)(2), employees must be trained to recognize and avoid unsafe conditions and the regulations applicable to his work environment to control or eliminate the hazards. This is especially true for trenching and shoring activities.

Training Tips

An excavation with utility lines can be as deadly as a mine field. It should be approached with the same care. Those employees responsible for unearthing and protecting underground installations should have this mentality. Focus on developing this attitude.

Where To Go For More Information

Regulatory text: 29 CFR 1926.650-.652

Regulatory text 29 CFR 1926.21(b)(2)—Safety training and education, employer responsibility

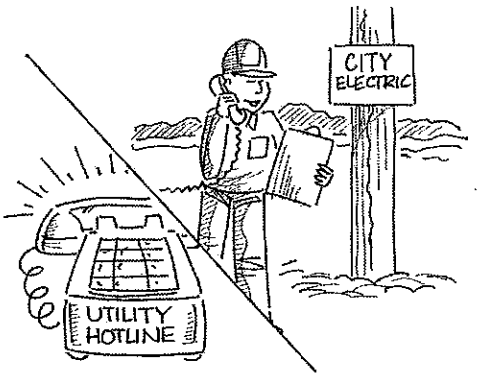
KELLER'S CONSTRUCTION TOOLBOX TALKS

Excavations — Underground Utilities

Ever have to probe for and diffuse a land mine? Most people can happily say no. But for construction workers, probing for underground utilities, or working in excavations with underground utilities exposed, the resemblance can be close.

Trenches and excavations are dangerous. Trenches and excavations with underground utilities exposed, or in the process of being exposed, are more dangerous.

Before excavation work begins, the OSHA rules require contractors doing the work to determine the estimated location of utility installations—sewer, telephone, fuel, electric, water lines, or any other underground installations—that may be encountered during digging. Your company must:



- Contact utility companies or land owners and inform them of the proposed work.
- Ask the utility companies or land/building owners to find the exact location of the underground installations.

If they cannot respond within 24 hours (unless the period required by state or local law is longer), or if they cannot find the exact location of the utility installations, contractors may proceed with caution.

Detection equipment

If the company proceeds on its own:

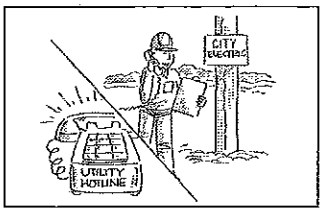
- Detection equipment or other acceptable means to locate utilities must be used.
- The exact location of the utilities must be determined by a safe and acceptable mean when the operation approaches the estimated location of the utilities.
- The underground utility must be located and totally exposed before digging begins.

Hazardous atmospheres

You must remember that where there are utilities, there is the possibility of hazardous atmospheres. If there is the potential that hazardous atmospheres exist or could reasonably be expected to exist, atmospheric testing and control is required.

After utilities are uncovered, and while the excavation is open, underground installations must be protected, supported, or removed as necessary for your safety.

Always be especially careful when working on, around, or in excavations where underground utilities may be or are known to be present.



Excavations — Underground Utilities Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Excavations — Underground Utilities at _____.
(company name)

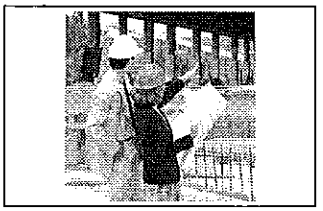
The session covered the following:

- Responsibility for notifying utility companies and land/building owners to locate underground utilities.
- Procedures for construction companies to proceed on their own.
- Requirements for detection equipment.
- Requirements for hazardous atmospheres.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	Print Name Here



Excavations—
OSHA's Top 5 Excavation Violations

Overview of Topic

Based on National Institute for Occupational Safety and Health (NIOSH) statistics, an average of 60 workers die in trench/excavation cave-ins each year. Of the 607 cave-in fatalities identified by NIOSH researchers in the ten year period from 1980 to 1989, construction workers accounted for 77% of those deaths. Almost without exception, trench/excavation deaths can be prevented by following existing OSHA safety regulations.

Several factors contribute to trench cave-ins. For example, soil stability is related to soil type, and may be affected by changes in weather. In the spring, unshored trench walls, heavy from rain, can become unstable. Also, when damp soil is exposed to air during excavation, it can dry out and lose the ability to stand on its own, increasing the risk that it will slide into the trench. Other factors, such as proximity to highways, large machinery, backfilled areas or existing structures, can affect soil stability as well.

The following trench/excavation rules are those that OSHA recently cited the most when inspecting construction jobsites.

#1 **Protection in excavations**—Employees in an excavation must be protected from a cave-in by an adequate protective system unless the excavation is: (1) made entirely in stable rock, or (2) less than 5 feet deep and a competent person has determined there is no indication of a potential cave-in. Protective systems that may be used include: sloping and benching, trench shields, or support systems such as timber or aluminum hydraulic shoring. (§1926.652(a)(1))

This is currently the 4th most violated construction regulation.

#2 **Inspections**—Your competent person must make daily inspections of excavations, the adjacent areas, and protective systems, for evidence of situations that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. Your competent person must conduct the inspection prior to the start of work and as needed throughout the shift. Inspections must also be made after every rainstorm or other hazard increasing occurrence. These

inspections are only required when employee exposure can be reasonably anticipated. (§1926.651(k)(1))

This is currently the 21st most violated construction regulation.

#3 **Access and egress**—In excavations that are 4 feet or more deep, a stairway, ladder, ramp, or other safe means of getting out must be located so as to require no more than 25 feet of lateral travel for employees to reach the escape method. (§1926.651(c)(2))

This is currently the 24th most violated construction regulation.

#4 **Spoil piles and other fall back**—Employees must be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into the excavation. Protection must be provided by placing and keeping materials/equipment at least 2 feet from the edge of the excavation, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary. (§1926.651(j)(2))

#5 **Exposed employees**——Where your competent person finds evidence of a situation that could result in a possible cave-in, indications of a failure of a protective system, hazardous atmospheres, or other hazardous conditions, exposed employees must be removed from the hazardous area until the necessary precautions have been taken to ensure their safety. (§1926.651(k)(2))

Employee Training

No specific employee training is mentioned in the excavation standard. There are however, a number of places where "implied" training is required for competent persons and engineers.

In addition, the "general" training reference for all construction employees (§1926.21(b)(2)) applies. It says that employees must be trained to recognize and avoid unsafe conditions at their work sites and understand the regulations that apply to their work environment to control or eliminate the hazards.

Training Tips

Demonstrate one or two of the above rules at an excavation at one of your jobsites. If you do not have any live excavations you might want to build a model to demonstrate the requirements.

Where To Go For More Information

Construction regulatory text: §1926, Subpart P—Excavations.

KELLER'S CONSTRUCTION TOOLBOX TALKS

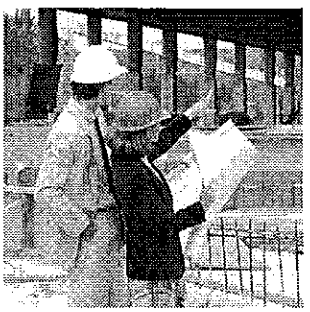
Excavations—OSHA's Top 5 Excavation Violations

An average of 60 workers die in trench/excavation cave-ins each year. Of the 607 cave-in fatalities identified by NIOSH researchers in the ten year period from 1980 to 1989, construction workers accounted for 77% of those deaths. Almost without exception, trench/excavation deaths can be prevented by following existing OSHA safety regulations.

Several factors contribute to trench cave-ins. For example, soil stability is related to soil type and may be affected by changes in weather. In the spring, unshored trench walls, heavy from rain, can become unstable. Also, when damp soil is exposed to air during excavation, it can dry out and lose the ability to stand on its own, increasing the risk that it will slide into the trench. Other factors, such as how close the excavation is to highways, large machinery, back filled areas or existing structures, can affect soil stability as well.

The following trench/excavation rules are those that OSHA recently cited the most when inspecting construction jobsites.

#1 Protection in excavations—Employees in an excavation must be protected from a cave-in by an adequate protective system unless the excavation is: (1) made entirely in stable rock, or (2) less than 5 feet deep and a competent person has determined there is no indication of a potential cave-in. Protective systems that may be used include: sloping and benching, trench shields, or support systems such as timber or aluminum hydraulic shoring.



#2 Inspections—Your competent person must make daily inspections of excavations, the adjacent areas, and protective systems for evidence of situations that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. Your competent person must conduct the inspection prior to the start of work and as needed throughout the shift. Inspections must also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

#3 Access and egress—In excavations that are 4 feet or more deep, a stairway, ladder, ramp or other safe means of getting out must be located so as to require no more than 25 feet of lateral travel for employees to reach the escape method.

#4 Spoil piles and other fall back—Employees must be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection must be provided by placing and keeping such materials or equipment at least 2 feet from the edge of the excavation, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

#5 Exposed employees—Where your competent person finds evidence of a situation that could result in a possible cave-in, indications of a failure of a protective system, hazardous atmospheres, or other hazardous conditions, exposed employees must be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

Excavations—
OSHA's Top 5 Excavation Violations
Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on OSHA's Top 5 Excavation Violations at _____.
(company name)

The session covered:

- Protection in excavations.
- Inspections.
- Access and egress.
- Spoil piles and other fallback.
- Exposed employees.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

_____
Supervisor's Signature