

Excavation for Construction



Industries engaged in excavation

- **General contractors**
- **Highway and street construction contractors**
- **Bridge and tunnel contractors**



Industries engaged in excavation

- ❑ **Water, sewer, pipeline contractors**
- ❑ **Communication and power line contractors**
- ❑ **Concrete worker and well drilling contractors**



Hazards of excavation work

- ❑ **Cave-ins**
- ❑ **Underground utilities**
- ❑ **Materials/ equipment falling into excavation sites**



Hazards of excavation work

- ❑ **Struck-by accidents**
- ❑ **Asphyxiation**
- ❑ **Explosions**
- ❑ **Falls**



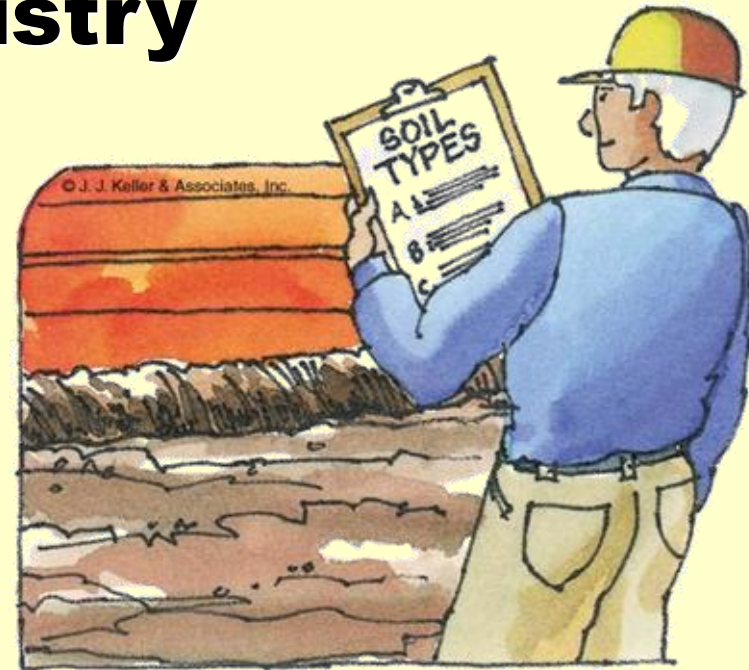
Hazards of excavation work

- ❑ **Electrocutions**
- ❑ **Drowning**



Safety considerations

- ❑ **Excavation is one of the most hazardous types of work in the construction industry**
- ❑ **Accidents result from inadequate planning**
- ❑ **Build safety into pre-bid planning**

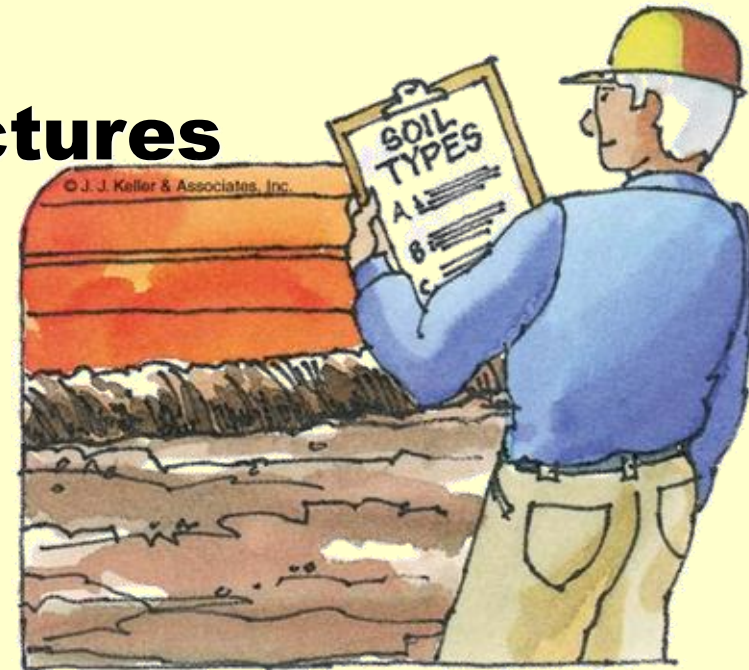


Safety considerations

□ Plan safety into the job.

Consider:

- Traffic
- Nearness of structures and their conditions
- Soil

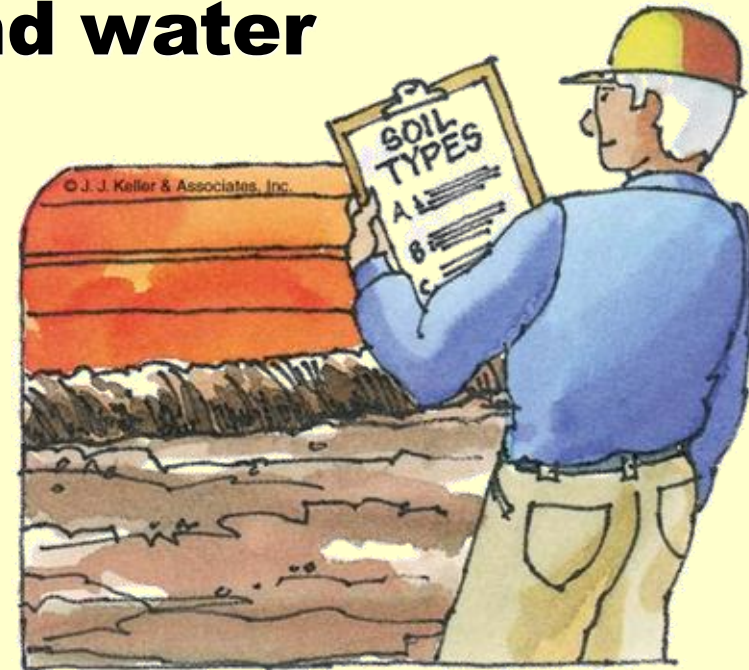


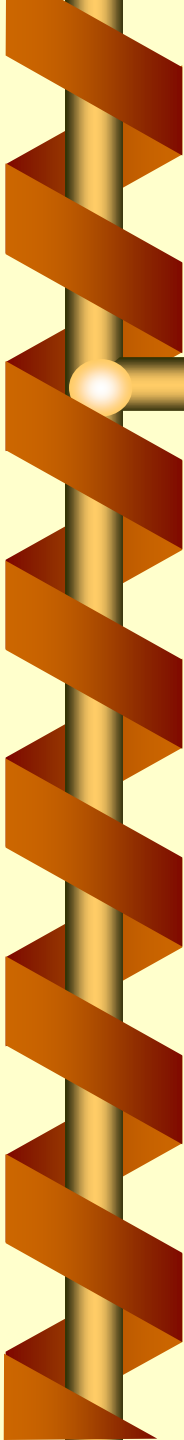
Safety considerations

□ Plan safety into the job.

Consider:

- **Surface and ground water**
- **Water table**
- **Overhead/
underground
utilities**
- **Weather**



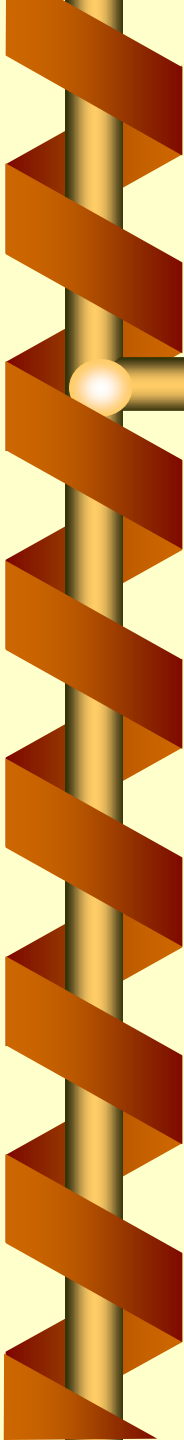


Jobsite safety and health programs

- Establish and maintain a safety and health program for the worksite**
- Provide adequate systematic policies, procedures, practices**
- Recognize job-related safety/health hazards**

Jobsite safety and health programs

- **Safety and health programs should reflect the unique characteristics of the jobsite**
- **Proper implementation depends on cooperation among:**
 - **supervisors**
 - **employee groups**
 - **individual employees**



Jobsite safety and health programs

- ❑ **Supervisors must understand his/her degree of responsibility/authority**
- ❑ **Get unions involved**

Locating utilities

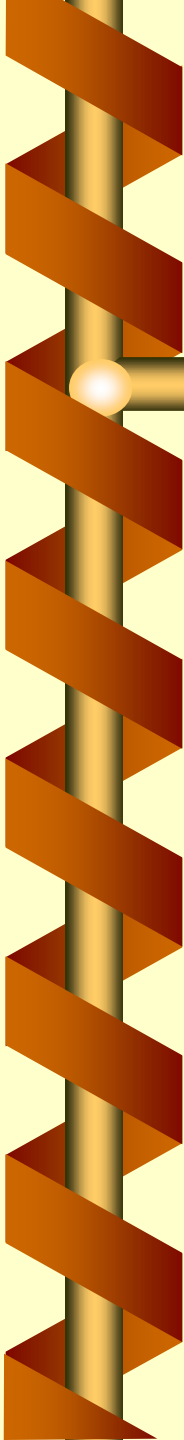
- ❑ **Employers must determine the estimated locations of utility installations**
- ❑ **Contact utility companies before starting excavation**
- ❑ **Utility owners must attempt to find exact location of utilities**



Locating utilities

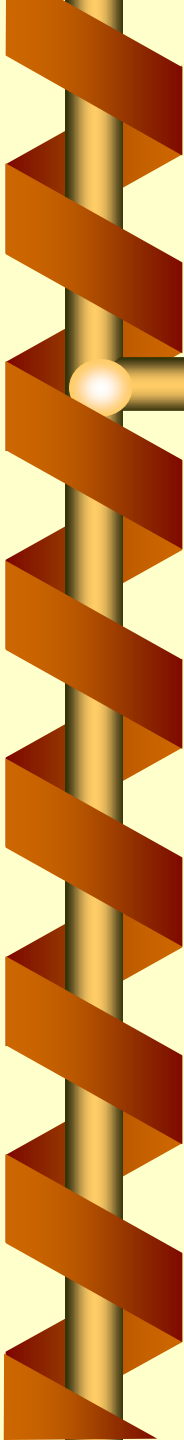
- ❑ **Proceed with caution if the exact location of utilities cannot be found**
- ❑ **Use safe and acceptable means to locate exact locations of installations**





Safety starts at the surface

- ❑ **Surface encumbrances that create hazards must be removed/supported**
- ❑ **Wear warning vests when near traffic**
- ❑ **Employees must be trained to operate heavy equipment**

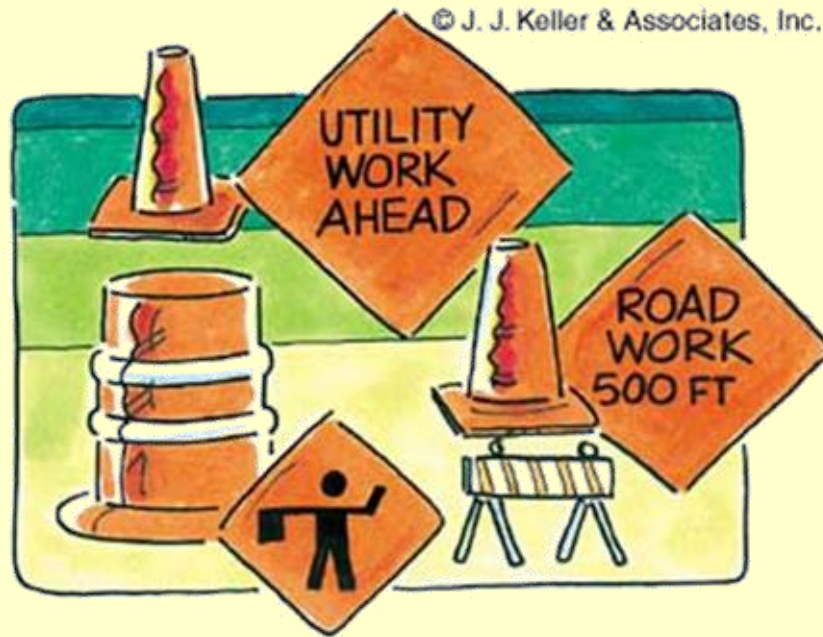


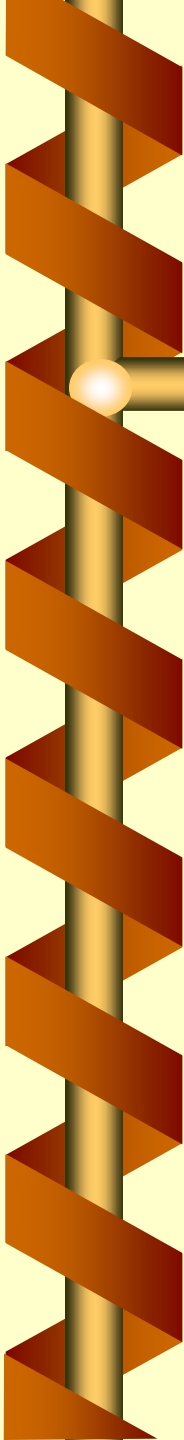
Safety starts at the surface

- ❑ **Stay away from loads being handled by lifting/digging equipment**
- ❑ **Stay away from vehicles being loaded/unloaded**

Safety starts at the surface

- **Use barricades, hand or mechanical signals, stop logs to keep operators safe**





Safety starts at the surface

- ❑ **Warn mobile equipment operators about the edge of the excavation site**
- ❑ **Keep the grade away from the excavation site**

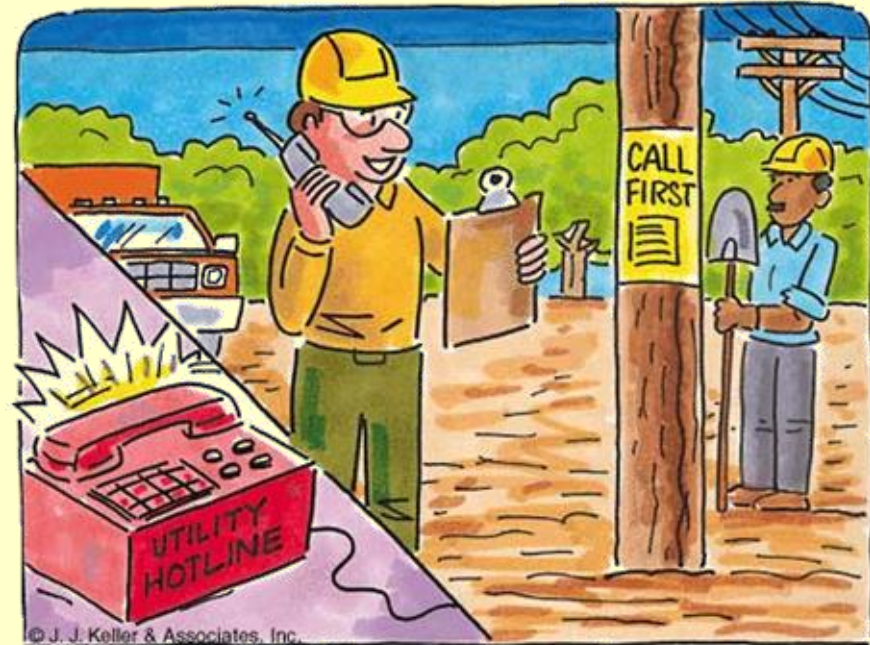
Safety starts at the surface

- **Take care when walking near excavation sites**
- **Barricade or cover wells, pits, shafts**
- **Use appropriate PPE**



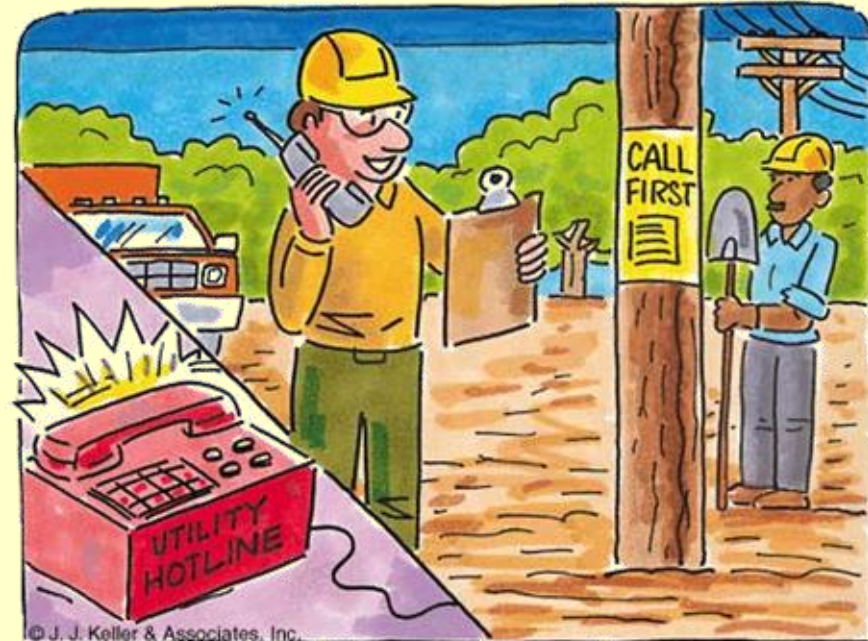
Protecting utilities

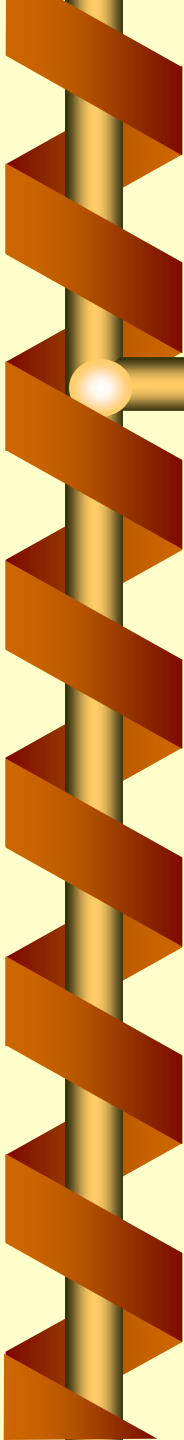
- ❑ **Exact locations of utilities must be determined**
- ❑ **Utilities must be exposed before digging**



Protecting utilities

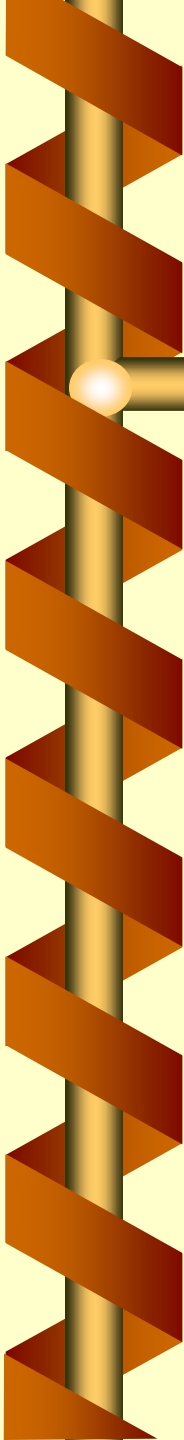
- ❑ **Excavation sites must be protected, supported to safeguard employees**
- ❑ **Approach utility lines as if they are land mines**





Employee access/egress from excavations

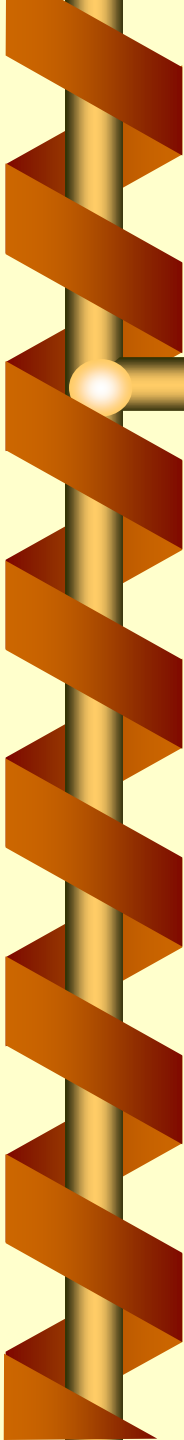
- ❑ Ramps must be designed by a competent person**
- ❑ Ramps must be structurally sound and not create a tripping hazard**
- ❑ Use surface treatments on ramps to prevent slipping**



Employee access/egress from excavations

- **Trenches 4 or more feet deep need a safe means of egress**
 - **Stairway**
 - **Ladder**
 - **Ramps**

- **Means of egress must be fixed and secure**

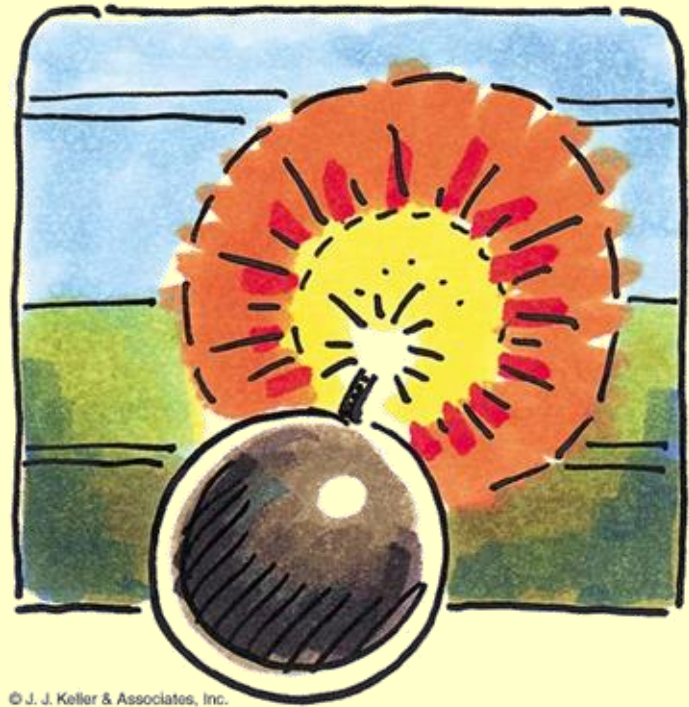


Employee access/egress from excavations

- Means of egress must be within 25 feet of workers**
- Ladders must extend a minimum of 36 inches above the landing**
- Use metal ladders with caution around utilities**

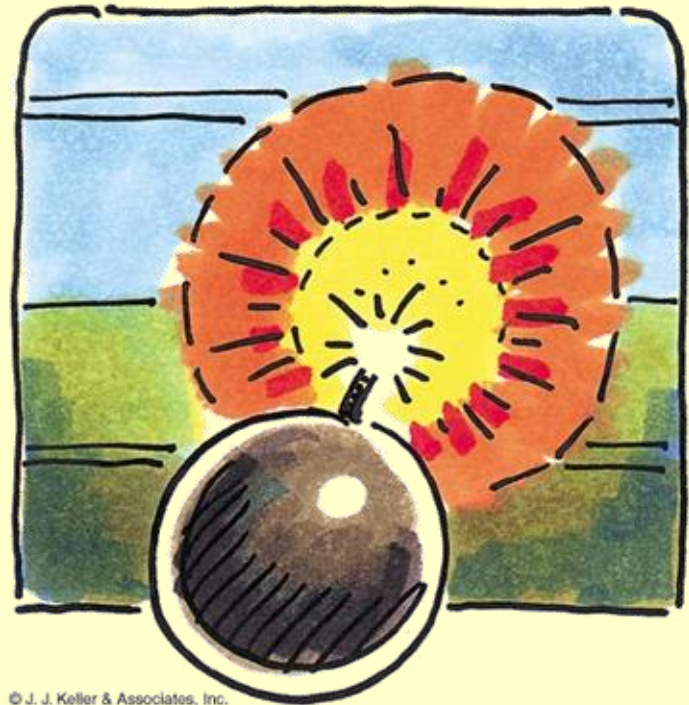
Hazardous atmospheres

- **Explosive**
- **Flammable**
- **Poisonous**
- **Corrosive**

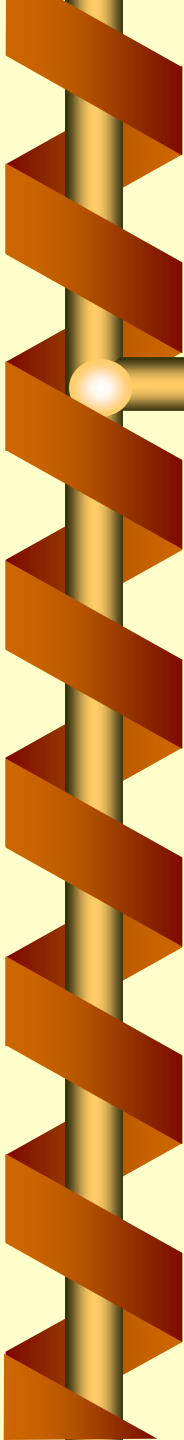


Hazardous atmospheres

- ❑ **Oxidizing**
- ❑ **Irritating**
- ❑ **Oxygen deficient**
- ❑ **Toxic**

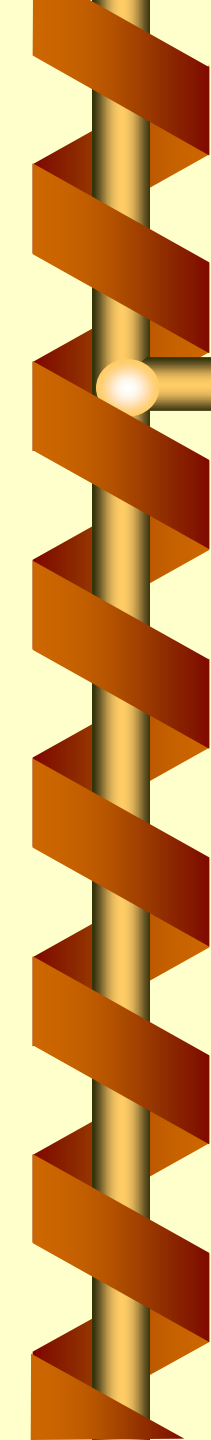


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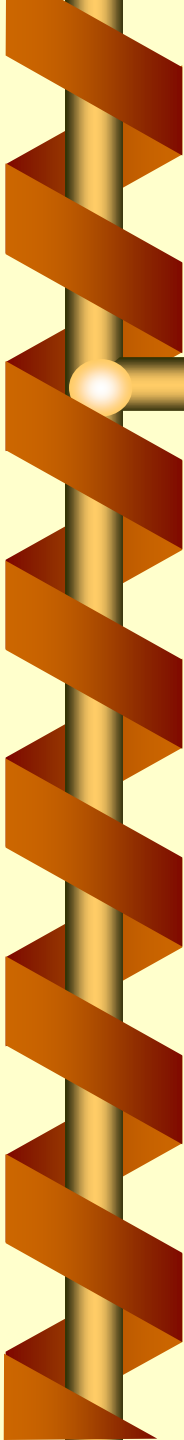
Hazardous atmospheres

- ▣ Operations inside an excavation can introduce a hazardous atmosphere**
- ▣ Test the air of excavation sites more than 4 feet deep before entering**



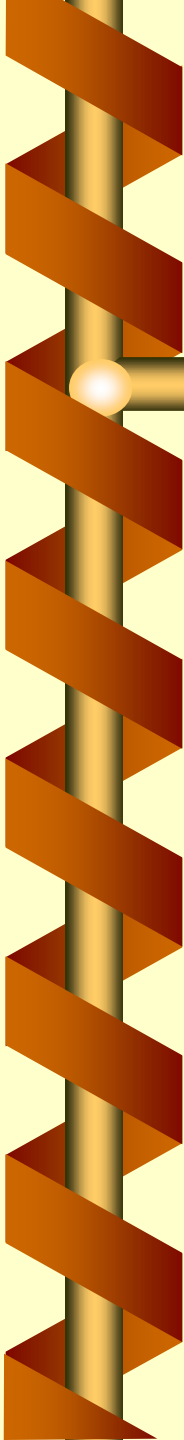
Hazardous atmospheres

- **Take extra precautions when the atmosphere has:**
 - **less than 19.5 percent, or more than 23.5 percent oxygen**
 - **a combustible gas concentration greater than 20 percent of the lower flammable limit**
 - **concentrations of hazardous substances that exceed threshold limit values**



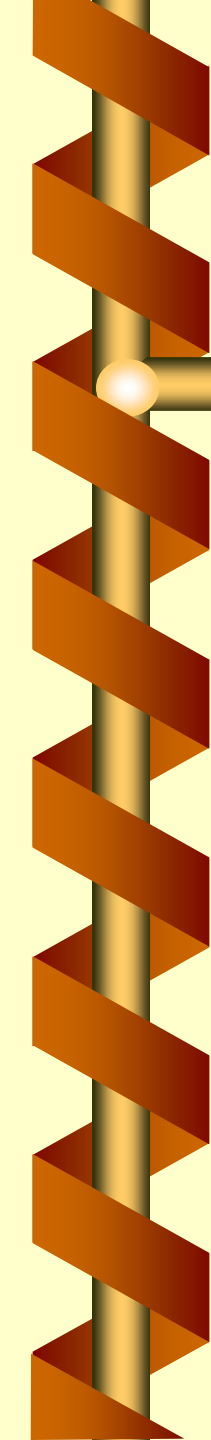
Hazardous atmospheres

- ❑ **Conduct all operations within OSHA requirements**
- ❑ **Regularly conduct atmospheric testing if atmospheric hazards are present**



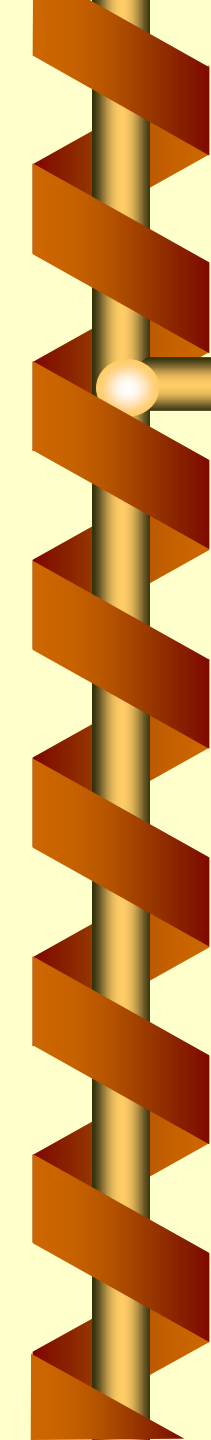
Hazardous atmospheres

- ❑ **Wear respiratory equipment when required**
- ❑ **Know the hazards of confined spaces**



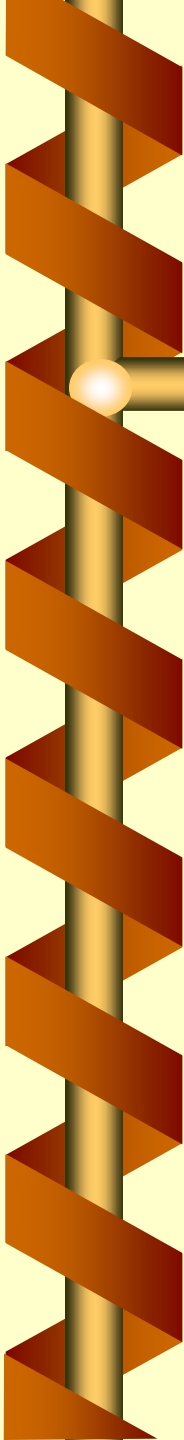
Emergency equipment

- **Emergency rescue equipment is required when there is a risk for hazardous atmospheres**
- **Emergency rescue equipment must be attended when in use**



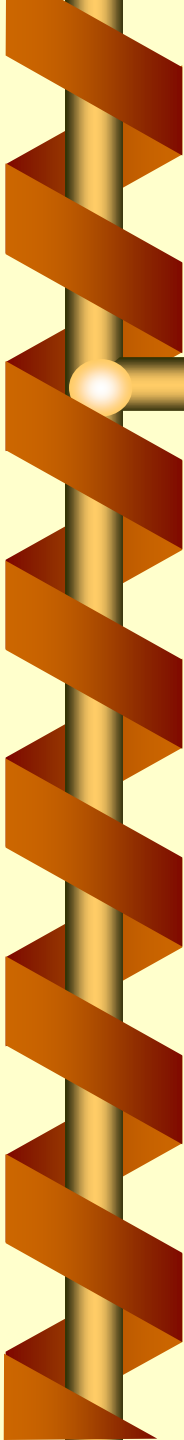
Emergency equipment

- ❑ **Respirators must be suitable for the type of exposure**
- ❑ **Independent lifelines must be provided when appropriate**



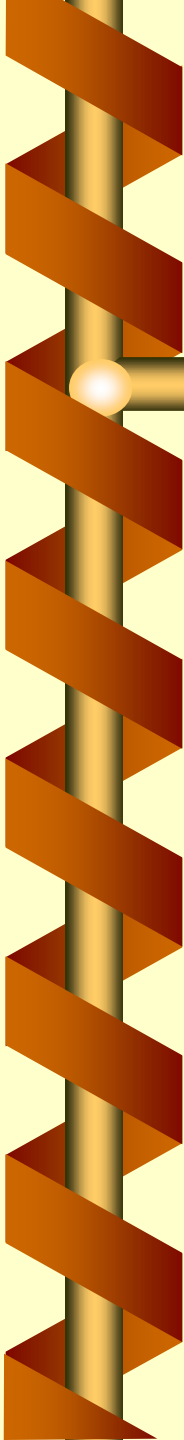
Water accumulation hazards

- ❑ **Employees are prohibited from entering excavation sites with accumulated water unless adequate protection has been provided**



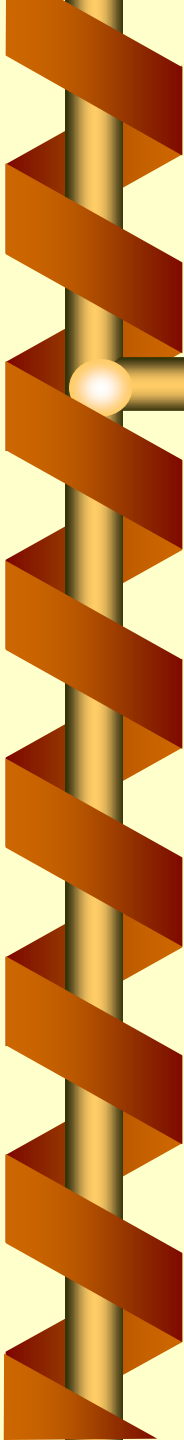
Water accumulation hazards

- **Methods for controlling standing water include:**
- **special support/shield systems**
 - **water removal equipment**
 - **safety harnesses and lifelines**



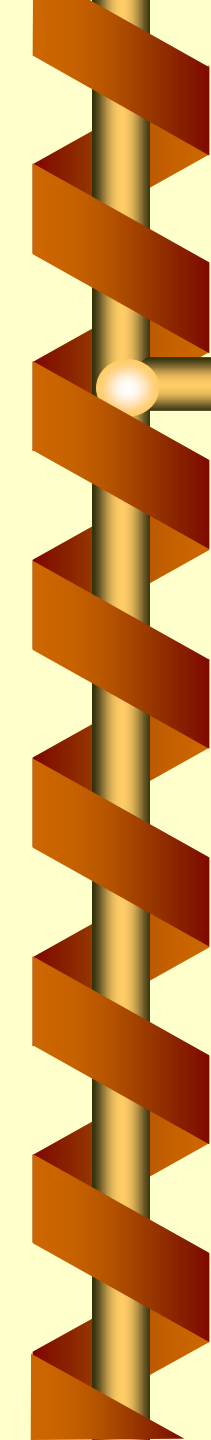
Water accumulation hazards

- ❑ **Workers should be prepared to leave excavation sites if control measures begin to fail**
- ❑ **Use diversion ditches or dikes to prevent surface water from entering excavation sites**



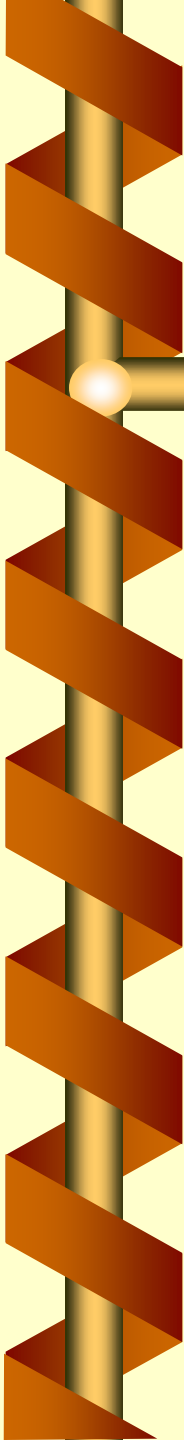
Water accumulation hazards

- **Competent person inspects excavation sites subject to water runoff**



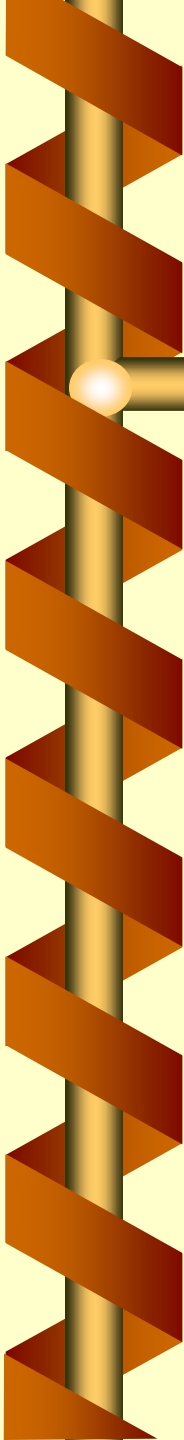
Protect structures next to excavation sites

- **Use support systems to keep nearby buildings, walls stable**
 - **Shoring**
 - **Bracing**
 - **Underpinning**



Protect structures next to excavation sites

- ❑ **Excavation below the base of a footing or retaining wall is prohibited unless a support system is provided**
- ❑ **Excavations under sidewalks/pavements are prohibited unless a support system is used**



Protect structures next to excavation sites

- ❑ **Workers must be prepared to leave excavation sites if support systems begin to fail**

Loose rock and soil as hazards

- ❑ **Prevent loose rock/soil from falling onto employees in excavation sites**
- ❑ **Use barricades to contain material**



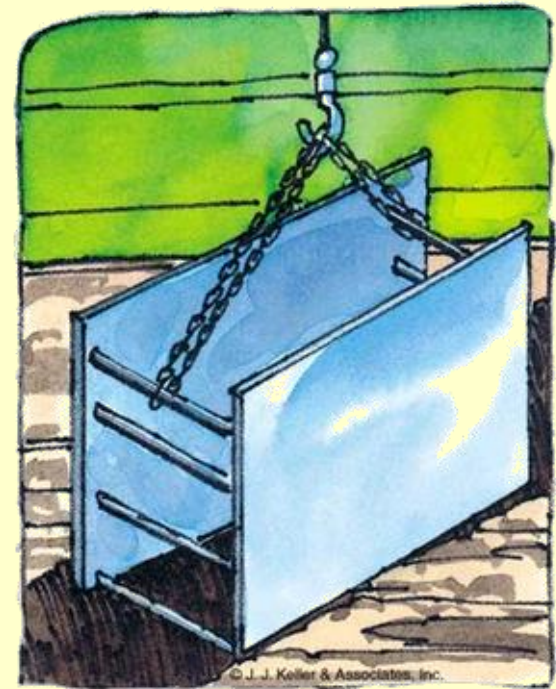
Loose rock and soil as hazards

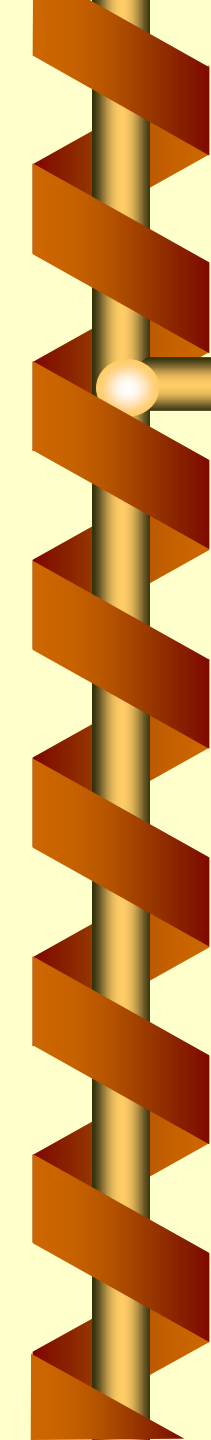
- ❑ **Keep surface materials at least 2 feet from the edge of excavation sites**
- ❑ **Keep employees off of sloped surfaces at levels above other employees**



Protective systems

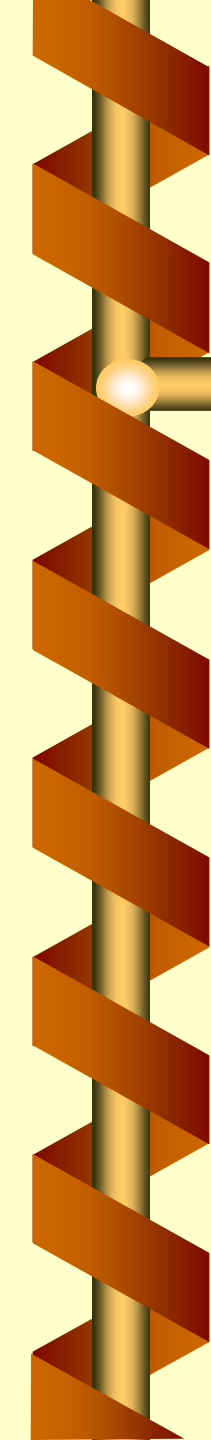
- **Excavations where employees are exposed to cave-ins must be protected by:**
- **sloping or benching**
 - **support systems**
 - **shield systems**
 - **other protective systems**





Protective systems

- **Protective systems are not needed if the excavation is:**
 - **made in stable rock**
 - **less than 5 feet deep**
- **Employers are free to choose the most practical design approach for a particular circumstance**



Protective systems

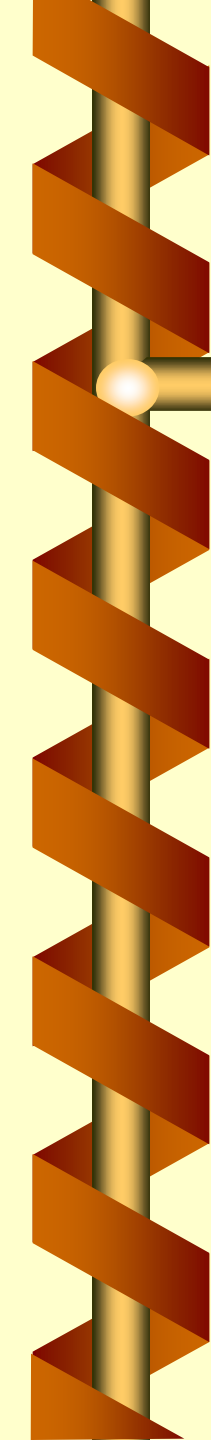
- **Designing a protective system is complex**
- **Protective systems must be able to resist all loads**
- **A competent person must examine protective systems' materials**

Soil types

□ Classify the soil type:

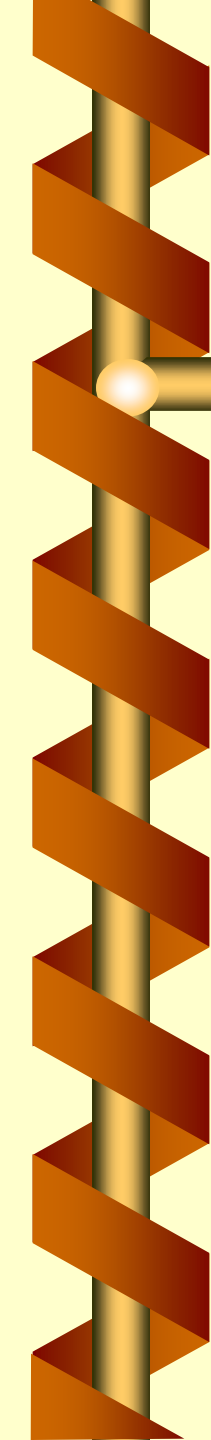
- Stable rock
- Type A
- Type B
- Type C





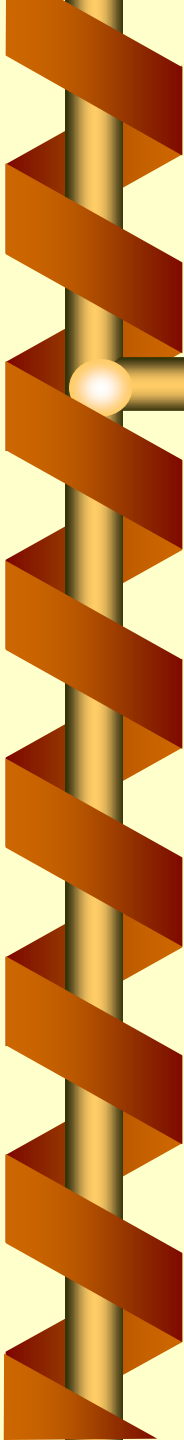
Sloping and benching

- ❑ **Slope the excavation's sides to a safe angle**
- ❑ **Slope angle not be steeper than 1 1/2 horizontal to 1 or less vertical is safe**
- ❑ **Soil classification may not be needed if sloped to this angle**



Sloping and benching

- ❑ **Other slopes may be used for other soil types**
- ❑ **Benching systems excavate the sides of an excavation to form a series of horizontal levels or steps**



Sloping and benching

- **Benching systems have vertical or near-vertical surfaces between levels**

Support, shield, and protective systems

□ **Shoring systems support the sides of the excavation with:**

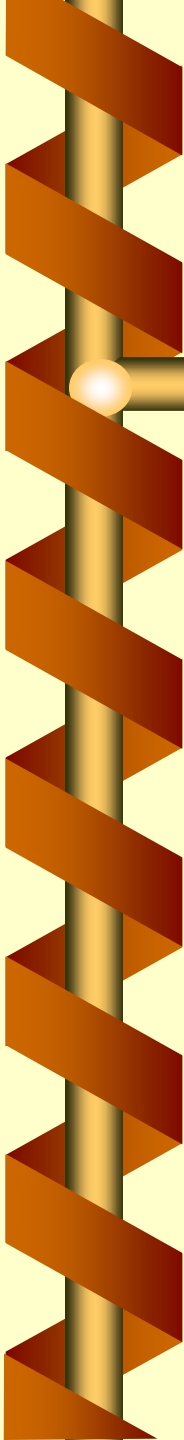
- **timber**
- **aluminum**
- **hydraulic, pneumatic, or mechanical systems**



Support, shield, and protective systems

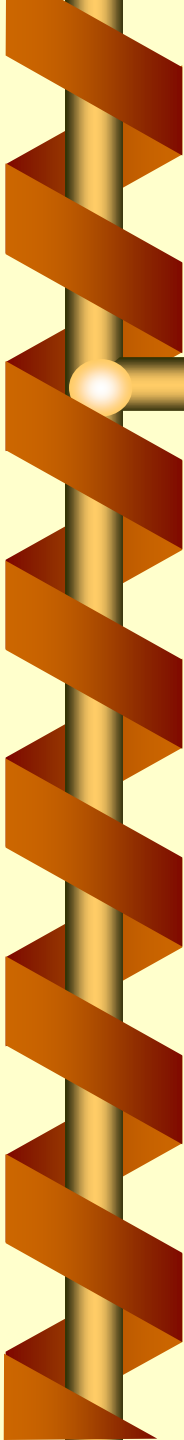
- ❑ **Shoring systems are made up of cross braces, wales, and uprights**
- ❑ **Selection and design involves using tabulated data**





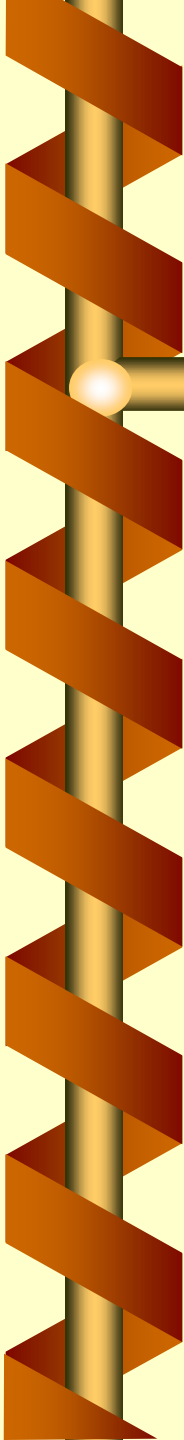
Precautions when protective systems are being installed

- ❑ **Securely connect members of support systems**
- ❑ **Safely install support systems**
- ❑ **Never overload members of support systems**



Precautions when protective systems are being installed

- Install other structural members to carry loads when temporary removal of members is necessary**
- The installation of support systems must be closely coordinated with the excavation process**



Daily inspections

- **Inspect excavations for possible:**
 - **cave-ins**
 - **failure of protective systems**
 - **hazardous atmospheres**
 - **other hazardous conditions**

Trench failure

- ❑ **Recognize hazardous conditions**
- ❑ **Sudden changes can mean disaster**



Trench failure

- **Things that can cause immediate change include:**
 - **bulldozers coming too close to the trench**
 - **a sudden downpour**
 - **striking an underground utility line**



Trench failure

- ❑ **Tension cracks can cause sliding, sluffing, or toppling**
- ❑ **Unsupported excavation can cause bulging in the vertical face**



Trench failure

- **Downward pressure can cause bottom heaving or squeezing**
- **Upward water flow can cause boiling in the bottom of the excavation**

