Trench Rescue
NFPA 1670 Awareness Level

Kansas Search & Rescue
Response System
General Training Requirement
NFPA 1670
Trench Rescue

• (1) Recognizing the need for a trench and excavation rescue
• (2) Identifying the resources necessary to conduct safe and effective trench and excavation emergency operations
• (3) Initiating the emergency response system for trenches and excavations
• (4) Initiating site control and scene management
NFPA 1670
Trench Rescue

• (5) Recognizing general hazards associated with trench and excavation emergency incidents and the procedures necessary to mitigate these hazards within the general rescue area

• (6) Recognizing typical trench and excavation collapse patterns, the reasons trenches and excavations collapse, and the potential for secondary collapse
NFPA 1670
Trench Rescue

- (7) Initiating a rapid, non-entry extrication of non-injured or minimally injured victim(s)
- (8) Recognizing the unique hazards associated with the weight of soil and its associated entrapping characteristics
WHAT IS A TRENCH?

- O.S.H.A. defines a trench as
  - Excavations that are deeper than they are wide, however no more than 15 feet wide and 20 feet deep.
  - O.S.H.A. only recognizes the need for worker protection in trenches that are in excess of 5 feet
  - The O.S.H.A. standard for trenches is 29CFR 1926
  - Trenches that exceed 20 feet deep and 15 feet in width require a Registered Professional Engineer (RPE)
HIDDEN HAZARDS

• 65% of deaths that occur in trenches are “would be rescuers”
• A second hazard is the “Secondary Collapse”
• Initial collapses weaken the trench side walls
• Buried utilities
• Bad air quality
O.S.H.A. Worker Protection

- O.S.H.A. prohibits entry into trenches over 5 feet deep unless one of the following conditions are met:
  - The walls are properly sloped back so they cannot fall in
  - The worker is properly protected by a properly designed and positioned trench shield
  - The worker is protected by properly designed and constructed shoring
Digging their own grave
3 TYPES OF WORKER PROTECTION

- Sloping
- Shielding
- Shoring
TYPES OF COLLAPSES

• 4 Types
  – Slough-in or slide-in: below grade section collapses
  – Side wall-in: entire side collapses
  – Shear-in: top portion collapses
  – Spoil-in: excavated soil collapses
FACTS ON SOIL

• The speed of dirt
  – Trench walls often collapse in less than 1/10 of a second

• Weight of dirt
  – A single cubic foot of dirt weighs approx. 100 lbs.
  – A cubic yard weighs 1.5 tons (3000 Lbs.)
RESCUE OPERATIONS

- Long term operations – 4 to 10 hours
- Victims must be entirely uncovered prior to attempting a rescue
- Backhoes and other hydraulic equipment MUST never be used
SOIL CLASSIFICATIONS

• Class A Soil
  – Most stable
  – Soil has clumps and clumps are difficult to break apart
  – Thumb test can only dent the clump

• Class B Soil
  – Soil has clumps
  – Clumps break apart with minimal effort
  – Thumb can penetrate or mold soil

• Class C Soil
  – Soil is granular
  – Trench is wet
METHODS FOR CLASSIFYING SOILS

• Thumb penetration method
  – Simplest and easiest
  – Soil that is removed from the spoil pile, is granular or wet = Class C Soil
  – Soil that is removed from the spoil pile is, difficult to break apart or only dents = Class A
  – Anything in between = Class B
ADJUSTMENTS TO SOIL CLASSIFICATIONS

- Once the basic soil classification has been determined, other environmental factors must be considered.
- In many cases the soil must be lowered, if the soil is being effected by dangerous environmental conditions.
- The longer a trench remains open and exposed to the elements, the more affected it will be.
SOIL ADJUSTMENTS

- Layered Soils
- Fissured Soils
- Previously Disturbed Soil
- Vibration
- Wet soils or standing water in the trench
  - Any wet soil is automatically considered Class C Soil
O.S.H.A. ADJUSTMENTS TO SOIL CLASSIFICATION

• Wet Soil = Class C
• Adjust Soil Class DOWN one level for the following:
  – Trench involves SLOPED-LAYERED SOIL
  – Trench involves FISSURED (Cracked) SOIL
  – Trench involves PREVIOUSLY DISTRUBED SOIL
  – Trench is subject to VIBRATION
OTHER FACTORS THAT AFFECT TRENCH STABILITY

- Water Removal
- Underground Utilities
  - *O.S.H.A. requires that all utilities or other structures exposed in trenches be properly supported*
- Surface Encumbrances
  - Items that cannot be moved and have to be supported
- Superimposed Loads
  - *O.S.H.A. requires that all superimposed loads, including the spoil pile, be placed more than two feet from the edge of the trench*
- Exposure to the elements
  - *O.S.H.A. requires that trenches be analyzed for safety and stability at least daily, and after any event which may have effected the stability of the trench or of the protection system*
ADDITIONAL REGULATIONS FOR WORKER SAFETY

- Personal Protective Equipment
  - Hard Hats
  - Shoes or Boots
  - In areas of traffic workers should wear reflective vests
  - In trenches with water accumulation, drowning precautions must be taken
PROTECTIVE SYSTEMS

• O.S.H.A. provide three methods for protecting workers in trenches
  – Sloping
  – Shielding
  – Shoring

• No worker is to enter a trench greater than 5 feet deep unless one of these protections is in place
ADDITIONAL REGULATIONS FOR WORKER SAFETY

- Escape Routes
  - No more than 25 Feet travel distances
  - Ladders are usually used
  - Ladders must extend a “few feet” above the lip of the trench and MUST be secured

- Air Quality Monitoring
  - Care should be taken with the sick or unconscious patient
  - Ventilation may be required
  - “Bad Air”
    - Oxygen deficient
    - Carbon Monoxide
    - Hydrogen Sulfide
CONTACT WITH UTILITIES CAN BE DANGEROUS & CAUSE DISRUPTION TO SERVICE

ROADWAY UNDERMINING

GAS SERVICE
SLOPING

• Involves the cutting back of the side of the trench to an angle at which the earth will no longer slide.

• ANGLE OF REPOSE – is defined as the angle at which soil will no longer slide

• Class A = 1 ft. down ½ ft. back
• Class B = 1 ft. down 1 ft. back
• Class C = 1 ft. down 1 ½ ft. back

• Safest form of protection, however is time consuming and takes a significant amount of space
SHIELDING / TRENCH BOXES

- Extremely strong steel boxes
- Assembled on site and moved into place
- Trench boxes should be placed so to extend above the lip of the trench and not more than 2 feet off the bottom of the trench
SHORING

- Shoring is designed to be strong enough to stop the walls from starting to move, but is not designed to be strong enough to stop moving dirt.
- Several types of shoring
  - Air shores
  - Hydraulic Shores
  - Dimensional Lumber Shoring
SHORING Continued

Timber Shoring
Shoring members
- Uprights
  - 4”x6”x 14’
- Cross braces
  - 8”x8”x 4’
- Whalers
  - 8’x8’x14’
- Sheeting
  - 1 1/8” plywood
  - 3/4” 14 ply thin forms

• Screwjack Shoring
• Uses up rights and whales
• Not O.S.H.A. approved
SHORING Continued

- Pneumatic Shoring
  - Use of air pressure
  - Locking collar and pin assembly
  - Working range is limited
  - Cost extensive due to the need to purchase different sizes

- Hydraulic Shoring
  - Assembled with cross braces and uprights in place
  - Pumped with a hydraulic pump
  - Very heavy
  - Not easy to store
  - Shores can be placed without entering the trench
SHORING INSTALLATION

• Of the four shoring systems, only the hydraulic shoring can be installed without entering the trench

• Shoring systems must be installed from the top of the trench down, and removed in the reverse order.
INITIAL COMPANY OPERATIONS

- Initial response personnel can still perform tasks which will serve to speed-up the rescue, protect the victim, and eliminate the need for rescue or recovery of additional personnel
  - Establish a Trench Rescue Training Program
  - Preplan and Activate a Trench Rescue Team Quickly
OPERATIONS TO BE CONDUCTED ON ARRIVAL

• DO NOT allow personnel into an unprotected trench
• DO NOT allow the use of heavy equipment
• Set up control zones
  – Hot, warm, cold
• Stop all sources of vibration
  – Stop all vibrations within 300 ft. of the trench
• Establish a Incident Action Plan
• Try to locate the victim
• Lay ground pads if available
• Place a ladder for victim to self rescue
• Test the air and Set-Up ventilation
• Prepare for injuries
• Notify O.S.H.A.
SUMMARY

- Recognize the need for trench rescue
- Initiate emergency response
- Establish control zones
- Recognize hazards
- Recognize collapse patterns
- Initiate IAP
- Initiate rapid non-entry rescue (Ladder)
This completes the general requirement for NFPA 1670 Trench Rescue Awareness Level

Click the box below to take a quiz and receive a Certificate of Completion.

FINAL QUIZ