



## APPENDIX M. EXCAVATION AND TRENCHING SAFETY POLICY September 2022

### Purpose

This Policy outlines procedures for the protection of VSC Fire & Security, Inc. (VSC) employees working in and around excavations and trenches.

### Regulatory Scope

This Policy addresses regulatory requirements outlined by OSHA in 29 CFR 1926.650, subpart P and applies to the following characteristics of a Trench or Excavation:

TRENCH	EXCAVATION
< 15 feet wide at the bottom	≥ 15 feet wide or greater
Has two sides	Wider than it is deep
Usually, Open less than 24 hours	Has one or more sides
	Open for long periods of time

### Competent Person:

VSC will have a designated Competent Person on each site where employees are working in or around excavations and trenches. It is the responsibility of each Competent Person to implement and maintain the procedures and steps set forth in this policy.

The Competent Person will:

- Identify existing and predictable hazards within the subject surroundings.
- Identify working conditions which are unsanitary, hazardous, or dangerous to employees.
- Have the authority to take prompt corrective measures to eliminate the hazards.
- Have demonstrated knowledge of OSHA's Trenching and Excavation Standard, as well as these related VSC policies: Hazard Communication, Confined Space, and Respiratory Protection.
- Be responsible for timely contacting the proper utility company(s) to identify existing in-ground utilities prior to any excavation and verify utility company(s) has properly identified all in-ground utilities with visible markers such as flags, stakes, or paint.
- Ensure appropriate Soil Classification tests are conducted and Reclassification occurs after any property, factor, or condition change. For example: a change in the soil's properties following a weather event.
- Fully understands adequate protective systems. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection to employees working in and around excavations and trenches.
- Conduct (or oversee) air monitoring for potential hazardous atmospheres.
- Conduct and document safety meeting with crew involved in excavation and trenching to review all applicable safe procedures and methods prior to any work.
- Ensure ladder(s) of appropriate height for access and egress of trench is located within 25 feet of employees who are in trenches 4 feet or greater in depth.
- Conduct and document daily and periodic inspections of excavations and trenches using *Exhibit A, "Trench Site Safety Plan & Daily Inspection Form."*
- Understand the design of structural ramps, if used.
- Verify Lock Out Tag Out (LOTO) and depressurizing in-ground fire protection and water supply lines prior to connecting or disconnecting any components.

- Properly set up in-take and discharge hoses when using de-watering devices designed to pump out potential water accumulation in trench. Only a person familiar with the equipment can operate the pump.

### **Employee Responsibilities**

Employees involved in or exposed to excavation or trenching operations are responsible for complying with all applicable safety procedures and requirements set forth in this Excavation and Trenching Safety Policy.

### **Training**

#### Competent Person

Employees identified to be the Competent Person for a job assignment in or around excavation and trenching will be trained on the following:

- Identification of existing and predictable hazards in the surroundings.
- Identification of working conditions which are unsanitary, hazardous, or dangerous to employees.
- Identification of hazards and the corrective measures to eliminate the hazards.
- The OSHA Excavation Standard and VSC trench safety procedures, including emergency response.
- Other applicable OSHA Standards (I.e., Hazard Communication, Confined Space, Lockout/Tagout).
- How to contact the proper utility for accurate identification of underground installations or utilities in a timely manner.
- How to conduct daily trench inspections using *Exhibit A*.
- Knowledge and understanding of soil classifications and methods to reclassify soil after conditions change.
- Knowledge and use of adequate protective systems (support systems, sloping and benching systems, shield systems, other systems that provide protection necessary for the specific operation).
- Methods and procedures to protect excavated exposed utilities from damage.
- How to set up ladders to enter and exit trench or protective systems.
- Methods of air monitoring for potential hazardous atmospheres.
- Requirements for daily and periodic inspections of excavations and trenches.
- Requirements for the design of structural ramps, if used.
- Procedures in LOTO and depressurization of inground fire protection systems.

#### Affected Employees

VSC employees who are exposed to the hazard(s) of working in or around excavations and trenches will be trained on the following:

- Identification of hazards associated with excavation and trenching. For example: Engulfing (cave-in), Hazardous Atmospheres, Water Accumulation, Falling Loads, Vehicular Traffic, Hazards presented by underground utilities or piping.
- Procedures to follow to minimize exposure to the hazards.
- Knowledge of Protective Systems applicable to excavation and trenching (i.e. sloping and benching systems, shield systems, support systems).
- LOTO of in-ground water supply and fire protection to prevent water accumulation and engulfment in trench.
- Set up and operation of de-watering devices and pumps to drain trench.
- Guidelines for PPE to be used when working in and around excavation and trenching, to include application of the PPE and its limitations.
- Understanding and use of personal protection systems.
- Soil classifications by type.

Any employee who does not comply with this training will be subject to discipline, up to and including termination of employment.

#### Recordkeeping

VSC's Risk and Safety Department will maintain training records with respect to this Excavation and Trenching Safety Policy. Records will include employee name, training topic-to include course content, date of training, certification (where applicable), and date of future training to maintain certification.

### **Soil Classification and Identification**

VSC will ensure that soil classification and identification has been completed prior to starting any excavation or trenching work. Retain documentation of the classification in the project file at the VSC Division office.

Note: To maintain the highest safety factor for trench collapse or cave-in, VSC will classify all soil conditions as Type C, unless excavating in solid rock. This standard practice is only applicable to excavating under direct control and authority of VSC. For excavating conducted by, or under the authority and control of the property owner or another contractor, VSC will obtain the

required tabulated data used to determine soil classification, prior to entering the excavated area. All documentation of the classification will be retained on file at the district office responsible for the project.

Although it is VSC's intent to classify all soil conditions as Type C, as explained in the preceding note, for purpose of education and hazard awareness, VSC requires the Competent Person to understand the following four soil categories and the associated level of hazard:

Stable Rock: A natural solid mineral that remains intact when excavated.

Type A soil (best soil): Cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples include clay, silty clay, sandy clay, clay loam, and sometimes silty clay loam and sandy clay loam.

Soil is NOT Type A if:

- It is fissured. (Fissured means: exposed soil shows breaks or cracks).
- The soil is subject to vibration from heavy traffic, pile driving or similar effects.
- The soil has been previously disturbed.
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater.
- The material is subject to other factors that would require it to be classified as a less stable material.

Type B soil (Good Soil):

- Cohesive soil with an unconfined compressive strength greater than 0.5 Tons per Square Foot (tsf), but less than 1.5 tsf.
- Granular cohesion less soil including angular, gravel, silt, silt loam, sandy loam and sometimes silty clay loam and sandy clay loam.
- Previously disturbed soils except those which would otherwise be classified as Type C soil.
- Soil that meets the unconfined compressive strength or cementation requirements of Type A soil but is fissured or subject to vibration.
- Dry rock that is unstable.
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontals to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C soil (Most Hazardous Type of Soil):

- Most unstable soil with the highest probability of collapse or cave-in.
- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less.
- Granular soils including gravel, sand, and loamy sand.
- Submerged soil or soil from which water is freely seeping.
- Submerged rock that is not stable.
- Material in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or steeper.

Soil Test and Identification

The competent person will classify the soil type in accordance with the procedural requirements and use at least one visual and one manual analysis. These tests will be run on freshly excavated samples from the excavation and are designed to determine stability based on the following criteria:

- The cohesiveness.
- The presence of fissures.
- The presence and amount of water.
- The unconfined compressive strength.
- The duration of exposure, undermining, and the presence of layering.
- Prior excavation and vibration.

The cohesion tests are based on methods to determine the presence of clay. Clay, silt, and sand are size classifications, with clay being the smallest sized particles, silt intermediate and sand the largest. Clay minerals exhibit good cohesion and plasticity (can be molded). Sand exhibits no elasticity and virtually no cohesion unless surface wetting is present. The degree of cohesiveness and plasticity depends on the amounts of all three types of soil (clay, silt, or sand) and water.

The Competent Person will conduct multiple tests on the excavation to obtain consistent, supporting data along its depth and length. This testing will allow for soil changes during the scope of the excavation due to weather and job conditions. The Competent Person will determine the level of protection based on the conditions that exist at the time of the test and allow for changing conditions. To monitor any changes in the soil condition, frequent testing during the duration of the trenching and excavation work is required.

**Methods of Testing Soils**

Prior to proceeding with excavation, the competent person will perform the following tests daily to determine if there is any change in the conditions of the excavation site:

- Visual Test: Look to see if the excavated soil is in clumps. If it is, then it is considered cohesive. If it breaks up easily, not staying in clumps, it is granular.
- Dry Strength Test: Try to crumble the sample in your hands with your fingers. If it crumbles into grains, it is granular. If it remains in small chunks and does not crumble, it is clay and cohesive.
- Wet Manual Test: Wet your fingers and work the soil between them. If the soil turns to a paste, it is clay and is cohesive. If the clump falls apart in grains, it is granular.
- Pocket Penetrometer Test: Use this instrument on saturated soil. This instrument will give unconfined compressive strength in tons per square foot (tsf). The spring-operated device uses a piston that is pushed into a coil up to a calibration groove. An indicator sleeve marks and retains the reading until it is read. The reading is calibrated in tsf or kilograms per cubic centimeter.
- Thumb Penetration Test (TPT): Obtain a fresh soil sample. Place the sample between your thumb and index finger and apply pressure. If the sample can be dented, but penetrated only with great effort, it is Type A. If it can be penetrated several inches and molded by light pressure, it is Type C. Type B can be penetrated with less effort and it can be molded, but will appear less stable than type A.
- Shear Vane Test: A Shear Vane is an instrument that measures the strength of saturated cohesive soils. The blades of the vane are pressed into a flat section of undisturbed soil, and the knob is turned slowly until soil failure. The dial is read directly when using the standard vane. The results will be in tsf or kilograms per cubic centimeter.

**Requirements for Protective Systems**

When required, VSC will use three basic protective systems for excavation and trenching: Sloping & Benching Practices, Shoring, and Shields.

Every employee in an excavation will be protected from cave-ins by an adequate protective system. The protective systems will have the capacity to resist, without failure, all loads that are intended, or could be expected to be applied to, or transmitted to, the system.

*Exceptions to Using Protective Systems:*

- *Excavations made entirely in stable rock.*
- *Excavations less than 5 feet deep and declared safe by the competent person.*

Sloping and Benching Practices

Sloping and benching practices for *excavations 5 feet to 20 feet in depth* will be constructed under the instruction of a designated competent person. Sloping and benching systems for *excavations > 20 feet in depth* will be designed and stamped by a registered professional engineer.

*Option 1:*

Allowable configurations and slopes:

- Excavations will be sloped to an angle no steeper than 34 degrees; and
- Slopes will be excavated to form configurations that are in accordance with the slopes required by the standard for Type C soil. (Refer to the table in Option 2).

*Option 2:*

Configurations of Sloping and Benching systems will adhere to the following criteria: (Source OSHA 29 CFR 1926 Subpart P, Appendix B.)

Soil or Rock Type	Maximum Allowable Slopes (H:V) for Excavations < 20 feet deep
Stable Rock	Vertical (90°)
Type A	¾:1 (53°)
Type B	1:1 (45°)
Type C	1 ½:1 (34°) note: Type C soil cannot be " Benched"

*Option 3:*

Designs using tabulated data:

- Designs of sloping or benching systems will be selected from, and in accordance with, tabulated data such as tables and charts.
- The tabulated data will be in writing and meet the following:
  - Identify the parameters that affect the selection of sloping or benching system drawn from the data.
  - Identify the limits of use of the data; to include the magnitude and configuration of slopes determined to be safe.
  - Any information that will aid the user in making a correct selection of a protective system from the data.
  - Tabulated data prepared by a registered professional engineer.

*Option 4:*

Design by a registered professional engineer. If Options 1, 2, or 3 are not utilized, a registered professional engineer shall approve the sloping and benching system.

Shoring Systems

VSC may also use shoring as another protective system to support the sides of an excavation designed to prevent cave-ins. Shoring utilizes a framework of vertical members (uprights), horizontal members (whales), and cross braces to support the sides of the excavation to prevent a cave-in. Examples are:

- Metal hydraulic.
- Mechanical shoring.
- Timber shoring.

Shield Systems (Trench Boxes)

VSC may also use shielding as a method to provide a safe workplace. Do not subject shield systems to loads exceeding those which the system is designed to withstand. The shield system must be designed to withstand the soil forces caused by a cave-in and protect the employees inside the structure. The shield must be rated for the soil type and depth for which it is used, with the legible design specification attached to the shield. Shields consist of two flat, parallel metal walls held apart by metal cross braces.

As noted in *Option 4* under the “Sloping and Benching Systems” section of this Policy, a professional engineer must certify the design of the shield. The shield must include a registration plate, or registration papers from the manufacturer must be on file at the jobsite. VSC shall not repair or modify shielding systems without prior written approval from the manufacturer.

Procedures and precautions for Shield Systems include:

- Shields will not have any lateral movement when installed.
- Employees will be protected from cave-ins when entering and exiting the shield (i.e. a ladder within the shield or a properly sloped ramp at the end).
- Employees are not allowed in the shield during installation, removal, or during any vertical movement.
- Shields can be 2 feet above the bottom of an excavation if they are designed to resist loads at the full depth and if there are no indications of caving under or behind the shield.
- The shield will extend at least 18 inches above the point where proper sloping begins (the height of the shield must be greater than the depth of the excavation).
- The open end of the shield will be protected from the exposed excavation wall.
- The wall will be sloped, shored, or shielded.
- Engineer designed end plates can be mounted on the ends of the shield to prevent cave-ins.

The Shield System design by a registered Professional Engineer will be in writing and include:

- The magnitude of the slope that was determined to be safe for the project.
- The configurations that were determined to be safe for the project.
- The identity of the registered professional engineer approving the design.

**Personal Protection Equipment (PPE) for Excavation Areas**

All employees working in or around excavation shall wear a hard hat, safety glasses, and safety toe work boots. Because of the hazards involved with excavations, other PPE such as Goggles, Gloves, Respiratory Equipment, Hearing Protection, etc. may be necessary. Complete an Activity Hazard Analysis to ensure all necessary PPE is utilized.

**Note: VSC employees are PROHIBITED from entering a Trench with a hazardous atmosphere requiring the use of a respirator!**

### **Hazards and Precautions Associated with Excavation and Trenching**

**Overhead Hazards:** Remove all surface encumbrances such as utilities, foundations, streams, water tables, transformer vaults, walkways, bridges, roads, vehicles, equipment, and geologic anomalies that create a hazard to employees because they provide excessive vertical load or weight that may affect the stability of the excavation, or properly support the encumbrance, as necessary, to safeguard employees.

**Access and Egress:** If a trench or excavation is 4 feet or deeper, stairways, ramps, or ladders will be used as a safe means of access and egress. For trenches, the employee must not be required to travel any more than 25 lateral feet to reach the stairway, ramp, or ladder. A competent person must design all structural ramps used by employees as a means of access or egress from excavations.

**Fall Protection:** Walkways will be provided where employees or equipment are required or permitted to cross over an excavation. Guardrails will be provided where walkways are 6 feet or more above the lower level. Barrier physical protection will be provided at all remotely located excavations. All wells, pits, and shafts will be barricaded or covered. Upon completion of exploration and other similar operations, the wells, pits, and shafts will be back filled.

**Exposure to Vehicular Traffic:** If work is in or around traffic, employees will be supplied with and wear orange reflective vests. Signs and barricades will be utilized to ensure the safety of employees, vehicular traffic, and pedestrians.

**Hazardous Atmosphere:** Excavations and trenches 4 feet or deeper that have the potential for toxic substances or hazardous atmospheres will be tested at least daily. **VSC employees are prohibited from entering an excavation or trench with a hazardous atmosphere. All hazardous atmospheric contaminants must be removed with proper ventilation prior to entry.**

### **Fire and Explosion Hazards:**

If an excavation is near known underground or above ground gas or fuel supply utilities, implement the following protection precautions *prior* to any work:

- ***If in-ground gas utility locates are not visible, do not proceed and contact the VSC supervisor immediately.***
- Use *Exhibit A* to identify and document phone number of local fire department response team.
- Have #75 rated fire extinguisher on site.
- Excavator bucket must have non-ferrous (non-spark producing) metal digging attachments when excavating near in-ground fuel lines.
- Hand dig (Pothole digging method) with shovels, as necessary.
- Barricade above ground fuel lines with red danger tape that are with-in proximity of being struck by heavy equipment.
- Conduct and document safety meeting with crew involved with excavation to review all safe procedures and methods prior to any work.
- Protect and secure exposed in-ground fuel lines as needed during excavation and work activities.
- ***If any employee smells gas at any time during excavation or work activities, stop all work & equipment and leave the area. Immediately contact the fire department and the VSC Supervisor! Erect barricades to prevent entry to the area, but only if this can be done safely, without creating additional hazard or harm.***



**Protection from Hazards Associated with Water Accumulation:** No employee will work in an excavation where water is accumulating such as rain or storm drainage unless adequate measures are used to protect the employees. A competent person will inspect all excavations and trenches daily, prior to employee exposure or entry, and after any rainfall, soil change, or at any other time needed during the shift. The Competent Person shall take prompt measures to eliminate all hazards.

**Stability of Adjacent Structures:** Use adequate protective systems, such as shoring or shielding, to protect employees against any risk posed by adjacent structures. Examples of adjacent structures include trees, sidewalks, building foundations, etc. The worksite must be analyzed to design adequate protection systems and prevent cave-ins. There must also be an excavation safety plan developed to protect employees. Workers must be provided and wear any PPE deemed necessary to assure their protection.

**Protection of Employee from Loose Rock or Soil:** Protection will be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation. This protection will consist of:

- Scaling to remove loose material.
- Installation of protective barricades.
- Other means that provides adequate protection.

**Material or Equipment:** Employees will be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into the excavation. All materials and equipment and excavated soils will be stored a minimum of 2 feet from the sides of the excavation. Materials and equipment must not block the safe means of egress.

**Exposure to Falling Loads:** No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations. Refer to OSHA 1926.601(b)(6) for details on required vehicle equipment.

**Flooding and Engulfment:**

- No employee is allowed to cut into or connect to any water supply or fire protection system without first verifying LOTO and depressurization of existing “live” utilities.
- If customer or other contractor has performed LOTO of in-ground water supply or fire protection, the VSC Competent Person must verify proper LOTO and attach a VSC lock and tag to the shut-off control valve prior to VSC employees entering the trench.
- All flooding and engulfment safety procedures must be documented in *Exhibit A*.



**Underground Pipe:** Exercise the following precautions prior to any work that involves tapping into an in-ground, existing, active fire protection system:

- Follow Lockout/Tagout procedures for an isolated shut off. (Refer to [Appendix H](#), “*Lockout/Tagout Safety Policy*” of the VSC Health & Safety Program for additional requirements and instruction).
- Drain residual water from the system.
- Use a pump or de-watering device as necessary to remove water from the trench.
- The Competent Person will classify the soil and use the appropriate protective system before re-entry can occur.

**Inspections**

The Competent Person will perform and document daily inspections of excavations, the adjacent areas, and protective systems for evidence of situations that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. Frequent inspections are required to identify any changes in the conditions that may occur during the work shift.

A competent person must conduct and record all inspections prior to the start of work and as needed throughout the shift. Freezing and thawing, dry sun baking conditions, inclement weather such as snow or a rainstorm, or other events increase the hazard level in the trench and require prompt additional inspections. Document all inspections using *Exhibit A* and maintain a copy in the jobsite safety files. Weekly, forward a completed copy to the VSC Field Superintendent.

**Hazard Assessment - Underground Installations**

- All excavations greater than 4 feet in depth with a hazardous atmosphere are classified as a Permit Required Confined Space. Conduct work in this space in compliance with [Appendix L](#), “*Confined Space Safety Policy*” of the VSC Health & Safety Program.
- Before work is performed, or an employee enters the excavation, a number of items must be checked and recorded in *Exhibit A*.

VSC shall have all utilities marked by calling “811” 72 hours prior to any excavation whatsoever. Document the ticket number, operator ID number, time, and date. All underground excavations shall be hand dug when digging within 2 feet on either side of the marking. You must record the utility locate ticket number and dates in *Exhibit A*.

VSC employees must not use the ticket number or approval obtained by another contractor and will always call “811” for their own approval. Maintain that approval ticket on the jobsite until all digging is complete. Once the digging is completed, the expired ticket will be added to the job file maintained at the VSC Division office.

Note: Documentation of utility locates conducted on private property will be obtained by VSC prior to excavation.

**Color Codes for Marking of Underground Utilities and Installations:**

The standard color code used by utilities and professionals who respond to “811” calls to mark the location of underground utilities and installations are:

- RED: existing electric power distribution and transmission.

- **YELLOW:** existing gas, oil, and petroleum products distribution and transmission, dangerous materials, product line and steam lines.
- **ORANGE:** existing telecommunication systems, police and fire communications systems, and cable television.
- **BLUE:** existing water systems and slurry systems.
- **GREEN:** sewer systems.
- **WHITE:** proposed excavation

