SVALOOS,	EX	CAVATION &	Doc No: Issue Date:	5101 - 5021 19 Jun 2023
	r	FRENCHING	Revision Date	N/A
COUNTY	-		Revision:	0
SAFETY OPERATING PROCEDURE (SOP)		Page 1 o	f 17	
OPR:		Approval:	DEPARTN	
James Millsaps, Coordinator, Safety & Health		Kelly Bird, Director, Human Resources/Risk Management	RISK MANA	JEMENT

TABLE OF CONTENTS

PAG	τĽ
	2
	2
	3
	4
	4
	6
ORT SHIELDS	6
	10
	.11
	.12
TIONS	.15
TING	.15
	16
	17
	17
Υ	17

INTENTIONALLY LEFT BLANK

TITLE	SOP	DATE
EXCAVATION & TRENCHING	5101 - 5021	19 Jun 2023

1.0 PURPOSE

1.1 To establish requirements and procedures to ensure safe operations during trenching and excavation work throughout Okaloosa County.

2.0 DEFINITIONS

- Acceptable Engineering Practices: requirements that are compatible with standards of practice required by a registered professional engineer.
- **Benching:** method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels of steps, usually with vertical or near-vertical surfaces between levels.
- Cave-In: separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.
- Competent Person: capable of identifying existing and predictable hazards in their surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
- **Cross Braces:** horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either upright or wales.
- **Excavation:** any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
- Faces or Sides: vertical or inclined earth surfaces formed as a result of excavation work.
- **Failure:** breakage, displacement, or permanent deformation of a structure member or connection so as to reduce its structural integrity and its supportive capabilities.
- **Hazardous Atmosphere:** atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful may cause death, illness, or injury.
- **Kickout:** accidental release or failure of a cross brace.
- **Protective System:** method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the

collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

- **Professional Engineer (PE):** person who is registered as a Professional Engineer in the state where the work is to be performed.
- Shield (Shield System): structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Also, known as trench box or trench shield.
- **Shoring:** structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.
- **Sloping:** method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.
- **Spoil:** materials consisting of topsoil or subsoil that has been removed during excavating or trenching.
- Trench is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation so as to reduce the dimensions measured from the forms or structure to the side of the excavation to 15 feet or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.
- **Trench Box:** see definition of Shield (Shield System).

3.0 RESPONSIBILITIES

- 3.1 Directors shall implement and enforce the guidelines of this procedure.
- 3.2 Supervisors shall ensure that affected employees are aware of the requirements of this procedure and ensure that excavation & trenching activities comply with these guidelines.

- 3.3 Competent Person shall classify and document soil type(s) and assist crew supervisor in determining protection requirements. Soil classifications must be made; upon starting work for every 100 feet of trenching/excavation work and when soil conditions change.
- 3.4 Employees will be knowledgeable of the warning signs of a potential failure. They will notify the Competent Person of any concerns. Employees shall not enter any trench/excavation that is determined or suspected to be unsafe.

4.0 REQUIREMENTS

- 4.1 All surface encumbrances that are located to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.
- 4.2 A sub-surface survey shall be conducted to determine location of any/all utility installations, such as sewer, telephone, gas, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation & trenching work. Such utilities shall be marked with highly visible flags, paint or both.
- 4.3 Utility, electric, gas companies or property owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to mark the location of the utilities *prior* to the start of the actual excavation. Call 811 before any excavation works begins.
- 4.4 When utilities or owners cannot respond to a request to locate underground utility installations within 48 hours, or cannot establish the exact location of these installations, the Supervisor on site may proceed, provided the supervisor does so with caution, and provides detection equipment or other acceptable means to locate utility installations.
- 4.5 Underground utilities shall be protected, supported, or removed as necessary to safeguard employees.

5.0 SAFETY

- 5.1 A stairway, ladder, ramp or other safe means of exiting shall be located in trench excavations that are 4 feet or more in depth.
- 5.2 All ladders will be tied off at the top as to prevent movement and extend at least 36 inches from top of excavation while being used in excavation activity.
- 5.3 In addition to hard hats and other necessary PPE, all employees will wear reflective vests while working in excavations that are exposed to traffic and its hazards.

- DATE 19 Jun 2023
- 5.4 Inspection of the excavation will be made by the supervisor before employees enter, prior to the start of work, and throughout the job. If a supervisor finds evidence that could result in possible injury to include cave-ins, failure of PPE a hazardous atmosphere or other hazardous conditions, employees will be removed from the hazardous area until the precautions have been taken to ensure everyone's safety.
- 5.5 Excavations will not be left unattended and unprotected. When it is necessary to leave an unattended excavation open during lunch or brief periods, it shall be protected with a safety fence, and/or barricades and tape. No Excavations are to be left unattended overnight or for long periods of time. The excavation must be backfilled before employees leave work area.
- 5.6 The majority of excavations dug by the County employees will be shallow (10 feet or less). However, for excavations deeper than 10 feet, but less than 20 feet or, special situations where a vertical wall excavation with shoring box is not possible, supervisors will refer to 29 CFR 1926, OSHA Standards for the Construction Industry; Appendix B and C to 1926 Subpart P-Shoring and Benching illustrations for further assistance.
- 5.7 Excavations 20 feet or greater shall be designed and approved by a PE.
- 5.8 Excavations around adjoining buildings, walls, or other structures shall be designed and approved by a PE.
- 5.9 All surface encumbrances that may pose a hazard to employees shall be removed or supported to safeguard employees. Examples of encumbrances are: street signs, traffic signals, lighting standards, trees sidewalks, etc.
- 5.10 Excavations below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard shall not be permitted except when:
 - 5.10.1 A support system such as underpinning, is provided to ensure the safety of employees and the stability of the structure.
 - 5.10.2 The excavation is in stable rock.
 - 5.10.3 A PE has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity.
 - 5.10.4 A PE has approved the determination that such excavation work will not pose a hazard to employees.

5.11 Sidewalks, pavements, or other structures will not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

6.0 SPOIL PILES

- 6.1 Spoil piles and/or equipment shall be placed at least 2 feet from the surface edge of the excavation/trench.
- 6.2 Spoil should be placed so that it channels rainwater and other run-off water away from the excavation and cannot accidentally run, slide, or fall back into the excavation.
- 6.3 Permanent spoil piles shall be placed a minimum of 50 feet from the excavation/trenching area.

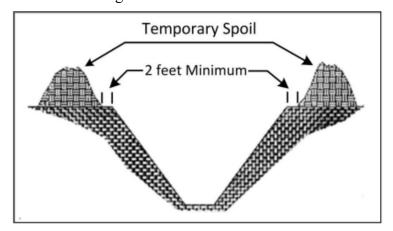


FIGURE 6.1: PROPER SPOIL PILE LOCATIONS

7.0 TRENCH BOX / SUPPORT SHIELD

7.1 A Trench Box is a safety device used to protect workers from cave-ins during excavation/trenching. It is a square structure made up of pre-constructed side sheets and adjustable cross members. It is usually made of steel or aluminum. Trench boxes are critical to the safety of workers working below ground as a trench collapse can be fatal.

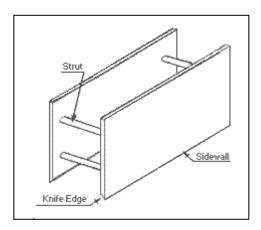


FIGURE 7.1: TRENCH BOX / SUPPORT SHIELD

- 7.2 Trench boxes shall be the primary means of protection for all excavations requiring protective support. For those excavations deeper than 20 feet or are difficult to properly use trench boxes, work crews must get permission from the PE before proceeding.
- 7.3 Employees shall not be allowed in trench boxes while they are being installed, removed, or moved.
- 7.4 Trench boxes shall not be greater than 2 feet above the floor of the excavation provided the box rests snug into the excavation where the walls of the excavation meet the sides providing no space between the side of the box and the excavation wall.
- 7.5 A copy of "Manufacturers Tabulated Data" for each trench box will be present and readily available at each excavation work site where the trench boxes are being used.
- 7.6 Trench boxes shall not be subjected to loads exceeding those that the system was designed to withstand.
- 7.7 Excavations or trenches deeper than 5 feet require a trench box or proper sloping.
- 7.8 Trench boxes will be visually inspected for stress cracks or wear on welds of cross braces prior to installation in excavation.
- 7.9 The Trench boxes shall be the primary means of protection for all excavations requiring protective support. For all excavations not able to accommodate the use of trench boxes and requiring the use of shoring and/or sloping, the

TITLE	SOP	DATE
EXCAVATION & TRENCHING	5101 - 5021	19 Jun 2023

- supervisor will perform a soil manipulation test to determine the type of soil composition.
- 7.10 Structural members of a support shield or system shall be securely connected in a manner that protects employees from cave-ins, structural collapses, or from being struck by them.
- 7.11 Individual members of support systems shall not be subjected to loads exceeding those that those members were designed to withstand.
- 7.12 Before temporary removal of individual support members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.
- 7.13 Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or when a possible cave-in of the sides of the excavation.
- 7.14 Backfilling shall progress together with the removal of support systems from excavations.

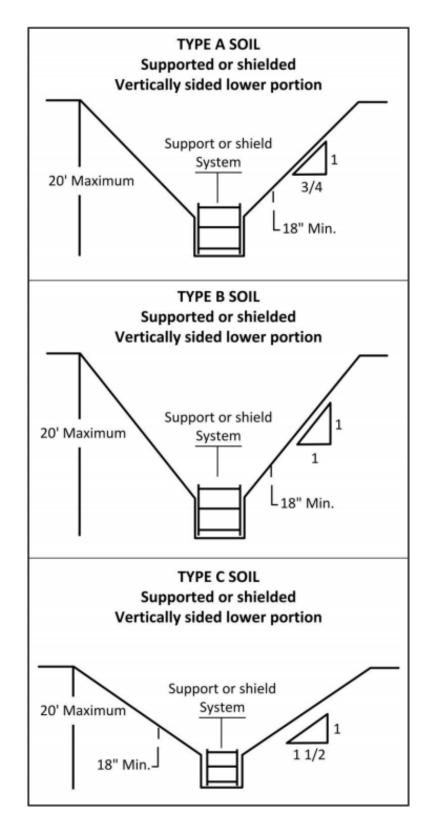


FIGURE 7.2: TRENCH BOX SLOPING REQUIRMENTS BY SOIL TYPE

TITLE	SOP	DATE
EXCAVATION & TRENCHING	5101 - 5021	19 Jun 2023

8.0 SHORING

- 8.1 Shoring or shielding shall be used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. There are two basic types of shoring: timber and aluminum hydraulic.
 - 8.1.1 Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install them. They are also light enough to be installed by one worker; they are gauge-regulated to ensure even distribution of pressure along the trench line; and they can be adapted easily to various trench depth and widths.
 - 8.1.2 All shoring shall be installed from the top down and removed from the bottom up. Hydraulic shoring shall be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.
 - 8.1.3 The top cylinder of hydraulic shoring shall be no more than 18 inches below the top of the excavation.
 - 8.1.4 The bottom of the cylinder shall be no higher than four feet from the bottom of the excavation. (Two feet of trench wall may be exposed beneath the bottom of the rail or plywood sheeting, if used).
 - 8.1.5 Three vertical shores, evenly spaced, must be used to form a system.
 - 8.1.6 Wales are installed no more than two feet from the top, no more than four feet from the bottom, and no more than four feet apart, vertically.
 - 8.1.7 Below are some typical installations of aluminum hydraulic shoring:

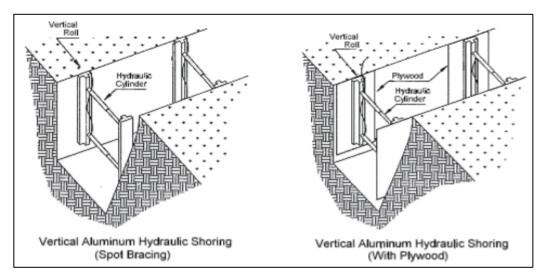


FIGURE 8.1: SPOT BRACING SHORING METHOD

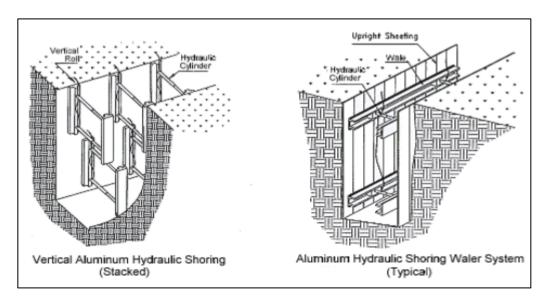


FIGURE 8.2: STACKED & WALER SYSTEM SHORING METHODS

9.0 INSPECTIONS

- 9.1 Competent Person/s are required to conduct inspections:
 - 9.1.1 Daily and before the start of each shift by using the *DAILY* EXCAVATION / TRENCHING CHECKLIST.

TITLE	SOP	DATE
EXCAVATION & TRENCHING	5101 - 5021	19 Jun 2023

- 9.1.2 As dictated by the work being done in the trench.
- 9.1.3 After every rain storm.
- 9.1.4 After other events that could increase hazards, such as a snowstorm, windstorm, thaw, earthquake, dramatic change in weather, etc.
- 9.1.5 When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur.
- 9.1.6 When there is a change in the size, location, or placement of the spoil pile.
- 9.1.7 When there is any indication of change or movement in adjacent structures.

10.0 SOIL TESTING

- 10.1 There are 3 different types of soil:
 - 10.1.1 Type A: Most stable: clay, silty clay, and hardpan (resists penetration). No soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, or has seeping water.
 - 10.1.2 Type B: Medium stability: silt, sandy loam, medium clay and unstable dry rock; previously disturbed soils unless otherwise classified as Type C; soils that meet the requirements of Type A soils but are fissured or subject to vibration.
 - 10.1.3 Type C: Least stable: gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rock, and soil from which water is freely seeping.
- 10.2 Layered Geological Strata: Soils types are geologically layered. In relation to classifying soil for excavation/trenching purposes, the soil must be classified on the basis of the weakest type soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer (i.e. where a Type C soil rests on top of stable rock).

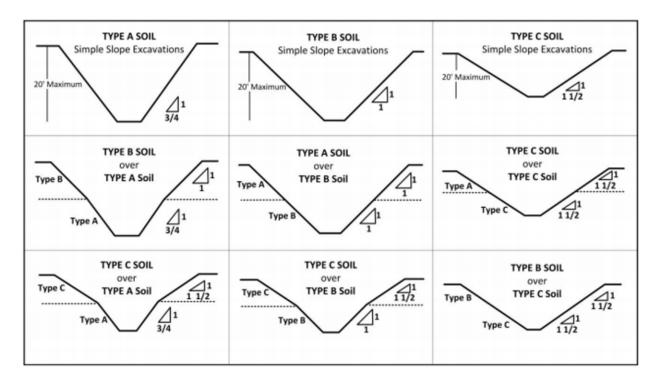


FIGURE 10.1: SLOPE REQUIREMENTS BASED ON SOIL TYPE

10.3 Testing Methods

10.3.1 Visual

- 10.3.1.1 A competent person should perform a visual test to evaluate stability of the soil in relation to the vibrations from equipment or adjacent traffic.
- 10.3.1.2 Check for crack-line openings along the failure zone that would indicate tension cracks, look for existing utilities that indicate that the soil has been previously disturbed, and observe the open side of the excavation for indications of layered geologic structuring.
- 10.3.1.3 Look for signs of bulging, boiling, or sloughing, as well as for signs of surface water seeping from the sides of the excavation or from the water table.
- 10.3.1.4 Area adjacent to the excavation should be checked for signs of foundations or other intrusions into the failure zone, and

- the evaluator should be checked for surcharging and the spoil distance from the edge of the excavation.
- 10.3.1.5 Excavations around adjoining buildings, walls, or other structures should be avoided. If no alternative exists, where needed, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.
- 10.3.2 Thumb Penetration Test: Attempt to press the thumb firmly into the soil in question. If the thumb penetrates no further than the length of the nail, it is probably Type B soil. If the thumb penetrates the full length of the thumb, it is Type C. It should be noted that the thumb penetration test is the least accurate testing method.
- 10.3.3 Dry Strength Test: Take a sample of dry soil. If it crumbles freely or with moderate pressure into individual grains it is considered granular (Type C). Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can only be broken with difficulty) it is probably clay in combination with gravel, sand, or silt (Type B).
- 10.3.4 Plasticity or Wet Thread Test: Take a moist sample of the soil. Mold it into a ball and then attempt to roll it into a thin thread approximately 1/8 inch in diameter by two inches in length. If the soil sample does not break when held by one end, it may be considered Type B.
- 10.3.5 Other Testing Methods:
 - 10.3.5.1 Pocket Penetrometer
 - 10.3.5.1.1 Used to test the soil to determine the consistency and unconfined compressive/shear strength of the excavation walls in order to quickly determine if shoring is needed.
 - 10.3.5.2 Shear Vane
 - 10.3.5.2.1 Measures the undrained shear strength of the soil.
 - 10.3.5.3 Torvane
 - 10.3.5.3.1 Measures the shear strength of the soil.

TITLE	SOP	DATE
EXCAVATION & TRENCHING	5101 - 5021	19 Jun 2023

11.0 SLOPE CONFIGURATIONS

- 11.1 Slope is the measure of the steepness of the excavation/trench walls.
- 11.2 Maximum allowable slope angle based on soil type (excavations less than 20 feet deep):

Soil Type	Height/Depth ratio	Slope Angle
Stable Rock	Vertical	90 deg.
Type A	3/4:1	53 deg.
Type B	1:1	45 deg.
Type C	1½:1	34 deg.
TYPE A SOIL Simple Slope Excavation 20' Maximum	TYPE B SOIL Simple Slope Excavation 20' Maximum	TYPE C SOIL Simple Slope Encavation 20' Maximum

FIGURE 11.1: SLOPE ANGLES BASED ON SOIL TYPE

12.0 ATMOSPHERIC TESTING

12.1 Atmospheric testing shall be performed in all excavations that are greater than 4 feet in depth and where there is a possibility of a hazardous or toxic atmosphere present (i.e., maintenance on all sewer lines, working around natural gas lines, near landfills, etc.). Testing will be conducted prior to entry and shall be continuous while employees are working within the excavation.

12.2 Exposure Limits

Oxygen	19.5% - 23.5%
Lower Explosive Limit	10%
(LEL)	
Hydrogen Sulfide	10 PPM
Carbon Monoxide	10 PPM

FIGURE 12.1: EXPOSURE LIMITS

TITLE	SOP	DATE
EXCAVATION & TRENCHING	5101 - 5021	19 Jun 2023

- 12.3 If atmosphere inside an excavation fails to meet any of the four above criteria, space will be ventilated using continuous forced air ventilation. At this time, the excavation will be classified as a permit-required confined space and will require coordination with Okaloosa County Risk Management / Safety office.
- 12.4 No employee shall enter a permitted excavation space until the Oxygen, Combustibles, and Toxic gas readings are below or within required limits.
- 12.5 Atmosphere within the permit required excavation/trench will be continuously tested and results noted on the Confined Space Permit every two hours. If entrants exit the confined space for more than 15 minutes, the excavation will be re-tested prior to re-entry.
- 12.6 The use of gas-powered equipment in excavations/trenches will require the use of ventilation equipment to prevent carbon monoxide build-up.
- 12.7 If a hazardous atmosphere is detected or a dangerous situation develops:
 - 12.7.1 All entrants shall immediately evacuate the excavation.
 - 12.7.2 The excavation/trench shall be inspected to determine the source of the hazardous atmosphere.
 - 12.7.3 Measures shall be implemented to eliminate the hazardous atmosphere before allowing and employees to re-enter the excavation/trench.

13.0 TRAINING

13.1 Any employee involved in excavation or trenching operations shall be trained on the requirements, procedures and safe operations of the process.

13.2 Retraining

- 13.2.1 Retraining shall be conducted when:
 - 13.2.1.1 Changes in the workplace render previous training obsolete.
 - 13.2.1.2 Changes in the types of excavation/trenching systems or equipment to be used render previous training obsolete.
 - 13.2.1.3 Inadequacies in an employee's knowledge or use of excavation/trenching systems or equipment indicate that the employee has not retained the understanding or skill.

TITLE	SOP	DATE
EXCAVATION & TRENCHING	5101 - 5021	19 Jun 2023

14.0 RECORD KEEPING

14.1 Training records shall be maintained at the department in which the employee is working and a copy of the training certificate will be sent to Human Resources for their permanent file.

15.0 ABREVIATIONS

ABBREVIATION	DESCRIPTION
CFR	Code of Federal Regulations
OSHA	Occupational Safety & Health Administration
PE	Professional Engineer
PPE	Personal Protective Equipment

16.0 DOCUMENT HISTORY

DATE	Түре	DESCRIPTION OF CHANGE		
19 Jun 2023	Initial	New Document		
	Revision 1			

INTENTIONALLY LEFT BLANK



DAILY EXCAVATION / TRENCHING CHECKLIST

1. Location:			2. Date: 3. Time:		3. Time:			
4. Weather: □ Dry □ Wet □ Raining □ Muddy			5. Employees Hydra	□Yes □No □N/A				
6. Signs Posted & Barrica	ades in Place:	□Yes □No	7. Safety Briefing Conducted:		□Yes □No			
WET (CONDITIONS:		UTILITIES					
Precautions take to preven water accumulation (Dewa		□Yes □No □N/A	Located and marked, if not has Sunshine 811					
Surface water or runoff diverted / controlled to prevent accumulation in the excavation / trench?		□Yes □No □N/A	Overhead powerlines identified and equipment operators briefed on their hazards?					
Excavation / Trench inspected after every rainstorm or other events that could increase the potential for hazards?		□Yes □No □N/A	g		rench □Yes □No □N/A			
ENT	RY & EXIT							
Are means of exit (i.e. laddetc.) within 25 feet of all e		□Yes □No □N/A	Are spoil piles, equip minimum of 2 feet freexcavation / trench?					
Ladders properly secured and extend 3 feet above the top of the excavation / trench?		□Yes □No □N/A	Are surface encumbrances (i.e. utilities, foundations, transformers, walkways, bridges roads, etc.) taken into account?					
Are wooden ramps constructed of uniform material thickness and cleated together at the bottom		□Yes □No □N/A	Are employees protected from falling loads (i.e. materials properly secured)?		oads			
Are employees properly protected from cavelins? \Box Yes \Box \Box N/.			Has the location of utilities been briefed to equipment operators?					
SOIL TYPES & TESTS			AIR MONITORING					
SOIL TYPE			Is the excavation / tre					
☐Type A Soil	Visual Test	□Yes □No	- If answer above is yes check the following:		_			
☐Type B Soil	Mechanical Test	□Yes □No	Oxygen levels between					
☐Type C Soil	e C Soil Type of Mechanical Test:		Lower Explosive Limit less than 10%? $\Box Y \in$					
☐Other:			Hydrogen Sulfide levels less than 10 ppm?					
	Results: □Pass □Fail		Carbon Monoxide levels less than 10 ppm? ☐ Yes ☐ No					
	TION SYSTEMS		PERSONAL PROTECTIVE EQUIPMENT (PPE)					
Is the excavation / trench deeper than 4 feet? \square Yes			Is PPE available and being utilized?		□Yes □No			
If yes, is a protective system in place?		□Yes □No	Safety Vest?		□Yes □No			
SLOPING					□Yes □No			
\square 3/4:1 Type A \square 1:1 Type B \square 1½:1 Type C			Eye Protection?		□Yes □No			
Other (i.e. shoring, benching, shielding, etc.):			Safety Shoes?					
	60.5	Other:						
COMMENTS:								
Form completed by:								
Name (Print): Sign:			Date:					