Applicable OSHA Standards: 29 CFR 1926.650, 651, 652

1. Purpose & Scope

1.1. The purpose of this policy is to comply with the OSHA standard guidelines for the protection of Cleveland Integrity Services Inc. employees working in and around excavations and trenches.

1.2. This program applies to all of work locations that are controlled by the Company where an employee or subcontract personnel may be occupationally exposed to excavations and trenches.

1.3. Compliance is mandatory to ensure employee protection when working in or around excavations. The programs in this manual on confined space, hazard communication, lockout/tagout, respiratory protection, and any other safety programs or procedures deemed essential for employee protection, are to be used in conjunction with this program.

2. Responsibilities

2.1. It is the responsibility of management and each Site Supervisor to implement and maintain the procedures and steps set forth in this program. Each employee involved with excavation and trenching work is responsible to comply with all applicable safety procedures and requirements of this program.

3. Definitions

3.1. BENCHING - A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near vertical surfaces between levels.

3.2. CAVE-IN - The 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 failing or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

3.3. COMPETENT PERSON - One who is capable of identifying existing and predictable hazards in the surroundings or working conditions, which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

3.4. DURATION OF EXPOSURE - The longer an excavation is open, the longer the other factors have to work on causing it to collapse.

3.5. EXCAVATION - Any man-made cut, trench, or depression in an earth surface, formed by earth removal.

3.6. HAZARDOUS ATMOSPHERE - An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

3.7. PROTECTIVE SYSTEM - A method of protecting employees from cave-ins, from material that could fall or roll from 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 necessary protection.

3.8. SHIELD - A structure that is capable of withstanding the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields can be pre-manufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields are also referred to as "trench boxes" or "trench shields."

3.9. SLOPING - A method of protecting workers from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences such as soil type, length of exposure, and application of surcharge loads.

3.10. SURCHARGE LOADS - Generated by the weight of anything in proximity to the excavation, push starts for a cave-in (anything up top pushing down). Common surcharge loads:

3.10.1. Weight of spoil pile

3.10.2. Weight of nearby buildings, poles, pavement, or other structural objects.

3.10.3. Weight of material and equipment

3.11. TRENCH - A narrow excavation below the surface of the ground, less than 15 feet wide, with a depth no greater than the width.

3.12. UNDERMINING - Undermining can be caused by such things as leaking, leaching, caving or over-digging. Undermined walls can be very dangerous.

3.13. VIBRATION - A force present on construction sites and must be considered. The vibrations caused by backhoes, dump trucks, compactors and traffic on job sites can be substantial.

4. General Requirements

4.1. The program establishes an excavation and trenching safety plan.

4.2. All surface encumbrances that are located at the excavation or trenching area so as to create a hazard to employees will be removed or supported, as necessary, to safeguard employees.

4.3. The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, will be determined prior to opening an excavation.

4.4. Utility companies or owners will be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation.

4.5. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the Company may proceed, provided the Company does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

4.6. When excavation operations approach the estimated location of underground installations, the exact location of the installations will be determined by safe and acceptable means.

4.7. While the excavation is open, underground installations will be protected, supported or removed as necessary to safeguard employees.

4.8. Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design, and will be constructed in accordance with the design.

4.9. Ramps and runways constructed of two or more structural members will have the structural members connected together to prevent displacement.

4.10. Structural members used for ramps and runways will be of uniform thickness.

4.11. Cleats or other appropriate means used to connect runway structural members will be attached to the bottom of the runway or will be attached in a manner to prevent tripping.

4.12. Structural ramps used in lieu of steps will be provided with cleats or other surface treatments o the top surface to prevent slipping.

4.13. Means of egress from trench excavations will be provided. A stairway, ladder, ramp or other safe means of egress will be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

4.14. Employees exposed to public vehicular traffic will be provided with and will wear warning vests or other suitable garments marked with or made of reflector or high-visibility material.

4.15. No employee will be permitted underneath loads handled by lifting or digging equipment. Employees will 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, in accordance with 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

4.16. Daily inspections of excavations, the adjacent areas, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions.

4.17. An inspection will be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections will also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

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

4.19. Walkways will be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with 1926.502(b) will be provided where walkways are 6 feet (1.8 m) or more above lower levels.

5. Safe Work Procedures

5.1. Before any work is performed and before any employees enter the excavation, a number of items must be checked and insured:

5.1.1. Before any excavation, underground installations must be determined. This can be accomplished by either contacting the local utility companies or the local "one-call' center for the area. All underground utility locations must be documented on the proper forms. All overhead hazards (surface encumbrances) that create a hazard to employees must be removed or supported to eliminate the hazard.

5.1.2. If the excavation is to be over 20 feet deep, it must be designed by a professional engineer who is registered in the state where work will be performed.

5.1.3. Adequate protective systems will be utilized to protect employees. This can be accomplished through sloping, shoring, or shielding.

5.1.4. The worksite must be analyzed in order to design adequate protection systems and prevent cave-ins. There must also be an excavation safety plan developed to protect employees.

5.1.5. Workers must be supplied with and wear any personal protective equipment deemed necessary to assure their protection.

5.1.6. All spoil piles will be stored a minimum of 2 feet from the sides of the excavation. The spoil pile must not block the safe means of egress.

5.1.7. 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 have to travel any more than 25 feet of lateral travel to reach the stairway, ramp, or ladder.

5.1.8. No employee will work in an excavation where water is accumulating unless adequate measures are used to protect the employees.

5.1.8.1. A competent person will inspect all excavations and trenches daily, prior to employee exposure or entry, and after any rainfall, soil change, or any other time needed during the shift. The competent person must take prompt measures to eliminate any and all hazards.

5.1.8.2. Excavations and trenches 4 feet or deeper that have the potential for toxic substances or hazardous atmospheres will be tested at least daily. Documentation of test data will be maintained throughout the course of the project. If the atmosphere is inadequate, protective systems will be utilized.

5.1.8.3. If work is in or around traffic, employees must be supplied with and wear orange reflective vests. Signs and barricades must be utilized to ensure the safety of employees, vehicular traffic, and pedestrians.

6. Competent Person Responsibilities

6.1. In most work situations, the Site Supervisor will be the competent person for excavation and trenching operations.

6.2. The OSHA Standards require that the competent person must be capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and have authorization to take prompt corrective measures to eliminate them and, if necessary, to stop the work.

6.3. A competent person is required to:

6.3.1. Have a complete understanding of the applicable safety standards and any other data provided.

6.3.2. Identify the proper locations of underground installations or utilities, and ensure that the proper utility companies have been contacted.

6.3.3. Conduct and document soil classification tests and reclassify soil after any condition changes.

6.3.4. Determine adequate protective systems (sloping, shoring, or shielding systems) for employee protection.

6.3.5. Conduct and document all air monitoring for potential hazardous atmospheres.

6.3.6. Conduct and document daily and periodic inspections of excavations and trenches.

6.3.7. Approve design of structural ramps, if used.

7. Excavation Safety Plan

7.1. An excavation safety plan is required in written form. This plan is to be developed to the level necessary to ensure complete compliance with the OSHA Excavation Safety Standard and state and local safety standards.

7.2. Excavation safety plan factors:

7.2.1. Utilization of the local one-call system

7.2.2. Determination of locations of all underground utilities

7.2.3. Consideration of confined space atmosphere potential

7.2.4. Proper soil protection systems and personal protective equipment and clothing

7.2.5. Determination of soil composition and classification

7.2.6. Determination of surface and subsurface water

7.2.7. Depth of excavation and length of time it will remain open

7.2.8. Emergency rescue system/procedure

7.2.9. Proper adherence to all other applicable OSHA Standards, this Excavation and Trenching Safety Program, and any other coinciding safety programs.

8. Soil Classification and Identification

8.1. The OSHA Standards define soil classifications within the Simplified Soil Classification Systems, which consist of four categories: Stable Rock, Type A, Type B, and Type C. Stability is greatest in Stable Rock and decreases through Type A and B to Type C, which is the least stable. Appendix A of the Standard provides soil mechanics terms and types of field tests used to determine soil classifications.

8.2. Stable Rock is defined as:

8.2.1. Natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

8.3. Type A soil is defined as:

8.3.1. Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (TSF) or greater.

8.3.2. Cemented soils like caliches and hardpan are considered Type A.

8.3.3. Soil is NOT Type A if:

8.3.3.1. It is fissured.

8.3.3.2. The soil is subject to vibration from heavy traffic, pile driving or similar effects.

8.3.3.3. The soil has been previously disturbed.

8.3.3.4. The material is subject to other factors that would require it to be classified as a less stable material.

8.3.3.5. The exclusions for Type A most generally eliminate it from most construction situations.

8.4. Type B soil is defined as:

8.4.1. Cohesive soil with an unconfined compressive strength greater than .5 TSF, but less than 1.5 TSF.

8.4.2. Granular cohesion less soil including angular gravel, silt, silt loam, and sandy loam.

8.4.3. The soil has been previously disturbed except that soil classified as Type C soil.

8.4.4. Soil that meets the unconfined compressive strength requirements of Type A soil, but is fissured or subject to vibration.

8.4.5. Dry rock that is unstable.

8.5. Type C soil is defined as:

8.5.1. Cohesive soil with an unconfined compressive strength of .5 TSF or less.

8.5.2. Granular soils including gravel, sand and loamy sand.

8.5.3. Submerged soil or soil from which water is freely seeping.

8.5.4. Submerged rock that is not stable.

9. **Soil Test and Identification**

9.1. The competent person will classify the soil type in accordance with the definitions in Appendix A of the Standard on the basis of at least 1 visual and 1 manual analysis. These tests should be run on freshly excavated samples from the excavation and are designed to determine stability based on a number of criteria: the cohesiveness, the presence of fissures, the presence and amount of water, the unconfined compressive strength, and the duration of exposure, undermining, and the presence of layering, prior excavation and vibration.

9.2. 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 depend on the amounts of all three types and water.

9.3. When examining the soil, 3 questions must be asked: Is the sample granular or cohesive? Fissured or non-fissured? What is the unconfined compressive strength measured in TSF?

10. **Methods of testing soils**

10.1. Visual test: If the excavated soil is in clumps, it is cohesive. If it breaks up easily, not staying in clumps, it is granular.

10.2. Wet manual test: Wet your fingers and work the soil between them. Clay is a slick paste when wet, meaning it is cohesive. If the clump falls apart in grains, it is granular.

10.3. Dry strength test: Try to crumble the sample in your hands with your fingers. If it crumbles into grains, it is granular. Clay will not crumble into grains, only into smaller chunks.

10.4. Pocket pentrometer test: This instrument is most accurate when soil is nearly saturated. This instrument will give unconfined compressive strength in tons per square foot. 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 tons per square foot (TSF) or kilograms per cubic centimeter.

10.5. Thumb penetration test: The competent person attempts to penetrate a fresh sample with thumb 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 effort and molded.

10.6. Shear vane: Measures the approximate shear 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 tons per square foot or kilograms per cubic centimeter.

10.7. The competent person will perform several tests along the depth and length of the excavation to obtain consistent, supporting data. The soil is subject to change several times within the scope of an excavation and the moisture content will vary with weather and job conditions. The competent person must also determine the level of protection based on what conditions exist at the time of the test, and allow for changing conditions.

11. **Hazardous Atmospheres**

11.1. To prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements will apply:

11.1.1. Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation will be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

11.1.2. Adequate precautions will be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation.

11.1.3. Adequate precaution will be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

11.1.4. When controls are used that is intended to reduce the level of atmospheric contaminants to acceptable levels, testing will be conducted as often as necessary to ensure that the atmosphere remains safe.

11.1.5. Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, will be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment will be attended when in use.

11.1.6. Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, will wear a harness with a lifeline securely attached to it. The lifeline will be separate from any line used to handle materials, and will be individually attended at all times while the employee wearing the lifeline is in the excavation.

12. **Water Accumulation**

12.1. Employees will not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

12.2. If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations will be monitored by a competent person to ensure proper operation.

12.3. If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means will be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with provisions of the two paragraphs above.

13. **Excavation Protection Systems**

13.1. The three basic protective systems for excavations and trenches are sloping and benching systems, shoring, and shields.

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

13.3. Exceptions to using protective system:

13.3.1. Excavations are made entirely in stable rock

13.3.2. Excavations are less than 5 feet deep and declared safe by a competent person

13.4. Sloping and Benching Systems

13.4.1. There are 4 options for sloping:

13.4.1.1. Slope to the angle required by the Standard for Type C soil, which is the most unstable soil type.

13.4.1.2. The table provided in Appendix B of the Standard may be used to determine the maximum allowable angle (after determining the soil type).

13.4.1.3. Tabulated data prepared by a registered professional engineer can be utilized.

13.4.1.4. A registered professional engineer can design a sloping plan for a specific job.

13.4.2. Sloping and benching systems for excavations 5 to 20 feet in depth must be constructed under the instruction of a designated competent person.

13.4.3. Sloping and benching systems for excavations greater than 20 feet must be designed and stamped by a registered professional engineer.

13.4.4. Sloping and benching specifications can be found in Appendix B of the Standard.

14. **Shoring Systems**

14.1. Shoring is another protective system or support system. 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. Metal hydraulic, mechanical or timber shorings are common examples.

14.2. Different examples of shoring are found in the OSHA Standard under these appendices:

14.2.1. Appendix C - Timber Shoring for Trenches

14.2.2. Appendix D - Aluminum Hydraulic Shoring for Trenches

14.2.3. Appendix E - Alternatives to Timber Shoring

15. **Shield Systems (Trench Boxes)**

15.1. Shielding is the third method of providing a safe workplace. Unlike sloping and shoring, shielding does not prevent a cave-in. Shields are designed to withstand the soil forces caused by a cave-in and protect the employees inside the structure. Most shields consist of 2 flat, parallel metal walls that are held apart by metal cross braces. Shielding design and construction is not covered in the OSHA Standards. Shields must be certified in design by a registered professional engineer and must have either a registration plate on the shield or registration papers from the manufacturer on file at the jobsite office.

15.2. Any repairs or modifications MUST be approved by the manufacturer!

15.2.1. Safety Precautions For Shield Systems

15.2.1.1. Shields must not have any lateral movement when installed.

15.2.1.2. Employees will be protected from cave-ins when entering and exiting the shield (examples - ladder within the shield or a properly sloped ramp at the end).

15.2.1.3. Employees are not allowed in the shield during installation, removal, or during any vertical movement.

15.2.1.4. Shields can be 2 ft. 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.

15.2.1.5. The shield must 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).

15.2.1.6. The open end of the shield must be protected from the exposed excavation wall. The wall must be sloped, shored, or shielded. Engineer designed end plates can be mounted on the ends of the shield to prevent cave-ins.

16. **Personal Protective Equipment**

16.1. It is Company policy to wear a hard hat, safety glasses, and work boots on the jobsite. Because of the potential hazards involved with excavations, other personal protective equipment may be necessary (examples - goggles, gloves, safety harness and lifeline, and respiratory equipment).

17. **Inspections**

17.1. Daily inspection of excavations, the adjacent areas and protective systems will be made by the competent person for evidence of a situation that could result in a cave-

in, indications of failure of protective systems, hazardous atmospheres or other hazardous conditions.

17.2. All inspections will be conducted by the competent person prior to the start of work and as needed throughout the shift.

17.3. Inspections will be made after every rainstorm or any other increasing hazard.

17.4. All documented inspections will be kept on file in the jobsite safety files

17.5. A copy of the *Daily Excavation Checklist* is located at the end of this program.

18. **Training**

18.1. When the Company is not initiating the excavation or trenching operation, basic awareness training will be provided by communicating all elements of this program to employees at the work location.

18.2. The competent person(s) must be trained in accordance with the OSHA Excavation Standard, and all other programs that may apply (examples Hazard Communication, Confined Space, and Respiratory Protection), and must demonstrate a thorough understanding and knowledge of the programs and the hazards associated.

18.3. All other employees working in and around the excavation must be trained in the recognition of hazards associated with trenching and excavating.