Lewis Energy Group®

STANDARD OPERATING PRACTICE

Excavation

Lewis Energy Group
Version 1.3
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Table of Contents

1.0 Purpose & Policy Statement

This Standard Operating Practice (SOP) provides information to ensure the safety of Lewis Energy Group (LEG) Team Members and contractors performing trenching and excavation work at LEG locations and facilities.

LEG Policy Statement

An **excavation** is any man made cut, cavity, trench or depression in the ground formed by earth removal. Site grading (normal road or pad smoothing) does not fall within the definition of excavation. One Call procedures must be followed if you are planning to dig 16 inches or deeper using mechanical equipment. **Team Members must adhere to the Excavation Program Standard Operating Practice (SOP)**.

2.0 Applicability

This SOP applies to all LEG Team Members conducting excavation work on LEG locations and facilities whether indoors or outdoors. Contactors acting on behalf of LEG must follow the OSHA guidelines on trenching and excavation. It is the responsibility of the LEG Authorized Company Representative (ACR) to ensure that compliance with this SOP is maintained for trenching and excavation work within their area of operation.

3.0 Excavation Requirements

The following information outlines the requirements that must be met before, during and after excavation work. These requirements include but are not limited to:

- Addressing surface encumbrances
- Identifying underground installations
- Setting up access and egress
- Addressing exposure to vehicular traffic
- Exposure to falling loads
- Having a warning system for mobile equipment
- Monitoring hazardous atmospheres
- Assuring stability of adjacent structures
- Assuring protection from loose rock and soil
- Excavation space inspections

Surface Encumbrances

All surface encumbrances that are located where they can create a hazard to Team Members shall be removed or supported as necessary, to safeguard Team Members.

Underground Installations

The estimated location of utility installations, such as sewer, telephone, gas, oil, or water lines, and electric or any other underground installations that may be expected to be encountered during trenching and

excavation work, shall be determined prior to opening the excavation. While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard Team Members. Excavations that must be left open during hours of darkness or will not be continuously monitored must be protected. In addition, warning lights must be used during hours of darkness in public areas. Excavations that are to be left open for extended periods will be fenced and marked with a highly reflective material.

Access and Egress

Whenever Team Members enter an excavation that is 4 feet or greater in depth, a safe means of egress shall be provided. Ladders or ramps are two choices for a safe means of egress. If a ladder is used, it shall be secured in a manner that prevents movement during use. Ladders shall also extend at least 3 feet above the excavation. Whenever Team Members enter an excavation that is 4 feet or greater in depth, the lateral travel distance to the closest means of egress shall not exceed 25 feet. Earthen ramps may be used as a means of egress provided the slope of the ramp allows Team Members to enter and exit while walking in an upright position.

Exposure to Vehicular Traffic

Team Members exposed to vehicular traffic shall be provided with, and shall wear warning vests or other suitable garments marked with or made of high visibility material.

Exposure to Falling Loads

No Team Member shall be permitted underneath loads handled by lifting or digging equipment. Team Members shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by falling materials.

Warning System for Mobile Equipment

When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as a barricade, hand or mechanical signals or stop logs. If possible, the grade should be constructed away from the excavation.

Hazardous Atmospheres

Atmospheric monitoring shall be performed in excavations greater than 4 feet deep where a potential exists for 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. Excavations that are 4 feet or greater in depth that may present an atmosphere that is oxygen deficient (less than 19.5% O_2), flammable (10 % of the lower explosive limit), or toxicity of 10 parts per million (ppm) Hydrogen Sulfide or 50 ppm Carbon Monoxide will be considered a permit required confined space. When controls are used which are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe. New construction greater than 4 feet in depth, where oxygen deficiencies (atmospheres containing less than 19.5 percent

oxygen) may exist or where a hazardous atmosphere exists or reasonably could be expected to exist, such as excavations in areas where hazardous substances are stored nearby, the atmosphere in the excavation shall be tested before Team Members enter the excavation. Emergency rescue equipment such as respiratory protection, safety harness and life line, or a basket stretcher shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation.

Protection from Water Accumulation

Team Members shall 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 Team Members against the hazards posed by water accumulation. The precautions necessary to protect Team Members may 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 with a lifeline.

If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation. Excavations subject to runoff from heavy rains will require an inspection by the ACR or other competent person. If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation.

Stability of Adjacent Structures

Where the stability of adjoining buildings, walls, or other structures may compromise excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure stability of such structures for the protection of Team Members working in or around an excavation.

Protection from Loose Rock and Soil

Adequate protection shall be provided to protect Team Members from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet from the edge of the excavation, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into the excavation.

Inspections

Daily inspections of excavations, adjacent areas and protective systems shall be made by the ACR or other competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or any other hazardous conditions. An inspection shall be conducted prior to the start of work and as needed throughout the shift. Inspections will also be conducted after every rain or other hazard increasing occurrence. An Excavation Inspection Form will be used to document the conditions. The Excavation Inspection Form is provided in Appendix A.

4.0 Responsibilities

It is the responsibility of the ACR to assure that compliance with this SOP is maintained for any known trenching or excavation work within their area of operation. Prior to starting work on any LEG property, necessary notifications must be made to determine underground hazards. The excavator must call the One Call System telephone number in Texas at 811 or 1-800-344-8377. In utilizing the One Call System the Excavator must give advanced notice of 48 hours (two working days), to give utility companies ample time to mark applicable underground utilities.

Once the underground installations are marked by the utility company or owner, the locate markings (i.e. paint, pin flags, stakes, etc.) are valid for 14 days.

5.0 Job Safety Analysis (JSA)

A JSA will be performed by LEG Team Members prior to beginning excavation activity using the appropriate LEG JSA form.

6.0 Protective Systems

During trenching and excavation, the potential for cave-ins is always present. The danger may be minimized in a number of ways including:

- Sloping or benching the walls of the excavation to such a degree that cave-in dangers are minimized or no longer present.
- By shoring the walls with material that can withstand the exerted force of a cave-in.
- By building a shield to sit within the excavated area, again with material that can withstand the exerted force of a cave-in.

Each system has pros and cons that must be weighed when determining the most effective and efficient system for the planned excavation. Each protective system shall be designed by a Registered Professional Engineer (for excavations 20 feet or deeper) the ACR or other competent person (for excavations less than 20 feet).

Sloping and Benching

Sloping involves cutting the sides of the excavation at an angle away from the work zone, reducing the likelihood of cave-ins. The angle of the slope depends on the soil type. Refer to Tables 1-3 in Appendix B for allowable slopes based on OSHA soil classifications (Type A, B, and C) as outlined in 29 CFR 1926.652(b)(1) and Appendix B.

Benching is as an approved alternative for stabilizing trench walls, particularly for deep excavations or unstable soils. It involves creating a series of horizontal levels or steps (benches) within the sloped trench wall. These benches provide additional support and act as working platforms.

Implementing Sloping and Benching:

Soil Classification: As required by OSHA (29 CFR 1926.652(a)(1)(i)), classify the soil using visual and manual tests outlined in this SOP (refer to Appendix B, Tables 1 & 2).

Slope Design: Following OSHA guidelines (29 CFR 1926.652(b)(1) and Appendix B), determine the required slope angle based on the classified soil type using the information in Appendix B, Table 3. Benching can be implemented in conjunction with sloping for increased stability, especially in deep excavations or with unstable soils.

Bench Design (if applicable): Engineer the depth and width of each bench based on the excavation depth, soil stability, and space requirements (when using benching).

For deep excavations or complex soil conditions exceeding the scope of this SOP, consult with a Registered Professional Engineer. They can design a safe and compliant slope or benching system as outlined in OSHA regulations (29 CFR 1926.652(b)(4)).Four options exist with sloping & benching:

Shoring

Another type of protective system is Shoring. Shoring braces the sides of an excavation using structural components whose strength is sufficient to prevent or withstand a cave-in. Types of shoring may include but not limited to:

- Timber shores
- Screw jacks
- Air-shores
- Aluminum hydraulic shores
- Sheet piles

7.0 Definitions

Authorized Company Representative (ACR) – The ACR is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are hazardous to contract employees/Team Members. The ACR has authorization to take prompt corrective measures to eliminate these hazards. This ACR individual (e.g. safety captain, safety tech, etc.), assures that all required preparations and precautions concerning the work site have been taken and signs any permits that may be required.

Benching – A system of protecting Team Members from cave-ins by excavating the sides to form one or a series of horizontal levels or steps, usually with vertical sides or near vertical surfaces between levels.

Competent Person – An individual must be trained and capable of identifying predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, existing and dangerous to Team Member, and who has authorization to take prompt corrective measures to eliminate them.

Dry Strength – A test that can be performed by trying to break a large piece of soil by hands. If the clump cannot be broken into smaller clumps without some difficulty, then it is probably an un-fissured soil (the

most stable). If soil breaks into small clumps that are hard to break, it is classified as Type B soil as opposed to Type C which crumbles on its own with minimal force into individual grains (granular soil such as silt, sand, or gravel).

Excavation – Any man-made cut, cavity, trench, or depression in the ground formed by earth removal. Excavations greater than 20 feet in depth must be designed by a Registered Professional Engineer (PE).

Hazardous Atmosphere – means 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.

Inspection – A process of checking the adjacent areas and protective systems looking for evidence of a situation that could result in possible cave-ins, protective system failures, hazardous atmospheres or other hazardous conditions. They are conducted by the Competent Person prior to Team Members entry and as needed throughout the excavation activity.

Job Safety Analysis (JSA) – is a method that can be used to identify, analyze and record:

- The steps involved in performing a specific job
- The existing or potential safety and health hazards associated with each step
- The recommended action(s)/procedure(s) that will eliminate or reduce these hazards

Means of Egress – A stairway, ladder, ramp, or other safe means of entry and exit into an excavation. A means of egress must be provided any time someone enters an excavation that is four feet or deeper in depth. The means of egress; must be provided so that lateral travel to the point of egress does not exceed 25 feet.

One Call System – A system that assists in the determination of the presence of underground utilities when performing excavation activities. Excavators can call one telephone number to provide notification to utility operators in a given area that an excavation will be performed.

Protective System – A method of protecting Team Member from cave-ins, material that could fall or roll from an excavation face into the excavation or from the collapse of adjacent structures.

Shoring – A metal, hydraulic, mechanical, or timber structure that supports the sides of an excavation to prevent cave-ins.

Sloping – A method of protecting Team Member by shaping the sides of the excavation to prevent cave-ins. The angle of slope on the sides will vary with different types of soil, environmental conditions and the amount of surcharge load applied.

Spoil – Earth or rock that has been excavated and set aside.

Stable Rock – Natural solid mineral material that can be excavated with vertical sides, and will remain intact while exposed.

Stop Logs – Material used to prevent equipment from rolling or falling into an excavation (chocks, blocks, etc.).

Support System – A structure such as an underpinning, bracing, or shoring which provides support to an adjacent structure, underground installation or the sides of an excavation.

Suspended Load – Only LEG Team Members essential to the operation are permitted in the fall zone (but not directly under the load). A Team Member is essential to the operation if the employee is conducting one of the following operations and the employer can demonstrate it is infeasible for the employee to perform that operation from outside the fall zone:

- Physically guide the load
- Closely monitor and give instructions regarding the load's movement
- Either detach it from or initially attach it to another component or structure (such as, but not limited to making an initial connection or installing bracing)

Thumb Penetration – A test that can be performed by inserting the thumb into an undisturbed soil sample as soon as possible after excavating to estimate the soils compressive strength.

Trench – An excavation made below the surface of the ground in which the depth is greater than the width, but the width is not greater than 15 feet.

Type "A" Soil – a cohesive soil with an unconfined compressive strength of 1.5 tons per square foot (tsf). Examples are clay, silty clay, sandy clay, clay loam, and in some cases silty clay loam, sandy clay loam and Cemented soils such as caliche and hardpan.

Type "B" Soil – A cohesive soil with an unconfined compressive strength greater than 0.5 tons per square foot (tsf) but less than 1.5 tsf. Examples include granular non-cohesive soils including angular gravel (crushed rock), silt, silt loam, sandy loam, and in some cases silty clay loam, sandy clay loam, and previously disturbed soils except those which would otherwise be classified as Type C, and soils that meet the tsf requirements of Type A soil but is fissured or subject to vibration or dry rock that is not stable.

Vibration – A force which is drastically underestimated. It is invariably present on a construction site and must be taken into consideration during pre-job planning.

Visual Tests – Test to determine qualitative information regarding the excavation Site in general, the soil adjacent to the excavation, and soil taken as samples from excavated material. Examples include estimated particle size (fine grain, cohesive and coarse grain or granular, soil that remains in clumps when excavated is cohesive, while soil that does not stay in clumps is granular, tension cracks could indicate fissured material, identify potential sources of vibration that may affect the stability of the excavation and look for the evidence of water.

8.0 Document Control Process

This SOP will be reviewed every 3 years or as necessary, to ensure that the policies and procedures remain current and appropriate. Whenever it is necessary to implement changes to procedures, this SOP will be updated, reviewed and approved. In the event this SOP describes a process that is no longer followed, it

will be retracted from the current file, archived and retrievable for audit purposes. The dates and details of all changes or withdrawals will be documented below.

Document Change History

Version	Change Date	Change Description	Changed by	Approved by	Approval Date
1.0	8/20/19	• Add Policy Statement • Change Business Objective to Purpose • Change Procedure to Practice	Colin Clark	Ken Phillips	8/20/19
1.1	10/17/19	• Update cover page • Update TOC	Colin Clark	Ken Phillips	10/17/19
1.2	2/26/20	Change Excavation PS to include 16in or deeper statement per Sec. 251.002 (5) of the Texas Utilities Code.	Colin Clark	Ken Phillips	2/26/20
1.3	5/28/24	Revised the Benching Section Add Sloping Configurations	Colin Clark	Ken Phillips	5/28/24

NOTE: Changes to this document shall be reviewed by the Sub-Committee and approved by the Executive Safety Committee (ESC). Any document revisions are to be noted on the Document Review Change Log. This form shall be kept current to maintain audit compliance.

Appendix A

EXCAVATION INSPECTION FORM

Excavation Inspection Form

Lewis Energy Group

Date/Time:	
Location:	
Competent Person:	
Location Service #	
Utilities Located:	

Hot Work Permit Required?	☐ Yes ☐ No
Confined Space Entry Permit Required?	☐ Yes ☐ No
Barricades and Traffic Control:	☐ Daylight ☐ Overnight ☐ Vest ☐ Visible Barrier
Person Protective Equipment:	☐ Hard Hat ☐ Safety toe boots ☐ FRC ☐ Safety Glasses
Non-entry Rescue Equipment:	☐ Full Body Harness ☐ Life Line
Atmospheric Testing: > or = to 4’ deep:	☐ O2 ☐ LEL ☐ H2S ☐ CO
Protective System if > or = to 4' deep:	
Egress and Ingress:	☐ Ladder ☐ Ramp ☐ Within 25’ travel
Soil Type:	☐ Stable Rock ☐ Type A ☐ Type B ☐ Type C ☐ Previously Disturbed
Shoring:	☐ Timber ☐ Hydraulic ☐ OSHA Charts ☐ Engineered Data
Slope Ratio (Horizontal: Vertical)	☐ $^{1/2}$:1 ☐ $^{3/4}$:1 ☐ 1:1 ☐ 1 $^{1/2}$:1 ☐ Other
Spoil Pile 2’ back from excavation?	☐ Yes ☐ No
Water Removal:	

Comments: _____

Appendix B

SOIL ANALYSIS TABLES & SLOPE CONFIGURATIONS

TABLE 1: SOIL ANALYSIS – VISUAL TESTS

I. **Estimate the range of particle sizes**
   - Fine grained = cohesive material
   - Coarse grained (sand and gravel) = granular material

II. **Observe the excavated soil**
   - Soil in clumps + cohesive material
   - Soil breaks up easily + granular material

III. **Observe the open location**
   - Sides
   - Surface area
   - Crack-like openings
   - Spall of vertical sides
   - Indication of moving ground

IV. **Observe previously disturbed soil**
   - Existing facilities
   - Other underground structures

V. **Observe the open excavation**
   - Layered systems
   - Layers sloped towards excavation
   - Estimate degree of layered slope

VI. **Observe evidence of water conditions**
   - Surface water (creeks, rivers, etc.)
   - Run off
   - Seeping from the sides
   - Water Table

VII. **Observe possible vibration present**
   - General areas (adjacent to)
   - In excavation (equipment, tools)

Table 2: SOIL ANALYSIS – MANUAL TEST

I. Plasticity determines cohesive soil
- Mold soil sample into a small ball
- Roll ball into threads 1/8" diameter
- Pick up 2" length of 1/8" thread by one end without breaking

II. Dry Soil Strength – Type C granular material
- Crumbles on its own
- Crumbles with moderate pressure by hand
- Breaks into individual grains or fine powder

III. Dry Soil Strength – Type B cohesive material
- Falls into clumps
- Breaks into smaller clumps
- Smaller clumps only broken with difficulty (by hand)

IV. Dry Soil Strength – Type A cohesive material
- Breaks into clumps
- Does not break into smaller pieces
- Clumps broken with difficulty (by hand)
- No visual indication of fissures

V. Thumb Penetration Test
- **Type A Soil**
  - ✓ Can be readily indented by the thumb with great effort
- **Type B Soil** – unconfined compressive strength of 0.5 tsf to 1.5 tsf
  - ✓ Can be indented by the thumb with effort
- **Type C Soil** – unconfined compressive strength of up to 0.5 tsf
  - ✓ Can be easily penetrated several inches
  - ✓ Can be molded by light finger pressure

  Note: All thumb penetration tests shall be run:
  - ✓ On large clumps of spoil material as it is excavated
  - ✓ If excavation is later exposed to wetting influences, it must be reclassified

VI. Unconfirmed Compressive Strength – All units are tons/foot^2
- Using a Pocket Penetrometer (take 10 readings and average)
  - ✓ Up to 0.5 (Type C Soil)
  - ✓ 0.5 – 1.5 (Type B Soil)
  - ✓ 1.5 – 2.0 (Type A Soil)

VII. Drying Test – soil sample should be 1" thick and 6" in diameter
- If crack develop as it dries, significant fissures are indicated (classify Type B or C)
- If soil material dries without cracks and breaks by hand with considerable force (classify as a unfissured cohesive material Type A)
- Once unfissured cohesive material has been established, check for unconfined compressive strength using another soil sample.
- If sample breaks easily by hand (classify as fissured cohesive or granular material)
- If clumps cannot be pulverized easily by hand or by stepping on them the material is cohesive with fissures
- If clumps pulverize easily into small fragments, the material is granular

Table 3: MAXIMUM ALLOWABLE SLOPES & SLOPE CONFIGURATIONS

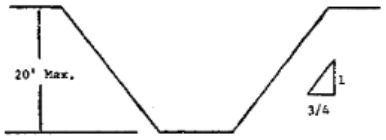
Stable Rock	Vertical (90°)
Type A Soil	¾' to 1' (53°) *Short term: 24 hours* ➢ ½' to 1' (63°) Excavations that are 12' or less in depth ➢ ¾' to 1' (53°) Excavations greater than 12'
Type B Soil	1' to 1' (45°)
Type C Soil	$1^{1/2'}$ to 1' (34°)

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

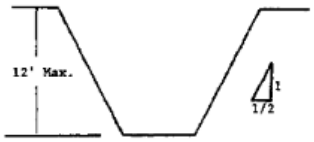
B-1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



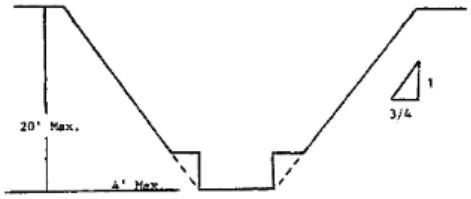
SIMPLE SLOPE--GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

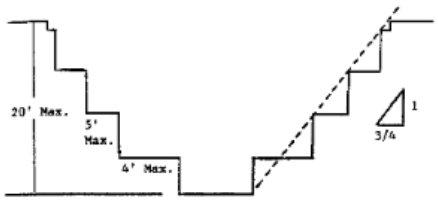


SIMPLE SLOPE--SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:



SIMPLE BENCH



MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.