Department of the Air Force
HQ AEDC (AFMC)
Arnold AFB, TN 37389

Safety, Health, and Environmental Standard

Title: EXCAVATIONS, TRENCHING, AND SHORING

Standard No.: C6

Effective Date: 05/17/2013

Releasability: There are no releasability restrictions on this publication.

The provisions and requirements of this standard are mandatory for use by all personnel engaged in work tasks necessary to fulfill the AEDC mission. Please contact your safety, industrial health and/or environmental representative for clarification or questions regarding this standard.

Approved:

Contractor/ATA Director
Safety, Health, and Environmental

Air Force Functional Chief

Record of Review/Revision
(Current revisions are highlighted in yellow and marked with a vertical line in the right margin.)

Date/POC	Description
05/09/13 Tate	Clarified Paragraph 4.3.1.1 to indicate Type "C" soil sloped to the maximum angle of slope in accordance with Table 2.
03/11/13	Added NFAC supplement; no other change.
10/19/11 R. Eichel F. Hutchinson	Two year review: Reformatted introduction. Moved training requirements to Section 5. Moved inspection requirements to Section 6.
02/22/10 R.Eichel	Two-year review. Added definition for Authorized Rescue Attendant. Reworded Paragraphs 4.1.5.2, 4.3.2, 4.4.6.6, 4.4.7.2 and broke out "hand digging requirements" making it a separate paragraph (4.4.7.3). Added "reclaimed water" as a service in the uniform color codes table. Deleted table "Trench Shoring – Minimum Requirements " and replaced it with a reference to OSHA 1926.652 Appendix (from which it was originally copied). Minor word changes to table "Underground Warning Tape for Marking Buried Utility Lines."
02/25/08	Annual review; no change required.
04/06/07 R. Eichel	Annual review; administrative change only: removed blank Form GC-1746 Daily Trench/Excavation Inspection as an attachment..
2/09/06 R. Eichel; M. Lindstrom	Annual review; minor revisions: Re-worded definition of embedded. Reworked section on Training. Incorporated use of Form GC-1746 (same data as previous Attachment 1) to document daily inspections; replaced previous Attachment 1 with Form GC-1746, Daily Trench/Excavation Inspection. Moved the hand digging requirements for buried lines in excess of 600 volts. Changed "5 feet" to "4 feet" as a requirement for shoring at AEDC.
03/10/05 R. Eichel	Reviewed; no change required.
02/02/04 R. Eichel	Complete revision, restructured and reformatted, clarified responsibilities, procedures, training requirements, and for employees being in excavation while digging is in progress. Added several definitions. Changed references to "digging permit" to reflect "Master Work Permit" Incorporated Parent company information.
9/30/02	General revision of this document.

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Safety, Health, and Environmental Standard

EXCAVATIONS, TRENCHING, AND SHORING

1.0 INTRODUCTION/SCOPE/APPLICABILITY

1.1 Introduction – This standard describes the tasks, activities and actions required when excavations or trenching operations are to be performed at AEDC. The standard implements the requirements of OSHA, ANSI, ASME, NFPA, API, Air Force and other nationally recognized national consensus standards.

1.2 Scope – This standard establishes general and specific guidelines for safety of personnel and facilities when performing excavation, trenching and shoring operations.

1.3 Applicability – This standard applies to all construction and maintenance-related excavation or trenching work on Arnold AFB and includes excavations and concrete breaking for embedded service lines.

2.0 BASIC HAZARDS/HUMAN FACTORS

The principal hazard of excavation work is death by suffocation or crushing when exposed soil falls and buries the workers. Workers are also subjected to hazards of falling materials, tools, equipment, and to the hazards involving with digging into energized/pressurized utilities such as electrical, water, steam, fuel and natural gas lines. An additional concern is the potential for an oxygen-deficient atmosphere. Muddy conditions (common to excavations) increase dangers of slips and falls. Hazards of striking against or being struck by objects are increased by congestion of personnel, materials, and equipment. Additionally, vibrations from heavy equipment or nearby vehicle traffic can cause soil to become unstable and collapse.

3.0 DEFINITIONS/TERMS

Aluminum Hydraulic Shoring – A pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross braces), used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such a system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Authorized Rescue Attendant – An employee that has been trained and equipped for rescue operations in accordance to the requirements in 29 CFR 1910.146(k). Includes specific training on PPE and rescue equipment, basic first-aid and cardiopulmonary resuscitation (CPR), and documented practice at least every 12 months by means of making simulated rescue operations from actual or representative permit spaces. For AEDC operations, these duties are normally performed by AEDC Fire Department Personnel who may or may not be standing by on-site, depending on On-Duty Fire Chief's determination.

Base Operating Contractor – A long-term contractor directly accountable to the Air Force for the AEDC mission. This is the term used to identify the AEDC Operation, Maintenance, Information Management and Support Contractor.

Bell Bottom Pier Hole – a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

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.

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 falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent Person – One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.

Embedded Service Lines – Utility piping or lines, such as electric, sewer, water, fuel, steam, and communications or other services which may be located underground in soil, roadways, hardstands, concrete slabs, and building floors, or located in above ground building walls, ceilings, etc.

Excavation – Any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reason of the excavation. At AEDC any digging deeper, then 12 inches will be considered an excavation.

Maximum Allowable Slope – The greatest angle above the horizontal plane at which a material will lie without sliding.

Outside Contractor/Subcontractor – An organization employed by the Base Operating Contractor or the Air Force to do construction, maintenance, repair or other work at AEDC. This term includes those who may be subcontracted by an outside contractor for specific portions of a project. Also referred to as the construction contractor.

Protective System – A method of protecting employees from cave-ins; from material that could fall or roll from an excavation face or into an excavation. Protective systems include: sloping systems, benching systems shoring systems and shield systems.

Ramp – An inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer – A person who is registered as a professional engineer (PE) in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed appropriate when approving designs for pre-engineered or manufactured protective systems. When a design requires PE approval, the reviewing PE shall stamp/seal the design upon approval.

Sheeting – Material (wood, steel, or concrete, which may form a continuous line) placed in close contact and providing a wall to resist the lateral pressure of water, adjacent earth, or other materials.

Shield (Shield System) – A 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 structure or can be designed to be portable and moved along as work progresses. Also known as trench box or trench shield.

Shoring (Shoring System) – A 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 (Sloping System) – A method of protecting employees 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 repose (incline) varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Spoil – The earth and material drawn from an excavation.

Stop Logs – Generally accepted term to include a temporary or permanent barrier suitable for stopping wheeled equipment from proceeding into restricted areas. Barricade must be suitable in size and strength to accomplish the above objective.

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

Trench (Trench Excavation) – 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 is not greater than 15 feet.

Underpinning – Support props, girders or masonry installed to support trench walls or other structures from below.

If forms or other structures are installed or constructed in an excavation as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less, the excavation is also considered to be a trench.

4.0 RESPONSIBILITIES/REQUIREMENTS

4.1 Responsibilities

4.1.1 Management Shall

4.1.1.2 Be responsible for assuring the overall implementation and compliance with this standard. They must be familiar with this standard and utilize expertise at their disposal to ensure Employees are protected from excavation hazards.

4.1.1.3 Directors or Managers shall designate by letter, Competent Persons for trenching and excavation activities on-site, only after they have completed an appropriate course taught by the Contractor Safety and Health, or some other recognized third party.

4.1.1.3.1 Letters are required upon initial appointment and again whenever refresher training is completed.

4.1.2 Supervision Shall

4.1.2.1 Ensure Competent Persons have been assigned to inspect the safety of excavations and monitor the work for any hazardous situations.

4.1.2.2 Confirm each excavation job is properly evaluated and prepared with hazards being addressed, ensuring Employees are protected.

4.1.2.3 Ensure Employees are aware of any hazards associated with their work, and they are properly trained on this standard and any site specific excavation procedures.

4.1.2.4 Ensure Employees adhere to all excavation requirements and any task requirements established.

4.1.2.5 Continuously monitor the work to assure compliance with this standard.

4.1.2.6 Ensure Form GC-1732, Master Work Permit, is initiated and processed before any work is begun. When applicable obtain necessary electrical hold orders/safety tags.

4.1.2.7 Be responsible for maintaining site documentation required by this standard.

4.1.3 Competent Persons Shall

4.1.3.1 Train Employees directly involved with the excavation on the content of this standard and ensure it is clearly understood. (See Section 4.2.1.)

4.1.3.2 Evaluate whether the excavation is also a confined space. If determined to be a confined space follow procedures in AEDC Safety, Health, and Environmental Standard (SHE Std) B5, Confined Spaces.

4.1.3.3 Perform daily inspections of excavations, the adjacent areas, and protective systems before the start of work each day and as necessary throughout the shift. Document these inspections using Form GC-1746, Daily Trench/Excavation Inspection, which shall be retained for a minimum of 30 days following project completion.

4.1.3.4 In addition to the daily inspection, inspect excavations after every rainstorm or other hazard increasing occurrence.

4.1.3.5 Where evidence indicates a possible cave-in, failure of the protective system, or other hazardous condition, remove employees from the excavation until the proper precautions have been taken.

4.1.4 Employees Shall

Know the hazards associated with their work in and around excavations and ensure these hazards are properly addressed according to training received.

4.1.5 Base Operating Contractor Operations and Maintenance – Utilities Maintenance Team Shall

4.1.5.1 Maintain and use electronic locators to find embedded service lines.

4.1.5.2 Prior to excavation, locate and mark the general location of buried utilities by flagging, chalking, or painting the surface. If utility type can be reasonably determined through drawings or other documented

evidence, use Table 1 for proper color-coding. If utility types are unknown, default to RED. (Rechecks may be necessary as work progresses closer to the lines or when excavating through different materials.)

4.1.6 Base Operating Contractor Work Control Shall

4.1.6.1 Search records and provide information on embedded lines as requested

4.1.6.2 Review and coordinate on all Forms GC-1732, Master Work Permit, when digging/excavation is indicated in Section II on the form.

4.1.7 Base Operating Contractor Design Engineering Shall

4.1.7.1 Ensure that service lines are properly located on drawings as applicable to a project.

4.1.7.2 Ensure that service line additions, deletions, or changes are properly recorded on drawings of record.

4.1.8 Base Operating Contractor Safety and Health Shall

4.1.8.1 When requested, advise management and supervision of excavation, trenching, and shoring safety requirements.

4.1.8.3 Assist in the monitoring of excavation activities and ensure any concerns are communicated to Site Management and Supervision and properly resolved.

4.1.8.4 Provide Phase One training for AEDC competent/qualified person initially when necessary and every three years as a refresher course.

4.2 General Requirements

4.2.1 All excavations shall be made in accordance with this standard and 29 CFR Part 1926 (OSHA).

4.2.2 Before any excavation is started, embedded service lines shall be located and protected. A GC-1732, Master Work Permit, with sections II and IV completed shall be executed. Multiple underground utility scans may be required for different phases of the project and when excavating through different types of material (e.g., initial scan of concrete prior to demolition and a second survey of the soil beneath the concrete once the concrete is removed and prior to excavation). The Competent Person will not allow excavation to begin until they are confident that all underground hazards have been located. If necessary the Competent Person will locate the person who conducted the actual survey of buried underground lines to better determine actual location and accuracy of available marking or prints.

4.2.3 All Employees shall be protected with personal protective equipment for the protection of head, eyes, respiratory organs, hands, feet, and other parts of the body as required.

4.2.4 In many instances excavations are considered confined spaces (See AEDC SHE Std B5, Confined Spaces). If this is the case, all parts of both the excavation and the confined space entry procedures must be followed.

4.2.5 Physical barricades must be placed around all excavations. Signs must be provided and posted in accordance with AEDC SHE Std B3, Control of Hazardous Areas Using Safety Signs, Tags, and Barricades.

4.2.6 The possibility of flammable or toxic gases settling in low places of excavations must be assessed before entering excavations or doing hot work.

4.2.7 A Competent Person shall be placed in charge of all excavations.

4.3 Specific Requirements

4.3.1 Excavations

4.3.1.1 At AEDC the walls and faces of all excavations 4 feet or more in depth, unless in solid rock, shale, or tested to be Type “A” or “B” shall be shored, sheeted, braced, sloped, or Type “C” soil sloped to the maximum angle of slope as specified in Table 2.

4.3.1.2 The walls and faces of excavations less than 4 feet in depth shall be protected by an adequate protective system when a Competent Person determines the possibility of hazardous ground movement.

4.3.1.3 Excavations or trenches 20 feet deep or greater shall have a protective system designed by a registered professional engineer.

4.3.1.4 Materials used for shoring, sheeting, or bracing shall be in good, serviceable condition and must meet dimension requirements as shown in 29 CFR 1926 Subpart P Appendix C.

4.3.1.5 Manufactured shoring and shield systems shall be used in accordance with the manufacturer's instructions and modifications to those systems will not be accomplished without the manufacturer's written consent.

4.3.1.6 In excavations that employees may have to enter, excavated material (spoil) and equipment shall be stored at least 2 feet or more from the edge of the excavation (as measured from the bottom edge of the spoil bank nearest to the excavation) or behind retaining devices sufficient to prevent material or equipment from falling or rolling into the excavation.

4.3.1.6.1 Spoil banks shall be sloped to reduce pressure on the sides of excavations and help prevent the spoilage from sliding back into the excavation.

4.3.1.7 All surface objects that may present a hazard to Employees by rolling or falling into an excavation shall be removed or secured to prevent movement.

4.3.1.8 While the excavation is open, underground installations shall be protected, supported or removed to safeguard Employees.

4.3.1.9 If the Operator of mobile equipment adjacent to or near the edge of an excavation does not have a clear view of the edge of the excavation, a warning system such as barricades, stop logs, or hand signals shall be used. If possible, the grade should be away from the excavation.

4.3.1.10 Upon completion of operations, temporary wells, pits, shafts, etc. shall be promptly and adequately back filled.

4.3.2 Access and Egress

4.3.2.1 Excavations 4 feet or more in depth shall have stairways, ladders, ramps or other safe means of egress located so as to require no more than 25 feet of lateral travel for egress.

4.3.2.2 If used, ladders shall be secured and extend a minimum of 36 inches above the landing surface.

4.3.2.3 Structural ramps used solely by Employees shall be designed by a Competent Person.

4.3.2.4 Structural ramps used by equipment shall be designed by a Competent Person qualified in structural design and shall be constructed accordingly.

4.3.3 Pedestrian/Vehicle Traffic

4.3.3.1 Excavations exposed to pedestrian or vehicular traffic shall be protected by temporary guardrails or barricades, installed so as to provide adequate warning of the excavation hazard. Flashing warning lights shall be provided if the excavation is left open overnight.

4.3.3.2 Where employees must cross over excavations, walkways or bridges with guardrails shall be provided. Walkways will have minimum clear width of 20 inches, be fitted with standard rails, and extend a minimum of 24 inches past the surface edge of the trench.

4.3.3.3 Vehicle crossings shall be designed by and installed under the supervision of a registered professional engineer.

4.3.3.3.1 Weight limitations shall be posted.

4.3.4 Exposure to Vehicles/Equipment

4.3.4.1 Employees are not normally allowed in an excavation, in close proximity (closer than 10 feet) to heavy equipment, and must remain visible and out of the swing zone while the equipment is digging; however, it is recognized that it sometimes becomes necessary for a person to enter an excavation for the purpose of guiding the equipment operator when digging is required in close proximity to a known buried object,

or when an unknown buried object is detected. When it becomes necessary for a person to enter the excavation and be in close proximity to heavy equipment, while it is digging, the following shall apply:

4.3.4.1.1 Contractor Safety and Health shall be notified and shall approve the entry for AEDC employees. This can be accomplished telephonically; in addition, the following is required for all personnel:

4.3.4.1.2 A member of supervision/management shall be present, and

4.3.4.1.3 When excavation is deeper than 4 feet, the employee shall be protected by adequate protective system(s) and shall not be allowed outside of protected area.

4.3.4.2 Employees outside of and exposed to vehicular traffic shall be provided with and be required to wear reflective vests or other suitable garments marked with or made of reflectorized or high-visibility materials.

4.3.4.3 Trained flag persons, signs, signals, and barricades shall be used when necessary.

4.3.5 Exposure to Falling Loads

4.3.5.1 No person shall be permitted under loads handled by lifting or digging equipment.

4.3.5.2 No employee shall remain near a vehicle being loaded or unloaded. Operators may remain in the enclosed cab of the vehicle.

4.3.6 Hazardous Atmospheres/Confined Spaces

4.3.6.1 Employees are not permitted to work in hazardous and/or toxic atmospheres. Where potentially hazardous atmospheres exist, the hazard abatement process of SHE Std A4 System Safety should be used to determine acceptable controls and authorizations for the work. Such atmospheres include those:

4.3.6.1.1 With less than 19.5% oxygen,

4.3.6.1.2 With a combustible gas concentration greater than 10% of the lower flammable limit, and,

4.3.6.1.3 With concentrations of hazardous substance that exceed the TLV for airborne contaminants established by the American Conference of Industrial Hygienists (ACGIH).

4.3.6.2 Where oxygen deficiency (less than 19.5%) or a hazardous atmosphere exists or could exist, the atmosphere in the excavation shall be tested.

4.3.6.2.1 Atmospheric testing shall be accomplished before employees enter excavations greater than 4 feet in depth.

4.3.6.2.2 Periodic testing shall be conducted to ensure all potentially hazardous atmospheres remain safe.

4.3.6.2.3 If internal combustion engine equipment is operating in or near the trench, or welding, cutting, or burning operations are conducted in the excavation, continuous monitoring must be accomplished.

4.3.6.3 Adequate precautions shall be taken to prevent employee exposure to oxygen deficiency or hazardous atmospheres. These precautions may include providing proper respiratory protection or ventilation.

4.3.6.4 Emergency rescue equipment such as breathing apparatus and safety harness and lifeline shall be readily available where hazardous atmospheres exist or may be expected to develop. This equipment shall be attended by an Authorized Rescue Attendant.

4.3.6.5 Employees entering bell-bottom pier holes or other similar deep and confined footing excavations shall wear a harness with a lifeline securely attached. The lifeline shall be individually attended at all times.

4.3.6.6 Some excavations may qualify as confined spaces. When the Competent Person determines that an excavation meets the conditions of a confined space; entry protocol must also comply with AEDC SHE Std B5, Confined Spaces.

4.3.7 Embedded Service Lines

4.3.7.1 Electric power tools used for drilling operations near embedded electric lines shall be double-insulated or have three-wire ground connections, and shall be connected through a Ground Fault Circuit Interrupter

(GFCI), or shall be of the cordless type. Air operated tools shall be grounded by a ground wire (at least No. 12 gauge) fastened to the tool frame and to a nearby building ground or equivalent.

4.3.7.2 Mechanical equipment, such as back hoes and ditching machines, shall not be used for excavating closer than 2 feet to embedded lines, unless the exact location of the line is determined by safe and acceptable means. Otherwise, work closer than this must be done with hand tools.

4.3.7.3 Only hand digging is allowed within 2 feet of buried electrical lines in excess of 600 volts.

4.3.7.4 When back-filling, marking tape as specified in Table 3 shall be used to warn future excavating crews of the presence of embedded lines.

4.3.8 Water Accumulation

4.3.8.1 Employees shall not work in excavations in which there is accumulated water, or which water is accumulating unless the proper precautions have been taken.

4.3.8.2 Precautions include support or shield systems, water removal to control the level, and use of a safety harness and lifeline. When used, water removal equipment must be monitored by a Competent Person.

4.3.9 Stability of Adjacent Structures

4.3.9.1 Except in stable rock, excavation below the level or base of footing of any foundation or retaining wall shall not be permitted unless the wall is underpinned and all other precautions taken to ensure the stability of the adjacent walls and the safety of Employees involved in the work.

4.3.9.2 Shoring, bracing, or underpinning shall be inspected daily, or more often as conditions warrant by a Competent Person and the protection effectively maintained.

4.3.10 Fall Protection

4.3.10.1 Where Employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guard rails shall be provided.

4.3.10.2 Adequate barricades providing physical protection shall be provided at all excavations. All wells, pits, shafts, etc., shall be barricaded or covered.

4.3.11 Soil Classification

4.3.11.1 Each soil and rock deposit at AEDC shall be assumed to be type "C" or classified by a Competent Person as stable rock, type A, type B, or type C in accordance with the definitions set forth in 29 CFR 1926 Subpart P Appendix A and documented on Form GC-1746.

4.3.11.2 The classification shall be based on at least one visual and at least one manual analysis. Such analysis shall be conducted by a Competent Person using tests described in 29 CFR 1926 Subpart P Appendix A.

5.0 TRAINING

5.1 All Employees involved in trenching and excavations shall be properly trained in accordance with this standard.

5.2 Employee training shall be conducted and documented by Competent Persons.

5.3 Refresher training for Competent Persons shall be accomplished at three-year intervals.

6.0 INSPECTIONS/AUDITS

6.1 Designated Competent Persons shall make inspections of excavations, the adjacent areas, and protective systems before any Employees or equipment are allowed to enter an excavation, before the start of work each day and as necessary throughout the shift, via Form GC-1746.

6.2 The designated Competent Person must also determine whether the excavation is a confined space, and what additional requirements shall apply.

6.3 Additional inspections shall be made by the Competent Persons after every rainstorm or other hazard increasing occurrence, such as:

6.3.1 Snowstorms, extended freezing or thaw, etc.

6.3.2 When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur,

6.3.3 When there is a change in the size, location, or placement of the spoil pile,

6.3.4 When there is any indication of change or movement in adjacent structures.

6.4 Where there is any evidence which indicates a possible cave-in, failure of the protective system, or other hazardous condition, Employees shall be removed until the Competent Person can inspect the situation, and proper precautions have been taken.

7.0 REFERENCES

AEDC Safety, Health, and Environmental Standards
- A4, System Safety
- B1, Master Work Permit
- B3, Control of Hazardous Areas Using Safety Signs, Tags, and Barricades
- B5, Confined Spaces

Occupational Safety and Health Administration
- 29 CFR Part 1926 Subpart P, Excavations

8.0 TABLES

1. Uniform Color Codes for Temporary Marking of Underground Utilities
2. Maximum Allowable Slopes
3. Underground Warning Tape for Buried Utility Lines

9.0 SUPPLEMENT

NFAC A321-0801-XSP C6 Excavation, Trenching, and Shoring

Table 1.

American Public Works Association (APWA)
Uniform Color Codes for temporary marking of underground utilities.

Red	electric power lines, cables, conduit, and lighting cables
Orange	telecommunication, alarm or signal lines, cables, or conduit
Yellow	natural gas, oil, steam, petroleum, or other gaseous or flammable material
Green	sewers and drain lines
Blue	drinking water
Violet	reclaimed water, irrigation, and slurry lines
Pink	temporary survey markings, unknown/unidentified facilities
White	proposed excavation limits or route

Table 2.

Maximum Allowable Slopes

Soil or rock type	**Maximum allowable slope (H:V)** [2] **for excavations less than20 feet deep**[3]
Stable Rock	Vertical (90°)
Type A	¾:1 (53°)
Type B	1:1 (45°)
Type C [1]	1½:1 (34°)
Type A (short-term) [4]	½:1 (63°) (For a maximum excavation depth of 12 ft)

Notes:

1. All soil at AEDC shall be considered as Type C unless soil testing proves otherwise.
2. Numbers shown in parentheses next to maximum allowable slope are angles expressed in degrees from the horizontal. Angles have been rounded off.
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.
4. *Short term exposure* means a period of time less than or equal to 24 hours that an excavation is open.

Table 3.

Underground Warning Tape for Marking Buried Utility Lines

All drawings produced at AEDC which depict the installation of underground pipes, lines, conduits, or other below-grade utilities shall contain provisions and instructions for placing underground marker tape to warn future excavating crews of such lines.

Marker tapes shall be acid and alkali resistant polyethylene film, W.H. Brady Co. ***Identoline*** tape or equivalent. Three-inch width shall be used for lines 6 inches or less in diameter and six-inch width shall be used for lines of greater than 6 inches in diameter. The marker tape shall be placed 6 inches minimum and 12 inches maximum below finished grade directly over the line. End of roll or broken marker tapes shall be overlapped a minimum of 5 feet. When non-metallic lines are used, aluminum tape shall be applied to top surface of lines; two-inch wide tape for lines four inches or less in diameter; four-inch wide tape for lines greater than 4 inches. Marker tape shall be provided as directed above. The following colors and legends based on American Public Works Standard shall be used for the services indicated:

Service	Color	Legend
Gas	Black on Yellow	Caution Buried Gas Line
Electric	Black on Red	Caution Buried Electric Line
Telephone and Communication	Black on Orange	Caution Buried Telephone Line
Water (Potable or Raw)	Black on Blue	Caution Buried Water Line
Sewer	Black on Green	Caution Buried Sewer Line
Reclaimed Water	Black on Purple	Caution Reclaimed Water
Steam	Black on Yellow	Caution Buried Steam Line
Fuel Oil	Black on Yellow	Caution Buried Fuel Oil Line
Air, Nitrogen, etc.	Black on Yellow	Caution Buried Utility Line

A321-0801-XSP C6 Excavation, Trenching, and Shoring Supplement

This supplement has been approved for the NFAC Site.

Review: This supplement will be reviewed and updated using the same cycle as the AEDC Safety, Health, and Environmental (SHE) Standard C6 Excavations, Trenching, and Shoring

References: AEDC SHE Standard C6 Excavations, Trenching, and Shoring at the AEDC NFAC Site

Ames Procedural Requirement APR1700.1 Chapter 27 “Construction Safety Management”

Scope:

This supplement describes the tasks, activities and actions required when excavations or trenching operations are to be performed at AEDC. The standard implements the requirements of OSHA, ANSI, ASME, NFPA, API, Air Force and other nationally recognized national consensus standards.

This supplement establishes general and specific guidelines for safety of personnel and facilities when performing excavation, trenching and shoring operations.

This supplement applies to all personnel conducting operations, maintenance, testing and support at NFAC, NASA AMES.

NFAC Worksite Application:

NFAC will follow Ames Procedural Requirement APR1700.1 Chapter 27 Construction Safety Management.

A signed excavation permit is required 24 hours in advance of any excavation or trench work exceeding 6 inches in depth as required by NASA AMES Procedure (APR) 1700.1 Construction Safety Manual, Chapter 27, Section 27.9.13 Excavation Permits.

Requirements/Responsibilities:

I. NFAC Site Management shall ensure employees, customers, and vendors comply with this supplement.

II. NFAC Supervisors and Test Directors shall

1. Ensure that employees, customers, and vendors performing trenching/excavations activities in their area have the required permit signed prior to any work activity beginning.
2. Ensure that required permits have been issued before work begins.

III. NFAC Safety Engineer/Management Designee shall assess all trenching operations to ensure that all requirements of APR 1700.1, Chapter 27, section 27.9.13 have been meet.

IV. NFAC Staff shall ensure employees follow this supplement.