

PROCEDURE 26 - Trenching and Excavation Operations

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Synopsis

The purpose of this procedure is to establish requirements relative to the hazards associated with trenching and excavation operations. The procedure applies to all NWS facilities, work locations and employees involved in trenching and excavation operations.

Initial Implementation Requirements:

- **Analyze Site Operation versus Requirements of Procedure**
- **Designate Person to Administer Trenching and Excavation Operations Procedure Requirements**
- **Provide Local Training of Site Personnel**
 - Competent Person Training. (26.5.2b)
- **Inventory Material/Equipment (Procure as required)**
 - Emergency Rescue Equipment. (26.5.2c, 26.3.14f)
 - Personal Protective Equipment. (26.5.2c, 26.3.14d)
 - Protective Systems. (26.5.2c, 26.3.21 & 26.3.22)
 - Shields. (26.5.2c, 26.3.28)

Recurring and Annual Task Requirements:

- **Perform Inspection/Assessment**
 - Conduct daily inspections of excavations, adjacent areas and protective measures (26.3.19)
- **Provide Refresher Training of Site Personnel (as required)**
 - Competent Person Training. (26.5.2b), as appropriate
- **Inspect/Replace/Recalibrate/Maintain Material/Equipment**
 - Emergency Rescue Equipment. (26.5.2c, 26.3.14f)
 - Personal Protective Equipment. (26.5.2c, 26.3.14d)

Trenching and Excavation Operations Checklist

Requirements	Reference	YES	NO	N/A	Comments
Is initial and annual review of this procedure conducted and documented?	26.4.2				
Are all Excavation operations being performed in full compliance with this procedure?	26.3.1				
For excavations on NWS property, has a Competent Person been appointed?	26.3.3				
Has the Competent Person been trained according to this procedure?	26.5.4 a-h				
Are all Protective Systems designed or approved by the Competent Person, and are they in accordance with this procedure?	26.3.21-25				
Have all underground utilities been identified and flagged prior to excavation?	26.3.5				
Are structural ramps designed or approved by the Competent Person?	26.5.2b, 26.3.7				
Are adequate safeguards, approved by a Competent Person, being utilized while an excavation is open to ensure workers safety?	26.3.6				
Do all ramps, used in lieu of steps, have cleats or treated surfaces to reduce slip hazards?	26.3.10				
Are safety precautions being implemented to ensure that no employees are permitted under loads being handled by lifting or digging equipment?	26.3.12				
Are employees exposed to vehicular traffic, provided with proper Personal Protective Equipment (PPE)?	26.3.13				

Requirements	Reference	YES	NO	N/A	Comments
For all excavations greater than 4 feet in depth and where required, is air monitoring performed to determine possible hazardous or oxygen deficient atmospheric conditions?	26.3.14b				
Are engineering controls, such as ventilation, being used, if possible, where there is potential hazardous or oxygen deficient atmospheric conditions?	26.3.14d				
Is rescue equipment available near excavations, and are Qualified Personnel available to perform a rescue?	26.3.14f				
Are adequate safety precautions being taken to protect employees against hazards posed when work is being done in an excavation where there is accumulated water?	26.3.15				
Are approved support systems being used where the stability of adjoining buildings, walls, or structures are endangered by excavation operations?	26.3.16				
Are procedures being followed when excavation operation is being done below the base or footing of any foundation/retaining wall that can pose hazard to personnel?	26.3.17				
Are personnel protected from the falling hazards such as loose rock and soil?	26.3.18				
Has the Competent Person performed daily inspections of excavations, adjacent areas and protective measures?	26.3.19				
Are walkways provided where employees or equipment are required or permitted to cross over an excavation?	26.3.20				

Requirements	Reference	YES	NO	N/A	Comments
Are employees performing excavations protected from cave-ins by an adequate protection system?	26.3.21				
Are support systems being designed, constructed and installed in accordance with this procedure?	26.3.26 a-e				
Are protective shields designed and used in accordance with this procedure?	26.3.28 b-e				

26 TRENCHING AND EXCAVATION OPERATIONS

26.1 Purpose and Scope

As part of its goal to provide a safe and healthful workplace, the National Weather Service (NWS) is promulgating this procedure related to hazards associated with trenching and excavation operations. This procedure applies to all NWS facilities, work locations and employees involved in trenching and excavation operations.

26.2 Definitions

Accepted Engineering Practices. Those requirements which are compatible with standards of practice required by a registered Professional Engineer.

Aluminum Hydraulic Shoring. A pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). These systems are designed to support the sidewalls of an excavation and prevent a cave-in.

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 bell shape.

Benching System. 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 rock or soil 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 sliding or falling, in sufficient quantity so that it could entrap, bury or otherwise injure an employee.

Competent Person. Defined by OSHA as 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 authority to take prompt corrective measures to eliminate them. The Competent Person must remain at the job site during operations.

Contracting Officer. Government Officer who is responsible for the award and overseeing of all contractor operations.

Engineering Controls. Ventilation system or air cleaning equipment used for remediation of hazardous air conditions.

Excavation. Any man-made cut, cavity, trench or depression in an earth surface, formed by earth removal operations.

Failure. The breakage, displacement or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Field Office. A Field Office may include the following: Weather Forecast Office (WFO), River Forecast Center (RFC), Weather Service Office (WSO), and a Data Collection Office (DCO).

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.

Kickout. The accidental release or failure of a cross brace.

Operating Unit. For the purpose of this procedure, Operating Unit includes the National Centers for Environmental Prediction (NCEP), National Data Buoy Center (NDBC), NWS Training Center (NWSTC), National Reconditioning Center (NRC), Radar Operations Center (ROC), or the Sterling Field Support Center (SFSC).

Professional Engineer. An individual licensed and registered under the laws of the State having jurisdiction to engage in the practice of engineering.

Shield. A structure that is able to withstand the forces imposed on it by a cave-in and therefore can protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields used in trenches are referred to as “trench boxes” or “trench shields.”

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 System. A method of protecting employees from cave-ins by excavating to form sides of excavation 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.

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

Station Manager. For the purpose of this procedure, the Station Manager shall be either the NWS Regional Director; Directors of Centers under NCEP (Aviation Weather Center, NP6; Storm Prediction Center, NP7; and Tropical Prediction Center, NP8; Space Weather Prediction Center, NP9); Directors of the NDBC, NWSTC, and Chiefs of NRC, ROC and SFSC facilities; or Meteorologist in Charge (MIC), Hydrologist in Charge (HIC), or Official in Charge (OIC).

Trench (Trench Excavation). A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of the trench as measured at the bottom is not greater than 15 feet.

Uprights. The vertical members of a trench-shoring system placed in contact with the earth.

Wales. Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or the earth.

26.3 Procedure

26.3.1 All excavations shall be performed in full compliance with OSHA 29 CFR 1926, Subpart P “Excavations.”

26.3.2 The Contracting Officer with assistance of a Competent Person shall ensure that all excavations are conducted in accordance with the OSHA standards.

26.3.3 The Contracting Officer shall ensure a Competent Person as defined in section 26.2 approves all procedures and hazard controls for excavations at the NWS site.

26.3.4 All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

26.3.5 The estimated location of utility installations, such as sewer, water, electrical service lines, etc., which may be affected shall be determined prior to opening an excavation. As the excavation approaches the estimated location, the actual location shall be verified by safe and acceptable means. Local utilities departments should be contacted before starting the trenching and excavation operations.

26.3.6 While the excavation is open, adequate safeguards shall be approved by the Competent Person to ensure underground utilities do not pose a safety or health hazard to personnel.

26.3.7 Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a Competent Person.

26.3.8 Ramps and runways constructed of two or more structural members shall have the members connected in such a way as to prevent the possibility of displacement. Members shall be of uniform thickness.

26.3.9 Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a way to prevent tripping hazards to personnel.

26.3.10 Ramps used in lieu of steps shall have cleats or a surface treatment to reduce the slipping hazard.

26.3.11 A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees.

26.3.12 No employee shall be permitted under loads being handled by lifting or digging equipment.

26.3.13 Employees exposed to vehicular traffic shall be provided with and shall wear warning vests or other suitable garments capable of warning approaching traffic. Reflective or high visibility material shall be used on all these garments.

26.3.14 Potentially Hazardous or Oxygen Deficient Atmospheres.

- a. No employee shall be exposed to harmful atmospheres in excavations. All contaminant levels shall be below the relevant OSHA Permissible Exposure Limits and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and their associated Short Term Exposure Limits (STELs) and Ceiling Values.

- b. Where the possibility exists of an oxygen deficient or a hazardous atmosphere, as determined by the Competent Person, air monitoring shall be conducted before the start of work by either government or contractor employees (no exception) in all excavations deeper than 4 feet. Air monitoring shall be conducted by a person trained in the use of the monitoring equipment.

NOTE: An oxygen deficient atmosphere is one with an oxygen concentration of less than 19.5 percent.
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- c. Continual air monitoring shall be conducted if the possibility exists of a hazardous or oxygen deficient atmosphere occurring in the excavation. A safety harness must be worn by personnel where the possibility of a hazardous atmosphere or oxygen deficient atmosphere exists to facilitate rescue.
- d. Adequate engineering controls must be used to eliminate hazardous atmospheres if possible. If not, adequate personal protective equipment must be used to reduce the hazard. Respirators must be selected by the Competent Person to ensure their adequacy. All respirator usage shall conform to the requirements of NWS Occupational Safety and Health Procedure 10, "Respiratory Protection." If the oxygen concentration in the excavation is less than 19.5 percent, a supplied air or self-contained breathing apparatus must be used.
- e. Adequate precautions, such as providing ventilation, shall be enacted to prevent any employee exposure to an atmosphere containing a concentration of flammable gas in excess of 20 percent of its lower flammable limit. Atmospheric testing must be conducted as frequently as necessary to ensure the continued effectiveness of the control measures.
- f. Emergency rescue equipment such as breathing apparatus, a safety harness and line, or a basket stretcher shall be readily available when hazardous atmospheric conditions exist or may possibly exist. Personnel shall be properly trained on the use of the rescue equipment.

26.3.15 Employees shall not work in excavations where there is accumulated water, or where water is accumulating unless adequate precautions have been taken to protect employees against the hazards posed by the water.

26.3.16 Where the stability of adjoining buildings, walls or structures is endangered by excavation operations, support systems shall be provided to ensure the stability of the structures and the safety of employees.

26.3.17 Excavation below the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to personnel shall not be conducted unless:

- a. A support structure to ensure the stability of the structure and the safety of employees is installed.
- b. The excavation is in stable rock.

- c. A registered Professional Engineer has determined that the structure is at a sufficient distance from the excavation to be unaffected.

26.3.18 Adequate protection shall be taken to ensure that personnel are protected from loose rock, soil or other falling hazards.

26.3.19 Daily inspections of excavations, adjacent areas and protective measures shall be conducted by the Competent Person for evidence of a situation which could result in a potential cave-in, indications of the failure of a protective system, hazardous atmospheres or other hazardous conditions. When any of the listed hazardous situations are identified, employees shall immediately leave the excavation and not return until adequate control measures are instituted.

26.3.20 Walkways shall be provided where employees or equipment are required or permitted to cross over an excavation. Guardrails complying with 29 CFR 1926.502 (b) shall be provided where walkways are 6 feet or more above lower levels.

26.3.21 Every employee performing excavation shall be protected from cave-ins by an adequate protection system designed in accordance with 29 CFR 1926.652, paragraphs unless:

- a. The excavation is made in stable rock.
- b. Excavations are less than 5 feet in depth and examination of the ground by a Competent Person provides no indication of a potential cave-in.

26.3.22 Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

26.3.23 The slopes and configuration of sloping and benching systems shall be selected and constructed by the NWS or its contractor shall be in accordance with 29 CFR 1926.652, paragraphs (b)(1), (b)(2), (b)(3) or (b)(4).

26.3.24 Materials and equipment used for protective systems shall be free from damage or defects which might impair their functions.

26.3.25 All pre-manufactured materials and equipment for protective systems shall be used and maintained in accordance with manufacturer's recommendations.

26.3.26 Support Systems.

- a. The design and construction of support systems shall be selected and constructed by the NWS or its contractor and shall be in accordance with 29 CFR 1926.652, paragraphs (c)(1), (c)(2), (c)(3) or (c)(4).
- b. Members of support systems shall be securely connected together to prevent sliding, falling, kickouts or other failures.
- c. Support systems shall be installed and removed in a manner that protects employees from cave-ins and other failures.
- d. Removal of support systems shall begin at the bottom of the excavation.

- e. Backfilling shall progress together with the removal of support systems from excavations.

26.3.27 Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when the employees at the lower levels are protected from falling, rolling or sliding materials or equipment.

26.3.28 Shields.

- a. Shields shall not be exposed to loads greater than their designed capacity.
- b. Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
- c. Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
- d. Employees shall not be allowed in shields when shields are being installed, removed or moved vertically.
- e. Excavations of earth material to a level not greater than 2 feet below the bottom of a shield shall be permitted.

26.3.29 Open excavations shall be protected by barricades, covers, or other means deemed appropriate by the Competent Person to prevent personnel from accidentally falling into the excavation, particularly during non-work hours.

26.4 Responsibilities

26.4.1 Regional or Operating Unit Environmental/Safety Coordinators

- a. Will monitor and promote compliance with the requirements of this procedure at field offices or Operating Unit facilities.
- b. Will ensure that applicable procedures are implemented at regional headquarters or Operating Unit facilities.

26.4.2 Station Manager

- a. Will have oversight over the implementation of this procedure, and ensure that the requirements of this procedure are followed by individuals at the NWS facility.
- b. Will ensure that initial and refresher training of competent person is provided.
- c. Will ensure that initial and periodic inventory of emergency rescue equipment, PPE, shields, protective systems is accomplished and adequate stock is maintained.
- d. Will review or delegate review, of this procedure on an annual basis to ensure that the facility is complying with its requirements. Confirmation of this review shall be forwarded to the Regional or Operating Unit Environmental/Safety Coordinator.

26.4.3 NWS Headquarters (NWSH)

- a. The NWS Safety Office will provide assistance to Regional Headquarters, Operating Units, and field personnel to ensure that NWS facilities comply with requirements of this procedure.
- b. NWSH will coordinate with NOAA SECO, as necessary, regarding compliance issues related to this procedure.

26.4.4 Safety or Environmental/Safety Focal Point

- a. Will ensure that any responsibilities delegated to them by the Station Manager are implemented in accordance with the requirements of this procedure.

26.4.5 Competent Person

- a. Will understand the requirements of this procedure and be able to recognize potential hazards associated with excavation and trenching work.
- b. Will provide requirements for the use of protective shielding and shoring systems in excavations.
- c. Will inspect excavations, at a minimum, once a day for the purpose of identifying and abating potential hazards associated with the excavation.
- d. Will have the authority to stop all work being performed in an excavation by NWS personnel or contract personnel working for the NWS due to a hazardous situation or hazardous practices.
- e. Will approve all hazard controls used at excavation sites at the facility.
- f. Will approve adequate measures to ensure underground utilities do not pose a safety or health hazard to personnel while the excavation is open.
- g. Will design structural ramps that are used solely by employees as a means of access or egress from excavations.
- h. Will determine, in all excavations greater than 4 feet deep, if the possibility of a flammable, toxic, or oxygen deficient atmosphere exists. If the possibility of any one or more of those hazardous atmosphere exists, the Competent Person shall ensure that air monitoring is conducted before the start of work by either government or contractor employees (no exception).

26.4.6 Employees

- a. Individual employees affected by this procedure are required to read, understand and comply with the requirements of this procedure and report unsafe or unhealthful conditions and practices to their supervisor or safety focal point.

NOTE: Reference NWS PD 50-11 for complete list of responsibilities
<http://www.weather.gov/directives/050/pd05011c.pdf>

26.5 References

Incorporated References. The following list of references is incorporated as a whole or in part into this procedure. These references can provide additional explanation or guidance for the implementation of this procedure.

- 26.5.1 American Conference of Governmental Industrial Hygienists, TLV's and BEI's, Threshold Limit Values for Chemical Substances and Physical Agents, Current Edition.
- 26.5.2 National Weather Service Occupational Safety and Health Procedure 8, "Personal Protective Equipment."
- 26.5.3 National Weather Service Occupational Safety and Health Procedure 12, "Confined Space Entry."
- 26.5.4 National Weather Service Occupational Safety and Health Procedure 10, "Respiratory Protection."
- 26.5.5 U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1926, Subpart P, "Excavations."
- 26.5.6 U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1926, Subpart M, "Fall Protection."

26.6 Attachments

None