



THE UNIVERSITY OF MAINE
TRENCHING AND EXCAVATION SAFETY PROGRAM

TABLE OF CONTENTS

Section	Title	Page
1.	Purpose & Background	1
2.	University of Maine Approval	1
3.	Background	2
4.	Scope of Trenching and Excavation Safety Program	2
5.	Program Administration and Responsibilities	2
6.	Hazard Identification, Evaluation & Mitigation	5
7.	Planning and Site Preparation	10
8.	Work Restrictions	10
9.	General Trenching and Excavation Requirements	11
10.	Personal Protective Equipment	15
11.	Site Safety	16
12.	Inspection Requirements.....	16
13.	Emergency Response	17
14.	Accident and Injury Reporting	17
15.	Training	18
16.	Documentation and Recordkeeping Requirements	18
17.	Enforcement	18
	Revision Page	19

Appendices

- A. Dig Safe Law
- B. Overhead High Voltage & Line Safety Act
- C. Definitions
- D. OSHA 1926 Subpart P Standard
- E. Figures

1. Purpose

The University of Maine (“UMaine”) is committed to conducting its Trenching and Excavation operations in the safest manner possible, with concern for the individual and in accordance with applicable Federal and State statutes. The University of Maine’s Trenching and Excavation Safety Program, has been prepared to comply with regulations promulgated by the Federal Occupational Safety and Health Administration (OSHA) and various State of Maine organizations, including Department of Labor (DOL).

This program establishes requirements for university and contractor personnel in order to work in, or around, any excavation operations, at the University of Maine or any of its remote sites. This program describes the training and certification requirements, rules of operation, accident reporting and other related information.

The primary goal of the Trenching and Excavation Safety Program is to protect human life and University of Maine property. The following program has been created as a guideline for conducting trenching and excavation projects. These projects will encompass all activities which involve the removal of earth to a depth of five (5) feet or greater. This includes hazardous and non-hazardous atmospheres.

2. University of Maine Approval

This program establishes the minimum requirements that University of Maine workers must follow in order to perform related to Trenching and Excavation work. Departments may utilize their own Trenching and Excavation Safety Program only if their program is equal to, or exceeds the minimum requirements set forth by this program.

This program has been reviewed and approved by:

//Signed// Signature on File in SEM

President of the University of Maine (or Designee)

Date

//Signed// Signature on File in SEM

Department of Safety & Environmental Management (SEM), Director

Date

//Signed// Signature on File in SEM

Associate Vice President for Administration and Finance

Date

3. Background

Excavation projects which are conducted on the University of Maine campus and remote sites present a significant threat to the health and safety of UMaine employees, students and visitors located within the vicinity of these sites.

Entry into trenches and excavations is a necessary work practice on campus and campus-owned locations. An objective of UMaine is to reduce the potential risk associated with these types of activities. Awareness training, project planning, evaluation of hazards (prior to the commencement of work), use of engineering controls (to reduce or eliminate environmental risks) and the use of personal protective equipment (PPE) and atmospheric monitoring equipment through the duration of the work are aimed at reducing risk associated with trenching excavation and work.

4. Scope of Trenching and Excavation Safety Program

Any UMaine employee, contractor, student or visiting researcher who operates within an UMaine facility or remote site and performs tasks involving trenching or excavation, shall comply with the rules set forth in this document.

Student interns and Co-operative (Co-op) students that work outside UMaine's premises and do not use UMaine owned equipment, are governed by the safety rules and regulations of the sponsoring organization. Sponsoring organizations are required to have written rules, which address safety and standard operating procedures.

Interns and Co-op students who either work on UMaine premises or use UMaine owned equipment must comply with this policy.

5. Program Administration and Responsibilities

The following departments and personnel shall be responsible for implementing this program and its policies to ensure the health and safety of UMaine personnel.

5.1 Department of Safety and Environmental Management (SEM)

The SEM department shall act as "Program Administrator" and shall be responsible for the following:

- Developing and Maintaining the written Trenching and Excavation Safety Program (Excavation Program);
- Periodically review and update the program as new regulations are promulgated;
- Periodically review and assess the implementation and management of the written excavation program;
- Conducting periodic site evaluations of on-going excavation projects for health and safety considerations for the campus community not directly associated with the excavation projects; and,
- Developing and implementing an excavation safety training program.

5.2 The Responsible Department (i.e., FM, Telecom, Farms, Research Departments or other entity) will be responsible for the following:

- Reviewing all work orders, requiring or potentially requiring excavation activities;
- Assigning a project manager (PM) for planning and coordinating the work activities and impacted shops or remote sites;
- Assigning a trained, competent person (CP) for overseeing the daily activities at the excavation site;
- Notifying the UMaine’s “Dig-Safe” program coordinator of proposed trenching or excavation activities;
- Arranging the use of monitoring equipment to be used by the excavation crew;
- Documenting and maintaining records related to Excavation Safety Training;
- Maintaining all training documentation for a period not less than three (3) years;
- Maintaining all project related documentation for a period not less than one (1) year;
- Reviewing all site-specific work plans prepared by the Project Manager (PM); and,
- Ensuring that all the necessary equipment and materials are available for the use in the excavation prior to the commencement of excavation activities.

It is important to note that Facilities Management (FM) shall be responsible for all excavation and trenching work completed on campus or on properties administered by UMaine. (Note: Facilities Management and SEM shall be notified of all trenching and excavation work performed by other departments.)

5.3 Individual Project Managers (PM) or Qualified Person (QP) for in-house projects shall:

- Review the proposed excavation work and prepare the site-specific excavation work plan;
- Submit the site-specific work plan to the “Responsible Department” for review and approval prior to the commencement of excavation activities (allowances will be made for emergency situations);
- Request assistance from Department Safety Staff and SEM for work place evaluations as needed;
- For planned projects on campus, notify the FM Engineering Services at least 24 hours prior to the commencement of excavation operations to request an “Excavation Permit.” For other projects performed by university personnel on non-university owned property, notify “Dig-Safe” at least three days prior to the commencement of excavation activities.
- Ensure appropriate engineering controls, personal protective equipment and monitoring equipment are available and properly used;
- Ensure Competent Person (CP) and other personnel working in and around the excavation have been properly trained in potential safety hazards and safe excavation work practices;
- Monitor safety performance of personnel assigned to the project;
- Correct any work practice or condition that may result in injury;
- Stop site operations in the event of an emergency or to correct unsafe work practices;
- Request correction of any work practices that may endanger university personnel;
- Report any unsafe work practices to supervisor;

- Remove any person from the work area who endangers other personnel or that may be causing a safety hazard to the persons in the work area; and,
- Make changes to the site-specific work plan, based upon changing site conditions.

5.4 UMaine Project Managers (PM) while supervising outside Contractor Projects shall:

- Require the contractor to submit a site specific work plan to FM Safety;
- Shall notify the contractor to stop site operations in the event of an emergency or to correct unsafe work practices;
- Shall complete a contractor observation form;
- Shall provide the contractor with a copy of UMaine required forms contained in this policy including notification, checklist and log.

The UMaine Project Manger provides minimal oversight for the day-to-day trenching and excavation operations. It is the responsibility of the contractor to provide a safe working environment as per the requirements of the UMaine contract and specifications. The contractor must have a Competent Person onsite at all times and must be provided with a copy of this program prior to the commencement of work.

5.5 The Competent Person (CP) shall:

- Maintain a thorough understanding and knowledge of the OSHA excavation standard;
- Classify soils based on the OSHA excavation standard (for simplicity, classify all soils as “Type C Soils”);
- Install appropriate protective systems necessary to provide adequate engineered personnel protection;
- Develop a site-specific Emergency Response Plan (ERP);
- Notify appropriate emergency response agencies or the Orono Fire Department of the planned excavation project. The location, work schedule and scope of work should be provided if the space is determined to be a confined space.
- Conduct inspections necessary to identify potentially hazardous conditions;
- Conduct site safety meetings to review site-specific health and safety issues related to the excavation project and emergency response plan;
- Ensure monitoring equipment is properly calibrated and used and that results are properly recorded and filed;
- Ensure appropriate engineering controls, personal protective equipment and monitoring equipment are available and properly used;
- Inspect equipment and materials that are used for protective systems for condition and suitability of use;
- Monitor safety performance of personnel assigned to the project;
- Correct any work practice or condition that may result in injury;
- Identify existing and predictable hazards in the surroundings or working conditions which are hazardous, unsanitary, or dangerous to employees;
- Be authorized to stop site operations in the event of an emergency or to correct unsafe work practices;

- Request correction of any work practices that may endanger university personnel;
- Report any unsafe work practices to the appropriate PM;
- Make changes to the site-specific work plan based upon changing site conditions.

5.6 Contractors working on excavation projects shall:

- Be familiar with safe excavation practices and the UMaine's Trenching and Excavation Safety Program;
- Take the necessary precautions to prevent injury to themselves and other UMaine employees;
- Perform only those tasks that they can do safely, and immediately report any accidents and/or unsafe conditions to the CP, QP or PM;
- Complete safe excavation work site plan review prior to starting a job with all employees;
- Immediately report any hazardous or potentially hazardous situations to the CP, QP or PM;
- Evacuate any excavation where hazards or potentially hazardous situations have been identified; and,
- Shall provide a site safety plan that includes the name and contact information of the competent person listed in the plan.

6. Hazard Identification, Evaluation and Mitigation

During the course of routine maintenance activities, renovation, construction and research, UMaine personnel may be required to work in or around excavations. Potential health and safety hazards that may be associated with these excavations include:

- Surface encumbrances including structures, fencing, piping, dirt, debris piles or stored material (spoil) and vegetation;
- Limited means of egress;
- Surface and subsurface utilities including water, sewer, electric, gas, cable, steam, telephone and fiber optics;
- Overhead utilities (power lines);
- Vehicle and equipment traffic in the vicinity or around the excavation;
- Falling loads from digging or lifting equipment;
- Water accumulation in the excavation;
- Hazardous atmospheres (i.e., oxygen deficiency, flammable gases, toxic fumes, etc.) which may occur in the excavation;
- Cave-in of loose soil and rock from the excavation face; and,
- Falling or driving into unprotected or unmarked excavations.

Prior to excavation activities, the site will be evaluated for potential health and safety concerns and an appropriate, site-specific plan of action will be prepared.

6.1 Surface Encumbrances

Surface encumbrances such as structures, fencing, piping, stored materials, vegetation, and other items, which may interfere with safe excavation, shall be removed prior to the start of excavation activities. Those structures that cannot be removed, such as buildings, foundations or footings, shall be assessed for stability by a registered professional engineer (PE). Any structures affected by the excavation shall be adequately supported using such systems as shoring, bracing or underpinning. All supports shall be engineered specifically for the type of structure to be supported and the excavation characteristics. Any support system in use shall be evaluated on a daily basis by the CP for strength and integrity. Excavations below the level of the base of a footing of a retaining wall shall not be permitted unless one of the following criteria is met:

- A support system is provided to ensure the safety of the employees and the stability of the structure;
- The excavation is in stable rock;
- A registered PE has determined that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activities; or,
- A registered PE has determined that such excavation work will not pose a hazard to university personnel.

6.2 Means of Egress

For excavations four (4) feet deep or greater an adequate means of egress such as a ladder, steps or ramp(s) shall be provided. A means of egress must be provided every 25 feet along the length of the excavation. The use of an excavator bucket or other heavy equipment means to lower and raise personnel into an excavation will not be considered as a means of egress and will not be allowed on any UMaine project.

6.3 Underground Utilities

Facilities Management Department is responsible for managing UMaine's "Dig-Safe" program. (It is based on 23 MSRA§ 3360-A). This regulation requires that the University participate in a damage protection program, manage notification of digging operation to all appropriate shops and organizations, and notify affected departments and buildings when a digging or trenching operation will be taking place.

For work performed on the Orono Campus, this is managed through Facilities Management (FM) Engineering Services at 581-2682. For remote sites, "Dig Safe" will be contacted directly for a site mark-out.

Prior to excavation activities the FM engineering staff or the remote site project manager shall determine if underground utilities are present in the area or vicinity of the excavation.

The party responsible for conducting an excavation will:

- Mark the proposed excavation area with approximate boundaries using highly visible spray paint or stakes.

- For planned projects, notify the University “Dig-Safe” Program Manager at least 3 days before an excavation operation begins. All boundaries of the proposed excavation will be noted on the permit.
- If blasting is required during the excavation process, the “Dig-Safe” Program Manager shall be modified at least 3 days in advance. For emergency situations, notification shall be made in writing at least 4 hours in advance of the commencement of the blasting activities.
- Ask the “Dig-Safe” Program Manager to establish the approximate location of utilities in underground installations prior to the start of the excavation/trenching project. This will include the locations of all underground utilities such as sewer, telephone, fuel lines, electric, water, cable, steam and fiber optic.

During the excavation process, the CP will:

- Identify the exact location of the underground installations when the operations are near the estimated location of these installations;
- Provide detection equipment or other acceptable means to locate the utilizes if the exact location of the underground utilities cannot be established;
- Protect, support or remove (as necessary), any underground installations upon opening a trench or excavation.

For all work performed off-campus, the “Dig-Safe” system shall be complied with. (See Appendix A)

6.4 Overhead Utilities

The University will comply with the HP 894 – L.D. 1247 “An Act to Create the Overhead High-Voltage Line Safety Act.”

When working under or in the vicinity of overhead power lines, a minimum distance of 10 feet shall be maintained or the lines will be de-energized. De-energizing and/or removal of overhead power lines shall be coordinated with and completed by the University of Maine’s FM Electric Shop. Once the line is de-energized, UMaine “Lock out/Tag out” procedures will be followed. The CP shall be responsible for maintaining the required minimum distance of 10 feet throughout the course of the work. (See Appendix B)

6.5 Vehicle and Equipment Traffic

University personnel and contractors exposed to public vehicular traffic during the course of excavation related work will be provided with and shall wear warning vests or other suitable garments marked with or made of highly visible reflective material. Personnel working at night will be fitted with high visible reflective material designed for evening conditions.

All excavation work occurring on streets or other vehicle accessible travel lanes shall be conducted in accordance with established Maine Department of Transportation (MDOT) guidelines. The work area shall be delineated through the use of approved signs, signals, traffic cones or barricades. Signs, signals and barricades shall be fully illuminated at night. If the CP determines that these methods

are not adequate, a flag person will be provided to direct traffic. Barricade type and placement shall be determined prior to the commencement of the excavation work.

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

6.6 Exposure to Falling Loads

University personnel and contractors shall not work underneath loads handled by digging or lifting equipment. Personnel will be required to stand at an adequate distance from any vehicle being loaded or unloaded to avoid being struck by any falling materials.

All personnel working in an excavation shall wear adequate head protection (hard hats) and eye protection.

6.7 Water Accumulation

University personnel and contractors will not work in excavations where there is accumulated water or in excavations where water is accumulating. If this is unavoidable, precautions are being undertaken such as shielding and dewatering.

Precautions to protect employees vary with each situation and may include support or shield systems to protect from cave-ins, water removal to control the level of accumulating water and the use of safety harnesses and lifelines.

If water accumulation is controlled by a water removal/pumping system, the equipment and function shall be monitored by the CP to ensure proper operation. If the excavation interrupts the natural drainage of surface water, diversion ditches, dikes or swales, suitable methods shall be used to divert the flow of surface water from entering the excavation. (The top of the faces and sidewalls of the excavation should be sloped to divert water away from the excavation.) Excavations exposed to heavy rainfall or high water tables shall be subject to the recommendations above and shall be inspected regularly by the CP for stability and integrity.

6.8 Sidewalks, Pavements and Other Horizontal Surfaces

Sidewalks, pavements and other objects and surfaces shall not be undermined or undercut unless a support system or other precaution is provided to protect employees from possible collapse. Employees will not work under unsupported vertical or horizontal structures.

Walkways, runways and sidewalks adjacent to excavations will be kept clear of excavated material (spoil pile) or other obstructions.

6.9 Cave-ins of Loose Soil from Excavation Phase (Spoil Pile)

Loose rock, excavated soil or other material and spoils will be stored and retained at least two (2) feet or more from all edges of the excavation or adjacent excavations.

Any exceptions due to location of the excavation or quantity of spoils or excavated materials, shall be reviewed by the PM or CP prior to the commencement of an excavation, or as necessitated by changing conditions and the site safety plan shall be updated.

6.10 Falling into Unprotected or Unmarked Excavations

Walkways shall be provided where employees or equipment are required or permitted to cross over excavations.

Guardrails are required where walkways are six (6) feet or more above lower levels. These guardrails shall be 42 inches, plus or minus three (3) inches, above the walking/working level. The mid-rails will be placed at 21 inches and installed with screens or mesh between the top edge and the walking/working surface and the along the entire length of the exposed opening. The top-rail of the guardrail system shall be capable of withstanding a force of 200 pounds. The mid-rail should be capable of withstanding a force of 125 pounds. No more than 8 feet should separate each top-rail.

All wells, test pits or shafts will be barricaded. Upon completion of operations, these openings will be backfilled immediately.

6.11 Hazardous Atmospheres

Hazardous atmospheres, such as oxygen deficiency (below 19.5 % and above 23.5 %), flammable gases or vapor (above 10%) and toxic gases or vapors may occur in any excavation on a UMaine campus or remote site. Acceptable entry conditions are between 19.5 % and 23 % for oxygen and below 10% for LEL. Toxic substances have varying entry level conditions that are contaminant dependent.

In excavations greater than four (4) feet in depth or locations where oxygen deficiency or hazardous atmosphere conditions are possible, such as sewer lines, manure pits, steam pits, aqua-cultural fish tanks, or near swamps or high traffic areas, the CP will test the air prior to allowing personnel to enter the area. The air will be tested using a calibrated, direct read Confined Space Entry Monitor. The CP shall be trained and proficient in the use of this monitor See Form MF10153.)

If a hazardous atmosphere exists or is likely to develop, engineering controls such as ventilation will be employed. Respiratory protection may also be required in addition to ventilating the excavation. When engineering controls (ventilation) or other controls are used to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted by the CP as often as necessary to ensure that the atmosphere remains safe. Standing water may also present a hazardous atmosphere and this must be monitored.

6.12 Confined Space Classifications

Excavations greater than four (4) feet in depth shall be considered confined spaces as defined by 29 CFR 1910.146, until it has been evaluated by the competent person (CP). Confined space

evaluations shall consider the excavation's configuration, available access and egress and the presence of hazardous atmospheres. The evaluation shall be included in the site safety plan.

If it is determined that a hazardous atmospheres exists within the excavation, it shall be considered a "Permit-required Confined Space." A permit must be obtained and all confined space entry protocols and procedures will be followed. (Refer to the "University of Maine's Confined Space Entry Program" for more information on confined spaces or permit-required confined spaces.)

7. Planning and Site Preparation

7.1 Notifications

For all work occurring on UMaine owned or administered properties, at a minimum, the following organizations or entities shall be notified prior to the commencement of excavation activities (Example form, Appendix C), and an attached map indicating the exact location of the excavation activity planned to:

- Facilities Management (FM);
- Impacted building(s); and,
- University of Maine's Safety and Environmental Management (SEM);

For work occurring at remote sites, local public safety organizations such as fire and ambulance as well as FM, shall be contacted prior to commencing excavation activities. These notifications shall also be included in the site safety plan.

7.2 Area Restrictions

Based upon the determined regulated area, appropriate barricades or other warning devices shall be selected and installed prior to the commencement of any excavation. Barricades used shall protect the health and safety of individuals in the area. Barricade tape, used alone, shall not be considered an acceptable means of restricting an excavation area.

The established barriers shall be maintained in place throughout the duration of the excavation project. Barriers shall be inspected on a daily basis to ensure the excavation is adequately isolated.

8. Work Restrictions

8.1 Staffing

All excavation projects will be staffed by a minimum of two (2) full-time employees, including one (1) who is trained as the competent person (CP). The competent person may periodically leave an excavation site as long as hazardous or potentially hazardous conditions do not exist and at least two (2) employees remain at the excavation site. These sites will be staffed by a minimum of two (2) persons when work is in progress.

8.2 Project Schedule

An estimated project schedule, including proposed hours of work, shall be included with the submitted excavation notification form. (See Form MF10152)

8.3 Work Coordination

As determined by the PM, a pre-construction meeting shall be held to review the scope and impact of the work. This meeting will include appropriate impacted groups. The purpose of this meeting will be to discuss the project schedule, extent of work, restricted areas, site contacts and other issues relevant to the project. The PM will be responsible for planning and scheduling the pre-construction meeting.

9. General Trenching and Excavation Requirements

Work that involves the removal of earth to a depth greater than five (5) feet shall be considered an excavation. Protective systems shall be designed and utilized specifically for all excavations greater than five (5) feet. These protective systems may include sloping or benching of the sides of the excavation or, supporting the sides of the excavation or by using a shield, such as a trench box, between the work area and the excavation side. Each protective system shall be designed specifically for the project-related excavation.

The installation and use of protective systems are not required when an excavation is made entirely in stable/competent rock or is less than five (5) feet deep and a competent person has examined the ground and found no indication of a potential cave-in.

The design of the protective system shall take into account the following factors:

- Soil classification;
- Depth of cut;
- Installation and removal of support systems;
- Hazardous atmospheres;
- Water/frost content of soil;
- Weather and climate; and,
- Other operations in the vicinity of the excavation.

9.1 Soil Classification

Any excavation activity, which occurs within the confines of UMaine property, shall be assumed to be Type C soil. For all excavations outside of the campus boundaries, soils shall be classified in accordance with 29 CFR 1926.650 (Subpart P Appendix A, OSHA Excavation Standard) prior to the commencement of excavation activities. (See Appendix D)

9.2 Depth of Cut

For all excavations greater than four (4) feet, but less than five (5) feet, the CP shall assess the cut (or excavation) for potential cave-in hazards. The CP will have the authority to install any protective systems necessary to protect the person(s) working in excavation from cave-ins. The CP shall also

determine if a hazardous atmosphere exists before persons are allowed to work within the excavation.

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

For excavations five (5) feet in depth or greater, protective systems shall be used. The CP and individual department policies shall determine the actual use of a specific protective system described below. Protective systems that may be employed are sloping, benching, shoring and shielding.

9.2.1 Sloping

Sloping is a method of protecting employees from cave-ins by forming sides that are inclined away from the excavation. The angle of the incline required will vary with the soil type and environmental conditions. Since we are operating under the assumption that all soils on the property are to be considered Class Type C soils, the walls of the excavation will be sloped at an angle not steeper than 1 ½ horizontal to 1 vertical (1.5 : 1) or thirty-four (34°) degrees measured from the horizontal plane.

This is the only non-structural protective method allowed in Class Type C soil.

Maximum allowable slopes and sloping configurations will be determined according to soil type as described in Appendix A and B of the OSHA excavation standard. It is presented herein as Appendix G.

9.2.2 Benching

Benching is a method of protecting employees from cave-ins by forming one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels. This method may only be used in Class Type A or Class B soils.

Maximum allowable number and configuration of benches will be determined according to soil type as described in Appendix A and B of the OSHA excavation standard. It is presented herein as Appendix D.

9.2.3 Shoring and Shielding

The CP shall select and oversee the construction of support systems, shield systems and other protective devices designed for the protection of personnel working in excavations. Materials and equipment used in protective systems will not be damaged or defective. Manufactured materials and equipment used for protective systems will be used and maintained safely and according to manufacturer's recommendations. The CP is responsible for daily inspections of the protective systems. General structural integrity and the ability to adequately support the excavation walls will be observed by the CP.

Excavation of the material shall not exceed two (2) feet below the bottom of the members of the support system. Excavation greater than two (2) feet below the bottom of the support system may be permitted only if reviewed and approved by a registered Professional Engineer (PE), and there are no indications of a possible loss of soil from behind or below the bottom of the support system.

9.2.4 Shoring

Structures such as metal, hydraulic, mechanical or timber-bracing systems that support the sides of the excavation and are designed to prevent cave-ins are acceptable shoring systems. All shoring systems shall be designed according to the conditions and requirements of Appendix C and D of the OSHA Excavation Standard. It is presented herein as Appendix D.

9.2.5 Shielding

A shield is a structure that protects employees and is able to withstand forces imposed upon it created by a cave-in. Shields may be permanent or designed to be portable and moved as the work progresses. Shields may also be manufactured to meet the project-specific needs of the excavation site. A trench box is an example of a shielding system.

The manufacturer's tabulated data for the trench box or shield that is used in the excavation project will be kept on-site at all times. This must be readily accessible to an inspector reviewing the site.

For excavations other than those described in the 29 CFR 1926.652 Subpart P or this document (i.e., excavations greater than 20 feet in depth), protective systems shall be designed and approved by a registered PE and the written design shall include at a minimum a plan indicating the sizes, types and configurations of materials to be used in the protective system and the name of the registered PE approving the design.

At least one (1) copy of the design shall be maintained at the job site during the construction of the protective system. After that time, the design may be stored off-site but shall be available for review upon request.

9.3 Installation and Removal of Support Systems

Support systems shall be installed and removed in a manner which protects employees from cave-ins, structural collapses or being struck by members of the support system. Members of support systems shall be securely connected together to prevent sliding, falling, kick-outs or other predictable failure. The individual members of support systems shall not be subjected to loads exceeding those for which they were designed to withstand.

Prior to installation of any support system, the system shall be inspected by the CP for structural integrity. The CP shall ensure that the selected support system is appropriate for the excavation activity (i.e., size, depth, height, work activity and configuration). The depth of the excavation shall not be greater than one (1) foot above the top of the installed support system.

Removal of support systems shall begin at the bottom of the excavation. Before removal begins, additional precautions shall be taken to ensure the safety of employees, such as installing other

temporary structural members to carry the loads imposed on the support system. Members shall be removed slowly, noting any indication of possible failure of the remaining members or possible cave-ins. Backfilling shall progress with the removal of the support systems from the excavation.

The number of employees present in the excavation shall be limited to only those necessary for the installation or removal of the support system.

9.4 Materials and Equipment for Protective Systems

All materials and equipment used for protective systems shall be free from any damage or defects that impair their proper function. These materials and equipment shall be maintained in accordance with the manufacturer's recommendations. They shall also be used in a manner that will prevent employee exposure to hazards. If the materials or equipment becomes damaged, the CP shall evaluate the damaged and determine the suitability for continued use. If the CP cannot assure the material or equipment is suitable for safe use then the item(s) will be removed from service. The item(s) shall be evaluated and approved by a registered PE before being returned to service.

9.5 Hazardous Atmospheres

Hazardous Atmospheres such: as oxygen deficiency (atmospheres containing less than 19.5% or more than 23.5% oxygen by volume), the presence of flammable gases or vapors and the presence of toxic gases or vapors may be present, or may occur, in excavations. Situations where hazardous atmospheres may occur include, but are not limited to: steam tunnels, sewer-related work, manure pits, aquaculture fish tanks or excavations in high vehicle traffic areas.

In locations where hazardous atmospheres are possible and in excavations greater than or equal to four (4) feet in depth, the CP will test the air in the excavation before employees are permitted to enter. Engineering controls will be established as specified in the site-specific work plan to maintain acceptable atmospheric conditions. When flammable gases or explosive atmospheres (at levels which are above an established percentage of the LEL) are present, adequate ventilation will be provided and sources of ignition will be eliminated. When using the Confined Space Entry Monitor, the monitor will be programmed to automatically indicate the presence of an explosive or flammable atmosphere by sounding an alarm.

Ventilation or respiratory protection will be provided to prevent personnel exposures to oxygen deficient or toxic atmospheres. Periodic retesting of the excavation will be conducted by the CP to verify that the atmosphere in the excavation is acceptable. Testing will occur, at a minimum, four (4) times throughout the workday. Testing should coincide with entry or reentry into the trench (i.e., in the morning, prior to beginning work, at the close of break times and after lunch).

All test results shall be recorded and maintained in the competent persons' inspection log. (See Form MF10153.)

9.6 Condition of Soil

The CP shall evaluate the soils in and around the excavation for conditions that may result in cave-ins. These hazardous conditions include frost, frozen soil and water content. Existing conditions

such as frozen ground are subject to change when exposed to ambient air temperatures or sunlight. These conditions shall be considered when designing protective devices.

9.7 Weather Conditions

Weather conditions including changes in temperature, humidity and precipitation will impact the integrity of the excavation sides. As weather changes, protective devices and work practices may require alteration to accommodate for the changing site conditions. The CP shall include observations of changing weather conditions as part of the routine inspection process. An inspection of the excavation, the adjacent areas and protective systems shall be performed after every rainstorm or other weather-related, hazard-increasing occurrence.

9.8 Access and Egress

Safe access and egress to the excavation shall be maintained at all times. For excavations greater than or equal to four (4) feet in depth, adequate means of egress must be provided. An appropriate ladder, ramps or other safe means of access and egress must be provided every 25 feet along the length of the excavation. If structural ramps are used as a means of employee access or egress, they must be designed by a CP. If structural ramps are used as a means of equipment access or egress, they must be designed by a registered PE and shall be constructed in accordance with the design. Structural members used for ramps or runways must be uniform in thickness and joined in a manner to prevent slipping, tripping or displacement. Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom surface of the runway to avoid tripping.

Steps, ramps or other safe means of access or egress will be provided with a handrail that meets OSHA requirements for walking and working surfaces (29 CFR 1926.651). Handrails must be between 39"– 45" in height and contain both a mid-rail and toe-board. The top rail should be capable of supporting 200 pounds and the mid-rail should be capable of supporting 125 pounds.

9.9 Other Operations in the Vicinity of the Excavation Site

Operations in the vicinity of the excavation site shall be evaluated by the CP for potential impact on the excavation. Any activities determined to have an impact on site safety or the integrity of the excavation shall be curtailed for the duration of the excavation project.

10. Personal Protective Equipment (PPE)

Prior to the commencement of any excavation, an assessment will be made by the CP as to appropriate PPE required to safely work in and around the excavation. The CP will ensure, at a minimum, that the following PPE is worn at all times by workers and visitors at the site:

- Hard hats;
- Safety-toed shoes;
- Impact-resistant eye protection; and,
- Appropriate gloves or hand protection.

Other issues such as hearing protection and respiratory protection must also be considered when assessing the project for PPE requirements. FM Department Safety Staff and SEM Staff will be available to advise and assist in the selection of appropriate PPE.

All employees and visitors shall wear the required PPE at all times while on the excavation site.

11. Site Safety

Prior to the commencement of the excavation project, site safety protocols shall be established in writing and discussed with all project personnel. Safety protocols may consist of established standard procedures; however, these established procedures shall be amended to incorporate any site-specific issues. These protocols shall become part of the site safety plan and will include the following elements:

- Restriction of site access to authorized personnel only;
- Installation of adequate engineering controls and barriers;
- Site authority and management responsibilities;
- Visitor's access protocols; and,
- General work practices and procedures.

These protocols shall be observed and maintained throughout the duration of the excavation project.

12. Inspection Requirements

Daily inspections of excavations, the adjacent areas and protective systems shall be made by the CP for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres or other hazardous conditions. An inspection shall be conducted by the CP prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. These inspections are only required when employee exposure can reasonably be anticipated.

Where the CP observes evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmosphere or other conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

The CP is responsible for maintaining a daily inspection report of the excavation project (Form MF10153.) This report will become part of the permanent project documentation. The following items shall be included in the CP's daily report:

- List of personnel on-site;
- Evaluation of physical hazards;
- Evaluation of atmospheric hazards and all monitoring data;
- Changing site conditions (including a change in the project scope, weather or vehicular traffic);

- Visitors;
- Summary of project-related activities.

The CP shall complete and sign the daily inspection logs before attaching them to the project documentation. A copy of the signed log shall be kept on-site for the duration of the project. (See Form MF10153.)

13. Emergency Response

Prior to excavation activities and as part of the site-specific work plan development, procedures for emergency response shall be determined and implemented. Personnel involved with a specific project shall be made familiar with project specific emergency response procedures as outlined in the site safety plan. These emergency response procedures shall include at a minimum the following items:

- Protocol for notification of emergency response agencies;
- Responsibilities of individuals on the site;
- Posting of local emergency response agencies;
- Notification of these agencies of the scheduled work prior to commencement; and,
- Identification of the nearest telephone, radio or other telecommunication device.

If the excavation is located on the Orono campus, Facilities Management (FM), and UMaine's Safety and Environmental Management (SEM); should be listed in the emergency section of the site safety plan and receive notification where the excavation is (building) and when the project commencement date and time.

If the excavation is located at one of the remote sites, the local fire department and ambulance needs to be listed in the emergency response plan and notified of the project commencement date and time.

For excavations where hazardous atmospheric conditions exist or may be reasonably expected to develop during the course of the work in the excavation, emergency rescue equipment such as safety harnesses, lifelines and basket stretchers shall be on-site and available to personnel working at the excavation site or responding to the site in the event of an emergency.

Personnel working in bell-bottomed pier holes or other deep and confined excavations shall follow all permit required confined space procedures and wear a safety harness with a lifeline securely attached to it. The lifeline shall be attended at all times while the employee wearing the line is in the excavation. The lifeline shall not be used to handle materials or equipment.

14. Accident and Injury Reports

Any serious injuries that require immediate medical attention requires contacting EMS at 911 or 581-4040. All injuries shall be reported to the UMaine Project Manager. All injuries occurring during excavation projects shall be reported to Safety and Environmental Management (SEM) within 24 hours of the incident. Accidents involving property damage shall be reported to the FM Risk Manager within 24 hours of occurrence.

15. Training

All University personnel working in or around excavations shall receive training to familiarize them with the OSHA excavation standard and other issues related to excavation projects. At a minimum, the following topics shall be discussed during the Annual Trenching Awareness training:

- Potential safety hazards of excavations;
- Safe excavation work practices;
- Hazardous atmosphere testing;
- Excavation inspection procedures;
- Requirements for protective systems; and,
- Standard rescue procedures

In addition to the awareness training, the Competent Person will attend a Designated Competent Person training program. These courses are offered free of charge by the Maine Department of Labor—Safety Works. This one-time, 8-hour training shall include soils evaluation; site inspection procedures; protective systems; and, a confined space overview. The CP will be required to attend annual Trenching Awareness Training.

The CP shall conduct a Site Safety meeting prior to the start of any excavation work. During the meeting, the CP will review the potential safety hazards of the project, safe work practices, site-specific health and safety issues and emergency rescue procedures.

16. Documentation and Recordkeeping Requirements

The Department responsible for the excavation work shall maintain copies of training records for all personnel completing excavation safety or CP training. These records shall be maintained for a minimum period of three (3) years. Project related records such as inspection forms, project logs and atmospheric evaluations shall be maintained for a minimum of one (1) year.

17. Enforcement

University personnel and contractors shall comply with the procedures described within this program. (Personnel deemed out-of-compliance shall be subject to enforcement actions in accordance with the UMaine Policy. All contractors and subcontractors that work on UMaine property will also comply with this Policy.)

Revision Page

DATE	TYPE	PAGE NUMBERS
May 22, 2008	Major New Template Conformity/Appearance	Throughout Document and All Appendices
May 23 2008	“Qualified Person” changed to “Competent Person”	Throughout Document
May 23, 2008	Department of Environmental Health & Safety (EH&S) changed to Safety and Environmental Management (SEM)	Throughout Document
May 23, 2008	Figures that were part of the original program dated 3/8/2000 were revised and incorporated into a separate Appendix Section.	Appendix E Figures
May 23, 2008	The document is one contiguous document with exception to the three forms.	Throughout document.
June 2, 2008	Defined Project Manager’s responsibilities for Outside Contractors and included the review of a Site Safety Plan.	Throughout responsibilities section.
June 2, 2008	Updated Dig Safe Law, Overhead High Voltage & Line Safety Act	Appendix A & B.
August 1, 2008	Example forms were removed from document and assigned form numbers.	Form numbers MF10152, MF10153 and MF10154 on the SEM Forms Web Page
November 25, 2008	Minor change to Trenching and Excavation Log, to include a non- confined space assessment by a competent person.	Form # MF10153

Appendix A
Dig Safe Law

Insert

Appendix B
Overhead High Voltage & Line Safety Act

Insert

Appendix C Definitions

Accepted Engineering Practices: requirements compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring: a manufactured shoring system consisting of aluminum hydraulic cylinders (cross braces) used with vertical rails (uprights) or horizontal rails (also known as wales).

Barricade: a movable structure designed to restrict access of unauthorized personnel, equipment or vehicles to the excavation work area.

Bell-bottom Pier Hole: the bottom of the excavation is bell shaped. A type of shaft or footing excavation in which the bottom 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 more horizontal steps usually with vertical or near vertical surfaces between levels.

Cave-in: the movement of soil or rock into the excavation, or loss of soil from under a trench shield or support system, in amounts large enough to entrap, bury or otherwise injure and immobilize a person.

CFR: Code of Federal Regulations

Competent Person (CP): a person 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 excavation hazards.

Confined Space: a space that has the following characteristics: is large enough and so configured that an individual can bodily enter and perform assigned work, has limited or restricted means for entry or exit and is not designed for continuous employee occupancy.

Cross Braces: the horizontal members of a shoring system installed perpendicular (side to side) to the sides of an excavation. The cross braces bear against either uprights or wales.

Department: any department or unit at the university that conducts work in excavations.

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

Faces: faces or sides are the vertical or inclined earth surfaces formed as a result of excavation work.

Failure: the movement or damage through breakage, displacement or permanent deformation of a structural member, or connection, that makes it unable to support loads.

FM: Facilities Management.

Hazardous Atmosphere: an atmosphere that is explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic or otherwise harmful, that may cause death, illness or injury.

Kick-out: the accidental movement or failure of a cross brace.

Layered Geologic Strata: where soils are configured in layers. The soil should be classified on the basis of the weakest soil layer classification. Each layer may be classified individually if a more stable layer lies below a less stable layer.

MSRA: Maine State Regulations Annotated

Permit - Required Confined Space: a confined space that contains one or a combination of the following conditions: hazardous atmosphere, engulfment hazard, a configuration that can trap or suffocate and entrant, mechanical or electrical hazards, or any other recognized safety and health hazards.

Program Administrator: an individual or department responsible for the developing, reviewing, updating and implementing the Excavation & Trenching program for the university.

Protective System: a method of protecting employees from cave-ins or from objects that could fall or roll from an excavation face, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems and other systems that provide the necessary protection.

Qualified Person (QP): an individual who, by possession of a recognized degree, certificate or professional standing, or who, by professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated their ability to solve or resolve problems relating to the subject matter, the work or the project.

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 (RPE): a person who is registered as a professional engineer in the state where the work is to be performed.

Responsible Department: entity planning and conducting the excavation or trenching project (e.g.: FM, Telcom, Remote sites, Research Departments).

SEM: Safety & Environmental Management Department.

Sheeting: the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield: a structure that is able to withstand the forces imposed upon it by a cave - in and thereby protect personnel 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: a structure that is built or placed to support the sides of an excavation and designed to prevent cave-ins. Examples are metal – hydraulic, mechanical or timber shoring.

Sloping: a method of protecting employees from cave-ins by excavating or sloping the sides of an excavation away from the excavation to protect employees from cave-ins. The required slope or *angle of incline* will vary with soil type, weather, and surface or near surface loads that may affect the soil in the area of the trench. This could include adjacent buildings or vehicles located near the edge of the trench.

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

Structural Ramp: a ramp built of steel or wood, used for vehicle access. Ramps made of soil or rocks are not considered structural ramps.

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.

Tabulated Data: tables and charts approved by a Registered Professional Engineer and used to design and construct a protective system.

Trench: a narrow excavation (in relation to its width) made below the surface of the ground. In general the depth is greater than the width, but the width of a trench, measured at the bottom, is not greater than 15 feet.

Type A Soil: cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf), previously undisturbed clays, silty clay, sandy clay, clay and loam, caliche or hard pan or bedrock. Soil that has been previously disturbed, is fissured, subject to vibration from heavy traffic, etc., cannot be considered Type A soil. (Type A is the most stable and cannot contain seeping water.)

Type B Soil: cohesive soils with an unconfined compressive strength greater than 0.5 tsf, but less than 1.5 tsf, or granular cohesion-less soils including; angular gravel, silt, silt and loam, sandy loam, previously disturbed soils except those which would be considered type C soil, dry rock that is not stable, and soils that meet Type A requirements but are fissured or subject to vibrations. (Type B soil meets Type A classifications but it is fissured or subject to vibration.)

Type C Soil: consist of either granular soils; including gravel, sand and loamy sand, submerged soil or soil from which water is freely seeping, submerged rock that is not stable, material in a sloped layered system where the layers dip into the excavation or soils with an unconfined compressive strength of 0.5 tsf.

Uprights: the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other. They are often called *sheeting*.

Wales: horizontal members of a shoring system placed in the direction of the excavation face whose sides bear against the uprights or sheeting (vertical members) of the shoring system or earth.

Appendix D
OSHA 1926 Subpart P Standard

Insert

Appendix E Figures

Insert