

Utilities Project Safety and Health Guide

FOD-Utilities High Voltage

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THE OHIO STATE UNIVERSITY

UTILITIES PROJECT SAFETY AND HEALTH GUIDE

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1.0 Purpose

This Safety and Health Guide provides a standard of documented safety and health requirements that shall serve as the minimum requirements related to construction. Prospective bidders shall review and address these standards, as a basis for inclusion when preparing a site-specific safety and health plan (SSHP) to perform the required field activities associated with the construction phase of a project. The safety and health requirements contained herein are to be met as a minimum standard. Companies that are interested in submitting qualified bids to perform work for the University on utilities Infrastructure projects are required to submit copies of their company Safety and Health plan that meets or exceeds the minimum requirements specified in this manual.

References

The following regulatory standards are incorporated by reference by this document and shall be considered the minimum standard for compliance on all Ohio State University Utilities Infrastructure Projects.

- 29 CFR, Part 1910: Occupational Safety and Health Administration (OSHA) General Industry and Health Standards
- 29 CFR, Part 1926: OSHA Construction Industry Standards
- NFPA 70E 2004
- OSU: Provisions for Contract Administration, Division 01 General Requirements
- OSU: Provisions for Contract Administration, Division 31 Earthwork
- OSU: Provisions for Contract Administration, Division 32 Exterior Improvements
- OSU: Provisions for Contract Administration, Appendix V: Safety and Health requirements 2006
- Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways 2003 Edition
- The Ohio Manual of Uniform Traffic Control Devices (OMUTCD) in substantial conformance with the Federal 2003 MUTCD

2.0 General Program

2.1 Contractor Employees

No person shall be required or instructed to work in surroundings or under conditions that are unsafe or dangerous to his or her health.

The contractor shall be responsible for initiating and maintaining a safety and health program that conforms to the University Utility Safety and Health Guidelines and complies with the regulations referenced above.

Each contractor employee is responsible for complying with applicable safety requirements, wearing prescribed safety equipment, and preventing avoidable accidents.

Safety and health programs, documents, signs, and tags shall be communicated to employees in terms and language that they understand.

2.1.1 Training

Contractor employees shall be provided specific safety and health training to enable them to perform their work in a safe manner. All required training shall be conducted by a qualified person(s) prior to beginning the work. Employees must be able to demonstrate competencies related to specific safety and health training.

Training shall be based on the safety and health program of the contractor and shall include:

- Requirements and responsibilities for accident prevention and maintaining safe and healthful work environments
- General safety and health policy and procedures
- Employee and supervisor responsibilities for reporting all accidents
- Provisions for medical facilities and emergency response and procedures for obtaining medical treatment or emergency assistance
- Procedures for reporting and correcting unsafe conditions or practices and job hazards and the means to control/eliminate those hazards, including specific activity hazard analyses

2.1.2 Supervision

The contractor is responsible for ensuring that all employees and subcontractors comply with the contents of this safety manual. Additionally, it is incumbent upon all supervisors to hold safety as a primary focus during all construction activity. The University and Patrick Engineering Inc. shall have the authority to perform random job site safety audits to verify compliance with this guidance manual.

The contractor shall plan, organize and execute the work with suitable emphasis on maintaining the continuity of the University operations, and provide for the safety of all persons, whether engaged in construction work, or a bystander.

2.2 *First-Aid and Medical Requirements*

2.2.1 First-Aid and CPR Training

When a medical facility or physician is not accessible within five minutes of an injury to a group of two or more employees for the treatment of injuries, at least two employees on each shift shall be qualified to administer first aid and CPR.

3.0 Personal Protective Equipment

The construction work at the University covered by this section shall, at a minimum, cover the following:

Based on hazard assessments, the contractor shall select, and have each affected employee use, personal protective equipment (PPE) that will protect the employee from hazards. The contractor shall communicate PPE decisions to each affected employee and select PPE that properly fits each affected employee. The contractor shall ensure employees using personal protective and safety equipment are trained to know: when and what PPE is necessary; how to properly don, doff, adjust, and wear PPE; limitations of the PPE; and proper care, inspection, testing, maintenance, useful life, storage, and disposal of the PPE. The contractor shall verify that each affected employee has received and understood the required training by a written certification that identifies the name of each employee trained, the date(s) of the training, and the subjects taught.

A copy of the manufacturer's use, inspection, testing, and maintenance instructions shall be maintained with the personal protective and safety equipment, and shall be available for review by a University representative.

Personal protective and safety equipment shall be tested, inspected, and maintained in serviceable and sanitary condition as recommended by the manufacturer.

Contractor employees involved in activities which subject the hands to injury (e.g., cuts, abrasions, punctures, burns, chemical irritants, toxins, vibration, and forces which can restrict blood flow) shall use hand protection appropriate for the hazard.

Persons exposed to vehicular or equipment traffic, including signalpersons, spotters, or inspectors, shall wear apparel marked with a reflectorized or high-visibility material.

Overhead protection shall be provided where workers or the public are subject to injury from falling objects.

Persons shall be provided with eye and face protective equipment. All eye and face protective equipment shall meet the requirements of ANSI Z87.1, *Practice for Occupational and Educational Eye and Face Protection*, and bear a legible and permanent "Z87" logo to indicate compliance with the standard. When required by this regulation to wear eye protection, persons whose vision requires the use of corrective lenses in eyeglasses shall be protected by one of the following: eyeglasses with protective lenses providing optical correction, goggles that can be worn over corrective lenses without disturbing the adjustment of the spectacles, or goggles that incorporate corrective lenses mounted behind the protective lenses.

Whenever sound-pressure levels equal or exceed 85 dBA (Time Weighted Average), a continuing effective hearing conservation program shall be administered in accordance with 29 CFR 1910.95.

All contractor employees shall be provided with and required to wear Class A (low voltage electrical protection) or Class B (high voltage electrical protection) protective headgear. All protective headgear shall meet the requirements of ANSI Z89.1.

Personal Fall Arrest Systems (PFAS) shall be used if the contractor's employees are exposed to falls from heights, exceeding six (6) feet. The contractor shall comply with all requirements of OSHA 29 CFR 1926.500 subpart M. In addition, contractor employees need to be able to provide documentation of completing training required by this subpart.

3.1 Electrical Personal Protective Equipment

Contractor employees shall wear appropriate PPE for the electrical job tasks to be performed.

- 29 CFR 1910.269, "Electric Power Generation, Transmission, and Distribution"
- 29 CFR 1910, Subpart S, "Electrical"
- NFPA 70E, Standard for Electrical Safety in the Workplace, 2004 edition

3.2 Arc Flash Protection NFPA 70E

Persons working on electrical distribution systems shall be provided with the appropriate electrical protective equipment, which shall be inspected, tested, and maintained in safe condition.

Employees may use rubber gloves, sleeves, blankets, covers, and line hose only when required by special conditions for work on energized facilities. Rubber goods provided to protect employees who work on or near energized facilities must meet ASTM specifications. Electrical workers' rubber insulating protective equipment shall be periodically tested and visually inspected for damage and defects prior to each use. Do not wear conductive articles of jewelry and clothing, such as watch bands, bracelets, rings, key chains, necklaces, cloth with conductive thread, or metal headgear when performing electrical work.

Arc flash protection shall be provided for any person who enters the flash protection zone. They must wear flame-resistant clothing and PPE, based on the incident exposure associated with the specific task. Refer to NFPA 70E for specific Hazard Risk Classifications and clothing/equipment requirements. Synthetic clothing such as acetate, nylon, polyester, rayon, either alone or in blends with cotton, is prohibited in the flash protection zone.

Employees must wear protective eye equipment whenever there is a danger from electric arcs, flashes, flying objects, or electrical explosion. Safety glasses must be constructed of non-conductive material.

Employees must wear flame-resistant clothing whenever they may be exposed to an electric flash. When used, flash suits and their closure design must permit easy and rapid removal. The entire flash suit, including the window, must have energy absorbing characteristics suitable for arc-flash-exposure. Use clothing and equipment to maximize worker protection. Clothing and equipment required by the degree of electrical hazard exposure can be worn alone, or be integrated with, normal apparel. Protective clothing and equipment must cover associated parts of the body and all normal apparel that is not flash-flame resistant, while allowing movement and visibility. Do not wear synthetic materials, that can melt, next to skin.

Employees must wear rubber-insulating gloves where there is a danger of hand or arm injury from electric shock or arc-flash burns due to contact with energized parts. Gloves made from layers of flame-resistant material provide the highest level of protection. Leather glove protectors should be worn over voltage-rated rubber gloves.

Dielectric overshoes are required where electrically insulated footwear is used for protection against step and touch potential.

Table 130.7 (C) (9) (a) of Part II of NFPA 70E should be used to determine the Hazard/Risk category associated with each task. Once the Hazard/Risk category has been determined the requirements for protective clothing or other PPE can be selected per table 130.7 (C) (10 & 11) of NFPA 70E.

Electrical rated safety gloves shall be worn when working around energized electrical equipment. Gloves shall have the appropriate rating for the level of voltage work is to be performed on. Ratings are as follows:

GLOVE CLASS	MAXIMUM USE VOLTAGE
00	500
0	1,000
1	7,500
2	17,500
3	26,000
4	36,000
<ul style="list-style-type: none"> • Maximum use voltage is the classification of the protective equipment that designates the maximum nominal design voltage of the energized system on which work may be safely performed. • Protector gloves need not be used with Class 00 gloves, during LV testing, or where instrument/tool manipulation necessitates higher finger dexterity. • The minimum under-lap of the protector gloves must be the glove class in inches or one inch, whichever is greater. 	

If the insulating capability of protective equipment may be subject to damage during use, protect the insulating material. For example, wear an outer covering of leather over rubber insulating gloves.

The contractor's employee shall inspect PPE prior to each use for defects which may affect the protective characteristics of the equipment. In addition, electrically rated safety gloves must be dielectrically tested every six months, at a minimum. The date of dielectric testing shall be marked on each glove to indicate the last test date.

4.0 Hazardous or Toxic Agents and Environments

4.1 Exposure Standards

Exposure, through inhalation, ingestion, skin absorption, or physical contact, to any chemical, biological, or physical agent in excess of the acceptable limits specified in the most recently published ACGIH guideline, "*Threshold Limit Values and Biological Exposure Indices*," or by OSHA, whichever is more stringent, shall be prohibited. For the purpose of this document, the term used for the most stringent standard is the Occupational Exposure Limit (OEL).

In case of conflicts between ACGIH and other standards or regulations referenced in this manual, the more stringent shall prevail.

The contractor shall comply with all applicable standards and regulations to reduce contaminant concentration levels As Low As is Reasonably Achievable (ALARA).

Activities where occupational exposure to a chemical or biological agent is possible shall comply with current safety and occupational health requirements for chemical and biological agents.

4.2 Hazard Evaluation

All operations, materials, and equipment shall be evaluated to determine the presence of hazardous environments or if hazardous or toxic agents could be released into the work environment.

A thorough Job Safety Analysis (JSA) shall be used for the evaluation. The analyses shall identify all substances, agents, and environments that present a hazard and recommend hazard control measures. Engineering and administrative controls shall be used to control hazards; in cases where engineering or administrative controls are not feasible, PPE may be used.

The analyses shall identify: the workplace and activity evaluated; the name of the person certifying that the evaluation has been performed; and the date of the evaluation.

Operations, materials, and equipment involving potential exposure to hazardous or toxic agents or environments shall be evaluated by a qualified industrial hygienist, or other competent person, and used to formulate a hazard control program. This program must be accepted by the University before the start of operations.

4.3 Testing and Monitoring

Approved and calibrated testing devices shall be provided to detect and measure hazardous or toxic agents, and environments. Devices shall be labeled with calibration information (name of individual performing the calibration and date of current calibration). Calibration results shall be logged.

Individuals performing testing and monitoring shall be trained in hazards awareness, testing and monitoring procedures. Testing devices shall be used, inspected, and maintained in

accordance with the manufacturer's instructions, a copy of which shall be maintained with the devices.

NIOSH or OSHA sampling and analytical methods or other approved sampling and analytical methods shall be used. Laboratories used for analysis shall be accredited by nationally recognized bodies, such as the American Industrial Hygiene Association (AIHA), for the type of analysis performed.

Determinations of the concentrations of, and hazards from, hazardous or toxic agents and environments shall be made by a qualified industrial hygienist or other competent person during initial startup and as frequently as necessary to ensure the safety and health of the work environment.

Records of testing/monitoring shall be maintained on site and shall be available to the University upon request.

4.4 Hazardous or Toxic Agents

A written hazard communication program shall be developed to provide assurance chemical hazards are communicated when hazardous or toxic agents (any chemical which is a physical/health hazard) are procured, stored, generated, or used at a project site (per 29 CFR 1910.1200).

Polychlorinated biphenyls (PCBs): PCBs were used as dielectric fluids in transformers and capacitors.

Precautions shall be taken to identify and protect workers from disturbing existing PCB-containing devices. The contractor shall not undertake any operations which could possibly disturb PCB-containing equipment without approval from the University. Based on the scope of work, it is not anticipated that PCB-containing equipment will have to be removed or replaced. It is possible however, that PCB-containing electrical apparatus may be encountered during the course of the project, and the contractor shall take the necessary precautions to protect workers and the environment as well as notify the University of such conditions. Precautions shall be made to ensure that employees are protected, regulatory requirements are followed, notification to the University is presented, and arrangements are made for proper handling and disposal prior to performing work that would disturb these materials.

Lead and Asbestos Hazard Control Activities.

In coordination with each project, an evaluation will be performed to determine the potential to contact asbestos-containing material (ACM) and lead bearing substances (LBS). In general, these materials were used extensively in construction of underground utility installations. Precautions shall be made to ensure that employees are protected, regulatory requirements are followed, notification is made to the University, and arrangements are made for proper handling and disposal prior to performing work that would disturb these materials.



- If the evaluation shows the potential for activities to generate unacceptable occupational exposure to LBS, a written lead compliance plan shall be written. The lead compliance plan shall be in accordance with 29 CFR 1910.1025 and 29 CFR 1926.62.
- If the evaluation shows the potential for activities to disturb ACM, an asbestos abatement plan shall be developed. The asbestos abatement plan shall be in accordance with 29 CFR 1910.1001; 29 CFR 1926.1101; and 40 CFR 61, Subpart M.
- These plan(s) shall be developed as an appendix to the contract, and the SSHP. The written plan(s) shall be submitted for acceptance by the University before beginning work.

5.0 Confined/Enclosed Space Entry (Underground Electrical Installations)

The contractor shall establish consistent safe work practices for the entry to, and occupancy of, confined/enclosed spaces (underground electrical installations) to assure proper safeguards and precautions have been taken to minimize the potential for personal injury.

When Confined/Enclosed space entry work is performed on University property, the contractor shall comply with the following where applicable:

- 29 CFR 1910.146, "Permit-required Confined Spaces"
- 29 CFR 1910.269(t), "Underground Electrical Installations"

Maintenance holes and unvented vaults shall be treated as, and subjected to the requirements of, confined/enclosed spaces.

Smoking shall be prohibited in maintenance holes and vaults.

Employees entering excavations classified as confined spaces, or which otherwise present the potential for emergency rescue, shall wear a harness with a lifeline securely attached to it.

The contractor shall communicate in detail their compliance with the applicable safety regulations when submitting the site-specific safety and health plan. The contractor shall provide detailed job safety analysis for each location/activity where this work is to occur. In addition, the contractor shall provide documentation of employee training and equipment to be utilized during construction.

The following definitions apply to all confined spaces:

Confined Space – A space that is large enough, and so configured, that an employee can bodily enter and perform assigned work, has limited or restricted means for entry or exit, and is not designed for continuous employee occupancy

Non-Permit Required Confined Space (NPRCS) – a confined space that does not contain, or have the potential to contain, an atmospheric hazard capable of causing death or physical harm. The atmosphere should be proven by air monitoring to be free of hazard.

Permit Required Confined Space (PRCS) – Is a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross section AND
- Contains any other recognized serious safety or health hazard

Confined Space Competent Person (CSCP) – A person with thorough knowledge of OSHA’s Confined Space Standard, 29 CFR 1910.146, experience with PRCS space entry procedures, and the authority to supervise and influence how work is performed on job sites and in facilities.

Training: All employees whose work exposes them to enclosed or confined spaces must acquire the understanding, knowledge, and skills necessary for the safe performance of their duties. Affected employees will be trained as follows:

- Before the employee is first assigned duties under this section
- Whenever there is a change in activities that presents a hazard for which an employee has not been trained, and
- Whenever there is reason to believe either that there are deviations from this procedure or there are inadequacies in the employee's knowledge or use of this procedure.
- Attendants, and Entrants will be trained in the recognition and evaluation of hazards, use of personal protective equipment, air monitoring, elements of the entry permit (where required), and the procedures for their specific duties prior to the involvement with enclosed and confined space entry. Enclosed and Confined Space Authorized Worker training, review of applicable equipment manufacturer instructions, and a documented review of this procedure will be used to ensure understanding of assigned responsibilities. Note: This training is required for personnel that enter enclosed or confined spaces.

Under normal operating conditions enclosed spaces (underground electrical installations) do not contain a hazardous atmosphere, but may contain a hazardous atmosphere under abnormal conditions. The following order of preference shall be followed for the protection of enclosed space entrants:

- Engineering controls, such as ventilation to maintain safe atmosphere
- Work practice controls, such as procedures and training
- Use of Personal Protective Equipment (PPE), such as safety glasses and protective clothing



Engineering Controls

Forced air ventilation is the most common engineering control used to maintain safe atmosphere in enclosed spaces. When ventilation is used to remove atmospheric contaminants from the enclosed space, the space shall be ventilated until the atmosphere is within the acceptable (safe atmosphere) ranges. Ventilation shall be maintained during the occupancy if there is a potential for the atmospheric conditions to move out of the acceptable range.

When continuous forced air ventilation is necessary the following safe work practices must be followed:

- Employees must not enter the space until the forced air ventilation has eliminated any hazardous atmosphere
- Forced air ventilation shall be directed to ventilate the immediate areas where an employee is or will be present within the space
- Continuous ventilation is maintained until all employees have left the space
- Forced air ventilation should be from a clean source, clear of vehicle exhausts or potential chemical spills

Atmospheric Testing is needed prior to entry into any enclosed space for two distinct purposes: 1) evaluation of the hazards of the space and 2) verification that acceptable conditions exist for entry into that space.

Before entry into an enclosed space, air monitor testing shall be conducted using a multi-gas detector. Additional testing is necessary when there is a reasonable possibility of change or the attendant or entrant(s) detect a change in atmospheric conditions.

Internal atmosphere must be tested with a calibrated, direct-reading instrument for the following, in the order given:

- Oxygen content
- Flammable gases and vapors
- Potential toxic air contaminants

Note: Atmospheric testing devices shall be calibrated on a monthly basis or in accordance with manufacturer instructions; whichever is more stringent. Additionally, a "bump test" shall be performed prior to use each day on each sensor to verify proper function.

Acceptable Limits must be met prior to, and during, entry. The following limits are considered acceptable for entry:

Oxygen – 19.5% to 23.5%

Flammability – less than 10% of the Lower Explosion Limit (%LEL) Note: Flammability must be 0% if performing hot work (e.g. welding) inside of enclosed spaces.



Toxicity – less than half the recognized Permissible Exposure Limit (PEL), or Threshold Limit Value (TLV), whichever is lower

Note: Personnel shall contact the CSCP for assistance with the evaluation of the spaces containing toxic atmospheres in excess of their PEL or TLV. If atmospheres are deemed Immediately Dangerous to Life and Health (IDLH), entry is prohibited.

Whenever testing of the atmosphere indicates levels of oxygen, flammability, or toxicity that are not within acceptable limits, entry shall be prohibited until appropriate hazard controls are implemented, and re-testing indicates the levels are within the safe atmosphere range.

Atmospheric stratification must be considered for entries involving a descent into an enclosed space that may contain gas layers.

Continuous monitoring of atmospheric conditions shall be performed during entry within enclosed spaces that present a reasonable possibility of changes in atmospheric conditions. The following are example scenarios where periodic or continuous monitoring is necessary:

- Monitoring for safe atmosphere where ventilation is needed to maintain oxygen level or prevent accumulation of flammable gas or vapor
- Monitoring for oxygen depletion and carbon monoxide accumulation where welding or cutting is performed inside the enclosed space

Opening an Enclosed Space requires caution. Always lift the cover using a manhole cover hook. Where feasible, two hooks should be used and the cover plate moved as a team with two employees. Place the manhole cover plate on the ground away from the open manhole. Once the cover plate is on the ground, it should be slid further out of the way to prevent a tripping hazard near the open space. Do not leave open utility manholes unattended for any period of time.

Once entrance covers are removed, a railing or other temporary barrier shall be erected immediately to prevent anyone from falling through the opening and protect employees working in the space from foreign objects entering the space.

Note: The opening of the railing or temporary barrier shall be placed along the side of the manhole which contains the ladder to provide ease of access. Chains shall be used to secure the opening when workers are not actively accessing the opening.

Ingress / Egress Safeguards must be considered to ensure safe entry, occupancy and exit from enclosed spaces. Each entry and exit point shall be evaluated to determine the most effective methods and equipment needed to enable employees to safely enter and exit the enclosed space.

Ladders shall be used to access subsurface enclosed spaces exceeding 4 feet in depth. Where the enclosed space is outfitted with a sturdy fiberglass ladder, that ladder shall be

used. If a ladder is introduced into the space, it shall be an electrical rated fiberglass ladder. Note: Do not step on cables or hangers when entering or exiting an enclosed space.

Prior to entry, the ladder shall be inspected for missing, broken or loose part. Ladders that fail inspection shall not be used until repaired or replaced.

Ladder safety guidelines:

- Never use the top two rungs of a ladder as steps.
- Only one person should be on a ladder at any one time.
- Keep your center of gravity between rungs.
- Always climb with three limbs in contact with the ladder.
- Face the ladder while ascending, working from, or descending.
- Do not carry items in your hands while climbing ladders.
- Be sure hands and footwear are free of grease, oil, or mud.

Equipment necessary to perform work shall be lowered into subsurface, enclosed spaces using a plastic bucket attached to a tagline. Buckets shall not be loaded above the top opening and taglines shall be of sufficient weight to withstand the load. Prior to lowering, the bucket and tagline shall be inspected for damage which might compromise capabilities; such as cracks, frayed stands, etc. While equipment is lowered, employees inside the enclosed space shall stand clear of the area directly below the enclosed space opening.

Electrical Safety work practices shall be followed at all times during occupancy of enclosed spaces.

Electrical safety guidelines:

- Treat all electrical equipment as “energized” unless tested and confirmed de-energized.
- Never touch or manipulate energized cables or components unless authorized by a restricted work authorization (RWA) permit and equipped with the proper personal protective equipment.
- Immediately report all abnormalities relating to cable or cable terminations to Utilities UTHVS.

Communications & Emergency Response Provisions shall be established prior to entry of enclosed spaces.

Communications shall be maintained throughout all enclosed space entry events. Where visual contact is not feasible, voice or radio communication shall be utilized.

Emergency Response Provisions must be in place for timely medical assistance to individuals entering an enclosed space should an emergency arise.

Emergency Response Provisions:



- Attendants must have current First Aid & Cardiopulmonary Resuscitation (CPR) training.
- First aid kit must be readily available for use at the work site.
- Attendants shall be equipped with a radio or telephone to summon emergency services.
- Entrants shall wear a full body harness when entering utility manhole enclosed spaces to expedite extraction if necessary.

Note: Attendants shall not enter an enclosed space to render medical assistance to entrant. In the event an entrant cannot exit the enclosed space safely on their own emergency services shall be summoned to rescue the entrant.

Demobilization safe practices shall be followed at the conclusion of work activities within enclosed spaces.

6.0 Temporary Traffic Control (TTC)

The contractor shall take all necessary precautions to provide for safe passage of all University students, faculty and personnel. Construction work zones shall be clearly identified, and the contractor will implement and continually monitor the required temporary traffic controls in coordination with Campus Authorities (Traffic and Parking) in order to maintain a safe environment.

The contractor should plan accordingly to arrange and provide suitable temporary traffic control as required.

Traffic Hazard Control must be discussed and determined as a component of the pre-job safety briefing where access to the enclosed space is on, or within 15 feet of roadways. The work team shall assess traffic and/or pedestrian safety concerns and notate protective actions on the pre-job safety briefing sheet.

Work Zone Setup – To make employees more visible and to warn affected traffic the specific type and number of traffic control devices needed shall be determined by the following: volume and speed of traffic, duration of work, and location of the work area.

If lane closure is required in order to safely perform work, the contractor shall make arrangements in advance with Campus authorities

If it is evident that traffic will become hazardous or restricted in any manner, uniformed Campus special duty police officers shall be provided by the University (Traffic and Parking), at the contractor's expense. These officers shall be requested by contacting the University Director of Public Safety at least two weeks before officers' services are required. The contractor shall also forward a copy of the request to the University and to the AE/Associate.

During joint occupancy of buildings, entrances and exits for public use must be provided to meet code requirements. At least one ingress and egress path of travel that is accessible to individuals with disabilities must be maintained to all user-occupied portions of the building.

7.0 Fire Protection and Prevention

The contractor shall include plans to mitigate ignition sources related to ordinary construction activities. If unusual fire hazards exist, or fire emergencies develop, additional protection shall be provided as required by the University.

- Fires and open flame devices shall not be left unattended.
- Vehicles, equipment, materials, and supplies shall not be placed so that access to fire hydrants and other firefighting equipment is obstructed.

7.1 Flammable and Combustible Liquids

All storage, handling, and use of flammable and combustible liquids shall be under the supervision of a qualified person. All sources of ignition shall be prohibited in areas where flammable and combustible liquids are stored, handled, and processed. Suitable **NO SMOKING OR OPEN FLAME** signs shall be posted in all such areas.

Flammable liquids shall be kept in closed containers or tanks when not in use. Contractor employees shall guard carefully against any part of their clothing becoming contaminated with flammable or combustible fluids; they shall not be allowed to continue work if their clothing becomes contaminated and must remove or wet down the clothing as soon as possible.

Ventilation adequate to prevent the accumulation of flammable vapors to hazardous levels shall be provided in all areas where flammable and combustible liquids are handled or used.

Only approved (by a nationally recognized testing laboratory) containers and portable tanks shall be used for the storage of flammable and combustible liquids.

Metal containers and portable tanks (less than 2.5 m³ (660 gal) individual capacity) meeting the requirements of, and containing products authorized by, Chapter I, Title 49 of the *Code of Federal Regulations* (U.S. DOT Hazardous Materials Regulations), Chapter 9 of the United Nations Rules for the Transportation of Dangerous Goods, or NFPA 386, *Standard for Portable Shipping Tanks for Flammable and Combustible Liquids*, shall be acceptable.

Plastic containers meeting the requirements of, and used for, petroleum products within the scope of one or more of the following specifications shall be acceptable: ANSI/ASTM D3435, *Plastic Containers for Petroleum Products*; ASTM F 852, *Standard for Portable Gasoline Containers for Consumer Use*; ASTM F 976, *Standard for Portable Kerosene Containers for Commercial Use*; ANSI/UL 1313, *Nonmetallic Safety Cans for Petroleum Products*.

7.2 Fire Protection Requirements

At least one portable fire extinguisher rated 20-B:C shall be provided on all tank trucks or other vehicles used for transporting and/or dispensing flammable or combustible liquids.

Each service or refueling area shall be provided with at least one fire extinguisher rated not less than 40-B:C and located so that an extinguisher shall be within 30 m (100 ft) of each pump, dispenser, underground fill pipe opening, and lubrication or service area.

The University policy reflected in this safety manual is that the contractor's personnel are not expected or required to fight fires. Emphasis shall be placed on first responders obtaining qualified competent assistance in all emergency situations

7.3 First Response Fire Protection

Portable fire extinguishers shall be provided where needed; fire extinguishers shall be inspected and maintained as specified in NFPA 10.

7.3.1 Approved Fire Extinguishers

- Fire extinguishers shall be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds.
- Fire extinguishers shall be marked with their letter (class of fire) and numeric (relative extinguishing effectiveness) classification.
- Fire extinguishers using carbon tetrachloride or chlorobromomethane extinguishing agents are prohibited.
- Soldered or riveted shell self-generating foam or gas cartridge water-type portable extinguishers, which are operated by inverting the extinguisher to rupture or initiate an uncontrollable pressure generating chemical reaction to expel the agent, are prohibited.

Fire extinguishers shall be in a fully charged, in operable condition, and shall be suitably placed, distinctly marked, and readily accessible.

When portable fire extinguishers are provided for employee use in the workplace, the employer shall provide training (upon initial employment and at least annually thereafter) in the following:

- General principles of fire extinguisher use and the hazards involved with incipient stage firefighting to all employees
- Use of the appropriate firefighting equipment to those employees designated in an emergency action plan to use firefighting equipment

The policy of this safety manual is to strictly prohibit the assumption that contractor personnel are to fight fires. Emphasis shall be placed on first responders obtaining qualified competent assistance in all emergency situations. The first responder shall immediately notify University Fire Department upon discovery of a fire. The use of fire extinguishing equipment during the incipient stages of the fire is a last resort, and a judgment call will be made on a case-by-case basis. Even if the contractor's employee thinks they can safely utilize the contents of an approved fire extinguisher to control a fire, they do so at their own risk.

8.0 Physical Protection

The work and craftsmanship performed in conjunction with this project shall comply with OSU Building Design Standards 2006, and subsequent revisions as specified in Division 33 – Utilities. By reference, all safety requirements contained therein shall apply. Additionally, the contractor shall incorporate and execute all construction work in accordance with OSHA 29 CFR 1910.269, Subpart S, 29 CFR 1926. Subpart K and NFPA 70E.

All electrical work shall comply with applicable National Electrical Safety Code.

All work shall be supervised and performed by qualified personnel.

8.1 *Underground Electrical Installations*

8.1.1 Guarding Underground Openings

Warning signs and rigid barricades shall be promptly placed when covers of manholes, handholes, or vaults are removed.

When an employee enters an underground opening the opening shall be protected with a barricade, temporary cover, or other guard appropriate for the hazard.

Underground opening guards and warning signs shall be lighted at night.

See section 5.0 for detailed information related to confined/enclosed space procedures.

9.0 Hazardous Energy Control Plan

9.1 *Isolation*

Before work is begun, the person in charge shall ascertain by inquiry, by direct observation, or by instruments, whether any part of an electric power circuit - exposed or concealed - is located such that the performance of work could bring any person, tool, or machine into physical or electrical contact with it.

Whenever possible, all equipment and circuits to be worked on shall be de-energized before work is started and personnel are protected by Lockout/Tag out (LOTO) procedure compliance and grounding.

Live parts of wiring or equipment shall be guarded to protect all persons or objects from harm.

Before cutting into a cable or opening a splice, the circuit cable shall be identified and verified to be the proper cable and that it is deenergized and grounded at its power source and under LOTO at all points of potential inadvertent energization.

Transformer banks and medium and high voltage equipment shall be protected from unauthorized access; entrances not under constant observation shall be kept locked; metallic enclosures shall be grounded; and signs warning of high voltage and prohibiting unauthorized entrance shall be posted at entrances.

Enclosure gates or doors shall swing outward or provide clearance from installed equipment. Procedures for removal of panels and covers need to take into account suitable steps to avoid contact with energized conductors. This shall be outlined in the contractor's safety plan.

When it is necessary to work on energized or potentially energized circuits or equipment, rubber gloves and other protective equipment or hotline tools meeting the provisions of American National Standards Institute and American Society for Testing and Materials standards shall be used.

In the following situations, at least two persons shall be assigned to work together:

- All medium voltage switching operations
- Work on energized overhead lines
- Work at substations/power plants where there is an arc flash potential
- Work at remote or isolated locations
- Work at night or during inclement weather near energized equipment
- Work involving handling energized conductors or apparatus

When three or more people form a work team for performing work activities as described above, one person, trained to recognize live conductors and other unsafe work practices or electrical hazards, shall be delegated to watch the movements of the others doing the work, to warn them of unsafe conditions, or work practices as well as to assist in case of an accident.

9.2 Procedures

Hazardous energy control procedures shall be developed in a hazardous energy control plan.

The plan shall clearly and specifically outline the scope, purpose, authorization, rules, and techniques to be used for the control of hazardous energy, including, but not limited to:

- A statement of the intended use for, limitations and assumptions of the procedure
- Means of coordinating and communicating hazardous energy control activities
- Procedural steps and responsibilities for shutting down, isolating, blocking, and securing systems to control hazardous energy
- Procedural steps and responsibilities for the placement, removal, and transfer of lockout and tagout devices

- Procedural steps and responsibilities for placing and tagging, and moving or removing and untagging, protective grounds
- A double verification process shall be applied with the expectation that self-checking, and independent verification will reasonably assure a safe work space.
- Requirements that apply when authority for removal of hazardous energy control devices must be transferred from the authorized employee to another individual, and the names of the individuals qualified for receiving such transfer
- The means to enforce compliance with the procedures

9.3 Control of Hazardous Energy (Lockout/Tagout)

Before any contractor employee performs any servicing or maintenance on a system where the unexpected energizing, start up, or release of kinetic or stored energy could occur and cause injury or damage, the system shall be isolated in accordance with the requirements of this section. Personnel and resources shall not be considered protected until hazardous energy control procedures have been implemented.

All control activities shall be coordinated with, and approved by, the University designated authority (UTHVS for electrical medium voltage work).

When contractors are planning the use of hazardous energy control procedures, they shall submit their hazardous energy control plan to the University designated authority for acceptance. Implementation of hazardous energy control procedures shall not be initiated until the hazardous energy control plan has been accepted by the University.

The University and contractor designated authorities shall fully coordinate their control activities with one another throughout the planning and implementation of these activities. Each shall inform the other of their energy control procedures, ensure that their own personnel understand and comply with rules and restrictions of the procedures, and ensure that employees affected by the hazardous energy control activities are notified when the procedural steps outlined in the hazardous energy control plan are to be initiated.

A preparatory inspection by University and contractor personnel shall be conducted to ensure that all affected employees understand the energy hazards and the procedures for their control.

- When energy control procedures affect the University and contractor(s), all University and contractor affected employees will participate in the preparatory inspection.
- The preparatory meeting shall be documented. The time and date of the meeting, the subject matter discussed, and the name of all employees in attendance shall be recorded.
- Lockout and tagout shall be performed only by authorized employees.
- All employees affected by the lockout or tagout shall be notified before, and upon completion of work and removal of lockout or tagout devices.

9.4 Training

Training shall be provided to ensure that the purpose and function of the hazardous energy control procedures are understood by employees and that employees possess the knowledge and skills required for the safe application, usage, and removal of energy controls.

- Each contractor employee shall receive training in the recognition of hazardous energy sources, the type and magnitude of energy available in the workplace, and the methods and means for energy isolation and control.
- Each contractor employee shall be instructed in the purpose and use of the energy control procedures.
- All incidental University or contractor personnel shall be informed of the procedures and prohibitions relating to restarting or reenergizing systems which are locked or tagged out.
- When tagout alone is relied upon, contractor employees shall be trained in the limitations of tags.

Employees shall be retrained in hazardous energy control procedures whenever:

- There is a change in job assignments, a change in systems or processes that present a new energy control hazard, or a change in energy control procedures
- Periodic inspection reveals, or there is reason to suspect, inadequacies in or deviations from the employee's knowledge or use of energy control procedures

The contractor supervisor shall certify and document all training and retraining. Certification shall contain such information as the names of employees trained; the time, date, and location of training; the name of the trainer, etc.

9.5 Periodic Inspections

Routine inspections shall be conducted to ensure that all requirements of the hazardous energy control procedures are being followed.

Inspections shall be documented and specify the system (location) where the energy control procedures were inspected, the date of the inspection, the names of employees performing and included in the inspections, and any deficiencies in complying with the hazardous energy control procedures.

University Facilities Maintenance Electricians perform all actual energy isolation (switching) procedures to support construction activities. The contractor shall coordinate construction related outage requirements with the University to ensure safe execution of the outages. The work schedule will need to be communicated well in advance of the procedures, to allow for information to be distributed to all stakeholders involved. Documentation for this process shall be included in the contractor's Hazardous energy control plan.

10.0 Hand and Power Tools

Power tools shall be of a manufacture listed by a nationally recognized testing laboratory for the specific application for which they are to be used.

To fully comply with OSHA 1910.333 (C) (2), insulated must be used. A complete insulated tool program shall be in place to meet these standards.

Hand tools shall meet OSHA, ASTM F 1505-07, IEC 900 and NFPE 70E standards.

10.1 Use, Inspection, and Maintenance

Hand and power tools shall be used, inspected, and maintained in accordance with the manufacturer's instructions and recommendations and shall be used only for the purpose for which designed. A copy of the manufacturer's instructions and recommendations shall be maintained with the tools.

Hand and power tools shall be inspected, tested, and determined to be in safe operating condition before use. Continued periodic inspections shall be made to assure safe operating condition and proper maintenance.

Hand and power tools shall be in good repair, with all required safety devices installed and properly adjusted. Tools having defects that will impair their strength or render them unsafe shall be removed from service.

10.2 Guarding

Power tools designed to accommodate guards shall be equipped with such guards.

Reciprocating, rotating, and moving parts of equipment shall be guarded if exposed to contact by employees or otherwise create a hazard.

10.3 Safe Tool Use

When work is being performed overhead, tools not in use shall be secured or placed in holders.

Throwing tools or materials from one location to another or from one person to another, or dropping them to lower levels, shall not be permitted.

Only non-sparking tools shall be used in locations where sources of ignition may cause a fire or explosion.

Tools requiring heat treating or redressing shall be tempered, formed, dressed, and sharpened by personnel who are experienced in these operations.

The use of cranks on hand-powered winches or hoists is prohibited unless the hoists or winches are provided with positive self-locking dogs: hand wheels with projecting spokes, pins, or knobs shall not be used.

Hydraulic fluid used in powered tools shall retain its operating characteristics at the most extreme temperatures to which it will be exposed.

Manufacturers' safe operating pressures for hydraulic hoses, valves, pipes, filters, and other fittings shall not be exceeded.

When fuel-powered tools are used in enclosed spaces, the requirements for concentrations of toxic gases and use of personal protective equipment, as outlined in this manual, shall apply.

10.4 Pneumatic Tools

Safety clips or retainers shall be installed and maintained on pneumatic impact tools to prevent dies and tools from being accidentally expelled from the barrel.

Pressure shall be shut off and exhausted from the line before disconnecting the line from any tool or connection.

Safety lashing shall be provided at connections between tool and hose and at all quick makeup type connections.

Hoses shall not be used for hoisting or lowering tools.

Airless spray guns of the type which atomize paints and fluids at high pressures (450 kg (1,000 lbs) or more) shall be equipped with automatic or visible manual safety devices which will prevent pulling of the trigger to prevent release of the paint or fluid until the safety device is manually released. In lieu of the above, a diffuser nut to prevent high pressure velocity release while the nozzle tip is removed plus a nozzle tip guard to prevent the tip from coming into contact with the operator, or other equivalent protection may be provided.

Impact wrenches shall be provided with a locking device for retaining the socket.

11.0 Rigging

During the construction process, the following minimum standards shall be incorporated into the contractors Site-specific Safety and Health Plan. Every precaution shall be made to ensure safe material handling when working on University property. The tight confines of the proposed work areas, in conjunction with the everyday University operations, need to be carefully addressed. Material placement at the construction site may pose hazards to the University students, faculty and personnel, as well as the contractor's employees. Special attention to detail and project planning is required. This particular topic shall be an area of concern during the submittal review, as well as during safety audits, to ensure safety for all parties.

11.1 Inspection and use

The contractors' rigging equipment for material handling shall be inspected for its physical condition as specified by the manufacturer, by a qualified person, before use on each shift and as necessary during its use to ensure that it is safe.

Defective rigging shall be removed from service.

The use and maintenance of rigging equipment shall be in accordance with recommendations of the rigging manufacturer and the equipment manufacturer: rigging equipment shall not be loaded in excess of its recommended safe working load.

Rigging equipment, when not in use, shall be removed from the immediate work area and properly stored and maintained in a safe condition.

Hoist rope shall not be wrapped around the load.

All eye splices shall be made in an approved manner; rope thimbles of proper size shall be fitted in the eye, except that in slings the use of thimbles shall be optional.

When hoisting loads, a positive latching device shall be used to secure the load and rigging.

Hooks, shackles, rings, pad eyes, and other fittings that show excessive wear or that have been bent, twisted, or otherwise damaged shall be removed from service.

Custom designed grabs, hooks, clamps, or other lifting accessories for such units as modular panels, prefabricated structures, and similar materials shall be marked to indicate the safe working loads and shall be proof-tested, before use, to 125% of their rated load.

11.2 Wire Rope

When two wires are broken, or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or re-socketed. **Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes.**

Wire rope removed from service due to defects shall be cut up or plainly marked as unfit for further use as rigging.

When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured to it by a clip. The clip shall not be attached directly to the live end.

Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, shall consist of one continuous piece without knot or splice.

An eye splice made in any wire rope shall have not less than five full tucks. This requirement shall not preclude the use of another form of splice or connection which can be shown to be as efficient and which is not otherwise prohibited.

Wire rope shall not be secured by knots except on haul-back lines on scrapers.

Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire rope clips or knots. Wire rope clips shall not be used to splice rope.

11.3 Chain

Only alloyed chain shall be used in rigging.

Chain shall be inspected before initial use and weekly thereafter.

When alloy steel chains, hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links, or other attachments are used, they shall have a rated capacity at least equal to that of the chain.

Job or shop hooks and links, makeshift fasteners formed from bolts and rods, and other similar attachments shall not be used.

11.4 Fiber Rope (Natural and Synthetic)

Fiber rope shall not be used if it is frozen or if it has been subjected to acids or excessive heat.

Fiber rope shall be protected from abrasion by padding where it is fastened or drawn over square corners or sharp or rough surfaces.

All splices in rope slings provided by the employer shall be made in accordance with fiber rope manufacturer's recommendations.

11.5 Eye Splices

In manila rope, eye splices shall contain at least three full tucks and short splices shall contain at least six full tucks (three on each side of the centerline of the splice).

In laid synthetic fiber rope, eye splices shall contain at least four full tucks and short splices shall contain at least eight full tucks (four on each side of the centerline of the splice).

Strand end tails shall not be trimmed short (flush with the surface of the rope) immediately adjacent to the full tucks: this applies to both eye and short splices and all types of fiber rope.

- For fiber ropes less than 2.5 cm (1 in) diameter, the tails shall project at least six rope diameters beyond the last full tuck.

- For fiber ropes 2.5 cm (1 in) diameter and larger, the tails shall project at least 15 cm (6 in) beyond the last full tuck.

In applications where the projecting tails may be objectionable, the tails shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).

For all eye splices, the eye shall be sufficiently large to provide an included angle of not greater than 60° at the splice when the eye is placed over the load or support.

Knots shall not be used in lieu of splices.

11.6 Slings

Slings and their fittings and fastenings, shall be inspected before use on each shift and as necessary during use.

Protection shall be provided between the sling and sharp unyielding surfaces of the load to be lifted.

The use of slings will be such that the entire load is positively secured.

Length of Rope:

- Wire rope slings shall have a minimum length of clear wire rope equal to ten times the rope diameter between each end fitting or eye splice.
- Braided slings shall have a minimum clear length of braided body equal to forty times the diameter of component ropes between each end fitting or eye splice.

Welded alloy steel chain slings shall have affixed durable permanent identification stating size, grade, rated capacity, and sling manufacturer.

The employer shall have each synthetic web sling marked or coded to show:

- Name or trademark of the manufacturer
- Rated capacities for the type of hitch
- Type of material

11.7 Rigging Hardware

Drums, sheaves, and pulleys shall be smooth and free of surface defects which may damage rigging.

The ratio between the diameter of the rigging and the diameter of the drum, block, sheave, or pulley tread shall be such that the rigging will adjust itself to the bend without excessive wear, deformation, or damage.

In no case will the safe diameters of drums, blocks, sheaves, or pulleys be reduced in replacement of such items unless compensating changes are made in terms of the rigging used and the safe loading limits.

Drums, sheaves, or pulleys having eccentric bores, cracked hubs, spokes, or flanges shall be removed from service.

Connections, fittings, fastenings, and attachments used with rigging shall be of good quality, of proper size and strength, and shall be installed in accordance with recommendations of the manufacturer.

11.8 Shackles

Manufacture tables shall be used to determine the safe working loads of various sizes of shackles, except that higher safe working loads are permissible when allowed by the manufacturer if a safety factor of at least five is maintained.

Shackles shall not be eccentrically loaded.

11.9 Hooks

The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. Any hook for which the manufacturer's recommendations are not available shall be tested to twice the intended safe working load before it is put into use. The employer shall maintain a record of the dates and results of such tests.

Open hooks are prohibited in rigging used to hoist loads.

Hoisting hooks rated at 9,000 kg (10 tons) or larger shall be provided with a means for safe handling.

12.0 Fall Protection

Personal fall protection devices (personal fall arrest systems PFAS), shall be used when contractor employees are exposed to falls from heights greater than six (6) feet. The contractor shall comply with OSHA 29 CFR 1926.500 subpart M.

Selection of personal fall protective equipment shall be based on the type of work; the work environment; the weight, size, and shape of the user; the type and position of anchorage; and the length of the lanyard.

Personal fall arrest systems, when stopping a fall, shall:

- Limit maximum arresting force on an employee to 820 kg (1,800 lb) when used with a body harness

- Be rigged such that an employee can neither free fall more than 1.8 m (6 ft) nor contact any lower level or other physical hazard
- Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 1 m (3.5 ft)
- Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 1.8 m (6 ft) or the free fall distance permitted by the system, whichever is less

12.1 Anchorage and Attachment

Anchorage used for attachment of personal fall arrest equipment shall be independent of any anchorage used to support or suspend platforms and shall be capable of supporting at least 2,270 kg (5,000 lb) per employee attached.

The attachment point for PFAS shall be the “D” ring, located in the center of the wearer's back.

Personal fall arrest systems shall not be attached to guardrail systems nor shall they be attached to hoists.

When a personal fall arrest system is used at hoist areas, it shall be rigged to allow the movement of the employee only as far as the edge of the walking/working surface.

12.2 Ladders

The construction, installation, and use of fiberglass ladders shall conform to the following, as applicable.

- Safety Codes for Portable Ladders, ANSI A14.1
- Portable Metal Ladders, ANSI A14.2
- Fixed Ladders, ANSI A14.3
- Job-Made Ladders, ANSI A14.4

12.2.1 Length

All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.

Portable ladders used as temporary access shall extend at least 0.9 m (3 ft) past the landing.

When a 0.9 m (3 ft) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist employees in mounting and dismounting the ladder.

In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

The length of portable step ladders shall not exceed 6 m (20 ft).

Ladders shall be surfaced so as to prevent injury to an employee from punctures or lacerations and to prevent snagging of clothing.

12.2.2 Use

No work requiring lifting of heavy materials or substantial exertion shall be done from ladders.

When ladders are the only means of access to or from a working area for 25 or more employees, or when a ladder is to serve simultaneous two-way traffic, double-cleated ladders shall be used.

Portable ladders shall have slip-resistant feet.

Ladders shall not be moved, shifted, or extended while occupied.

The top or top step of a step ladder shall not be used as a step.

Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use.

Broken or damaged ladders shall be immediately tagged "**DO NOT USE**," or similar wording, and withdrawn from service until restored to a condition meeting their original design.

Fiberglass non-conductive electrically rated ladders shall be used exclusively for electrical work

13.0 Excavations

Prior to opening an excavation, underground installations (e.g., sewer, telephone, water, fuel, electric lines) shall be located and protected from damage or displacement. The University shall be contacted to locate and mark the locations, and if they so desire, direct or assist with protecting the underground installations.

Underground utilities at The Ohio State University are located by contacting the following agencies:

- Facilities Operations and Development service desk, 614-292-HELP (4357)

13.1 Excavation Inspection and Testing

When persons will be in or around an excavation, the excavation, adjacent areas, and protective systems shall be inspected daily, as needed, throughout the work shifts, and after every rainstorm or other hazard-increasing occurrence by a competent person.

If evidence of a situation which could result in possible cave-ins or slides, failure of protective systems, hazardous atmospheres, or another hazardous condition is identified, exposed workers shall be removed from the hazard and all work in the excavation stopped until all necessary safety precautions have been implemented.

In locations where oxygen deficiency or gaseous conditions are known or suspected, air in the excavation shall be tested prior to the start of each shift, or more often if directed by the designated authority. A log of all test results shall be maintained at the work site.

13.2 Protective Systems

The sides of all excavations in which employees are exposed to danger from moving ground shall be guarded by a support system, sloping or benching of the ground, or other equivalent means.

Excavations less than 1.5 m (5 ft) in depth, and which a competent person examines and determines to be no potential for cave-in, do not require protective systems.

Sloping or benching of the ground shall be in accordance with OSHA 29 CFR 1926.650 Subpart P.

Support systems shall be in accordance with OSHA 29 CFR 1926.652 Subpart P.

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

A support system, such as underpinning, is provided to ensure the stability of the structure and to protect employees involved in the excavation work or in the vicinity thereof.

If a contractor elects to depart from a recognized method, a registered professional engineer may approve the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation and that the excavation will not pose a hazard to employees if: **something is missing here—what follows doesn't make sense???**

The stability of adjoining buildings or walls is endangered by excavations; shoring, bracing, or underpinning designed by a qualified person shall be provided to ensure the stability of the structure and to protect employees.

Sidewalks, pavements, and related structures shall not be undermined unless a support system is provided to protect employees and the sidewalk, pavement, or related structure.

Where it is necessary to undercut the side of an excavation, overhanging material shall be safely supported.

13.3 Protection from Water

Diversion ditches, dikes, or other means shall be used to prevent surface water entering an excavation and to provide good drainage of the area adjacent to the excavation.

Employees shall not work in excavations in which there is accumulated water or in which water is accumulating unless the water hazards posed by accumulation is controlled.

Freezing, pumping, drainage, and similar control measures shall be planned and directed by a registered engineer. Consideration shall be given to the existing moisture balances in surrounding soils and the effects on foundations and structures if it is disturbed.

When continuous operation of ground water control equipment is necessary, an emergency power source shall be provided. Water control equipment and operations shall be monitored by a competent person to ensure proper operation.

13.4 Protection from Falling Material

Employees shall be protected (by scaling, ice removal, benching, barricading, rock bolting, wire mesh, or other means) from loose rock or soil which could create a hazard by falling from the excavation wall. Special attention shall be given to slopes which may be adversely affected by weather, moisture content, or vibration.

Materials, such as boulders or stumps, that may slide or roll into the excavation shall be removed or made safe.

Excavated material shall be placed at least 0.6 m (2 ft) from the edge of an excavation or shall be retained by devices which are sufficient to prevent the materials from falling into the excavation. In any case, material shall be placed at a distance to prevent excessive loading on the face of the excavation.

13.5 Mobile Equipment and Motor Vehicle Precautions

When vehicles or mobile equipment are utilized or allowed adjacent to an excavation, substantial stop logs or barricades shall be installed. The use of a ground guide is recommended.

Workers shall stand away from vehicles being loaded or unloaded to avoid being struck by spillage or falling materials.

Excavating or hoisting equipment shall not be allowed to raise, lower, or swing loads over personnel in the excavation without substantial overhead protection.

Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at lower levels are adequately protected from the hazard of falling material or equipment.

When operations approach the location of underground utilities, excavation shall progress with caution until the exact location of the utility is determined: workers shall be protected from the utility and the utility from damage or displacement.

13.6 Safe Access

Protection shall be provided to prevent personnel, vehicles, and equipment from falling into excavations.

All wells, pits, shafts, etc., shall be barricaded or covered.

Excavations shall be backfilled as soon as possible. Upon completion of exploration and similar operations, test pits, temporary wells, etc., shall be backfilled immediately.

Walkways or bridges with standard guardrails shall be provided where people or equipment are required or permitted to cross over excavations.

Where personnel are required to enter excavations over 1.2 m (4 ft) in depth, sufficient stairs, ramps, or ladders shall be provided to require no more than 7.5 m (25 ft) of lateral travel.

At least two means of exit shall be provided for personnel working in excavations: where the width of the excavation exceeds 30 m (100 ft), two or more means of exit shall be provided on each side of the excavation.

When access to excavations in excess of 6 m (20 ft) in depth is required, ramps, stairs, or mechanical personnel hoists shall be provided.

13.7 Sloping and Benching

Sloping or benching of the ground shall be in accordance with one of the systems outlined as follows:

- For excavations less than 6 m (20 ft) in height, the maximum slope shall be 34° measured from the horizontal (1½ horizontal to 1 vertical).
- The design shall be selected from, and be in accordance with, written tabulated data such as charts and tables. At least one copy of the tabulated data shall be maintained at the job site during excavation. The tabulated data shall include:
 - Identification of the parameters that affect the selection of a sloping or benching system drawn from the data
 - Identification of the limits of use of the data, including the magnitude and configuration of slopes determined to be safe
 - Explanatory information as may be necessary to aid the user in correctly selecting a protective system from the data
 - The identity of the registered professional engineer who approved the data
- The sloping or benching system shall be designed by a registered engineer. At least one copy of the design shall be maintained at the job site during excavation. Designs shall be in writing and include:



- The magnitudes and configurations of the slopes that were determined to be safe for the particular excavation
- The identity of the registered engineer who approved the design

13.8 Support Systems

Support systems shall be in accordance with one of the systems outlined as follows:

- Designs drawn from manufacturer's tabulated data shall be in accordance with all specifications, limitations, and recommendations issued or made by the manufacturer.
 - Deviation from the specifications, recommendations, and limitations are only allowed after the manufacturer issues specific written approval.
 - A copy of the manufacturer's specifications, recommendations, and limitations - and the manufacturer's approval to deviate from these, if required - shall be in written form and maintained at the job site during excavation.
- Designs shall be selected from, and be in accordance with, tabulated data (such as tables and charts). At least one copy of the tabulated data which shall be maintained at the job site during excavation. The tabulated data shall include:
 - Identification of the parameters that affect the selection of the protective system drawn from such data.
 - Identification of the limits of use of the data.
 - Explanatory information as may be necessary to aid the user in correctly selecting a protective system from the data.
 - The identity of the registered professional engineer who approved the data.
- Designs that are site-specific shall be designed by a registered engineer. At least one copy of the design shall be maintained at the job site during excavation. Designs shall be in writing and include:
 - A plan indicating the sizes, types, and configurations of the materials to be used in the protective system
 - The identity of the registered engineer who approved the design

13.9 Materials and Equipment Used for Protective Systems

Materials and equipment shall be free from damage or defects that might impair their proper function.

Manufactured materials and equipment shall be used and maintained in a manner consistent with the recommendations of the manufacturer and in a manner that will prevent employee exposure to hazards.

When material or equipment is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use.

13.10 Shield Systems

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.

Employees shall be protected from the hazard of cave-ins when entering or exiting the area protected by shields.

Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

13.11 Additional Requirements for Trenching

Installation of support systems shall be closely coordinated with excavations of trenches.

Bracing or shoring of trenches shall be carried along with the excavation.

Backfilling and removal of trench supports should progress together from the bottom of the trench. Jacks or braces shall be released slowly and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after personnel have cleared the trench.

Excavation of material to a level no greater than 0.6 m (2 ft) below the bottom of the members of a trench support system (including a shield) shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

14.0 Tree Removal and Clearing

Each location where tree maintenance or removal is done shall be under the direction of a qualified tree worker.

14.1 Working near Electrical Equipment and Systems

Employees working in the proximity of electrical equipment or conductors shall consider all such equipment or conductors energized with potentially fatal voltage, never to be touched (directly or indirectly).

An inspection shall be made by a qualified tree worker to determine whether an electrical hazard exists before climbing, otherwise entering, or performing any work in or on a tree.

Only a qualified line-clearance tree trimmer or qualified line-clearance tree trimmer trainee (under the direct supervision of qualified personnel) shall be assigned to the work if it is found that an electrical hazard exists.