ENVIRONMENT, SAFETY & HEALTH DIVISION

Chapter 11: Excavation Safety

Physical Requirements

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1 Purpose

The purpose of these requirements is to protect workers, SLAC property, and the environment from common hazards associated with *excavations* (including *ground disturbance* activities), such as structural instability, cave-in, lack of egress, falls, hazardous atmosphere(s), water accumulation, and hazards associated with heavy equipment. These requirements cover establishing protections for utilities and encumbrances, workers, and the environment. They apply to workers, supervisors, competent persons, and project managers (PMs)/field construction managers (FCMs).

2 Requirements

2.1 Protecting Utilities / Encumbrances

2.1.1 Surface Encumbrances

All surface encumbrances that could cause a hazard (such as equipment, pipe, spoil, sources of vibration) must be evaluated and removed or supported, as necessary, to safeguard workers.

2.1.2 Underground Installations

All exposed utilities must be protected, supported, or removed to prevent damage to the utility and to prevent injury to workers.

2.1.3 Heavy Equipment

Use of heavy machinery is not allowed within an *exclusion zone* (comprised of the width of the utility plus 18 inches in all directions) around a known utility. Only hand digging is allowed.

2.1.4 De-energization / De-pressurization

All utilities in the area must be de-energized/de-pressurized and locked and tagged (see Chapter 51, "Control of Hazardous Energy") before work begins unless an exception is approved by the Facility and Operations division director.

2.2 Protecting Workers

2.2.1 Access and Egress

All excavations four feet or more in depth must have a stairway, ladder, ramp, or other safe means of egress so as to require no more than 25 feet of lateral travel for workers. Requirements include the following:

- Structural ramps used solely by personnel as a means of access or egress from an excavation must be designed by a competent person.
- Structural ramps used for access or egress of equipment must be designed by a competent person qualified in structural design and constructed in accordance with the design.
- If a ramp or runway is constructed of two or more structural members, the members must be connected together to prevent their displacement.
- Structural members must be of uniform thickness.
- Cleats or other appropriate means used to connect structural members must be attached either to the bottom of the runway or in a manner so as to prevent tripping.
- Structural ramps used in lieu of steps must be provided with cleats or other surface treatments on the top surface to prevent slipping.

2.2.2 Shoring

All excavations five feet or more in depth must be shored, benched, or sloped according to Cal/OSHA standards (8 CCR 1541.1). Excavations less than five feet in depth that are not shored must be examined by a competent person and found to have no potential for edge or wall collapse, cave-in, or other hazardous conditions before entry.

Where the stability of adjoining buildings, walls or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning must be provided to ensure the stability of such structures for the protection of workers. A qualified engineer must make this determination.

All excavations 20 feet or more in depth must have a protective system designed by a registered professional engineer and a description of the system must be submitted prior to excavation.

All materials and equipment used for protective systems must be free from damage and defects that might impair their proper function.

Support systems must be installed and removed in a manner that protects workers from edge or wall collapse, cave-in, structural collapse, or from being struck by members of the support system. Removal must begin at, and progress from, the bottom of the excavation. Members must be released slowly to so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation. During the removal of support systems, a competent person must be present, and, only persons involved in the removal must be in the excavation.

2.2.3 Protection of Workers from Loose Rock or Soil

Workers must be protected from excavated or other material or equipment that could pose a hazard by falling or rolling into excavations. Protection must be provided by placing and keeping such materials or

equipment at least two feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavation, or by a combination of both if necessary. If a retaining device is to be used, it must be placed at least two feet from the edge of the excavation.

2.2.4 Fall Protection

The following requirements apply

- Where workers or equipment are required or permitted to cross over excavations over six feet in depth and wider than 30 inches, walkways or bridges with standard guardrails that comply with Cal/OSHA standards (8 CCR 1541) must be provided.
- Adequate barrier physical protection must be provided at all remotely located excavations. All openings such as wells, pits, and shafts must be barricaded or covered and when the work is complete any such temporary opening must be backfilled.
- Each worker within six feet of the edge of an excavation that is six feet or more in depth must be protected from falling by guardrail systems, fences, personal fall arrest systems, or barricades.

For more information on fall protection, see Chapter 45, "Fall Protection".

2.2.5 Oxygen Deficiency

The excavation atmospheres must be tested before personnel enter any excavation that is five feet or more deep and where *oxygen deficiency* (atmospheres containing less than 19.5 percent oxygen) or a *hazardous atmosphere* exists or could reasonably be expected to exist. Examples of such areas are excavations in a landfill area or in an area where hazardous substances are stored nearby.

For more information, see Chapter 36, "Cryogenic and Oxygen Deficiency Hazard Safety".

2.2.6 Water Accumulation

Personnel must not work in an excavation in which water has accumulated or in which water is accumulating unless adequate precautions have been taken to protect against this hazard.

2.2.7 Traffic

Barricades, trench plates, or other measures must be placed over an open excavation to prevent workers from falling in and to prevent damage to any exposed utilities. Use of trench plates must be approved by a California-licensed civil engineer and in accordance with approved building and construction plans. Trench plates used to bridge excavations over which vehicles will travel must be secured against displacement.

Personnel exposed to public vehicular traffic must be provided with and wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

2.2.8 Warning System for Mobile Equipment

When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation and the operator does not have a clear and direct view of the

excavation's edge, a warning sign must be used such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

2.2.9 Exposure to Falling Loads

No personnel will be permitted underneath loads handled by lifting or digging equipment. Personnel must be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials.

2.3 Environmental Protection

2.3.1 Erosion Control

Appropriate sediment controls must be used during all excavation operations to prevent stormwater pollution. Examples of sediment controls that may be used include covering stockpiles, use of drain inserts or covers and/or wattles (see Stormwater: BMP Category 13 – Building Repair, Remodeling, and Construction and Stormwater: Construction Site Requirements).

2.3.2 Disposal of Excavated Material

Excavated material such as soil, asphalt, concrete, base rock, and slurry, must be disposed of as specified in the excavation permit.

Important Construction debris must remain segregated from excavated material.

2.3.3 Backfill and Restoration

Backfilling and pavement or surfacing restoration must be in accordance with the excavation permit and project specifications. If excavated material is listed as *re-use*, the permit will specify if it is to be used as backfill or if it can be relocated on-site. In all instances, guidance and oversight by the Environmental Protection Department and the Building Inspection Office is required.

3 Forms

The following forms and systems are required by these requirements:

- None

4 Recordkeeping

The following recordkeeping requirements apply:

- None

5 References

SLAC Environment, Safety, and Health Manual (SLAC-I-720-0A29Z-001)

- Chapter 11, "Excavation Safety"
  - Excavation Safety: Excavation Procedures (SLAC-I-730-0A23C-001)
- Chapter 2, "Work Planning and Control"
- Chapter 6, "Confined Space"
- Chapter 17, "Hazardous Waste"
- Chapter 26, "Stormwater"
  - Stormwater: BMP Category 13 – Building Repair, Remodeling, and Construction (SLAC-I-750-0A16E-013)
  - Stormwater: Construction Site Requirements (SLAC-I-750-0A16S-009)
- Chapter 36, "Cryogenic and Oxygen Deficiency Hazard Safety"
- Chapter 45, "Fall Protection"
- Chapter 51, "Control of Hazardous Energy"

Other Documents

- Title 8, *California Code of Regulations*, "Industrial Relations", Division 1, "Department of Industrial Relations", Chapter 4, "Division of Industrial Safety", Subchapter 4, "Construction Safety Orders", Article 6, "Excavations" (8 CCR 1539–1947) with the following exception: SLAC uses an internal permitting and notification system to control excavations in lieu of 8 CCR 1541, paragraph (2)