



Excavation CoW Technical Standard

Version	Date	Approver
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Introduction

The excavation standard is designed to help prevent injuries, property damage, and adverse environmental impact as a result of hazards associated with excavation work (e.g., digging, cut & filling, micro-tunneling, pipe bursting, vibratory plowing, trenching, etc.). This includes potential for encountering underground utilities or subsurface installations, recognition of overhead hazards, control of hazardous atmospheres, falls prevention, protections from items falling, and prevention of cave-ins or collapses.

This standard defines the enterprise requirements for excavation activities.

Requirements

The following sections provide minimum requirements for excavations as well as supporting guidance to clarify the intent of those requirements.

- **Requirements** of this Standard **shall** be met.

1.	Requirement:	Hazard Analysis shall be conducted in accordance with the Hazard Analysis JO Standard when planning work involving excavations.
2.	Requirement:	Notifications of planned excavations shall be made to the appropriate stakeholders, utility companies and owners of underground installations prior to beginning work.
	Guidance:	Utility companies or call before you dig agencies, may have required notification timeframes that should be considered when planning excavation activities.
3.	Requirement:	JO shall have a written process for identifying, locating, and marking underground utilities and/or subsurface installations.
	Guidance:	After outside agencies, owners, and utility companies have marked underground utilities and/or subsurface installations, additional testing/checking should take place to identify any potentially missed or abandoned lines within the planned excavation area. Equipment such as ground penetrating radar (GPR), magnetometer, electromagnetic (EM), radio detection, pipe and cable locator, probing, maps and drawing, or other similar tools should be utilized. See JOSOP 470 Installation and Clearance for Buried Piping, Cables, Underground Structures and Buildings
4.	Requirement:	Excavations shall be authorized in accordance with the Work Authorization JO Standard.
5.	Requirement:	An Excavation Permit shall be required prior to breaking the surface, including but not limited to the following:
		<ul style="list-style-type: none"> a. Breaking the surface by mechanical (invasive) excavation (e.g., trencher, backhoe, pile driver, boring machine, jackhammer, or similar) regardless of depth. b. Excavating 4 feet (1.2 m) or deeper utilizing manual excavation (hand tools only).
	Guidance:	JO may determine if an excavation permit is required for mechanical (noninvasive) excavation (hydro-excavation / lancing / probing, hand tool used less than 4 feet (1.2 m), scraping the ground (e.g., removal of weeds, small oil spills, removing crane pads, removing dirt or asphalt, etc.)).
6.	Requirement:	The exact position of underground utilities and/or subsurface installations shall be located by a safe and acceptable means when excavating activities come within the estimated location of identified utilities.

	Guidance	Safe and acceptable means includes, but is not limited to, soft digging techniques such as daylighting by hand digging, pneumatic probing, vacuuming, or probing with a blunt object. When workers approach a known or suspected pipeline or other utilities using machinery for excavation, JO may require an observer (spotter) or encroachment monitor, as applicable.
7.	Requirement:	Underground utilities, electrical cables, pipelines, or sewers within the limits of the excavation shall be protected, guarded, and/or controlled.
	Guidance:	Methods for protecting, guarding or controlling underground utilities include, but not limited to, isolating utilities, using barriers to prevent access, flagging and/or posting signage on the hazard, using plate steel, concrete tiles, or heavy wood timbers for shielding, driving sheet pilings, or adding support structure.
8.	Requirement:	Surface encumbrances that present a hazard in the planned excavation work area shall be removed or mitigated prior to beginning excavation work.
	Guidance:	Surface encumbrances might include trees, utility poles, rocks, buildings or structures, vehicles, equipment, etc.
9.	Requirement:	A competent person shall determine soil conditions and identify soil type. a. Soils with the least stability shall be used to determine methods to prevent cave-in or collapse when multiple soil types are present. b. When unsure of soil type, default to Type C soil requirements.
	Guidance:	Verifying soil conditions and soil type should happen prior to starting the excavation and periodically throughout the excavation at a frequency determined by the competent person or when there is a change in the soil type, look, or condition.
10.	Requirement:	Excavations near buildings, roads, retaining walls, and other structures or excavations deeper than 20 feet (6.1 m) shall be reviewed and approved by a qualified professional (e.g., Registered Professional Engineer) as determined by the local regulation.
	Guidance:	JO may work with a qualified professional to identify and document any buildings, roads, or other structures that this requirement would not apply to (e.g., access dirt roads, excavation is in stable rock, etc.).

11.	<p>Requirement:</p> <p>Guidance:</p>	<p>When personnel enter an excavation with a depth greater than 4 feet (1.2 meters), a safe means of access and egress (e.g., ladders, stairways, ramps, sloping) shall be provided, requiring no more than 25 feet (7.5 meters) of lateral travel for the worker.</p> <ul style="list-style-type: none"> • If a ladder is used, it should extend beyond the lip of the excavation by a minimum of 3 ladder rungs. • If sloping is used for the purpose of access and egress, the angle cannot be greater than 34-degree angle (1½' out for 1' of depth)
12.	<p>Requirement:</p>	<p>Structural ramps used solely for worker access or egress, shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design.</p> <ul style="list-style-type: none"> • Structural members used for ramps or runways shall be of uniform in thickness and joined in a manner to prevent tripping or displacement. • Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner that prevents tripping. • Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.
13.	<p>Requirement:</p>	<p>Excavation and other equipment shall maintain minimum clearances from overhead obstructions and overhead power lines (per the Electrical Safe Work JO Standard).</p>
14.	<p>Requirement:</p> <p>Guidance:</p>	<p>Personnel exposed to public vehicular traffic shall wear safety garments made of reflective or high visibility material.</p> <ul style="list-style-type: none"> • JO may determine how to identify / protect workers within a facility or controlled location (non-public). • High Visibility (Hi-vis) or reflective material garments are suggested when flagging/ spotting vehicles or earth moving equipment for loading and offloading of materials. • Spotter/ Flaggers should have clear line of sight to the equipment operator/ truck driver. If the line of sight is interrupted, all movement should stop until it is restored.
15.	<p>Requirement:</p> <p>Guidance:</p>	<p>The excavation area shall have signage and barriers erected to prevent unauthorized access by vehicles, personnel, or the public.</p> <p>When excavating in high-traffic areas, additional controls (ex. guardrails, fences, walkways, additional signage, and additional lighting) should be added to protect the public or personnel.</p>

16.	Requirement:	Unauthorized personnel shall not enter an excavation when heavy equipment is in use. No personnel are allowed in the line of fire (such as where loads, equipment arms or weights may swing or move). No personnel are permitted underneath loads handled by excavation or lifting equipment.
	Guidance:	If authorized personnel must enter the excavation to perform a task (such as spotting, aligning pipe, or setting cribbing), a hazard analysis should be completed to address the risks to all personnel involved in addition to the completion of the Working around mobile equipment SWC.
17.	Requirement:	Personnel shall be protected from loose rock, excavated soil, or other materials that could enter the excavation.
	Guidance:	Protection methods include the following: <ul style="list-style-type: none"> • Scaling to remove loose material • Installation of protective barricades, retaining devices, or netting/shielding • Placing, storing and/or retaining excavated materials no closer than 2 feet (0.61 meters) from the edge of the face unless otherwise designed and approved by a qualified engineer.
18.	Requirement:	When vehicles, excavation equipment, and other equipment will be operated in close proximity of an excavation, controls shall be put into place to prevent equipment from accidentally entering the excavation.
	Guidance:	Use of a warning system (e.g., spotters, hand or mechanical signals, barricades, stop logs, concrete barriers) to alert mobile equipment operators of an excavation edge when an equipment operator may not have a clear and direct view of the edge of the excavation.
19.	Requirement:	Personnel shall not work on the faces of sloped or benched excavations at levels above other personnel without adequate protection for personnel at lower levels (e.g., safety net, fall protection, etc.).
	Guidance:	Protection methods could include: <ul style="list-style-type: none"> • Safety nets • Fall protection • Installation of protective barricades, retaining devices, or shielding
20.	Requirement:	All excavations 4 feet (1.2m) or greater shall be gas tested in accordance with the Portable Gas Detection CoW Technical Standard.

21.	<p>Requirement:</p> <p>Guidance:</p>	<p>Excavations greater than 4 feet (1.2 m) deep that meet the definition of a confined space shall be managed in accordance with the Confined Space Entry CoW Technical Standard.</p> <p>Controls may be implemented to change the excavation so that it no longer meets the definition of a confined space or a permit required confined space when greater than 4 feet (1.2 m) deep.</p> <p>Examples of controls include:</p> <ul style="list-style-type: none"> • Sloping to allow easy entry and exit (no greater than 34-degree angle / 1½' out for 1' foot of depth) • Benching to prevent engulfment hazards • Gas testing to verify no hazards are present
22.	<p>Requirement:</p> <p>Guidance:</p>	<p>When personnel are reasonably anticipated to enter an excavation work area, a competent person must conduct and document excavation inspections (including adjacent areas and protective systems), including but not limited to:</p> <ol style="list-style-type: none"> a. Before work starts each shift b. As dictated by the work performed c. After a rainstorm when work is being performed d. When fissures, tension cracks, sloughing, underground cutting, water seepage, bulging at the bottom, or other similar conditions occur. e. When there is a change in the size, location, or placement of the soil pile f. When there is an indication of change or movement in adjacent structures g. After any event that may damage protective equipment h. After other events that could increase potential hazards (e.g., windstorm, earthquake, dramatic change in weather) <p>Where the competent person finds evidence of a situation that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to secure their safety.</p> <p>Entry of personnel into the excavation area includes entry by driving equipment into the excavation (e.g., dozer, dump trucks, track hoe etc.). Excavation SWC shall be completed prior to each shift.</p>
23.	<p>Requirement:</p>	<p>Personnel entering excavations 4 feet (1.2 meters) or deeper or when a competent person identifies the potential for cave-in at any depth, personnel shall be protected by a protective system.</p> <ol style="list-style-type: none"> a. Materials and equipment used for protective systems shall be free from damage or defects and

		<p>installed and maintained in a manner consistent with manufacturer recommendations.</p> <p>b. Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.</p>
	Guidance:	Examples of protective systems include the following: support systems (e.g., underpinning, bracing, shoring), sloping, benching, trench boxes, and/or shield systems designed by a qualified professional (e.g., Registered Professional Engineer).
24.	Requirement:	Work shall stop and immediate notification made to appropriate authorities upon unintentional contact or discovery of damage (e.g., breaks, leaks, dents, gouges) to any subsurface utility or installation.
	Guidance:	Appropriate authorities could include: a supervisor, emergency response personnel, utility company, etc.
25.	Requirement:	<p>Personnel shall be protected from water accumulation in excavations including, but not limited to the following:</p> <p>a. Water and drainage shall be controlled through suitable means (e.g., cut-off drains, diversion ditches, berms, bunds, dikes) so that water is collected and discharged clear of the working area.</p> <p>b. A competent person shall monitor water and drainage controls to ensure proper operation.</p> <p>c. Excavations subject to runoff from heavy rains will require an inspection by a competent person to confirm that water infiltration and accumulation is controlled.</p>
	Guidance:	JO should consider water removal equipment and controls in the low-lying areas around the excavation where equipment is kept. This is to protect the equipment from potential flooding and to protect any pipeline from floating due to water accumulation.
26.	Requirement:	Where hazardous atmospheric conditions exist or may reasonably be expected to develop, an emergency rescue plan, rescue equipment, and trained personnel shall be available as determined by the Hazard Analysis.
27.	Requirement:	Personnel assigned responsibilities in excavation roles shall meet the training and competency requirements in accordance with the Training and Competency CoW Standard.
28.	Requirement:	Documentation associated with excavations shall adhere to the record retention requirements detailed in the Control of Work Standard.

Appendix A: Terms and definitions

Term	Definition
Barricade	An obstruction, such as rope netting, mesh covers, metal or wood covers, flasher units, danger tape, chain, or traffic cones placed in such a way as to prohibit personnel and/or equipment from passing into an area where potential hazards may be present. A barricade must present an easily recognizable warning against entry.
Benching	A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.
Competent person	One who can identify existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
Day-lighting	In the context of excavation, the process of safely exposing an underground utility to precisely locate and identify it. Day-lighting is done with hand tools, vacuum excavation, or other means that cannot damage the utility.
Excavation	Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
Hazardous Atmosphere	An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from the following: <ul style="list-style-type: none"> • Flammable gas or vapor in excess of 10% of the Lower flammable limit • Airborne combustible dust at concentrations that meets or exceeds its lower flammable limit • Atmospheric oxygen concentrations less than 19.5% or greater than 23.5% • Atmospheric concentrations of any substance more than the permissible limit • Atmospheric conditions immediately dangerous to life or health
Manual Excavation (hand digging)	An excavation activity performed with a hand shovel or other in-kind non-powered hand tool.
Mechanical (Noninvasive) Excavation	An excavation activity performed using of a positive displacement vacuum pump to remove soil (i.e., Mud Dog, hydro-vac (with pressure limits), Supersucker, etc.).
Mechanical (Invasive) Excavation	An excavation activity performed with mechanical, powered or air supplied equipment (i.e., excavator, jack hammer, etc.).
Protective system	A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, 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.

Term	Definition
Registered Professional Engineer (Qualified professional)	A person who is registered as a professional engineer in the state/country/region where the work is to be performed. However, a professional engineer registered in any location is deemed to be a “registered professional engineer” within the meaning of this standard when approving designs for “manufactured protective systems” or “tabulated data” to be used in interstate commerce.
Shield	A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as “trench boxes” or “trench shields.”
Shoring	A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.
Sloping	A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.
Soil type	<p>Soils can be classified as Stable Rock, Type A, Type B, or Type C. Type A soil is the most stable soil in which to excavate. Type C is the least stable soil. It is important to remember that a trench can be cut through more than one type of soil.</p> <p>Stable Rock is natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed. It is usually identified by a rock name such as granite or sandstone. Determining whether a deposit is of this type may be difficult unless it is known whether cracks exist and whether or not the cracks run into or away from the excavation.</p> <p>Type A soil is cohesive and has a high unconfined compressive strength: 1.5 tons per square foot or greater. Examples of type A soil include clay, silty clay, sandy clay, and clay loam. Soil cannot be classified as type A if it is fissured, if it has been previously disturbed, if it has water seeping through it, or if it is subject to vibration from sources such as heavy traffic or pile drivers.</p> <p>Type B soil is cohesive and has often been cracked or disturbed, with pieces that do not stick together as well as Type A soil. Type B soil has medium unconfined compressive strength; between 0.5 and 1.5 tons per square foot. Examples of Type B soil include angular gravel, silt, silt loam, and soils that are fissured or near sources of vibration, but could otherwise be Type A.</p> <p>Type C soil is the least stable type of soil. Type C includes granular soils in which particles do not stick together and cohesive soils with a low unconfined compressive strength: 0.5 tons per square foot or less. Examples of Type C soil include gravel, and sand. Because it</p>

Term	Definition
	is not stable, soil with water seeping through it is also automatically classified as Type C soil, regardless of its other characteristics.
Support System	A system, such as underpinning, bracing or shoring, trench box, that provides support to an adjacent structure, underground installation, or the sides of an excavation.
Surface Encumbrance	<p>Anything that is located on the ground in the area of the excavation that may get in the way or create a hazard for those working in the excavation or trench.</p> <p>Includes but not limited to the following: utilities, foundations, streams, trees, walkways, roads, and geologic anomalies.</p>
Subsurface installations	<p>Man-made fabrications installed below the surface of the ground that could cause concern or hazard.</p> <p>Include but are not limited to electrical lines, pipelines, water, compressed air, sewer, telecommunication lines, etc.</p>
Trench	A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.
Underground Utilities/Subsurface Installations	Any man-made underground object such as, but not limited to pipelines, electrical or telecommunications cables, sewer lines, tanks, etc.

Appendix B: Roles and responsibilities

Role	Responsibilities
Excavation Competent Person	<ul style="list-style-type: none">• Classify soil• Inspect protective systems• Monitor water removal equipment• Conduct site inspections daily when work is active or as needed
Rescue Team / Personnel	<ul style="list-style-type: none">• Has access to the excavation site• Understand the hazards of excavation activities and the specific hazards of the excavation site• Has access to life safety equipment and is properly trained in the use of the equipment and rescue techniques.
Spotter	<ul style="list-style-type: none">• Maintain position that is easily identifiable and visible to the equipment operator• Maintain position in a safe location that allows for them to assist in the safe operation of the heavy equipment• Identify hazards in the excavation• Watch for hazards in the swing radius

Appendix C: References

Internal References

Joint Operations Control of Work JO Process
Joint Operations Hazard Analysis JO Standard
Joint Operations Work Authorization JO Standard
Joint Operations Electrical Standard
Joint Operations Training and Competency JO Standard
Joint Operations Lifting and Rigging JO Standard.
Joint Operations Confined Space Entry JO Standard

External References

International Association of Oil & Gas Producers (IOGP)

Report No. 459 Life-Saving Rules

Occupational Safety & Health Administration (OSHA)

OSHA 1926. 650 Scope, application and definitions applicable to this subpart

OSHA 1926.651 Specific Excavation Requirements

OSHA 1926.652 Requirements for protective systems

National Fire Protection Association

NFPA Standard for the Technical Rescue of Personnel
Professional Qualifications