# JOSOP 401 - Excavation Standard

**Approved 27 February 2008**
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# 1.0 Purpose, Objectives and Scope

## 1.1 Purpose

The purpose of this standard is to ensure that excavation work is performed in a safe and controlled manner.

## 1.2 Objectives

This standard establishes requirements for excavations.

**NOTE:** Each Upstream strategic business unit (SBU) or location may have additional regulatory requirements.

## 1.3 Scope

This Excavation Safe Work Practice standard covers work performed by JO employees and their delegates and contractors within JO operational control.

This standard **does not** cover:

- Rescue techniques for emergency response
- Blasting activities associated with excavations
- Underwater excavation

# 2.0 Requirements

The following requirements apply to this JO – Safe Work Practices – Excavation Standard:

1. Hazards associated with excavations shall be identified and mitigated prior to beginning work.
2. Complete the steps necessary to properly and safely prepare the jobsite and equipment for the start of work.
3. Protect personnel who enter excavations by using support systems (e.g., shoring, bracing, sloping, benching, and shields). Design and construct the excavation support system using competent trained persons.
4. Personnel performing work shall be trained and competent in the roles for which they are responsible.
5. Inspect excavation shoring or bracing systems daily and after a rainstorm, earthquake or other hazard-increasing occurrence.
6. Cease all work in the excavation until necessary precautions have been taken to safeguard personnel. Personnel shall not work above other personnel without adequate protection for the personnel working at lower levels (e.g. fall protection, scaffolding, barriers, etc.).
7. Exceptions to the JO Excavation requirements will be documented and will follow the JO exception process.

# 3.0 Terms and Definitions

The following terms and definitions apply to this JO – Safe Work Practices (SWP) – Excavation Standard.

**Barricade –** An obstruction, such as tape, rope, netting, flasher units, or traffic cones, placed in such a way as to prohibit personnel and/or equipment from passing into an area where hazards may be present. A barricade must present an easily recognizable warning against entry.

**NOTE: Colored warning tape, rope, cones or flasher units alone do not serve as a physical barrier and should only be used as a temporary measure until permanent barriers are provided. An exception can be made for no or low traffic areas such as pipeline installation trench.**

**Benching –** Terracing or stepping the sides of an excavation to prevent a cave-in. Forming one or more horizontal levels or steps.

**Classified Hazardous Area –** Any area classified as a hazardous zone area (Zone 0, 1 or 2, or Class I, Division 1 or 2) in accordance with API RP 505/API RP 500 or other equivalent local standards.

**Day-lighting –** In the context of excavation, the process of safely exposing the 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.

**Entry Watch –** A competent person stationed at the entry point of a permitted confined space whose only duties are to control the entry and exit of personnel, to monitor the acceptable entry conditions both in and outside the confined space and to raise an alarm if any problem should occur.

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

**Excavation Permit/ Certificate –** A separate document attached to a Permit to Work specifying the control measures necessary to carry out the excavation work safely that is greater than 0.3 meters.

**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:

- Flammable gas, vapor or mist 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 in excess of the permissible limit.
- Atmospheric conditions immediately dangerous to life or health.

**Protection Systems –** Methods used to protect workers from cave-in, from material that could fall into an excavation, or from collapse of an adjacent structure. Protection systems include support systems, sloping, shoring, benching, and shields.

**Responsible Party –** A competent individual trained in the excavation process and who has responsibility for an assigned area, the facility, or a project, as well as any permitted work performed within that area. Examples include facility manager, operator, or contractor supervisor.

**Shields –** Structures capable of withstanding the forces of a cave-in. The structures, also called “trench boxes,” are designed to protect employees within the structure and moved as the work progresses.

**Shoring –** Hydraulic, mechanical, or timber reinforcement used to support the sides of an excavation to prevent cave-in.

**Sloping (Battered) –** Removing soil from the sides of an excavation, so they are inclined away from the excavation sufficiently to prevent cave-ins. The angle of the incline required varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

**Support system –** A system, such as underpinning, bracing or shoring, that provides support to an adjacent structure, underground installation, or the sides of an excavation.

**Trench –** A narrow excavation made below the surface of the ground in which the depth is greater than the width. But the width of a trench (measured at the bottom) is not greater than 15 feet (4.6m).

**Utilities –** Any piping, wiring, conduit or other equipment that serves as a conduit for electricity, fuel, water, compressed air, sewer, and telecommunication, etc., to or from a facility.

**NOTE:** The utility may be above or below ground.

**Utility Locator –** An electronic device for scanning and locating underground services/utilities.

## 4.0 Roles, Responsibilities and Training Requirements

Roles must be clearly defined, and personnel must meet the training and competency requirements of this standard prior to starting work. The SBU may specify additional training and competency requirements.

A single individual may fulfill more than one role as long as he or she meets the competency requirements, and is able to fully meet multiple responsibilities. When selecting personnel for these positions, consideration should be given to their level of experience and their past performance.

The following roles and responsibilities are specific to excavation:

- Person entering excavation
- Civil Engineer or other qualified professional
- Operator of powered excavating equipment
- Competent Person for surface water drainage verification

### 4.1 Initial Training

Personnel must meet the competency requirements of this standardized safe work practice before starting work. Refer to the JO – Training Requirements Tool.

The JO shall maintain documentation of workers authorized to perform excavation activities.

### 4.2 Refresher Training

Refresher training must be provided as follows:

- As required by applicable regulations and/or SBU policy
- As needed when identified by verification, inspections, incidents, or audits

# 5.0 Standard Instructions

## 5.1 Pre-job Planning and Hazard analysis

Pre-job planning and hazard analysis activities will be performed in accordance with the JO Hazard Analysis Procedure when planning excavation activities:

- To identify significant, potential hazards (e.g. underground utilities, excavation collapse/cave in potential, hazardous atmosphere, etc.).
- To identify the need for special processes such as gas testing and confined space entry.
- To identify if work will require permits (e.g. Permit to Work, Isolation of Hazardous Energy, Confined Space Entry, Excavation, etc.).
- To assess the need for Simultaneous Operation (SIMOPs).
- To identify and evaluate precautions to ensure that work may be conducted safely (e.g. soil evaluation, shoring, benching, sloping, barricading, etc.).

## 5.2 Collect Site Data

Before beginning any work, the maximum amount of data should be gathered about the site conditions and location of utilities. This may be achieved by referring to site geological surveys and site plans, and by holding discussions with relevant personnel that are knowledgeable about the site. A site inspection/survey noting the proximity to other buildings, roads, and structures as part of the site data collection may be required. Soil samples may also need to be collected and tested to determine soil classification to ensure that appropriate protection systems are identified.

## 5.3 Utilities and Pre-work Site Inspection

Before excavation, the site shall be thoroughly inspected by the Work Team Leader or competent person to determine if special safety measures must be taken.

## 5.4 Underground Utilities Location

Underground utilities such as sewers, telephone, fuel, electric, water lines, or any other underground installations that may be encountered during excavation work shall be located and marked, and proper notifications made, before excavation with powered equipment begins. A utility locator may be used initially then confirmed by other means (e.g., day lighting) to accurately determine the location of utilities. The location of buried utilities shall be marked on the surface in a manner that will last until the excavation is commenced.

Arrangements shall be made as necessary with the appropriate utility company or agency for the protection, removal, shutdown, or relocation of underground installations.

Excavation shall be done in a manner that does not endanger the underground installations (including utilities) or the persons engaged in the work. Utilities left in place shall be protected by barricades, shoring, suspension, or other means as necessary.

Do not use power-driven excavating equipment such as power shovels, bulldozers, or air-driven jackhammers, within 5 feet (1.5 Meters) on either side of an electric warning marker unless:

- An electrician is present while work is in progress near electrical lines.

- The electrical service has been located and flagged indicating service route and boundaries; i.e. 1.5m.
- The location of the electric conduit, cable or other electrical equipment has been precisely located by hand-digging.
- It has been positively determined that the electrical equipment is safely encased in a concrete envelope.
- The above conditions are outlined in a written procedure and approved by the Permit Approver.
- When necessary to excavate close to (5 feet 1.5 Meters) of an underground pipe, the location of the pipe shall be precisely located by an electronic pipe/cable locator and hand-digging the last foot. (300 mm)
- After locating the pipe, power driven equipment may be used if there is a responsible person (spotter) present to monitor the operation.
- Use of hydro-excavation may eliminate the need to hand dig around certain lines. Contact operations and HES to determine proper equipment to be used.

## 5.5 Documentation

### 5.5.1 Permit to Work

A Permit to Work and Excavation Permit are required for any excavation work in the following situations:

1) before breaking the surface with power tools, or
2) before breaking the surface, if the excavation is anticipated to reach a depth which requires shoring, as described in 5.10, or
3) it is anticipated that the controls prompted by a specialized work certificates are necessary to manage the risks of the excavation.

Additional Permits may also be required depending on the nature of the work (i.e., hot work, confined space entry, electrical). The permits must have a duplicate copy at a minimum. The permit and associated documentation must be available in the language appropriate for the Permit Approvers and Work Team Leaders. To ensure an Excavation Permit consistent with this Standard refer to Appendix D: JO Excavation Work Certificate and Guidance for Specialized Work Permits (certificates). The Excavation Certificate should include the information found on the sample certificate in Appendix D and any additional information the SBU deems necessary.

The excavation permit is renewable three times. Each renewal shall not exceed one month. A fourth extension requires a memorandum stating the reason for requiring the extension from the controlling division's Superintendent to SEHS with concurrence by his General Superintendent. EHS approval is required for extending the permit.

A drawing/sketch showing route of the required work should be attached to the permit, indicating any services like buried electrical/communication cables, overhead lines, water lines, etc.

**NOTE: Other companies or authorities may require their prior approval if excavating within a certain distance of their services.**

## 5.6 Inspections

A competent or Responsible Party person shall conduct inspections:

- Before the start of each shift
- To ensure that the Permit to Work is in place
- As dictated by the work being performed in the excavation
- After every rainstorm
- After other events that could cause increased hazards, such as windstorm, earthquake, dramatic change in weather, etc.
- When fissures, tension cracks, sloughing, underground cutting, water seepage, bulging at the bottom, or other similar conditions occur
- When there is a change in the size, location, or placement of the soil pile
- When there is an indication of change or movement in adjacent structures
- After any event that may damage protective equipment

## 5.7 Change in Conditions

Any change in work conditions that are potentially hazardous to personnel shall result in a reassessment of the work tasks and area. Changes in work conditions may result in the Work Permit(s) being suspended or withdrawn (refer to JO – Permit to Work Standard).

Changes in work conditions can include, but are not limited to:

- Activities being performed (e.g., need to now perform hot work, entry, or work at height)
- Other facility activities being performed
- Scope of work
- Weather
- An emergency situation at the facility

## 5.8 Modes of Failure

All excavations, no matter what depth, may be hazardous. Modes of failure will depend on:

- Depth
- Soil type or soil types, if layered
- Bedding planes
- Vibration
- The presence of moisture, rain, or a high water table level
- Any superimposed loading close to the edge of the excavation
- The time the excavation is open
- Any previous disturbance of the soil

While some types of soil often look stable and may stand for quite a long time, this appearance may promote a false sense of security. Indeed, experienced employees have been the victims in trench collapses. Some common failure modes are shown in Figure 1:

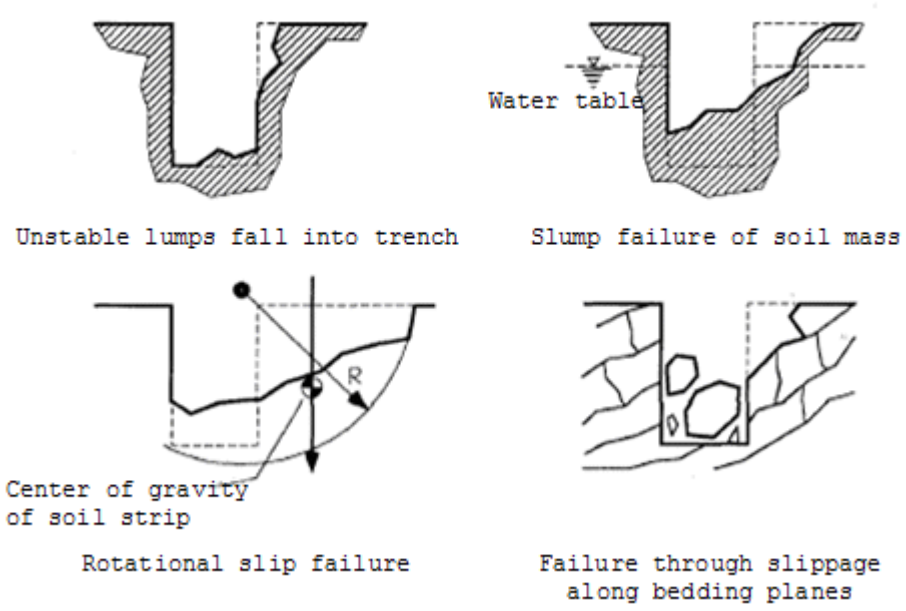



**Figure 1. Soil Failure Modes.**

Removal of soil from an excavation causes unbalanced soil stresses. The use of a shoring system, or the cutting of the sides of the excavation to a safe slope, will help compensate these soil stresses. A shoring system or the design of safe side slopes requires engineering expertise that involves both structural design and soil mechanics. While experience can guide operators in recognition of hazardous situations, it is only engineering practice that can provide known safe solutions.

Just because a "solution" worked previously does not mean that solution is satisfactory for a current situation. There may be additional factors that need to be taken into account.

## 5.9 Soil Types

A civil engineer or other qualified professional must first determine soil conditions and then identify the soil type. Typically, soils are classified into the following categories:

- **Type A –** Most stable: Clay, silty clay, and hardpan (resists penetration). Soil is not Type A if it has been fissured, subjected to vibration of any type, has previously been disturbed, or has seeping water.
- **Type B –** Medium stability: Silt, sandy loam, medium clay, and unstable dry rock, previously disturbed soils unless otherwise classified as Type C; soils that meet the requirements of Type A soil but are fissured or subject to vibration.
- **Type C –** Least stable: Gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rock, and soil from which water is freely seeping; layered geological strata (where soils are configured in layers). The soil must be classified on the basis of the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer, i.e., where a Type C soil rests on top of stable rock.

NOTE: SBU locations may have different categories of soil types.

## 5.10 Excavations to Be Shored

### 5.10.1 Excavations 1.5 meters (5 ft) or Deeper

Excavations greater than or equal to 1.5 m (5 ft) deep are particularly hazardous and must be shored unless:

a. The face is cut back to a safe slope and the material in the face will remain stable under anticipated conditions of work and weather; or

b. Shoring is impracticable or unreasonable, and a civil engineer or other qualified professional has certified that adequate safety precautions have been taken; or

c. No one will be entering the excavation.

### 5.10.2 Excavations Shallower than 1.5 Meters (5 ft)

Excavations shallower than 1.5 m (5 ft) have been known to collapse. Protection of personnel in excavations lower than 1.5 m (5 ft) shall also be provided where hazardous ground movement may be expected.

## 5.11 Safe Slopes in Excavations

Unless the stability of the excavated face is determined by a civil engineer or other qualified professional, the safe slope should not exceed:

a. 1 Vertical:1 Horizontal or the angle of repose, whichever is flatter, for soils above the water table.

b. 1 Vertical:1.5 Horizontal or the angle of repose, whichever is flatter, for saturated or submerged soils, or for excavations greater than 3 m (9.8 ft) in depth.

c. Where the slope of an excavation is benched, the maximum height between benches should not exceed 1.5 m, with the exception of the bench adjacent to the work area, which should not exceed l m (Figure 2). Overall, the total width of the benched excavation should not be less than required in a or b, above.

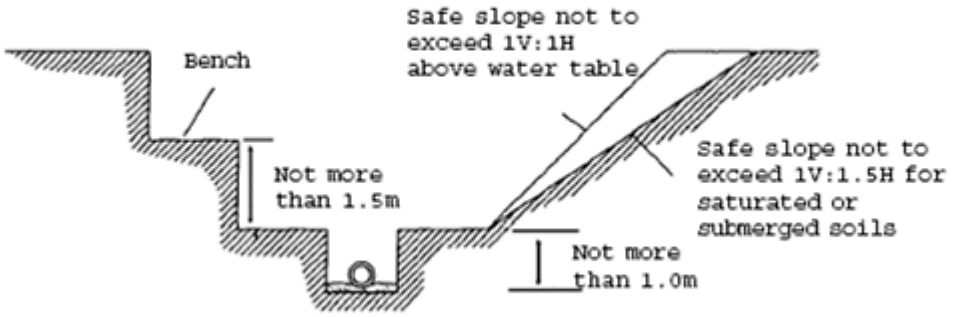



**Figure 2. Excavation Faces Benched and Battered to a Safe Slope.**

## 5.12 Exposure to Vehicular Traffic

The excavation area should be isolated from access by vehicles not involved in the excavation work. Traffic should be re-routed and the area sufficiently barricaded. Any workers who must be exposed to or direct vehicular traffic shall wear warning vests made of reflective or high visibility material.

## 5.13 Barricades

Vehicles and personnel not working in the excavation are to be kept at a safe distance from the area. Barriers should be erected to prevent unauthorized people from entering the excavation area or accidental falls into the excavation. Barriers should also be erected to prevent vehicles or equipment contacting overhead utilities.

**NOTE: Colored warning tape, rope, cones or flasher units alone do not serve as a physical barrier and should only be used as a temporary measure.**

## 5.14 Positive isolation

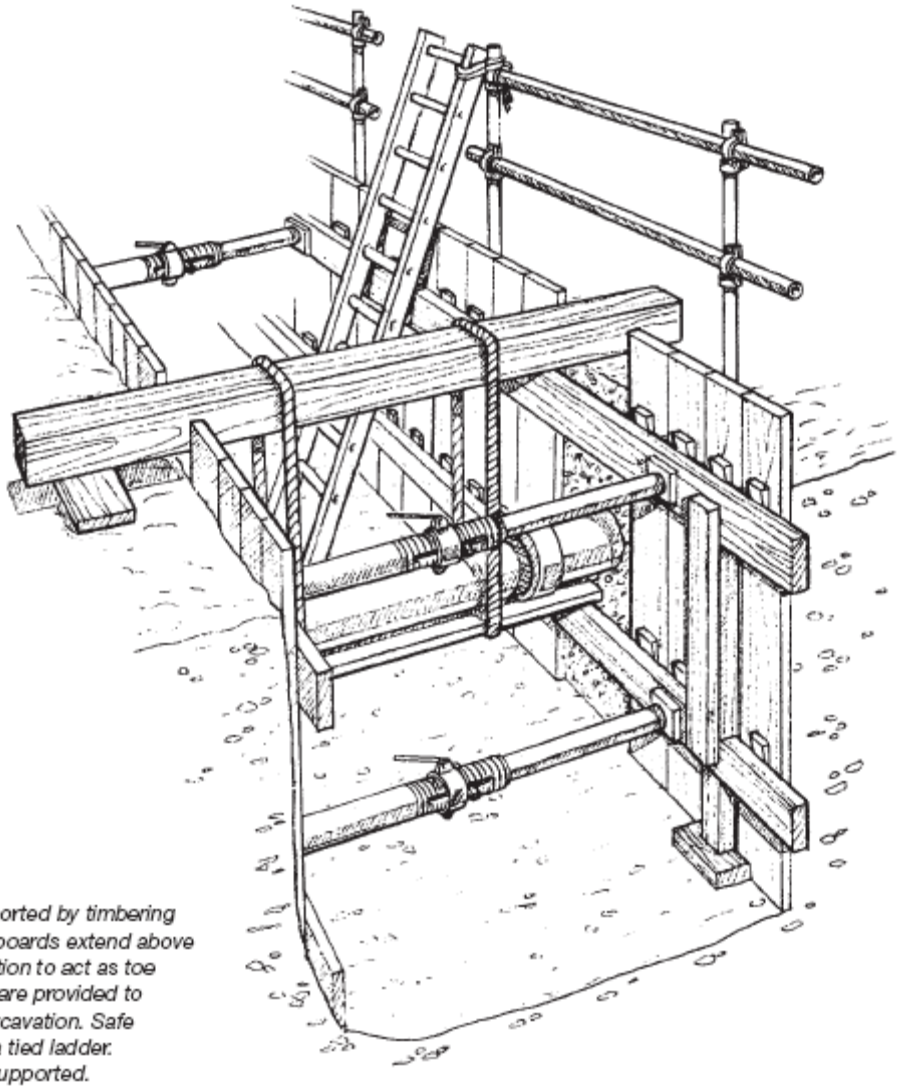
Where reasonably practicable, underground conduits, electrical cables, and product lines or sewers within the limits of the excavation should be isolated. The JO - Isolation of Hazardous Energy Standard should be followed.

## 5.15 Day-lighting

When it is not possible to positively determine the precise location of underground utilities or when excavating within 300 mm (12 inches) of a known utility, the exact position of the utility shall be precisely located by hand digging or probing with a blunt object.

## 5.16 Support of Underground Utilities

Where the excavation exposes underground utilities they must be either protected, supported, or removed as necessary (Figure 3). If damage (e.g. leaks, breaks, dents, gouges, etc.) is to these subsurface installations is discovered, work will immediately be stopped. Immediate notification (e.g. supervisors, utility companies, emergency response personnel, etc.) will occur if damage is discovered.



*This excavation is supported by timbering and props. The poling boards extend above the edge of the excavation to act as toe boards and guard rails are provided to prevent falls into the excavation. Safe access is provided by a tied ladder. Exposed services are supported.*

**Figure 3. Excavation supported by timbering and props.**

## 5.17 Adjacent Buildings or Structures

Excavation in close proximity to buildings, roads, retaining walls, and other structures must be reviewed by a civil engineer or other qualified professional before the excavation is started to determine the appropriate controls to address the risk of cave-in.

Any hazards nearby an excavation must be removed or secured if they could endanger workers. Hazards include trees, utility poles and overhead wires, rocks and similar objects, and the proximity of structures, excavated material, and vehicles/equipment to the excavation.

## 5.18 Surface Water and Drainage

Surface water and drainage shall be evaluated by a competent person to ensure effective controls and installed and working.

In excavations, the safety of faces and fillings often depends on the effectiveness of the control of surface and groundwater. To control surface water, cut-off drains, constructed parallel, and a safe distance back from the face, should collect water and discharge it

clear of the working area. Drains may also be necessary in the excavation itself. Any inflow should be collected in sumps and pumped clear of the excavation. An alternative may be to construct a small berm (bund/dyke) 150 mm (6 inches) high around the excavation to prevent ingress of surface water.

Subsurface drains, well pointing, or sump pumping should be installed to cut off, remove, or intercept groundwater and channel it away from the site if this is a hazard. During construction, checks should be made for inflow from springs or seepage. Any inflow should be collected in sumps and pumped clear of the excavation.

Springs coming up through the floor of an excavation are another cause of unstable conditions. Sands and gravels are particularly vulnerable. This condition is usually called "quicksand" and barricading the area, pending the control of the water flow, is recommended. Leaching out of fine granular material by inflow may cause slumping or cave-ins. The presence of sediment in inflows may indicate the development of unstable conditions.

Where an excavation is likely to collect or retain water of such depth as to constitute a hazard to children or persons in the vicinity, the excavation must be covered by suitable material such that persons cannot fall through it, or be securely fenced off during times when workers are not present.

Where pumping is being carried out to lower the groundwater level, subsidence of the adjacent structure may result. If such works are to be undertaken, expert advice should be obtained.

## 5.19 Harmful Gases/Vapors and Odors

Workers must be protected against the effects of toxic or explosive gases that may be encountered or created when working in excavations. Excavations, being below ground, are a natural receptacle for gases heavier than air. Gases may be natural, like hydrogen sulfide, they may arise from nearby internal combustion engines (carbon monoxide), leakage from liquefied petroleum gas (LPG) equipment, leakage from above-ground or underground storage tanks, from piping or sewer gases, or from piped natural gas.

**Table 1. Document Gases and vapors commonly found in excavations and trenches**

| Type of Ground | Gases or Vapors Found |
|---|---|
| Peaty ground | Methane, hydrogen sulfide |
| Filled and made ground | Carbon dioxide, hydrogen sulfide |
| Reclaimed land and tip fills | Carbon dioxide, methane |
| City streets | Natural gas, carbon dioxide, steam |
| Thermal areas | Carbon monoxide, carbon dioxide, hydrogen sulfide, sulfur dioxide, methane |
| Petroleum installations, service stations | Gasoline vapor, LPG, kerosene |

Where there is any likelihood of air contamination, the excavation must be tested using the correct type of detection equipment (and before entering the excavation) and the appropriate mitigation measures implemented.

The testing frequency should also be increased if welding, cutting, or burning is done in the excavation.

There is always the possibility of odors being present during excavation. Any unusual odor should be investigated and reported to the Company Representative or designee. Odors may indicate soil contamination by hydrocarbons or other sources. Odors may also indicate a leak in an underground utility. Judgment must be used to determine if odors may affect neighbors and the Company Representative should develop a plan to deal with complaints.

## 5.20 Contaminated Soil

If the soil or material being excavated appears contaminated, work shall stop and an environmental specialist's advice sought on the precautions to be taken and any disposal requirements. Preplanning the handling and disposal procedure can minimize work disruption if contaminated soil is anticipated.

## 5.21 Contaminated Water

If the groundwater may contain hydrocarbon contamination, the water shall be suitably treated before discharged off-site. Explosion-protected pumping equipment (or air-driven pump) that is suitably bonded and grounded to eliminate the risk of a static discharge, may also be required if hydrocarbon vapors are present.

## 5.22 Access / Egress

Excavations with a depth greater than 1.22 meters (4 feet) must be provided with safe means of access (e.g. ladders, stairways, ramps, etc.) and egress every 7.5 meters (25 feet) of horizontal travel.

Excavations may also be classified as confined space, and additional requirements may be required. Refer to the JO - Confined Space Entry Standard.

Persons shall not enter an excavation while heavy equipment is in use or mechanical digging is taking place.

## 5.23 Firewalls and Berms / Bunds

Any excavation that cuts through a firewall or containment berm/bund requires an approved method of work that shall provide alternate means of containment while the job is progressing.

## 5.24 Fire Safety

For excavations carried out in hazardous areas, adequate fire extinguishers shall be located near the active work area(s) at all times. No smoking shall be allowed in any work area. Other areas may also require fire extinguishers, depending on the work environment and hazards identified. In addition, a hot work certificate may be required.

## 5.25 Personal Protective Equipment

The requirement for specific personal protective equipment must be identified during the hazard analysis before commencement of work. Safety helmets, safety shoes and any other essential protective equipment must be worn by men working in excavations.

## 5.26 Emergency Equipment

Emergency rescue equipment must be available as determined by the hazard analysis and if a hazardous atmosphere is likely to be encountered. Examples include self-contained breathing apparatus (SCBA), harness with lifeline, and basket stretcher.

## 5.27 Protection Systems

These are methods used to protect workers from cave-in, from material that could fall into an excavation, or from collapse of an adjacent structure. Protective systems include support systems (e.g., shoring, sloping, benching, and shields). Subject to section 5.10.1 Excavations 1.5 meters (5 ft) or Deeper, protective systems must be designed by a civil engineer or other qualified professional. Hydraulic shoring systems, portable trench boxes, or sliding trench shields may also be used if designed, constructed, maintained, and used in a manner to provide protection equal to or greater than shoring system diagrammed in the Safety in Designs manual (3.80KB).

All materials to be used in strutting and shoring must be inspected by the Work Team Leader carrying out the work.

### 5.27.1 Shoring

Shoring provides effective and adequate temporary support for an exposed face of an excavation. Shoring must be adequately designed in accordance with sound engineering practice and the materials used must be suitable and of sound quality to suit the depth of the excavation, the type of soil, and the nature of the work.

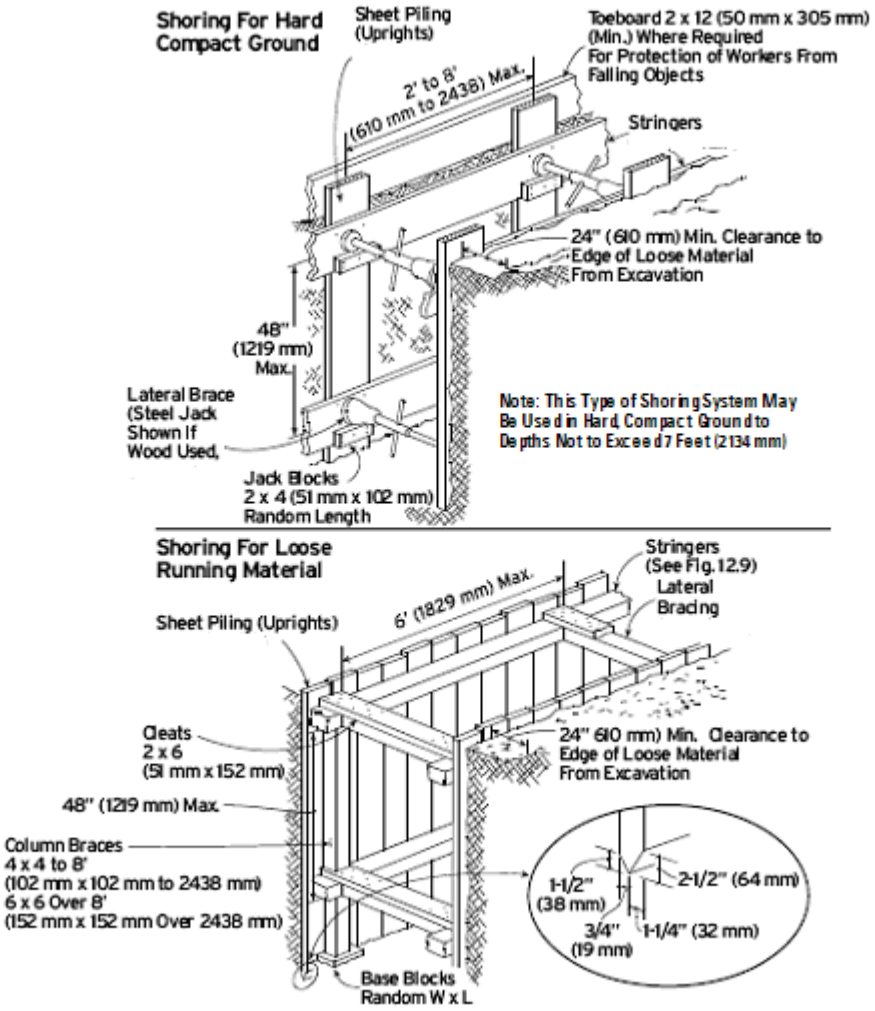



**Figure 4. Typical shoring and bracing systems for excavations. (ref. Chevron Safety in Design Manual)**

### 5.27.2 Sloping

Sloping may be substituted for shoring. The slope shall be at least 1.5 horizontal to 1 vertical (34 degrees measured from horizontal), unless the instability of the soil requires a flatter slope or as determined by a civil engineer or other qualified professional. A slope steeper than 1.5 horizontal to 1 vertical may be used, up to maximum slope of 1 horizontal to 1.5 vertical, where a civil engineer or other qualified professional has assessed the soil conditions and issued an engineer's certificate for the steeper slope.

### 5.27.3 Benching

Where benching is substituted for shoring, the benching shall have a slope ratio of 1.5 horizontal to 1 vertical, unless the instability of the soil requires a flatter slope as is determined by a civil engineer or other qualified professional. A slope steeper than 1.5 horizontal to 1 vertical may be used, up to maximum slope of 1 horizontal to 1.5 vertical, where a civil engineer or other qualified professional has assessed the soil conditions and issued an engineer's certificate for the steeper slope.

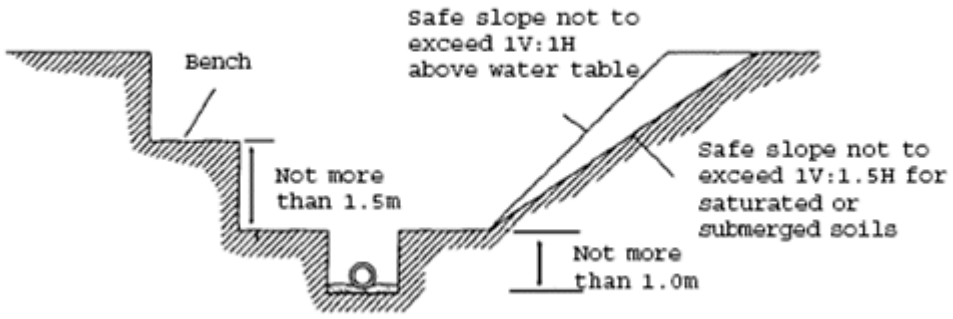



**Figure 5. Examples of Benching and Shoring.**

### 5.27.4 Shields

Shields are frequently used in wide excavations for the installation of large pipes where greater disturbance of the ground occurs. While they do not in effect provide support to the trench walls, they are a very effective means of preventing the collapse of ground on workers within the excavation. It is essential to ensure the shield is of sufficient length and there is no danger of ground spilling over the top of the shield. The basic form of a shield is two vertical plates permanently braced apart to provide a safe working place between them.

Shields must be designed in accordance with sound engineering practice by a competent engineer.

Shields must be installed per the design and in accordance with fabricator recommendations.

Typically, the excavation area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench box and the excavation must be backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those which the system was designed to withstand.

Workers must enter and leave the shield in a protected manner, such as by a ladder or ramp.

Workers must not be in the excavation when a shield is being installed, moved or removed.

## 5.28 Archeological Sites

Archeological sites require special consideration. Comply with local regulations and laws. Wherever possible, avoid excavating in archeological sites.

## 5.29 Warning System for Mobile Equipment

A warning system shall be used when mobile equipment is operated adjacent to the edge of an excavation if the operator does not have a clear and direct view of the edge of the excavation. The warning system shall consist of barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

## 5.30 Materials and Loads above Excavations

Excavated or other loose material must be effectively stored or retained no closer than 1 m (3 ft) from the edge of the face unless the face is specially shored to allow for the increased load, and suitable toe boards/stop logs or other safeguards are provided.

Heavy Equipment uses must:

- Operators of excavators must not undercut a bank, overload excavators and jib over the heads of workers.
- A watch should be kept on the rear of the machine whilst it is turning or reversing.
- Buckets must always be lowered to the ground when not in use.
- Care must be taken to avoid exhaust gases entering the excavation if men are working below ground level in the immediate vicinity of the excavator.

Mechanical plant, vehicles or any heavy loads must not approach closer than:

- 1 m (3 ft) from the edge of the excavation, which is battered to a safe slope; or
- The edge of the face, if battered to a safe slope unless the actual face is specifically shored to allow for the full effect of the additional load.

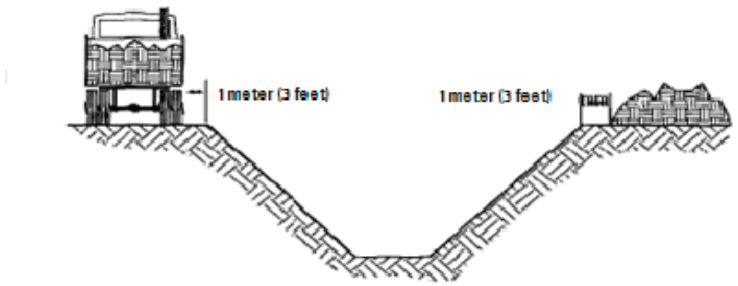



**Figure 6. Excavation with sloping (battered) faces.**

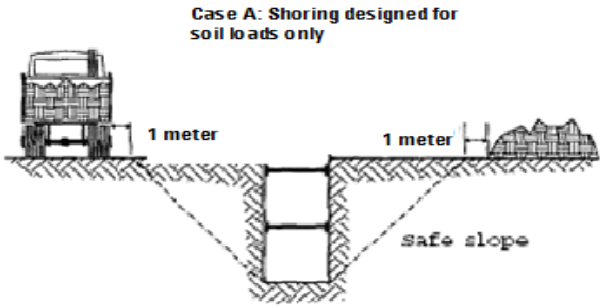



**Figure 7. Excavation with shored faces.**

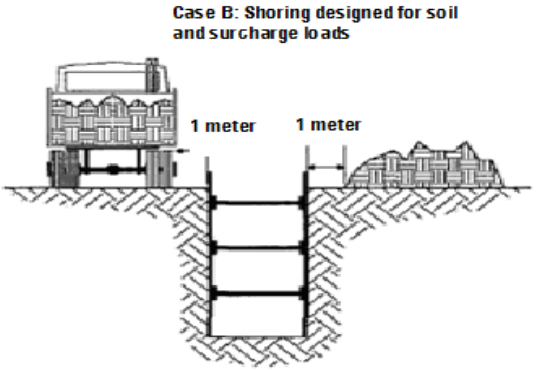



**Figure 8. Excavation with shoring designed for surcharge loads.**

## 5.31 Protection of the Public

Barricades, walkways, lighting, and posting shall be provided as necessary for the protection of the public before the start of excavation operations.

Guardrails, fences, or barricades shall be provided on excavations adjacent to walkways, driveways and other pedestrian or vehicle thoroughfares. Warning lights or other illumination shall be maintained from sunset to sunrise as necessary for the safety of the public and employees.

Wells, holes, pits, shafts, and similar hazardous excavations shall be effectively barricaded or covered and posted as necessary to prevent unauthorized access. Temporary excavations of this type shall be backfilled as soon as possible.

Walkways or bridges protected by standard guardrails shall be provided where employees and the general public are permitted to cross over excavations. Where workers in the excavation may pass under these walkways or bridges, a standard guardrail and toe board shall be used.

Excavations should be back filled immediately after the completion of the work. If for any reason a contractor carrying out an excavation work has not back fill the excavation on time, Joint Operations may back fill the trench at the contractor expense.

Refer to the Safety in Designs manual for requirements for guardrails and toe boards.

# 6.0 Records

## 6.1 Required Records

The following records will be kept:

- Copies of permits and associated documentation shall be maintained in accordance with the SBU Permit to Work Standard.

## 6.2 Records Retention

Documentation shall be retained as required by local regulation, SBU policy or for a minimum of six months, whichever is greater.

# 7.0 References

The following is a complete list of the documents referenced by this standard:

**Table 2. Document List**

| Title | File Name |
|---|---|
| JO – Permit to Work Standard | JO_MSW_PermittoWorkStandard.doc |
| JO – Confined Space Entry Standard | JO_MSW_ConfinedSpaceEntryStandard.doc |
| JO - Isolation of Hazardous Energy Standard | JO_MSW_IsolationofHazardousEnergyStandard.doc |
| JO – Training Requirements Tool | JO_MSW_TrainingRequirementsTool.doc |
| Chevron Safety in Design Manual | Safety in Designs manual |
| Guidance for Specialized Work Permits (certificates) | Guidance for Specialized Permits (certificates).doc |

# 8.0 Other Guidance Documents

None listed.

## 9.0 Document Control

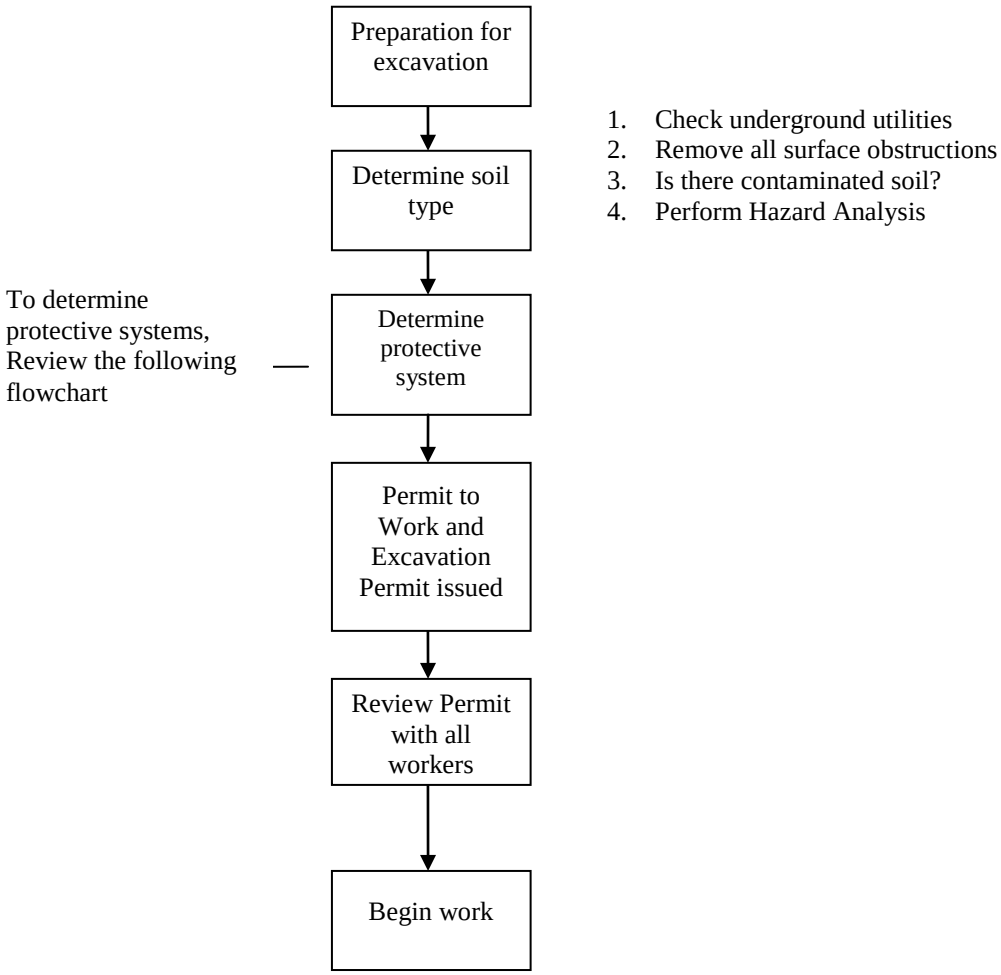
**Table 1: Document Control Information**

| Description | GU Common | SBU-Specific |
|---|---|---|
| **Approval Date** | 27 February 2008 | *17 December 2009* |
| **Next Revision Due** | 27 February 2011 | *17 December 2011* |
| **Control Number** | | *Optional* |

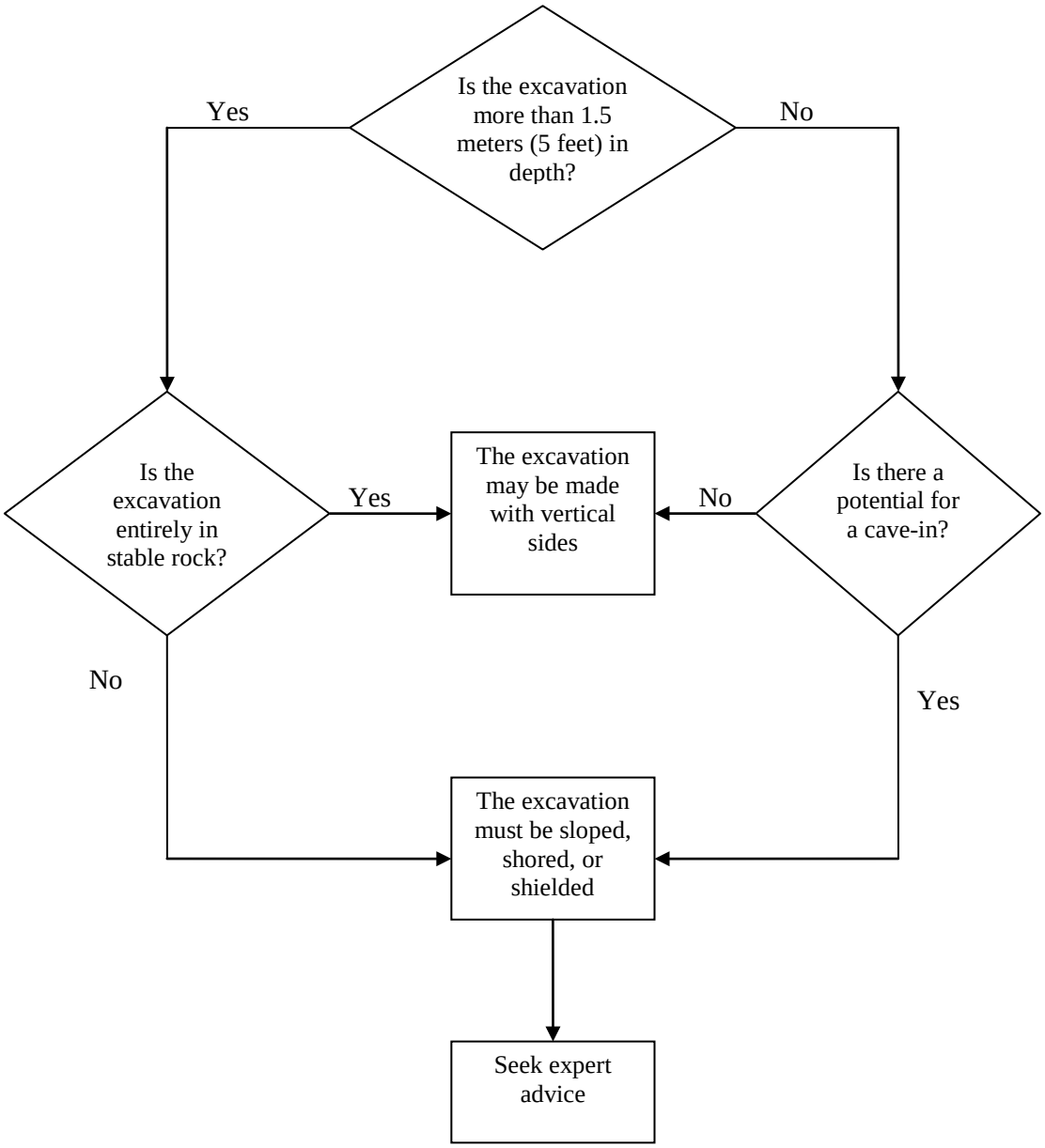
**Table 2: Document History**

| Version Number | Date | Notes |
|---|---|---|
| **1.0** | 27 February 2008 | Initial Release |
| **1.1** | 8 December 2008 | Added bookmarks for OE Mentor |
| **1.1.1** | 17 December 2008 | SAC Approval |
| **1.1.1.A** | 30 March 2009 | JO Version Created |
| **1.1.1.B** | 23 May 2010 | Added GU language on when Excavation permit is required |

## Appendix A: Process Overview



## Appendix B: Determine Excavation Protective Systems Flowchart



## Appendix C: JO Trenching Safety Checklist

This is a basic check list. Other items should be added as appropriate to a particular scheme.

- ☐ Is the surface clear of plant, spoil heaps, materials, etc., for at least 1 meter (3 feet) from the edge of the excavation?
- ☐ Are spoil heaps being properly controlled and will they stay like this in wet weather?
- ☐ Is the trench clear of employees while the spoil heap is being worked on?
- ☐ Is the space between the trench and the spoil heap clear of pipes, bricks, stones, tools, etc.?
- ☐ Is the work properly fenced off and sign posted during the day? Is the work properly fenced off, sign posted, guarded and lit during the night?
- ☐ Is access adequate without anyone having to jump across? Are footbridges with guard rails available and being used?
- ☐ Are ladders available and being used?
- ☐ Is the supervisor ensuring that no one climbs on the timbering?
- ☐ Is the trench safe from exhaust gases from machines working in the trench or nearby?
- ☐ Does everyone know where the buried services are and are they clearly marked?
- ☐ Are the employees who are excavating and shoring the trench experienced in this sort of work?
- ☐ Are they working at safe distances from each other?
- ☐ Is the ground as the design assumed?
- ☐ Is there any movement or deterioration of the ground that may put adjacent services, roads or structures at risk?
- ☐ Is the area affected by any blasting or other heavy vibrations?
- ☐ Is the groundwater level as used in the design (i.e., not higher)?
- ☐ Have proper sumps been provided?
- ☐ Does the pumping arrangement avoid drawing material from behind the sheeting?
- ☐ Is the work being done in accordance with the drawings or sketches? If not, is the variation permissible?
- ☐ Are unsheeted faces safe, with no sign of peeling away, etc?
- ☐ Are materials used of the correct design size and quality?
- ☐ Are wedges tight?
- ☐ Is timbering free of damage?
- ☐ Are deflections excessive?
- ☐ Are struts horizontal and positioned squarely to the walings (within 1 in 40)?
- ☐ Are frames supported against downward movement (by hangers or lip blocks, puncheons and sole plates)?
- ☐ Have correct pins been used in steel trench struts?
- ☐ Is the method of withdrawing sheeting and support for the trench during backfill safe?
- ☐ Is the work area tidy?
- ☐ Are stops provided for mobile plant?
- ☐ Is visibility adequate in trench?
- ☐ Are safety helmets, goggles, etc., available and being used?

## Appendix D: JO Excavation Work Certificate

**JOINT OPERATIONS**

**EXACAVTION WORK CERTIFICATE**

**Printed Sl. No. ……**

| **To be Filled by Executing Division** | |
|---|---|
| **1. Work Location**<br>…….<br>Area/ Unit / Equipment Etc. | |
| **2. Valid From** | **To ( Valid for one month)** |
| **3. Permission requested by ( Division/ Contractor)**<br>……<br>Name of the division/ section/ contractor | |
| **4. Scope of work**<br>**Note :** Attach drawing /sketch showing route of the exact work. Indicate if any service like buried electrical/communication cables, pipelines are encountered | |
| **5. Size of Excavation**<br>…… M Depth X… …….M Wide X …….. M Length | |
| **6. Details of Machinery/ Equipment to be used** | |
| **7. Precise location of work/road to be closed** | |

**8. Approval**
(Permission is granted to excavate, Under Ground drawing reviewed , U/G installations identified and conditions mentioned in section 9 & 10.

| **Designation** | **Name/ Signature / Badge No.** |
|---|---|
| Area Supervisor ( Operations) | |
| Area Supervisor ( Electrical Maint.) | |
| Area Supervisor ( Instrument Maint. ) | |
| Area Supervisor ( PGP & DAD) | |
| Telecommunication & Testing Supervisor | |
| Supervisor carrying out the job | |

**9. Conditions & Endorsement**

**10. Safety Requirements :**

☐ Hand excavation only ☐ Provide means of access ☐ Sloped/ step excavation

☐ Barricade ☐ Attach JSA ☐ Provide shoring

☐ Provide warning signs ☐ Use confined Space entry certificate ( if depth > 1.2 M) ☐ Excavated soil 1 m away from edge.

☐ Cable detectors to be used to check the under ground cables ☐ Ladder /ramps/stairway for depth >1 M

☐ Others ( Mention ) ☐ Gas test to be carried out before entry and attach gas test log

……

**11. Approval/ Extension**

| **Date** | | **Supervisor carrying out the job ( Name & Signature )** | **Area Supervisor - Operations** |
|---|---|---|---|
| **From** | **To** | | |
| | | | |
| | | | |
| | | | |

**12. Excavation Closure**

☐ Excavated site restored to normal ☐ Excavation continues/remains open , renew from Sl. No. ……..

| | **Printed Name** | **Signature** | **Date** |
|---|---|---|---|
| **Executing Division Supervisor** | | | |
| **Area Supervisor -Operations** | | | |

Note : Send a closed copy of Excavation certificate to EHS.

***GENERAL CONDITIONS FOR EXCAVATION CERITIFICATE***

1. *A General Work Permit and this Excavation Certificate is required for any excavation 0.3 meters or deeper. The Certificate must be attached to and becomes a part of the General Work Permit.*

2. *The excavation certificate is valid for one month, can be extended for subsequent three more months.*

3. *This excavation certificate must be present at the worksite along with general work permit.*

4. *Buried cables or piping known or suspected to exist in or near the excavation must be isolated and de-energize.*

5. *Surface structures and platforms, walkways etc. which may lose support or be undermined must be supported by shoring, bracing, underpinning or other means.*

6. *Open excavations must be barricaded with temporary fencing or pipe barricades at all times while unattended. Road diversions must remain until the excavation is properly backfilled and the road surface is restored.*

7. *A protective system like sloping/bench or shoring is required for any excavation more than 1.5 meters deep.*

8. *A stairway, ladder, dirt ramp or structural ramp for entry and exit is required if the excavation is deeper than 1 meter. Workers must be able to reach an exit by traveling no more than 7.5 meters.*

9. *For excavation deeper than 1.2 M, an additional confined space entry certificate is required.*

10. *In case excavation deeper than 1.2 M, the atmosphere must be tested using a portable electronic gas monitor for oxygen concentration, the presence of combustible gas/vapor, carbon monoxide and hydrogen sulfide ($H_2S$). All gas monitors used must be in calibration.*

11. *In case cutting / closing of main roads, F&S Dispatcher to be informed. Alternate road to be marked on the drawing.*