Excavation & Trench Safety Compliance Game Plan

The 10 things to do to avoid excavation deaths and OHS violations.

Excavation work is extremely dangerous. Common hazards:

- **Cave-ins or excavation collapses**;
- Excavated materials, which can fall back into the excavation or destabilize the walls;
- Falling objects like tools and equipment located near or over the excavation;
- **Powered mobile equipment** like back hoes, concrete trucks and excavators that can strike or fall on top of workers or cause cave-ins and collapses;
- Slips, trips and falls, especially when workers enter and exit an excavation;
- Hazardous atmospheres inside the excavation that can cause asphyxiation, fire, explosion or harm to health;
- Flooding and water hazards; and
- Underground electrical, oil, gas, sewer and other utility lines and conduits that workers in excavations may contact.

Because of these dangers, work performed inside excavations and trenches is heavily regulated Here's a 10-step game plan for protecting your workers and ensuring compliance with OHS excavations requirements. (There's also a Policy template on the OHSI website you can adapt to implement this game plan.)

Defining Our Terms: The Difference between Excavations & Trenches

While you should check the specific definitions in your jurisdiction's OHS laws, in general:

***Excavations** is a broader term that includes any dug-out areas of ground or earth, including foundations, trenches, tunnels and shafts.*

***Trenches** are a kind of excavation that are typically deeper than their width at the bottom.*

We'll refer to excavations and trenches collectively as 'excavations,' unless the context requires otherwise.

Step 1. Notify Your Jurisdiction's OHS Authority Before Starting Excavation Work

In BC, MB, NT, NU, ON, QC and SK, the owner, employer or prime contractor/constructor of a project where excavation work is to be carried out must provide the jurisdiction's OHS agency written notification within a specific time before starting the work. While specifics vary, the notification (sometimes called a 'registration' or 'notification of project') typically must be posted at the project site and list:

- Name and contact information of the owner, employer and/or prime contractor/constructor;
- The address of the construction project or its location in relation to the nearest highway;
- Indication that excavation work requiring notification is to be performed; and
- The project's starting date and estimated duration and costs in labour and materials.

Step 2. Locate & Clearly Mark Underground Utility Lines

If workers hit buried utility equipment, they may not only cut off the service but also cause electrocutions, explosions or fires. So, before work can begin, you must identify any buried utility equipment (often referred to as 'locates'), such as underground pipes, electrical cables and oil or gas lines. Locates must be clearly and conspicuously marked so that workers can see and avoid them.

Example: Seven people lost their lives in an Ontario gas explosion caused when a backhoe struck an gas pipe that hadn't been located and marked before the excavation work began. The construction company pleaded guilty and was fined $225,000 for the incident [*R. v. Enbridge Gas Distribution Inc*., [2010] ONSC 2013 (CanLII)].

Utilities located above ground can also pose a hazard, such as overhead power lines that equipment may contact or nearby utility poles'and the power lines to which they're attached'that the digging or vibration may cause to topple. In either case, you may need the utility company's help to identify the locates at your site. The utility may also have to turn off the services while you perform the excavation work.

Step 3. Determine Stability of Soil in Excavation Area

The cave-in and collapse hazards and engineering measures required to prevent them depends, in part, on the type of soil in the excavation area. So, before digging, you must perform a visual and physical examination of the soil at the excavation walls and within a horizontal distance from each wall equal to the depth of the excavation measured away from the excavation.

OHS regulations of some jurisdictions specify the soil classifications you must use. There are 2 approaches:

ABC Classification: AB, BC and YK classify soil into 3 categories, from most to least stable:

Soil Classification	**Description**
A	Hard and compact
B	Likely to crack and crumble
C	Soft, sandy and loose

Types 1 to 4 Classification: NT, NU, ON and SK take a similar approach but base it on a more technically detailed 4-tier classification scheme:

Soil Classification	**Description**
Type 1	• Hard, very dense + penetrated with difficulty only by a small sharp object; • Low natural moisture content + high degree of internal strength; • Has no signs of water seepage; and • Can be excavated only by mechanical equipment
Type 2	• Very stiff, dense + can be penetrated with moderate difficulty by a small sharp object; • Low to medium natural moisture content + medium degree of internal strength; and • Has a damp appearance after it’s excavated

Soil Classification	Description
Type 3	• Previously excavated soil; or • Soil that's stiff to firm or compact to loose + has one or more of following characteristics: - It exhibits signs of surface cracking; - It exhibits signs of water seepage; - If it's dry, it may run easily into a well-defined conical pile; - It has a low degree of internal strength
Type 4	• Soft to very soft and very loose, very sensitive + upon disturbance is significantly reduced in natural strength; • Runs easily or flows, unless it's completely supported before excavating procedures; • Has almost no internal strength; • Is wet or muddy; and • Exerts substantial fluid pressure on its supporting system

Rule of Thumb: If the excavation area contains several different soil types, take the precautions required as if all of the soil is of the least stable type.

Step 4. Safely Locate Excavated Material & Tools

Once you start the digging, you must be mindful of the hazards posed by the dirt, rock and other material you dig up. If stored to close to the excavation, this material can fall back in on the workers inside and bury them alive. Accordingly, OHS laws require you to pile excavated material at least 1 metre

away from the excavation's edge. For the same reasons, you must also keep tools, other materials and powered mobile equipment a minimum distance from the excavation edge, typically 1 metre.

Also beware that if the 'spoil pile' is very large or heavy, it can exert lateral pressure on the excavation walls and cause them to collapse. So, you need to account for this lateral pressure when determining whether you need shoring or other temporary protective structure for the excavation in accordance with Step 5 below.

Step 5. Determine Need for Temporary Protective Structure to Prevent Cave-In

Perhaps the greatest hazard posed by excavation work is the risk of cave-in or collapse. **Example:** An Alberta truck driver was killed when a 15-metre-high wall of dirt and rock that wasn't properly shored collapsed on him in an excavation pit. The court convicted 2 related companies that knew about the dangers for about 2 months and imposed fines of, respectively, $1,437,500 and $1,035,000, plus 15% victim surcharges, for a total fine of $2,472,500 [Perera Development Corp. and Perera Shawnee Ltd., *Edmonton Journal*, June 5, 2012].

The next step, then, is to determine whether a temporary protective structure, that is, system or device inside the excavation to prevent cave-ins, collapse, sliding or rolling materials, is necessary for your excavation based on:

- The type of soil;
- The depth of the excavation;
- The sloping of the excavation's walls; and
- Work conditions surrounding the excavation, such as the presence of vibrations.

The most common form of temporary protective structure is shoring, a system in which aluminum, steel, or wood panels supported by screws or hydraulic jacks are installed to support the sides or walls of the excavation.. The factors that determine whether shoring is needed also determine the type of shoring necessary, along with technical requirements like the materials support beams must be made of and how far they're spaced. In general:

- Shoring materials must be installed from the top down and removed in reverse order;
- Workers may not enter an excavation to remove shoring materials if ground conditions have deteriorated so as to make entry for shoring removal unsafe;
- Shoring or manufactured or prefabricated support systems must be installed in firm contact with the faces of the excavation, and in a manner which ensures no loss of soil from behind or below the bottom of the shield or shoring while the excavation is open; and
- Voids between the shoring and excavation face must be backfilled or blocked, unless the manufacturer or a professional engineer indicates otherwise.

Other forms of temporary protective structures include trench boxes and trench shields. Trench boxes, which are commonly used in open areas away from utilities, roadways and foundations, don't support the trench walls but protect workers in the event of cave-in or collapse. The space between the box and trench wall should be backfilled with soil and compacted properly to ensure the cave-in doesn't cause the trench box to tip over. When used in excavation projects, trench boxes should have a wall height greater than or equal to the wall height of the surrounding trench.

Strategic Pointer: Temporary protective structures may also be necessary to prevent cave-in or collapse of structures located near the excavation site.

Sloping Instead of Shoring’

Instead of these structures, you may be allowed to prevent cave-ins by controlling the slope of the excavation walls. Sloping involves cutting back the trench wall at an angle that’s inclined away from the work area of the excavation. The angle of slope required depends on the soil conditions. Benching is a similar method to sloping with the sides excavated in levels similar to steps.

Example: In Nova Scotia, sloping may be used instead of shoring or bracing a wall of an excavation or trench that’s higher than 1.2 metres as long the trench or excavation is sloped to within 1.2 metres of the bottom of and the slope doesn’t exceed 1 metre of vertical rise to each 1 metre of horizontal run.

Step 6. Ensure Safe Means of Entry & Exit

You must ensure that there’s a safe way for workers to enter and exit the excavation, such as a ladder, stairway or ramp. Ladders should extend at least 1 metre above the top of the excavation or trench. And the entry and exit areas must be located near where workers will be working, that is, generally within 8 metres, and be safely braced and supported.

Step 7. Protect Against Hazardous Atmospheres Inside Excavation

Chances are that the excavation will be considered a ‘confined space’ under the OHS laws of your jurisdiction. **Result:** You must ensure that work inside the excavation complies with requirements for confined spaces. Among other things, that means testing the air inside to ensure that it doesn’t contain dangerously high or low levels of oxygen and/or toxic

substances above the occupation exposure level (OEL) or lower explosive limit (LEL) for that particular substance under your province’s OHS regulations. If the atmosphere is actually or potentially hazardous, you must implement appropriate safety measure based on your hazard assessment, which may range from engineering controls to ventilate the atmosphere inside to requiring workers who enter to use the required respiratory protective equipment.

Step 8. Protect Against Water Build Up Inside Excavation

Water poses risk of not only flooding but also weakening the soil and stability of the excavation. That’s why you must not allow water to accumulate inside an excavation or surface water to erode the slopes so as to endanger the workers inside.

Step 9. Use Barriers to Protect Workers Outside of Excavation

In addition to workers inside the excavation, you must protect workers, passersby and others nearby who may be endangered. As with other dangerous openings, you may have to use barriers, fences or guardrails to prevent people and equipment on the surface from getting too close to the edge of the excavation and tumbling in.

Step 10. Implement Safe Work Procedures

So far, we’ve been talking mostly about engineering controls. You must also implement and train your workers in safe work procedures to ensure that excavation work is carried out safely. Such procedures should provide for:

- Orderly entry and exit;
- Posting a competent worker at the edge of the excavation to stand watch and warn the workers inside if any hazards arise;
- Safe use of the required tools and equipment inside the excavation;
- Regular inspection of excavations;
- Proper use of required safety equipment and PPE; and
- Emergency evacuation and response.