

# DIRECTIONAL DRILLING SAFE WORK PRACTICE

## PURPOSE

The purpose of this practice is to promote compliance with both government and company guidelines regarding directional drilling for a safe and productive work environment.

## PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE / Equipment	Mandatory	Assessment Dependant
CSA/ANSI approved hardhat	✓	
CSA/ANSI approved footwear	✓	
CSA/ANSI approved eye protection	✓	
CSA/ANSI approved hi-vis safety vest or clothing displaying reflective materials meeting regulatory standards.	✓	
Protective clothing – (including fire retardant coveralls) where workers need protection from temperatures, moisture	✓	
CSA/ANSI approved hearing protection - muffs or plugs		✓
Hand protection (work gloves)		✓

## Safe Work Practices

This section sets forth safety guidelines and practices for projects utilizing horizontal directional drilling (HDD) techniques in order to protect existing underground utilities and minimize risks to crew and public safety.

### APPLICABLE STANDARDS

Applicable standards include the Horizontal Directional Drilling Good Practices Guidelines by the HDD Consortium, and the HDD manufacturer’s equipment operation manual.

The HDD Operator and/or support worker shall become familiar with and follow the safety guidelines established in the above standards at all times.

### GENERAL

The HDD Operator and/or support worker shall implement the following general safety guidelines and practices:

- Occupational and Health & Safety: (OH&S):** Norseman HDD Underground Solutions and/or support worker shall perform all operations in compliance with OH&S guidelines and Norseman HDD Underground Solutions’ HSE Program.
- Training:** Norseman HDD Underground Solutions and/or support worker shall ensure all personnel are properly trained and equipped.
- Planned Emergency Response:** The HDD Operator and/or support worker shall

follow procedures set out below under “Response to Events” in the event of a utility strike as dictated by each individual bore.

#### 4. Operator

Operators of drilling, tracking and support equipment must be competent or supervised by a qualified operator. Operators must have continuous 2 way radio contact with the driller locator and product side personnel to coordinate the drilling operation. Back up radios or spare batteries should be available.

#### 5. Support

Support personnel should be briefed by the operator upon arrival, and must follow and maintain all safety procedures throughout the job. Support personnel and visitors must be informed of hazards, their responsibilities, and any restrictions of activities.

### PRE-CONSTRUCTION

Prior to the start of construction, the HDD Operator and/or support worker shall complete the following:

1. **Work Area Familiarization:** The HDD Operator and/or support worker shall familiarize itself with the work area and the technical requirements of the plans.
2. **Utility Locates.** The HDD Operator and/or support worker shall request utility locates and complete all other utility coordination requirements.
3. **Complete an On-Site Hazard Assessment: include the following:**
  - \*Discuss specific hazards and procedures; Discuss location of emergency facilities;
  - \*Discuss evacuation plan and emergency procedures Brief all personnel, subcontractors and visitors as they arrive
  - \*Record discussions and attendees. It is imperative that site-specific hazards identified and appropriate safety procedures are discussed, as every site has unique safety issues that need to be addressed. Crews should be aware of specific safety and emergency procedures.

## Specific Hazards

### 1 Underground

Underground hazards to consider include:

- Electrical power cables, which can cause serious injury or electrocution if connected
- Fiber optic cables carry laser light signals, which can cause eye damage
- Fluid and gas pipes, which may transport asphyxiating, toxic, flammable, and/or explosive gases or liquids
- Low-pressure sewage and storm water lines. These pose a unique hazard potential if an HDD gas or electric line installation has been installed that has intersected the sewage line without detection. Subsequent maintenance or repair activity could cause a gas leak, explosion, or electrocution

## 2. Surface

Surface hazards to include:

- Manholes within the drill area should be opened and inspected, without entry, to determine the underground utility it services. The direction of flow in a sewer should be checked to determine the approximate grade. This information can be used to project depth of the utility where the bore is being made
- Wires attached to poles should be assumed to be live
- Out buildings (i.e. storage sheds) should be checked to determine if they have electrical wires or other utility services that may not be marked on any plans
- Gas barbeque grills, outdoor lighting, etc. should be identified and services confirmed
- Ditch line depressions in the landscape or obvious changes in vegetation may reveal previous excavation and should be investigated
- Road repairs may indicate the presence of recently installed or repaired utilities
- Marker signs or casing vents at or near property lines indicate underground hazards
- Private utilities and utilities that do not subscribe to the one-call system are not marked by One Call operators.
- The Contractor should check local regulations and proper due diligence should be taken to verify the existence of such (e.g. Rural Water Lines)

## 3. Overhead

Overhead hazards include:

- Overhead lines must be avoided. Overhead lines are of particular concern during mobilization/demobilization, while handling drill pipe, or loading and unloading heavy equipment. Always maintain a safe separation between equipment and power lines. If necessary, place highly visible markers on either side of the overhead hazard or designate an individual to notify equipment operators as they approach.

## 4. Verify Utility Locates

- The location of all identified utilities must be verified using non-destructive methods of excavation. The bore profile must be designed to maintain acceptable clearances between underground utilities and structures, and the final reamed hole. Possible migration of the back reamer from the pilot bore toward the utility, due to excessive steering or a tight radius, must be carefully considered when establishing clearances. As easements become increasingly congested, it may be necessary to increase the easement widths to accommodate demand for new utilities.
- If there is any risk to the utility from the drilling activity, a window must be excavated at or near the utility to visually monitor the potentially hazardous situation. A vacuum unit is required to remove the drilling fluid during this process, and high pressure drilling fluid hazards must be addressed. If the bore passes closely by a utility, it may be necessary to continuously monitor the separation after the drill head or reamer passes the window as the drill string or product pipe may subsequently contact the utility during the completion of the installation.

- Communication is a critical ingredient of any successful horizontal directional drilling project. It is imperative that the drill locator and the drill rig operator have an understanding of the job prior to commencement of the work. They should walk the planned borepath with the tracking equipment to evaluate any potential fields of electromagnetic (active) interference and look for signs of reinforced concrete or other possible passive interference that may hinder the operation, and discuss the identified hazards.
- During the actual boring process, if abnormal readings are found with the tracking equipment, the contractor should stop, back up, and verify previous readings prior to commencing the bore. This is critical; as deviation from the planned bore profile could result in an underground utility strike. Care must also be taken during the pullback to ensure that utilities are not damaged due to the upsizing by the enlarged back reamer and possible straightening of the bore during back reaming and product installation.

#### 5. Traffic Control (Pedestrian and Vehicle)

- Necessary traffic control must be maintained throughout the project. Typically, mobilization, demobilization, material handling, and intermittent movement of mobile equipment require traffic control if the activity conflicts with vehicle or pedestrian traffic. Traffic control includes permits, planning, notification, flag persons, warning signs and barricades. The work area, particularly around the drill rig and entrance/exit pits, must also be secured to prevent unauthorized entry. Emergency vehicles and buses must have access during construction.

#### 6. Drilling Unit

- If the drilling unit is equipped with an Electrical Strike Sensing System, its use should follow manufacturer's recommendations. The system may include audible and visual warning alarms, grounding mats, and personal protective equipment. Electrical sensing stakes must be driven into the ground and the strike alert system tested prior to operation.

### DURING CONSTRUCTION

While the work is being performed, the HDD Operator and/or support worker shall complete the following:

1. **Calibration and Tracking:** The HDD Operator and/or support worker shall calibrate the tracking and locating equipment at the beginning of each work day and maintain a calibration log.
2. **Monitoring and Recording:** The HDD Operator and/or support worker shall monitor and record the alignment and depth readings provided by the tracking system every 25-30 feet for normal conditions, and every 5-10 feet when precise alignment control is necessary.
3. **Maintain Drilling Fluid Circulation:** The HDD Operator and/or support worker shall maintain drilling fluid circulation throughout the HDD process including the initial pilot hole installation, and the reaming and back pull process. The pull back shall not exceed the fluid circulation rate capabilities.

4. **Back-reaming:** The HDD Operator and/or support worker shall back-ream as required to accommodate the product size. Compaction reamers are not permissible. The HDD Operator and/or support worker shall plan the back pulling operations carefully to ensure that all back pulling operations can be completed without stopping and within the permitted work hours.
5. **Clearances.** The HDD Operator and/or support worker shall maintain all required clearances and offsets from existing utilities.
6. **Documentation:** The HDD Operator and/or support worker shall at all times and for the entire length of the HDD alignment be able to demonstrate and provide the horizontal and vertical position of the alignment, the fluid volume used, return rates, and pressures.
7. **Inspection:** The HDD Operator and/or support worker shall inspect the work and surrounding area to ensure damage has not occurred to existing utilities due to HDD construction operations.

## SAFE PRACTICES

### 1. DRILLING PRECAUTIONS

The following precautions should be observed during the drilling operation:

- If a hazardous situation is suspected, work should be stopped until an evaluation is made and appropriate corrective action taken
- Potential “pinch points” on the drill rig and support equipment must be identified and avoided
- Safe clearances (as specified by regulatory authorities) must be maintained between the bore and all utilities. The minimum clearance must take into consideration the final reamed diameter and the bend radius of the pilot bore
- Workers must stay clear of the rotating drill string
- The drill must not be operated when personnel are working on or near the drill string
- The drill must not be operated without positive communication with the drill locator or exit side personnel
- The manufacturer’s specified maximum torque and thrust/pullback capacity of the drill pipe must not be exceeded
- Remote breakout wrenches must be used safely
- Drilling machine torque or backhoes with wrenches should never be used to make or break tool joints.

### 2. Reaming and Installation Precautions

The following precautions should be observed during reaming and product installation:

- Two-way radio communication must be maintained at all times between the entry and exit sides
- The drill pipe must not be rotated until all personnel have been notified and acknowledgement has been made by all personnel
- Workers must never step over rotating drill pipe and must maintain a safe distance when working near rotating drill pipes

- When crossing existing underground utilities, the utility must be exposed at the crossing location and monitored during the crossing.
- 3. Other Activities:** Common hazards such as slips, trips, and falls, excavation cave-ins, pinched fingers and toes, vehicle accidents, and back injuries and hazards specific to HDD equipment and operations must be identified and isolated or removed to avoid incidents and accidents.

## RESPONSE TO EVENTS

If an existing utility is struck during the boring operation, emergency procedures must be initiated to reduce the likelihood of human injury. Procedures to follow in the event of utility strikes are summarized below by type of utility.

- **Electrical Strike** If an electrical strike occurs, workers should not move. The voltage difference between the equipment and the ground, or between a person's feet may be sufficient to cause injury or death. Do not touch the machine, drill pipe, water system, mud-mixing system, or anything connected to the drill as these items may be highly charged. The drill operator should remain calm and reverse the direction of advance in an attempt to break contact with the electrical line. The electrical utility company must be contacted immediately. The drill operator should follow the manufacture's procedure to determine if the drill is electrically charged before attempting to dismount the drill.
- **Gas Strike** If a gas line strike occurs, evacuate the area immediately. The drill operator should shut down all engines and under no circumstance should the operator attempt to reverse the bore to break contact as further movement may cause a spark. Emergency services and the gas utility company should be contacted immediately.
- **Fiber Optic Strike** If a fiber-optic strike occurs, workers must not look into the cut ends of the cable, which can cause severe eye damage. Drilling must stop immediately and the utility owner must be contacted.
- **Communications Line Strike** If a communications line strike occurs, drilling must stop immediately and the utility company should be contacted.
- **Sanitary/Storm Sewer And Water Strike** If a water or sewer line strike occurs, drilling should be stopped immediately and all bystanders should be warned that a strike has occurred and that they should stay away. Medical attention should be obtained for personnel who have come into contact with sewage. As with any strike, the utility owner should be contacted immediately.