

Environmental Management and Construction Plan

Appendix H

Horizontal Directional Drill Contingency Plan

**Empire Generating Co, LLC
16" Gas Pipeline Interconnect Project**

August 28, 2008

**ISSUED FOR CONSTRUCTION
REV. 0**

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1.0 INTRODUCTION

The purpose of this document is to establish procedures for addressing potential impacts associated with a “frac out” of drilling fluid during the horizontal directional drill (HDD) process. The term “frac out” is used to describe an inadvertent release of drilling fluid resulting from the fluid escaping from an underground HDD borehole and rising to the surface.

The HDD installation technique is susceptible to difficulties caused by subsurface ground conditions. If the first attempt at installing a particular crossing by HDD is unsuccessful, an attempt will be made to select an alternate location and complete a successful drill. This document establishes the criteria by which Empire, DPS and other appropriate regulatory agencies will determine when a proposed HDD is unsuccessful. Site specific variations for crossings with more specific requirements will be described elsewhere. As an alternative, the crossing will be constructed using a slick bore the site of the original proposed crossing within the approved pipeline right-of-way.

Empire will provide on-site environmental and construction inspection during the HDD process to monitor the progress on the drill and to maintain daily progress reports. Any alternative crossing methods will not be implemented until Empire has received approval from the DPS.

2.0 HDD PROCESS AND FAILURE MODES

The HDD process generally includes three distinct phases beginning with the drilling of a pilot hole from the entry point on one side of the HDD along a designed profile to an exit point at the surface on the other side of the HDD. The second phase entails the reaming of the pilot hole to a diameter large enough to accept the pipeline to be installed. Finally, the pipeline is pulled into place within the enlarged hole.

2.1 Drilling Fluid

The HDD process involves use of a drilling fluid (also referred to as drilling mud) made up primarily of water and bentonite, with pH values between 8 and 10. Bentonite is a naturally occurring, non-toxic, inert substance that meets National Sanitation Foundation/American National Standards Institute (NSF/ANSI) Standard 60 and 61 Drinking Water Additives Standards and is frequently used for drilling potable water wells. Therefore, the environmental impacts of an inadvertent release of drilling fluid in a waterbody is a temporary increase in local turbidity until the drilling fluid dissipates with the current or is settled.

The primary purpose of drilling fluid is to remove the cuttings from the borehole, stabilize the borehole and act as a coolant and lubricant during the drilling process. The water and clay drilling fluid consists of 1 to 5 percent active clays and from 0 to 40 percent inert solids with the rest being water. The primary active clay component is bentonite. The drilling fluid is first prepared in the mixing tank with both new and clean recycled drilling fluid. The fluid is pumped at 100 to 1,000 gallon per minute rates through the center of the drill pipe to the cutters. Return flow is through the annulus created between the wall of the boring and the drill pipe.

The cuttings are then carried to either the entry or exit pit, depending on a combination of elevation difference and drilling/hole opening direction. Once in the entry pit, the fluid moves into the pickup pit to be pumped to the fluid processing equipment. Typically, shaker screens, desanders, and desilters remove increasingly finer cuttings from the drilling fluid. The cleaned and recycled fluid is returned to the mixing tank and pumps for reuse in the borehole. Cuttings and bentonite mud (clay) is often desirable for agricultural applications and would either be made available to landowners for their use or disposed of in a landfill

A reduction or loss of drilling fluid returns does not necessarily indicate that these fluids are being released to the environment through fractures. The loss of returns may occur because of lower pressures and volumes, thereby allowing gravity and friction to overcome the ability of the fluid to return to the bore site. As previously described, drilling fluid will likely be absorbed by the formation or drawn down into fractures within the formation.

Drill fluid is easily contained by standard erosion and sedimentation control measures such as straw bales and silt fence. Drill fluid would be contained on entry and exit worksites by hay bales and silt fence installed and maintained around the perimeter of each site. Within the boundaries of the worksites drill fluid would be controlled through the use of pits at the crossing entry and exit points and typical fluid handling equipment such as trash pumps. Drill fluid is released regularly on the drill rigs as part of normal operations when sections of drill pipe are separated. The worksite will be graded such that fluid released on the rig will flow into the fluid pit in front of the rig.

2.2 Pilot Hole

The pilot hole is typically the most important phase of the HDD technique. It determines the final route and position of the pipeline in the HDD hole. Usually, a small-diameter (5-inch) drill string penetrates the ground at the designed entry point and at a predetermined angle (between 5 and 15 degrees to horizontal). The pilot borehole will be reamed to enlarge the hole to accommodate the pipeline. Generally, the reaming operation requires multiple reaming passes with increased diameters until the bore reaches the desired diameter. Once the drilled hole is enlarged, the pipeline can be pulled into the reamed hole, which is filled with drilling fluid.

The pilot hole is drilled along a predetermined alignment and profile. The entry and exit points are located using traditional survey methods. The trajectory of the pilot hole is surveyed by two separate methods both of which employ a down hole survey tool referred to as a probe. The first method uses the earth's natural magnetic field as a reference while the second method uses a system known as TruTracker that uses a wire coil on the surface that creates a magnetic field. After each section of the drill pipe has been drilled (approximately 30 feet), both methods of survey are used to calculate the pilot hole location.

The pilot hole process consists of drilling a small diameter hole along the pre-determined alignment and profile. The pilot hole is drilled using either a jetting assembly or a down hole mud motor connected to a tri-cone rotary bit. Drilling fluid is pumped downhole via the string of drill pipe. The flow of drilling fluid powers the mud motor or jetting assembly that cuts the rock strata or soil. The fluid then flows back to the surface along the annular space between the drill pipe and the inside of the pilot hole. As it does so, the fluid also lubricates the drill stem, suspends and carries the drilled cuttings to the surface, and forms a wall cake to keep the hole open.

Data obtained during the pilot hole process will aid the contractor in planning the details of subsequent phases of the installation. These data include the rate of penetration and the friction forces acting upon the drill string. More subjective data on the behavior of the drill string during the process is equally valuable.

2.1.1 Pilot Hole Failure Mode

Failure can occur during the drilling of the pilot hole when the hole collapses on the drill pipe string. This is typically caused by either not being able to maintain a good bentonite wall cake to keep the hole stable or an unfavorable drilling stratum containing glacial till, highly fractured rock, noncohesive alluvial material, or cobbles. If the hole collapses on the drill pipe and creates high friction on the drill pipe surface, the torque required to rotate the drill pipe will increase. The increased friction can become great enough to prevent the drill pipe from being moved. In an effort to free the drill pipe, torque and tension are applied to the drill pipe by the drill rig. Under the right conditions, the combined stress load exerted upon the drill pipe will exceed the strength of the drill pipe, and will cause the drill pipe to either shear or twist into two pieces. Multiple changes in strata and long drill lengths contribute to the probability of this type of failure.

A second mode of pilot hole failure is also a result of unfavorable ground conditions. Formations consisting of alternating strata of hard and soft rock, or soft clay containing large numbers of boulders can push the downhole assembly off course resulting in an unacceptable drill trajectory. In this event all or a portion of the pilot hole must be abandoned and redrilled. This would be considered an unsuccessful pilot hole attempt

The HDD installation method will be considered a failure if there are two unsuccessful attempts at completing the pilot hole.

2.2 Reaming Process

Once the pilot hole is complete the borehole diameter must be increased to allow it to accommodate the pipeline. Typically, the final borehole diameter is approximately 1-1/2 times the pipe diameter. The final borehole diameter is determined by the contractor and is dependent to a large degree on the length of the crossing and the types of geological formations through which the borehole passes.

The borehole diameter is typically increased in several increments or passes. There are two types of downhole tools that are used: fly cutters, used for most soil formations, and rock hole opening tools, used for very dense soil or rock formations.

Typically, the fly cutter or hole opening tool is attached to the drill pipe string that drilled the pilot hole and is then rotated and pulled back towards the drill rig from the entry point. A second drill rig or a track hoe is typically used to handle the drill pipe at the exit point.

For each hole opening pass, as the fly cutter or hole opening tool progresses along the crossing profile, drill pipe is added to the string behind it while drill pipe is removed from the string ahead of it. Doing so maintains a continuous string of drill pipe in the borehole over its entire length. Depending on the stability of the hole, the HDD contractor may use a barrel reamer, typically several inches smaller than the outside diameter of the final hole opening tool, and pull it through the hole immediately prior to pullback. This is typically referred to as a swab pass. The purpose of the swab pass is to ensure the establishment of a good drilling fluid wall cake, a clean hole, and a hole full of drilling fluid with the proper density.

2.2.1 Reaming Process Failure Mode

There are generally two modes of failure during the hole opening process. The first results from collapse of the borehole, the second from failure of the drill pipe string or other downhole components.

As in the pilot hole process, a severe borehole collapse can cause friction acting on the drill pipe string and downhole tools to increase to the point where attempts to move the string result in it breaking. This would be considered a failure.

The second mode of failure occurs when hole opening in hard rock or in formations containing large amounts of cobbles and boulders. In these instances the downhole tools are subjected to severe amounts of wear and or impact loading. In extreme cases this can result in the hole opener breaking apart. Pieces of downhole tools lost in the borehole impede or halt further efforts at completing the installation.

It may be possible to recover pieces of downhole tools that have been lost in the borehole. Recovery efforts are generally very time consuming, are hampered by cobbles and boulders and are often fruitless. However, often it is possible to push the offending piece out of the borehole and into a soft zone in the surrounding formation. In either scenario the hole opening process can resume. If attempts at recovering or displacing lost pieces of downhole tools take more than seven working days the process will be considered a failure.

The HDD installation will be considered a failure if there are two failed attempts at hole opening.

2.3 Pullback Process

The last step to complete a successful installation is the pullback of the prefabricated pipeline into the enlarged hole. A reinforced pull head is attached to the leading end of the pipe and to a swivel that is connected to a hole opener or fly cutter and the drill pipe. On the surface, the pipeline is supported with rollers as it is guided into the borehole. Once in the borehole the large diameter pipeline will be very buoyant in the drill fluid that occupies the borehole. The buoyancy will push the pipeline to the top of the borehole with considerable force. This will result in a significant increase in the friction between the side of the borehole and the pipe. The buoyant force will be counteracted by adding water to the pipeline to increase its weight. The amount of water will be controlled to make the pipe as close to neutrally buoyant, or weightless, as possible.

2.3.1 Pullback Process Failure Mode

During the pullback process the drill rig must exert a pull load sufficient to overcome the friction forces acting on the pipeline as it is pulled into the borehole. If the friction forces rise to excessive levels, the pullback operation must be halted. At this point the direction of pull must be reversed and the pipeline pulled from the borehole. Once the pipeline is successfully withdrawn the portions of the hole opening and swabbing process are repeated to recondition the borehole and then the pullback process is repeated.

On occasion the pipeline becomes stuck in the borehole before the pullback operation is complete. When this occurs it is impossible to move the pipe in either direction.

The HDD installation method will be considered a failure if there are two unsuccessful attempts at the pullback process or if the pipe becomes stuck in the borehole.

3.0 FRAC OUT OF DRILLING FLUID

Throughout the HDD process there is a loss of drilling fluid into the geologic formation through which the drill passes. In some cases, the drilling fluid may be forced to the surface resulting in what is commonly referred to as a frac out. Therefore, while the intent of the

HDD method is to avoid surface disturbance, surface disturbance may occur when there is a frac out of drilling fluid.

It is extremely important to note that a loss of drilling fluid into the formation is not necessarily an indication that a frac out has occurred or is about to occur. It is normal to lose a significant amount of fluid into the formation without ever having a frac out. In fact, in very soft ground formations or in highly fractured formations it is normal to lose all of the drill fluid pumped into the borehole without a frac out occurring.

A frac out cannot occur unless drill fluid escapes from the borehole into the formation. Hence preventing and managing such escapes will in turn prevent and manage frac outs.

Drilling fluid releases are typically caused by pressurization of the drill hole beyond the containment capability of the overburden soil material. In some cases, a frac out of drilling fluid can be caused by existing conditions in the geologic materials (e.g., fractures) even if the down hole pressures are low.

Drill fluid pressures are generally the highest during the pilot hole process; hence it is this process that presents the greatest risk for a frac out. If a frac out occurs during the pilot hole process, it opens a path through the formation for drill fluid to escape during subsequent processes. For this reason frac outs are likely at the same location during the hole opening and pullback process. Conversely, if the pilot hole process can be completed without a frac out, then it is likely that the entire installation can also be completed without a frac out.

Considerations for preventing and managing frac outs are described below.

3.1 Frac Out Prevention

The risk of a frac out in a sensitive area can be mitigated through profile design and through implementation of specific measures throughout the installation process. The HDD contractor is responsible for execution of the HDD operation, including actions for detecting and controlling drilling fluid seepage. Empire will closely supervise the progress and actions of the HDD contractor through the use of on site inspection teams.

3.1.1 Profile Design

The HDD profile is designed to minimize the potential for the release of drilling fluid in sensitive areas. The type of subsurface material and the depth of cover material are factors considered in developing the profile of an HDD crossing. Cohesive soils, such as clays, dense sands, and competent rock are considered ideal materials for containment of drill fluid. An industry recommended minimum depth of cover of 25 feet in cohesive soils should be maintained to provide a margin of safety against drilling fluid loss in sensitive areas. In non cohesive soils, a greater depth of cover will be used. In the design of the HDD crossing, Empire has used depths of cover well in excess of the recommended minimum.

In the vicinity of the entry and exit points of the crossing the depth of cover will be minimal. It is probable and expected that frac outs will occur in these segments of the crossing. The crossings are designed such that these segments will be in upland areas.

3.1.2 Preventative Measures Implemented During Installation

Key preventative measures implemented during installation are geared toward keeping the drill fluid contained in the borehole and preventing its escape to surrounding ground formations. This is accomplished through monitoring and management of drill fluid pressures and drill fluid volumes.

3.1.2.1 Drill fluid pressure monitoring and management

Drill fluid pressures are affected by several factors. A description of some of these factors and how they can be managed follows.

- *Drill fluid density.* Greater drill fluid densities result in greater downhole pressures. A large component of drill fluid density is the concentration of cuttings in the fluid. By controlling drilling and hole opening penetration rates and maximizing the effectiveness of drill fluid recycling equipment drill fluid densities can be kept below acceptable limits.
- *Drill fluid viscosity.* Greater drill fluid viscosities result in greater downhole pressures. However, greater viscosities also help seal off fissures and other escape paths into the surrounding formation from the HDD borehole. Similarly increased viscosity improves the cuttings carrying capability of the drill fluid. Drill fluid viscosity must be carefully managed to obtain a balance between these conflicting requirements.
- *Borehole cleanliness.* Cuttings tend to settle out of the flow of drill fluid in the annular space around the drill pipe string. Accumulations of cuttings or cutting beds restrict the flow of drill fluid through the annular space. This results in an increase in the pressure required to maintain flow. Careful management of drill fluid properties and the regular use of borehole swabbing techniques will keep the borehole free of cuttings beds and their associated pressure increases.

The drill fluid pressures in the borehole will vary throughout the installation processes. They will change with the depth of cover, the distance drilled, and the borehole diameter. However, changes in pressure should be gradual and can to large extent be predicted. Rapid or unexpected changes in pressure are indicators of potential problems downhole. It is critical that drill fluid pressures be monitored and recorded throughout the pilot hole process, when pressures are the highest. There are two techniques available for drill fluid pressure monitoring. They are standpipe pressure monitoring and downhole pressure monitoring.

3.1.2.2 Standpipe pressure monitoring

Standpipe pressure is the pressure in the drill pipe string at the surface. The difference between this pressure and the downhole pressure in the borehole is the pressure drop experienced by the fluid as it flows down the drill pipe string and through the downhole tool. Hence standpipe pressure gives only an approximate indication of the downhole pressure.

Nevertheless, careful monitoring of standpipe pressure can provide an indication of a rapid or unexpected change in downhole pressure.

3.1.2.3 Downhole pressure monitoring

Downhole pressure monitoring can be used during the pilot hole operation only. This is a sophisticated technique that involves the use of a pressure transducer incorporated into the downhole survey probe immediately behind the drilling assembly. The transducer measures the drill fluid pressure in the annular space around the probe. Data from the transducer is transmitted to the drill rig at the surface via the same electrical wire line used to transmit survey data. Due to the added complexity and cost associated with the use of this technology it will only be used on crossings that are deemed to be particularly sensitive.

Prior to beginning the HDD installation, the HDD contractor shall develop an annular pressure diagram for the crossing. This diagram will show, for every point along the length of the planned profile, the maximum annular pressure that can safely be resisted by the formations. This pressure is known as the confining pressure. The curve will also show the predicted drill fluid pressure that will be required to push the cuttings laden drill fluid back to the surface via the annular space.

Throughout the pilot hole drilling operation the annular drill fluid pressure measured at the bottom hole assembly will be continuously monitored. The measured pressure will be compared with the predicted and allowable pressures shown on the annular pressure curve. The following three scenarios are possible

1. **Measured pressure approximately equal to predicted pressure.** This is an indication that conditions are normal and the driller will be allowed to proceed with the pilot hole drilling.
2. **Measured pressure greater than predicted pressure.** This is an indication that the annular space behind the drill bit is becoming plugged with cuttings or that the concentration of cuttings in the drill fluid returns is too high resulting in excess drill fluid density. The driller will be required to implement measures to clean the annular space and or reduce the concentration of cuttings. This typically involves “swabbing” the borehole by slowly retracting the drilling assembly while pumping clean drill fluid into the bore to flush out cuttings and replace the cuttings laden fluid with clean, less dense fluid. The composition of the drill fluid pumped into the bore may also be modified to improve its cuttings carrying capacity.

3. ***Measured pressure less than predicted pressure.*** If the measured pressure is significantly less than the predicted pressure this is normally an indication that some of the drill fluid is escaping from the borehole. It is extremely important to note that having fluid escape from the borehole is not necessarily an indication that a frac out has occurred or is about to occur. It is quite normal to have a significant amount of fluid lost to the surrounding formation without a frac out occurring. Nevertheless, if the measured pressure is less than the predicted pressure, and in particular if this is the result of a sudden drop in pressure, the contractor will be required to implement measures to reduce or eliminate the loss of drill fluid from the borehole. One measure that may be implemented is the use of Lost Circulation Materials (LCM) to plug a fissure in the formation. The use of additives to improve the sealing properties of the drill fluid is another measure.

3.1.2.4 Drill fluid volume monitoring and management

It is intuitive that if drill fluid is not allowed to escape from the borehole then the entire volume of fluid pumped downhole should return to the surface via the annular space. However, as described above, it is normal that a portion or all of the drill fluid will be lost to the surrounding formation. Nevertheless a program for monitoring and managing the volumes of drill fluid used will be beneficial in identifying sudden increases in the volume of fluid lost which could signal a potential frac out.

Throughout the HDD processes the HDD contractor will keep a running balance of the total volume of fluid pumped downhole and the total volume recovered from the return pits. The difference between these volumes will be the volume lost from the borehole.

If the rate of loss of fluid is greater than expected or if it suddenly increases this could be an indication of a problem downhole. Measures to reduce the loss of fluid from the borehole would be implemented as described in previous paragraphs.

3.2 Frac Out Management

Management of frac outs is key to minimizing the environmental impact of an HDD crossing and ensuring its successful completion. Managing frac outs requires that appropriate equipment is available, that the frac outs are detected in a timely manner, and that appropriate procedures are used to minimize the volume of fluid released and its environmental impact. A discussion of these issues follows.

3.2.1 Response Equipment

Equipment for containing, controlling and cleaning up any drill fluid released during a frac out will be kept on site throughout the installation process. Heavy equipment not specifically designated for control and clean up of drill fluid such as backhoes will also be available on site.

The following list identifies some materials and equipment that will be maintained at the HDD site in sufficient quantities to help ensure containment of frac outs of drilling fluid:

- Straw bales
- Sand bags
- Stakes to secure bales
- Silt fence
- Shovels, rakes, brooms and buckets
- Trash pumps and flexible hose
- Light tower(s), so that cleanup work could continue after dark
- On-Call vacuum truck(s) and agreement(s) with an approved drilling fluid disposal site(s)

3.2.2 Monitoring and Detection

An obvious key to the timely detection of a frac out is monitoring of the surface above the HDD crossing for drill fluid. Empire will employ a program of visually monitoring the ground above the HDD crossing for frac outs. However, this program will be supplemented by data from the downhole monitoring measures described above, namely pressure monitoring and volume monitoring.

Survey stakes will have been placed and labeled on the surface at 100 foot intervals along the HDD centerline. The monitors will be constant radio contact with the driller who will keep them apprised of the position of the downhole tool. The survey stakes will provide the monitors with the necessary reference to allow them to concentrate their efforts above the downhole tool.

The HDD contractor will also keep the monitors apprised of the drill fluid pressures and mud volume balance and will provide his professional opinion of level of risk of a frac out occurring at any given time. Armed with this data the monitors will be able to decide if monitoring a difficult area, such as a deep swift river at night is warranted. It will also allow them to allocate their resources in the most effective manner.

The identification of a potential frac out prior to it actually occurring is dependent upon the skill and experience of the people involved. For this reason, Empire will utilize a contractor that specializes in HDD to perform the proposed crossings. Similarly the Environmental Inspector who will supervise monitoring and mitigation efforts will also be experienced in this type of work.

3.2.3 Corrective Action for Frac Outs

If a frac out occurs, the Environmental Inspector and DPS staff will be immediately notified. The HDD contractor will temporarily suspend forward progress of the drilling operations if excessive loss of mud circulation is noted and conduct a detailed examination of the drill path and surrounding area for evidence of a release to the surface.

The HDD equipment may continue to operate during this period. It is important to initially maintain operations since soils such as sands, gravels, and some clays do not have the frictional characteristics necessary to maintain a void or hole from a drill. The weight or load from the soils has enough downward pressure to cause the hole to collapse. Shutting down the drilling operation further jeopardizes the success of the drill and it may not be possible to regain circulation. The weight of the settled soils may impede removal of the drill stem. The necessary torque to start the drill head rotating again, in the collapsed soils, may be more than the stress of the pipe can bear; in which case the drill stem and head will twist apart. The pieces may have to be abandoned in place and the process started again, without an assurance that the second attempt will have greater success. Once the clean-up response has started, the drilling activities will immediately resume. After the drilling fluid seepage has been contained, the HDD contractor and Empire will make every effort to determine why the seepage occurred. Once the cause of the seepage has been determined, measures will be enacted to control the factors causing the seepage and to minimize the chance of recurrence.

3.2.3.1 Minimization of volume released

The first action required when a frac out is detected is to minimize the volume of drill fluid that is released. This will be done by immediately halting pumping of drill fluid downhole. Pumping will not resume until the situation is assessed and, if possible, the fluid release is contained and controlled. As it is probable that the frac out will resume as soon as fluid pumping starts again containment and control measures will have to be able to contend with a further release of fluid. Normally the frac out stops of its own accord when the drilling assembly progresses a short distance ahead of the release point.

The risk of failure of the HDD installation increases dramatically as the duration over which pumping is halted increases. Hence, actions will be taken quickly in order that pumping may resume as quickly as possible.

3.2.3.2 Containment and control of drill fluid released

The types of measures implemented to contain the fluid released will depend on the type of area in which the release occurs.

Upland Areas

If an inadvertent release of drilling fluid is observed aboveground, the following measures will be implemented:

1. Immediately notify Empire's Environmental Inspector, DPS staff, and the HDD contractor.
2. Attempt to regain returns. Trip drill pipe and downhole tools back toward the direction of flow until returns through the drilled hole return to the entry/exit pit. Correct the bentonite properties, if necessary, and start drilling back in the same hole to see if the seepage

continues. By swabbing the tool through the hole, this may remove any build up of cuttings that created the inadvertent release. If the fracture is mitigated and controlled, resume HDD activities.

3. Evaluate the release to determine if containment structures are necessary. If containment structures are necessary, they will be installed under the direction of Empire's Environmental Inspector. If the volume of the release is too small for containment measures to be practical, the area will be allowed to dry. This applies to upland releases only. The containment structures (i.e., straw bales, silt fence, sandbags, or berms) will be placed around the affected area to prevent flow of the drilling fluid. If the inadvertent release exceeds the amount that can be contained with the abovementioned barriers, then a small (generally less than four cubic yards) collection sump pit will be excavated at the release location.
4. If there is a threat to a sensitive resource or to public health and safety, HDD activities will be suspended immediately. Empire would implement the agency notification procedures outlined in Section 4.1 of this plan. Upland releases that do not pose a threat would not be reported to each agency.

Wetlands

Frac outs in wetlands are quite rare as the depth of cover provided in these areas is normally sufficient to prevent frac outs. If a frac out occurs the containment and control measures will be similar to those used in upland areas with the exception that the use of heavy equipment will be severely restricted. Once the containment measures are in place drilling operations will resume. Depending of the flow rate of fluid released, drilling procedures may be modified to reduce that rate. These modifications include introduction of LCM's (Lost Circulation Material) into the drill fluid, increasing drill fluid viscosity and the temporary reduction of drill fluid pumping rates. Drill penetration rates may also be temporarily increased in an effort to move the drilling assembly away from the release point as quickly as possible in order that the release stops quickly.

Waterbodies

Empire has specifically designed the HDD profile in order to minimize the potential for an inadvertent release into a waterbody. Frac outs in waterbodies are also rare due to the provision of adequate depth of cover. However, if an inadvertent release is observed in a waterbody, the following measures will be implemented:

1. Temporarily suspend forward progress and immediately notify Empire's Environmental Inspector, DPS staff, and the HDD contractor. The Environmental Inspector will monitor the extent of the drilling fluid plume and observe if the release results in distressed or dying fish.
2. Water samples will be collected at both upstream and downstream locations from any plume associated with an inadvertent release of drilling fluid per federal, state, and local

regulations. The samples will be tested for turbidity analysis. Proper storage and shipping methods will be followed.

3. Attempt to regain returns. Trip drill pipe and downhole tools back toward the direction of flow until returns through the drilled hole return to the entry/exit pit. Correct the bentonite properties, if necessary, and start drilling back in the same hole to see if the seepage continues. By swabbing the tool through the hole, this may remove any build up of cuttings that may have contributed to creating the inadvertent release. If the fracture is mitigated and controlled, resume HDD activities.
4. Empire will notify appropriate downstream water intake authorities of the existence and location of any plume that extends more than 1,000 yards from the HDD crossing site.
5. Empire would implement the agency notification procedures outlined in Section 3.9 of this Plan.
6. Upon completion of HDD activities, Empire will prepare a report that summarizes: a) The events leading up to the inadvertent release, b) The measures taken to minimize the impacts following the release, c) Any impacts from the release, d) Mitigation for the impacts from the release, e) Agency contacts.

Implementation of containment and control measures is most difficult in waterbodies and is only practicable when the depth of water is less than two feet and the water is slow moving. In these cases, the drill fluid will be contained by hand carrying sand bags into the waterbody. A containment barrier that extends above the water surface will be built by hand placing the sand bags around the release point. If practicable, a trash pump will be placed on the shore and a suction hose extended from the pump to the release point. The drill fluid will then be pumped through a flexible hose back to the drill rig. Once the containment measures are in place drilling operations will resume.

The effectiveness of the measures implemented to limit the release of drill fluid will be closely monitored. If the measures are not effective and if the environmental impact of the release is deemed unacceptable the HDD installation will be abandoned. Another attempt using a modified profile or at an alternate location may be made.

3.2.3.3 Additional control measures

A determination will be made of the cause of the frac out. If it is determined that downhole pressures are excessive then measures to reduce them will be implemented. These measures are described above and include swabbing the hole and or modifying the drill fluid properties.

3.2.4 Drill Fluid Clean Up

Measures to clean up drill fluid released by a frac out will be determined on a case by case basis in consultation with DPS staff and the Environmental Inspector. Often, if the features

affected are not sensitive and the volumes released are small minimal or no clean up will be required.

Drill fluid can be cleaned up by collecting it by hand with shovels, brooms and buckets. Larger volumes can be cleaned up by means of pits and pumps or mechanized equipment.

3.2.5 Agency Notification Procedures

If a frac out occurs within a stream, wetland or wetland buffer, or other sensitive resources, or poses a threat to public safety, the Environmental Inspector will immediately notify DPS staff.

The Environmental Inspector will provide the following:

- The location of the frac out;
- Description of the area affected; and
- The containment measures implemented.

As soon as possible, a report, containing the following information, will be prepared and emailed to the appropriate agencies.

- The cause of the release;
- Photographs of the release site;
- The area affected;
- The location and size of the resulting work area; and
- The location of any drainage, streams or wetlands in the area and the distance to them from the failure site.

Upon completion of HDD activities, Empire will prepare a report that summarizes:

- The events leading up to the frac out;
- The measures taken to minimize the impacts following the release;
- Any impacts from the release;
- Mitigation for the impacts from the release; and
- Agency contacts.

Agency	Contact	Telephone
U.S. Department of Commerce, National Marine Fisheries Service	Northeast Regional Office One Blackburn Drive Gloucester, MA 01930 Fax: (978) 281-9333	978-281-9300
U.S. Fish and Wildlife Service	U. S. Fish & Wildlife Service Office of Law Enforcement 300 Westgate Center Drive Hadley, Massachusetts, USA 01035 Fax:(413)253-8459	413-253-8274

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U.S. Army Corps of Engineers	Jacob K. Javits Federal Building 26 Federal Plaza, Room 2109 New York, NY 10278-0090	917-790-8500
New York Department of Environmental Conservation	DEC Region 4 1130 N. Westcott Rd. Schenectady, NY 12306	518-357-2075
Rensselaer County	Division of Environmental Health 2nd Floor, Ned Pattison Government Center, Troy, NY 12180	518-270-2664