Inadvertent Release Contingency Plan for Horizontal Directional Drilling

Natural Gas Liquefaction, Storage, and Truck-loading Facility, Charlton, MA

Prepared for:
NEC, LLC
100 Front Street, Suite 940
West Conshohocken, PA 19428

Submitted to:
Charlton Conservation Commission
37 Main Street
Charlton, MA 01507

Prepared by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, Massachusetts 01754

In association with:

Weston & Sampson Engineers, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867

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1.0 INTRODUCTION

Northeast Energy Center LLC (“NEC”) proposes to construct a natural gas liquefaction (“LNG”), storage, and truck-loading facility in the town of Charlton, Massachusetts (“Project” or “Facility”). The project is needed to reliably meet the energy needs of the region. This Facility will provide a critical supply of LNG for winter peak requirements for local gas distribution companies and gas-fired electrical generation facilities, as well as potential industrial, commercial, and agricultural applications. The proposed location of the Facility includes parcels of land along Route 169, (294 to 314 Southbridge Road) in Charlton, Massachusetts, i.e., the “Facility.” Appurtenant facilities include the gas interconnection pipeline along the north side of Route (“Rte.”) 169 and the meter station adjacent to the Tennessee Gas Pipeline (“TGP”) pipeline at 190 Southbridge Road. Combined these three elements comprise the “Project.”

The gas interconnection pipeline along Rte. 169 is designed to be a 10-inch diameter gas interconnection pipeline along the west side of Rte. 169. The route requires crossing Cady Brook in two locations. To avoid direct alteration of the brook bed and banks NEC proposes to use horizontal directional drilling (“HDD”) methods. This Inadvertent Release Contingency Plan was developed to support the environmental permit applications and provide information to bidders responding to NEC’s Request for Proposals to construct the Project.

A primary potential environmental concern associated with HDD involves the inadvertent release (“IR”) of drilling fluids during the drilling process. The purpose of this plan is to establish general procedures to prevent a fluid release (frac-out) during HDD construction and to outline steps to manage, control and minimize the impacts in the event that an IR of drilling fluid occurs. The objectives of this plan are to:

- Provide an overview of the HDD process with a specific focus on the management and use of drilling fluids;
- Identify controls to be implemented during construction to minimize the potential of an IR;
- Provide a means of monitoring to permit early detection of IRs;
- Protect areas that are considered environmentally sensitive (rivers, wetlands, other biological resources or cultural resources);
- Establish site-specific environmental protection measures to utilize prior to, during, and following drilling and pipe installation activities to minimize and control erosion and sediment releases to adjoining wetlands or watercourses;
- Establish a general response program for construction that is understood and can be implemented immediately by field crews in the event of an IR of drilling fluid occurs; and
- Establish a chain of command for reporting and notifying, in a timely manner, the construction management team, the Owner, and the proper authorities in the event of an IR of drilling fluid and of the response actions that are to be implemented.

It is important to note that the plan in this document serves as the preliminary framework for the Contractor's submittal presenting a site-and-contractor-specific Inadvertent Release Contingency Plan consistent with the site conditions and constraints, and the Contractor's selected means, methods and equipment. This plan was prepared to support the environmental permit applications and will be updated with Contractor's specific information prior to the start of HDD construction. The selected HDD Contractor will be responsible for incorporating specific permit conditions, applicable regulatory requirements, site specific environmental features and geotechnical information into its Inadvertent Release Contingency Plan submittal. The final plan will be submitted for review and approval by NEC's environmental representative prior to the start of construction.

2.0 DESCRIPTION OF HDD PROCESS

The HDD process begins by mechanically excavating entry and exit pits at either end of the directional bore alignment. A small diameter (on the order of 6 to 9 inches in diameter) pilot bore is then drilled from the entry pit using directional boring methods. During the pilot bore, a drilling fluid (typically bentonite and water based with selected polymers/additives to improve and modify fluid and drilling properties to address site-specific ground characteristics) is pumped through nozzles in the drill head to support the hole and to hydraulically transport drill cuttings from the drill bit back to the entry pit. Environmentally acceptable polymers and additives will be required for use on this project.

A guidance system is mounted immediately behind the drilling head to allow the crew to track and steer the path of the drilling so that it follows the proposed alignment. The drilling fluid holds the cuttings in suspension and carries the drill cuttings back through the annular space between the drill rods and the bore hole wall to the entry pit where it is collected and processed for re-use by a recycling system. The cuttings are separated from the bentonite using screens, centrifuges, and de-sanding units which prepare the bentonite for re-use. Once the pilot bore reaches the exit pit, a larger diameter back-reaming head is attached to the drill string and pulled back through the pilot hole to enlarge the hole. Depending on the size of the pipe to be installed and the ground conditions, several successively larger reaming passes may be needed. Again, a bentonite and water slurry are pumped into the bore hole during reaming to remove cuttings and to stabilize the bore hole. Lastly, the drill string is pulled back through the bore hole with the new interconnection pipeline attached to it in one continuous process until the lead end of the pipe reaches the entry pit. Steps two and three may be combined, with the pipeline pulled back through the bore hole immediately behind the final reaming bit.

Specific to this plan, it is important to have an awareness of the function and composition of the HDD drilling fluids. The drilling fluid composition and drilling fluid management are integral components of the HDD process with the following purposes:

- Support and stabilize the drill hole,
- Suspend and transport cuttings from drill bit through the drill hole annulus,

- Control fluid loss through the bore's side walls by forming a filter cake on the bore hole walls,
- Managing and modifying the drilling fluid mix to improve its cutting carrying characteristics, its pumpability, and its hole stabilization and support characteristics,
- Power the downhole cutting tools (e.g., via mud motors if required); and,
- Serve as a coolant and lubricant to the drill bit during the drilling process, and lubricant during the pipe insertion process.

The drilling fluids are composed primarily of potable water, which will likely be obtained from municipal or private sources. As mentioned above, the drilling fluid also contains bentonite clay as a means to increase viscosity. Bentonite is a naturally occurring, nontoxic, inert substance that meets NSF/ANSI 60 NSF Drinking Water Additives Standards and is frequently used for drilling potable water wells. While bentonite is non-toxic and commonly used in farming practices, it has the potential to impact plants, fish and their eggs if discharged to waterways in significant quantities. Frequently, additives are used to: amend the drilling fluid, improve its compatibility with the ground and groundwater chemical characteristics, improve its cutting suspension and carrying characteristics, improve its hole stabilization ability, and reduce seepage loss through the ground characteristics. Environmentally acceptable additives are required for this project.

During the HDD process and subsequent pipe insertion, the drilling fluid pumped downhole will tend to flow along the path of least resistance. Generally, this will be through the annulus between the drill string and the drill hole side wall. However, the bore alignment may encounter ground conditions where the path of least resistance is an existing fracture, fissure or hole of anthropogenic origin, areas with low overburden confinement, or coarse gravel zones in the soil. When this occurs, circulation can be lost or reduced. This is a common occurrence in the HDD process, but does not necessarily prevent completion of the bore or result in a release to the environment. However, the environment may be impacted if the fluid inadvertently releases to the surface along a waterway's banks or within a waterway or wetland. Again, environmentally acceptable additives to amend the properties of the drilling fluid will be used as necessary to prevent and limit releases and losses through such paths of lower flow resistance.

3.0 ORGANIZATION AND STAFF RESPONSIBILITIES

Responsibilities of Various Organizations

The principal organizations involved in this project include the Regulatory Agencies, Owner, Design Engineer, and HDD Construction Contractor. The roles and responsibilities of the principal organizations are discussed in the following subsections.

Regulatory Agencies

NEC is working to obtain necessary permit authorizations and approvals to implement the Project. Anticipated regulatory agencies reviewing and issuing permits include:

- Town of Charlton Conservation Commission
- Massachusetts Department of Environmental Protection ("MassDEP")
- Massachusetts Department of Transportation ("MassDOT")

Owner

The Project Owner is NEC ("Owner"). NEC will provide Construction Manager(s) and Environmental Monitoring for the Project and will be responsible for correspondence and coordination among the parties including the HDD contractor and the Design Engineer.

Design Engineer

The Design Engineer for the HDD Design is Weston & Sampson Engineers, Inc. ("WSE"). During construction, the Design Engineer will be responsible for reviewing and accepting required contractor submittals, shop drawings, and material certificates. The Owner in coordination with the Design Engineer will take responsibility for review and acceptance of submittals, and documenting the materials and methods used comply with the contract documents.

HDD Construction Contractor

The HDD Construction Contractor ("HDD Contractor") for this Project has yet to be selected. The HDD Contractor will be responsible to complete the pipe installation by HDD in accordance with the design criteria, contract documents, environmental compliance permits and local, state, and federal regulations. The HDD Contractor will be expected to use the appropriate construction procedures and techniques to complete the installation, including a site/Contractor means and methods specific Inadvertent Release Prevention and Contingency Plan prepared by the Contractor in accordance with the contract documents.

The HDD Drill Operator ("Drill Operator") will be responsible for operating the HDD drill rig and observing and managing changes in annular fluid pressure or loss of circulation. The Drill Operator will communicate with other members of the drill crew as needed when issues arise. The HDD Contractor will be responsible for developing the specific lines of communication within their organization and shall dedicate a responsible person for communicating IRs to the Owner's Construction Management team and Environmental Monitor.

Lines of Communication and Authority

In the case of a detected or suspected IR of drilling fluids from the boring, the Drilling Operator will l notify the HDD Contractor's foreman or superintendent and the Owner's Construction Manager immediately. The Owner will be responsible for notifying regulatory agencies, as necessary.

Training

The HDD Contractor will ensure that all construction personnel have appropriate environmental training before beginning work. NEC's Environmental Monitor will also conduct a project orientation and field training meeting for staff assigned with specific roles during the HDD installation and will review the site-specific environmental concerns and permit conditions. The Owner and Design Engineer will also attend the orientation meeting to review the procedures that will be used to document IRs in accordance with the HDD specifications.

4.0 FLUID RELEASE MINIMIZATION MEASURES

Geotechnical Investigation

The first steps taken to minimize the potential risk of an IR included conducting a geotechnical investigation at the site to develop an understanding of the subsurface soils. Soil borings were conducted near the proposed pipe alignment within or immediately adjacent to Cady Brook along Rte. 169. The top five to ten feet of each boring was backfilled and sealed with a cement/bentonite grout to limit the risk of a release through an abandoned bore hole during the HDD construction.

HDD Design

The HDD crossings are being designed to reduce the potential risk of an inadvertent fluid release during construction. Design considerations include:

- Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the nearby brook bottom or ground surface. Depth of cover at the target HDD bore elevation is approximately 16 feet below the brook bed at the northern crossing and approximately 20 feet at the southern crossing;
- Generally, for the formation of IRs, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest;
- Adjusting the drill alignment to miss existing infrastructure including existing utilities;
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up;

- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures;

- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment;

- Preliminary analyses indicate that the likely potential IR to the ground surface is the last 25 feet before the exit pit and the first 25 feet after the entry pit, which for both crossings are substantially far away from Cady Brook. This is common for HDD operations as the bore approaches the ground surface; and

- The Contractor should consider utilizing real-time annular pressure monitoring with the use of a down-hole annular pressure tool throughout pilot hole drilling operations, or provide alternative monitoring methods and/or best drilling practices to so that the drilled and bored (reamed) holes do not become plugged with drill cuttings leading to hydrofracture and IR.

Contingency Plan

As mentioned above, prior to construction the selected HDD Contractor will be required to submit a final Site- and Contractor-Specific Inadvertent Release Contingency Plan for review and acceptance by the Owner. The project specifications will require that the following major elements be addressed in detail in the Contractor's Plan:

- Work plan and detailed description of the drilling program (details for executing pilot hole, reaming, pull-back operations, and schedule), this plan shall include necessary procedures for addressing problems that are typically encountered during HDD installations through the anticipated subsurface for each drill location, including the potential use of conductor casings in the softer, weaker soils at the ends of the bore;

- Drilling fluid composition design and on-hand amendments to alter fluid properties to reduce pressures, potential for plugging, and seepage losses;

- Description of the proposed drilling equipment and drill site layout;

- Material Safety Data Sheet ("MSDS") information for all drilling fluid products proposed for use;

- Procedures for drilling fluid pressure control, and fluid and pressure loss monitoring and management to aid in the detection of an IR (i.e., metering of makeup water, recording of drilling fluid product quantities utilized, fluid return volumes, fluid and cuttings disposal quantities, turbidity of surface water, etc.);

- Contingency plans for addressing IRs into waterbodies, or other sensitive areas, which includes the specific procedures used to halt the release and then contain, clean-up, and remove materials from the release site;

- Notification procedures and chain-of-command in the event of a release;

- Criteria for evaluating the need for a drill hole abandonment and the associated plan for sealing the drill hole if abandoned; and,

- Drilling fluid management and disposal procedures.

In addition to providing a site-specific Inadvertent Release Contingency Plan, the HDD Contractor will be responsible for implementing the necessary safeguards to minimize the likelihood of a fluid release and management/control should a release occur. This includes having a readily available supply of spill response devices (e.g., containment booms, pumps, straw bales, silt fence, sediment logs, sandbags, vacuum trucks, silt curtains) and other materials or equipment necessary to contain and clean up IRs. To maximize protection to sensitive environmental areas these measures will be pre-positioned at the site, readily available and operational prior to the start of drilling. Such additional spill response will be employed immediately, as secondary measures, in the event of a fluid release.

The workspace layout for HDD materials and equipment will be configured to reduce the likelihood of a release. The entry and exit points are established outside the brook boundary to permit detection and response, in the event of a release, before environmentally sensitive boundaries are reached or impacted. Erosion and sediment control measures will be placed between the entry/exit location and watercourses, waterbodies, and environmentally sensitive areas as an additional precaution.

Early Fluid Release Detection

The HDD method has the potential for seepage or fluid loss into pervious geologic formations through which the bore path crosses. This may occur because of fractures in the rock, low overburden confinement, or from seepage through porous soils such as coarse gravels. It is important to note that IRs of drilling fluid can occur even if the down-hole pressures are minimal. Subsurface conditions that could be conducive and lead to IRs or drill difficulties include:

- Highly permeable soil such as cobbles and gravel;

- Considerable differences in the elevations of HDD entry and exit points (typically greater than 50 feet);

- Disturbed soil, such as unconsolidated fill; and,

- Soft soils with low overburden capacity.

An experienced drill crew is the most effective approach to detecting reaction to drilling fluid seepage prior to a surface release and promptly stop the drilling and they can modify the drilling fluid composition, properties and pressures to address indications of loss of drill fluid. The HDD Contractor will be required to utilize experienced drill crews as the HDD alignment is adjacent to environmentally sensitive areas. The following factors can be used for identifying the potential for drill fluid release:

- The loss of pressure within the drill hole utilizing a downhole pressure monitoring system;

- A substantial reduction in the volume of return fluid (loss of circulation); and
- The lack of drill cuttings returning in the drill fluid

In addition to an experienced drill crew, the HDD Contractor will be required to perform periodic (at least twice a day) visual inspection and monitoring of the brook bottom in the vicinity of the drill bit or reaming bit for signs of an IR. If visual monitoring indicates a potential release additional measures such as turbidity measurements and bentonite accumulation measurements both upstream and downstream of the current active location of the drill bit will be required.

5.0 INADVERTENT RELEASE MONITORING AND NOTIFICATIONS

The HDD Contractor is responsible for monitoring of the drilling operation to detect a potential IR by observing and documenting the flow characteristics of drilling fluid returns to the HDD entry/exit pits and by visual inspection along the drill path. If drilling fluid to the HDD entry/exit pits are lost, the HDD Contractor shall implement the following steps:

- The Drill Operator will monitor and document pertinent drilling parameters/conditions and observe and monitor the drill path for evidence of an IR. If there is evidence (typically visual) of a release, the contractor will be required to stop the drilling immediately;
- The HDD Contractor shall notify the Owner’s Construction Manager or Environmental Monitor of significant loss of drilling fluid returns at the drill rig;
- The HDD Contractor will take steps to modify the drill fluid properties and pressures to reduce the potential of drill fluid loss or release; and
- The Drill Operator will take steps to restore drilling fluid circulation in accordance with the requirements of the HDD technical specifications.

If a fluid release is identified, an immediate response is necessary and the proper corrective actions must be taken to minimize impacts to environmentally sensitive resources (e.g., watercourse, waterbodies, and wetlands).

Inadvertent Release Notification

The drill crew shall notify the Owner’s Construction Manager or Environmental Monitor immediately if an IR is identified regardless of its location. The HDD Contractor will be responsible for notifying applicable regulatory agencies, as necessary. IRs that occur within uplands that are properly contained and removed from the site may not be reported to regulatory agencies at the discretion of the Owner. The HDD Contractor shall not resume HDD activities until the release is controlled and confirmation has been received from the proper authorities. The Owner’s Construction Manager shall notify the HDD Contractor when HDD drilling operations may resume.

6.0 INADVERTENT RELEASE RESPONSE (UPLAND)

A common reason for upward movement and release of drill fluid is from pressure exerted by drill pumps. Lowering drill fluid pressure is a first step to limiting a release and can be accomplished by stopping drill rig pumps and allowing pressure to bleed off. With no pumping pressure in the hole, surface seepage will generally stop, then the HDD Contractor can trip the drill steel back a selected distance and attempt to clear cuttings from the annulus to re-establish circulation.

The contractor will be required to contain/isolate and remove fluid that has emanated from the surface. On land this can be done through use of berms, straw bales, or silt fence in conjunction with excavating a small sump pit if needed. Sufficient spill-absorbent material will also be available on-site.

If a release is identified in an upland area, the HDD Contractor will be required to immediately respond as described above to limit the extents of the release. After containment is established, cleanup and removal can be conducted by hand, with vacuum trucks, or other equipment. The Environmental Monitor will be present during clean up and removal activities, as they may need to be conducted outside of the pre-authorized temporary workspace areas. The Environmental Monitor, Construction Manager, and the HDD Contractor will work closely to determine the best course of action for IRs occurring within upland areas.

Upon containment of the release, the HDD Contractor will be required to evaluate the cause of the seepage and develop mitigation strategies to limit the likelihood of recurrence. The location of the seepage and the area around the seep will be monitored upon the re-start of the HDD operations for changes in conditions. The segments of borehole nearest the entry and exit points and other areas of low overburden cover tend to be the most susceptible to surface seepage as they have the least amount of soil confinement. These locations may have areas of dry land where seepage detection is easily identified and contained. If areas of high risk for IRs are identified during the HDD design phase, they can be protected from an uncontrolled release through use of strategically placed confinement/filter beds, straw bales, silt fence, or earthen berms place prior to the start of drilling.

7.0 INADVERTENT RELEASE RESPONSE (IN RESOURCE AREAS)

If an IR occurs within the nearby waterway, the HDD Contractor will be required to cease drilling operations, reduce pressures in the borehole immediately, and notify the Owner’s Construction Manager and Environmental Monitor. The Environmental Monitor, with input from the Drill Operator, will evaluate the potential impact of the release on a site-specific basis and will determine the appropriate course of action. The contractor will be required to develop general response methods for within the resource area(s) and pre-place necessary materials and equipment at the site prior to construction. Specific response actions will be determined in consultation with the Environmental Monitor and Contractor and could include the following:

- Shutting down or slowing the drill fluid pumps – slowing fluid pumps is preferred because there are risks to the complete shut down;

- Modifying the drill fluid properties, add agents to reduce drilling fluid pressures and/or to plug/seal release path;
- Tripping the drill steel back a selected distance and attempt to clear cuttings from the annulus to re-establish circulation
- Stopping drilling activities for 24 hours to allow the bentonite in the subsurface pathways to gel and seal the pathways;
- Evaluate the current drill methods to identify site specific improvements to lower the risk of additional IRs;
- Implementation of proper in-stream hand-placed sedimentation control measures including, but not limited to gravity cells, silt curtains, turbidity curtains, or if suitable, sandbags and confinement/filter beds. These activities will require that qualified personal and equipment and other support materials, and supplies be prepositioned and readily available at or near the site; and
- Use of a relief well installed at the location of the release. In the soft sediments of a river bottom this well may be installed using vibration-type methods and equipped with a subsurface pump to control pressures and future releases at that location by evacuating drilling fluid as it accumulates. The relief well can be utilized to immediately lower the borehole pressures in the event of an IR and later to control and manage the release as the drilling continues.

8.0 DRILL HOLE ABANDONMENT PLAN

In the event the HDD Contractor must abandon the drilled hole, a plan to fill the abandoned hole will be implemented as outlined in the contractor's Inadvertent Release Contingency Plan and an alternative plan/alignment for crossing shall be evaluated. If it becomes necessary to abandon a partially completed hole, the abandoned hole will be filled with a mixture of high-yield bentonite, water, and drill spoil. The first ten feet of the bore path will be compacted and filled with soil or a cement-bentonite mix to prevent future settlement. The HDD Contractor's site-specific abandonment plan shall be accepted by the Design Engineer and Owner prior to being performed in the field.

After the abandoned hole has been filled, an alternate entry and exit hole and bore path alignment will be evaluated by the HDD Contractor, Owner, and the Design Engineer. The new alignment will be offset from the abandoned hole by at least 10 feet (except at the ends where a 5-foot offset may be used) to help limit the risk of steering difficulties due to the presence of or hydraulic connection causing drill fluid loss to the abandoned hole.