ENVIRONMENTAL ASSESSMENT REGISTRATION DOCUMENT

Baker Hughes Canada Company

Abstract

Proposed Jet Perforating Gun Assembly Facility in Cape Broyle, NL; for the assembly and storage of jet perforating guns for use by Operators in the Newfoundland offshore oil and gas industry

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Jet Perforating Gun Assembly Facility

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3.0 THE UNDERTAKING

3.1 Name of the Undertaking

Jet Perforating Gun Assembly Facility

3.2 Purpose/Rationale/Need for Undertaking

In the Oil and Gas Industry, after a well is drilled, an essential part of the completion process is to make a connection between the wellbore and the reservoir of oil or gas that needs to be pumped out. This is a crucial phase since the quality of the connection has a major influence on well's future performance.

Well perforating is the process of punching a hole in the well's cement liner (or casing) in order to enable the reservoir connection to be made. Establishing a connection to the wellbore means the well can begin to flow and production can begin. For injection wells, it means that injection can commence.

In the vast majority of cases, wells are perforated using compacted shaped charges. The shaped charges are held in perforating guns, which are loaded in highly engineered containment buildings and later transported to well location. When fired, they have enough power to punch through the liner or casing and into the bedrock.

The purpose of the undertaking proposed by Baker Hughes Canada Company is to assemble pre-fabricated components into "jet perforating guns" and store them locally for use by Operators in the Newfoundland offshore oil and gas industry.

3.2.1 Proponents Experience

Baker Hughes Canada Company is part of Baker Hughes Company; recognized worldwide as a leading provider of products, services and solutions for the petroleum industry. Since entering the oilfield in 1932 as the Lane-Wells Company, Baker Hughes has grown through a series of mergers and acquisitions; building on more than seven decades of technological breakthroughs and service excellence.

In its early years as Lane-Wells Company, Baker Hughes was the first perforating company with the development of the first gun perforating system. Through all these years, Baker Hughes has grown to become one of the leader companies for oil-well services, with a comprehensive portfolio, including perforating services and manufacturing of encapsulated explosive devices for oil and gas applications (Pine Island, TX).

As well, Baker Hughes is an active member of IME (International Makers of Explosives); a nonprofit association founded in 1913 to provide accurate information and comprehensive recommendations concerning the safety and security of commercial explosive materials. IME also produce SLP (safe learning practices) that are reference in API RP 67 and shipping regulation across the globe.

Baker Hughes first concern has always been the safety and protection of employees, users, the public and the environment.

4.0 DESCRIPTION OF THE UNDERTAKING

4.1 Geographical Location

The undertaking has been proposed to be located at in Cape Broyle, NL in the Avalon Peninsula; approximately 830m south of the nearest inhabited zone in the proximity with Hell Hill Pond and 360m west from NL-10 road. (Refer to figures A, B and C and Appendix A: Site Location).

Site Location and Installations: GLF coord: 47° 8' 6" N, 52° 54' 32"W

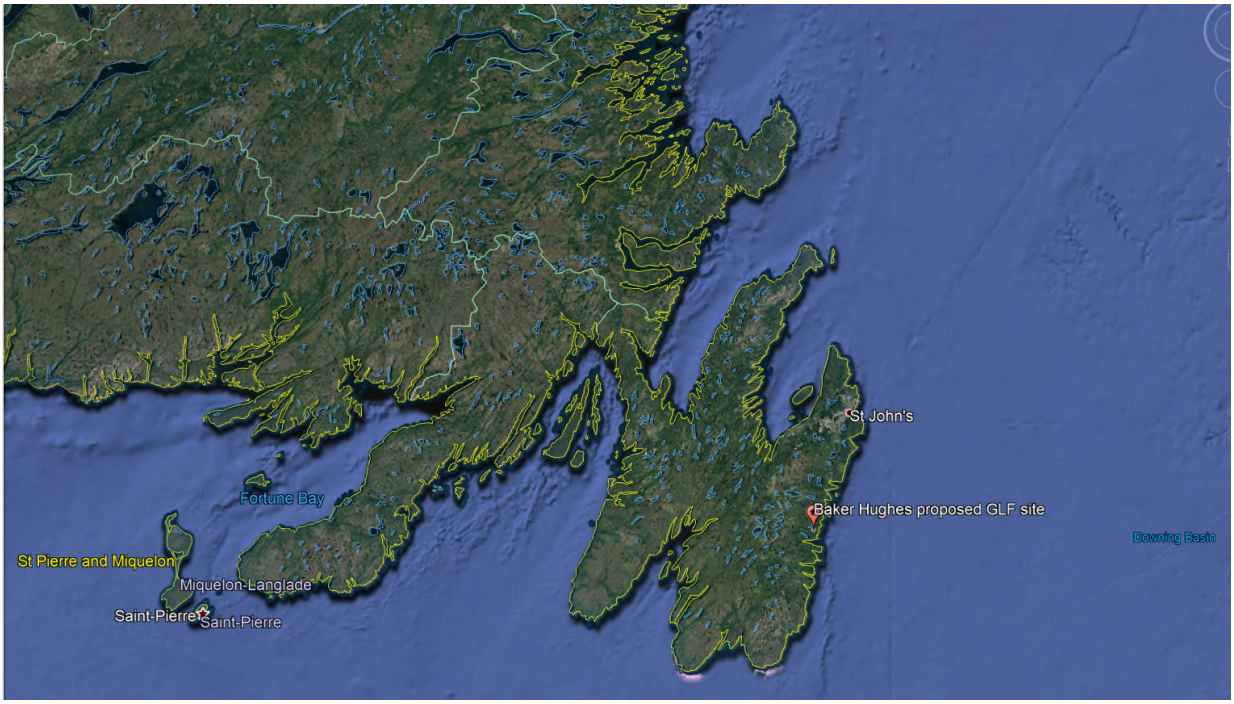

Figure 1. Location Plan

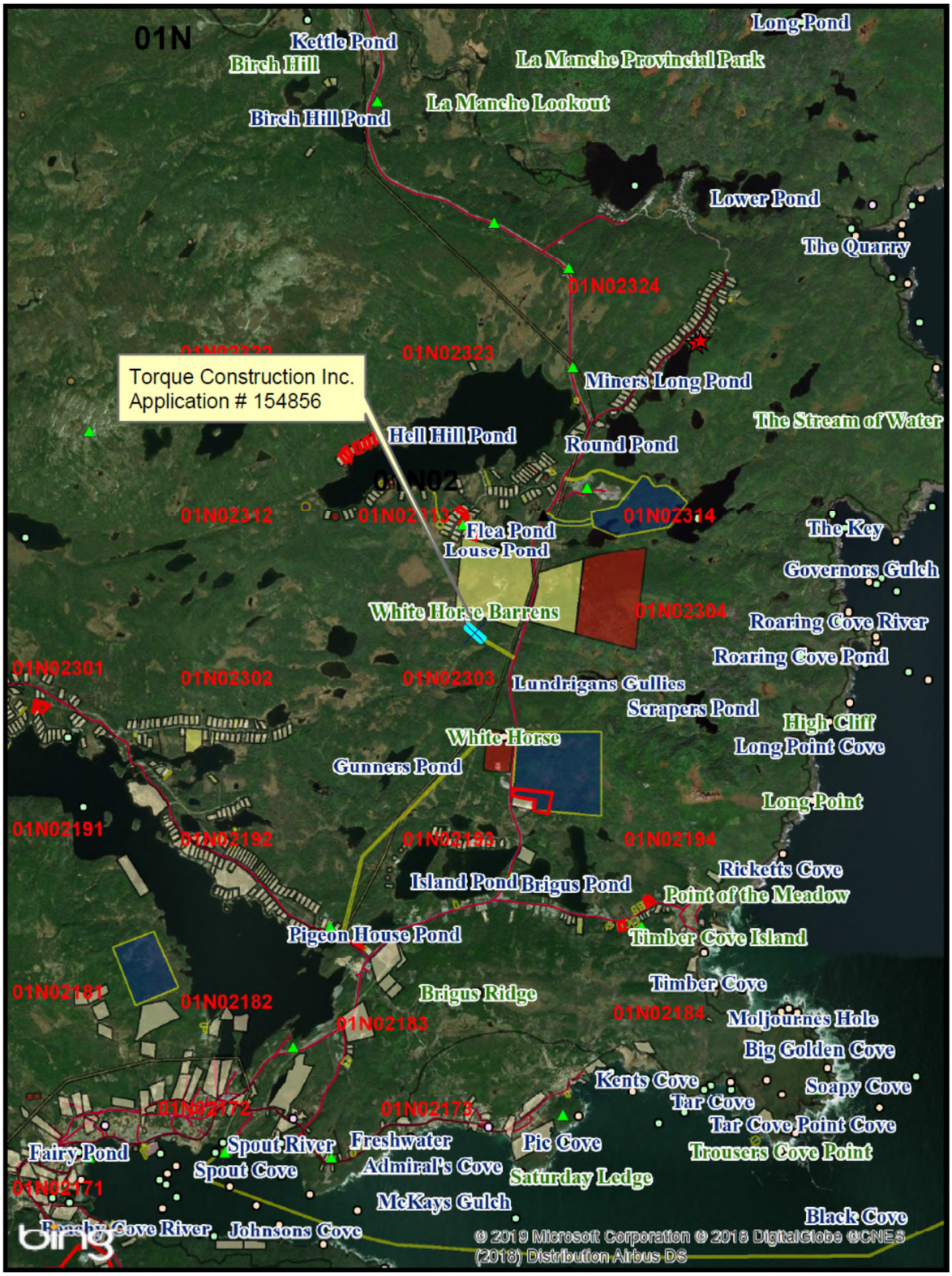

Figure 2. Proposed site and vicinity

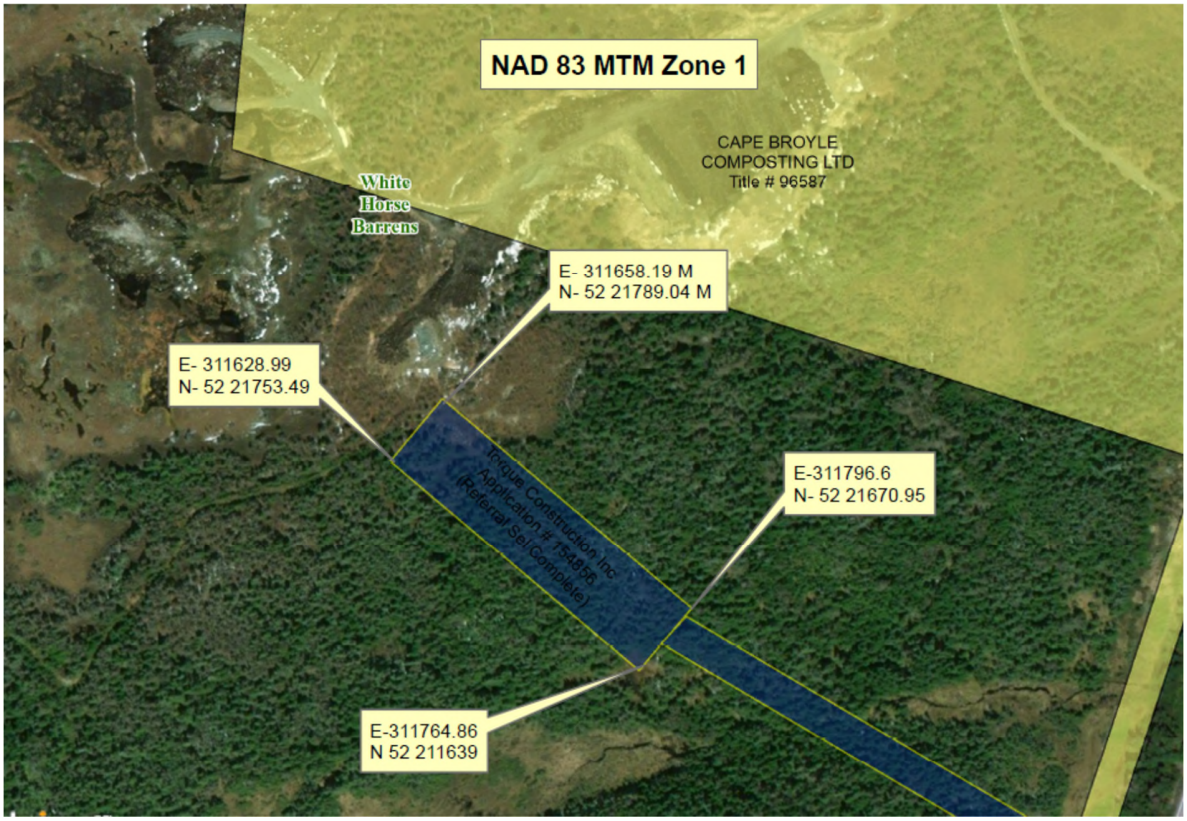

Figure 3. Site Boundaries Physical Features

4.2 Physical Features

4.2.1 Site Description

Gun loading operations will be located on a polygonal shape lot covering approximately 8900 square meters. The entire area will be prepared for the operations involving construction work for site clearing and site access road from NL-10 to be built.

The GLF will positioned in the center of the proposed location with the man doors facing the northwest/southeast direction. In general, following structures will be on the yard:

- *GLF:* Sitting on gravel
- *Type 4 magazines:* Additional storage for loaded jet perforating guns with man door facing to the southeast.
- *Fuel generator*: situated 25 meters northwest from GLF and magazines
- *Water services and Sewer*:

Gun Loading Facility (GLF) and the additional storage buildings (magazines) are pre-manufactured containment buildings.
Figure four displays general proposed site distribution; for more detail please refer to Appendix B: Site Distribution and Technical Drawings.

Figure 4. Proposed site distribution

Structures at location as per described below:

Standard Gun Loading Facility (GLF)

The gun loading facility is a purposed built super magazine building, 17.7m x 4.9m. Two (2) Type 4 magazine doors and Two (2) standard doors with panic hardware to provide access and weather protection. Small Access doors allow guns (empty or loaded) to be moved in or out and between rooms of the facility from the loading tables or from racks.

Standard layout is used with Gun Assembly Area (GA) and Loaded Gun Storage Area (LGS) separated by two (2) integrally built magazines. This allows for two associated passageways between the two areas.

Gun Loading Facilities (GLF) are design for blast mitigation and distance reduction, being able to be stablished 35.88m from an inhabited building (inhabited building refers to a building holding +25 people a minimum of 8 hours a day).

Light / Electrical: Class I / II Dual, 208V, 3 Phase, 100 amp. No electrical outlets are permitted inside. Electrical supply: Once magazine is set on site, a generator is used for

the power supply. Heating: one 7200 watt and one 9690 watt ceiling supported Class II, Division II (Roughneck) unit heaters. Heaters are protected by an expanded metal cage.

Features of GLF:

- Highly engineered containment building.
- High strength steel double wall, filled with ballistic resistant material.
- Global best practice for assembly and storage of Oil well perforating devices.
- Built under Canadian standards (CAN/BNQ 2910-500 2015)
- Approved for use by federal government.
- Equipped with high security system for 24/7 surveillance
- Separated Assembly and Storage Areas

Figure 5. Standard Gun Loading Facility

GLF Assembly and Storage Areas:

Gun Assembly Area (GA):	Storage Area (LGS):
• Charges loaded into hollow steel carriers • Standard operating procedures by competent technicians	• Finished assemblies stored ready for deployment • Maximum of 25 kg NEQ.

Figure 6. GLF Interior (Gun Assembly and Storage Areas)

- Only approved personnel in both areas
- Activities inside the building strictly regulated by federal, provincial and company requirements.

Type 4 magazines (Additional storage building)

These magazines are built under CAN/BNQ 2910-500/2015 standard and they are used as permanently or portable storage area of explosives. They are fabricated with ballistic resistant walls. Exterior walls are 6mm thick steel plate with continuously welded seams. Corner seams must be full-penetration welds. Inner walls are sheathed with 19mm Exterior Grade A or B plywood with one good side fastened to the flats of the wall spacers. The good side faces the interior. Top of the wall may be removable panel to permit the installation of the ballistic-resistant material. Doors and vents are the only permitted openings.

Features of Type 4 magazines:

- Highly engineered containment building.
- High strength steel double wall, filled with ballistic resistant material.
- Global best practice for storage of Oil well perforating devices.
- Built under Canadian standards (CAN/BNQ 2910-500 2015)
- Approved for use by federal government.
- Equipped with high security system for 24/7 surveillance

Figure 7. Additional Storage (Type 4 Magazine)

Fuel Generator

Proposed method for site power supply is a Doosan G40WDO-3A-T4F fuel generator or equivalent.

The G25-70 range is powered by fuel-efficient Doosan diesel engines. These engines have been designed to be powerful and reliable while meeting EPA tier 4 emissions standards. In addition, these high-performance engines provide excellent transient response ensuring precision frequency stability.

This generator has an enclosure acoustically treated to minimize sound levels as low as 64 dB(A) while ensuring proper cooling airflow through the package to operate at maximum load in high ambient temperatures.

It features skid base frames with integrated high capacity fuel tanks, which provide a full load runtime of at least 24 hours. In addition, the base frame is part of the environmental containment system that prevents spillage of fuel or oil outside of the package, safeguarding the environment.

Figure 8. Fuel Generator

No fuel storage for generator has been considered on site. Fuel will be supplied directly to generator as per needed.

Potable Water and Sewer Services

Food and liquids are prohibited in the gun loading facility. Nevertheless, potable water will be provided to the employees in water bottles, which will remain in the company pick-up trucks for consumption. Portable restrooms will be set at location using a third party company (such as D&S Vacuum Services) for installation, maintenance and waste collection. Sewer residuals will be collected and disposed of in accordance with Provincial Waste Management Regulations.

4.2.2 Site Security

For the site in general, a chain link fence 2.2 meters high will surround property, topped with barbed wire with a gate on the south side of the property.

The gate has restricted access controlled by approved employees only. Contractors and service personnel will call in and will be granted access by an approved employee, being under direct supervision all time. The GLF and magazines are equipped with remote monitoring systems (24/7).

Visitors must report to the front office to be met and signed in by an employee for access.

4.2.3 Physical and Biological Environments

For complete detail please refer to Appendix C: Baker Hughes Gun Assembly Facility, Physical and Biological Environments Study.

4.3 Construction

4.3.1 Description

The construction phase of the development will consist of the following four components:

A. Site access excavation / road building.
B. Clearing
C. Grubbing
D. Site excavation / storage yard final grade

These activities will be carried out as follows:

A. Site Access

Access to the site will consist of a newly constructed gravel access road, 19.4 meters wide and 290 meters long leading into the storage yard. Access road will start on 47° 7' 58.85" N, 52° 54' 16.13" W; situated 6.8km north of Cape Broyle NL, at Newfoundland and Labrador 10 highway (NL-10). The access road will end at 47° 8' 3.86" N, 52° 54' 27.96" W (site location entrance). A culvert will be installed at the junction of Highway 210. The culvert will be sized and installed in accordance with requirements of all Federal and Provincial regulatory and permitting authorities.

B. Clearing

Site access road and storage yard will require woodcutting. Any clearing needed in this area will salvage all merchantable timber and be carried out in accordance with all requirements and permits of the Department of Fisheries and Land Resources.

C. Grubbing

All overlying organic material and topsoil located on site will be excavated and stockpiled near the perimeter of the site for subsequent re-use in rehabilitating the area when storage area is no longer required.

D. Storage Yard Development

The storage yard will cover an area, 181.47 meters by 45.95 meters. Activities to be undertaken during this period will involve removal of organic and vegetative cover from the area, which will be stored in a location that will not promote sedimentation or water run-off.

4.3.2 Timeframe

The preparation activity is expected to take approximately two weeks. Construction will start as soon as approval and permits are in place.

4.3.3 Potential sources of pollution during construction

The construction phase of the work will involve vegetation removal and earth moving activities only. Potential sources of pollution during this period include noise, air emissions from construction equipment and accidental release of hydrocarbons from heavy equipment leaks or refueling activities.

Noise and air emission pollution Mitigation

Impacts related to noise and emissions are expected to be minimal due to the remote location of the site in relation to any populated areas. This will be further reduced through use of the following mitigation measures:

- All heavy equipment and machinery will be provided with well-maintained mufflers that are compliant with all applicable Provincial and Municipal noise regulations and bylaws.
- All motorized equipment will be fitted with air emission controls that meet or exceed Provincial regulatory requirements.
- All machinery will be properly maintained.

Site Run-off

- Work will be scheduled to avoid heavy periods of precipitation if any runoff issues are expected.
- Excavated areas will be graded to a low point in the storage yard to reduce/ prevent any run-off from the site.
- New excavation footprints will be minimized by limiting any exposed areas to only those that are needed for storage yard.

4.3.4 Accidents and Malfunctions

Accidents or malfunctions of heavy equipment could result in a spill of fuel, engine oil or hydraulic fluid. The following mitigation measures will be utilized to reduce the potential effects of such occurrences to levels that are unlikely to be significant.

- Maintenance and servicing of equipment will be conducted off site.
- All petroleum products will be handled in accordance with regulations governing the storage and handling of Gasoline and Associated Products under The Environmental Protection Act.

4.3.5 Potential Causes of Resources Conflicts:

The land is new for usage and the only company on vicinity is Cape Broyle Composting Ltd, which occupies the area just north of the proposed site, not finding any potential cause of resource conflict.

4.4 Operation

The main operation at a Jet Perforating Gun Assembly Facility is the assembly of jet perforating guns using encapsulated pre-manufactured explosive devices. Nevertheless, other tasks are inherent to this activity. As a result, following operations will be carried out at the proposed site:

- Storage
- Jet perforating gun loading operations
- Shipping

Note: **No** explosive devices will be detonated at site location. Combustion of explosive material is not part of the activities carried out at a Jet Perforating Gun Assembly Facility.

4.4.1 Storage

A jet perforating gun, is nothing more than an assemble of pre-manufactured encapsulated explosive devices. The main objective is to “punch” a pattern of holes through the casing and cement sheath an into the productive formation.

The perforating gun assembly consists of three components:

- Hollow carrier: Hollow steel tubes designated to protect shaped charges in handling, transport and deployment into wellbore. Available in a range of sizes and shot densities with pre-machined scallops to line up with shaped charges.

Figure 9. Hollow carriers

- Shaped Charges: Encapsulated explosive devices designed to create a perforation tunnel in the well. Consists of steel case, compressed powder and metal liner. No loose explosive material.

Figure 10. Shaped charge and cross-sectional

- Detonating Cord: Compressed powder sheathed with protective inner braid and flexible outer cover. It is used to transfer the detonation to the shaped charges. No loose explosive material.

Figure 11. Detonating Cord

All components will be received in their original UN rated packages from the manufacturing plant in Pine Island, TX. The material will be stored in Type 4 magazines on shelves and organized by product type. All packages labeled for storage and transportation as per regulatory requirements dictated in Explosives Regulations 2013 and TDG Regulations.

There is an additional space for surplus material, which always is labeled and packaged for final disposal and never re-used for assembly.

Figure 12. Shaped charges packaging

Figure 13. Materials packaging and storage

The final product (jet perforating gun), will be also stored in a type 4 magazine adequate for gun storage. These devices are always stored in a different magazine than the assembly materials.

Figure 14. Perforating guns storage

Storage procedures include:

- Restricted access to approved employees only
- Classification
- Strict inventory control
- Strict security protocols
- Reporting and record filing procedure
- Emergency response plan
- Training matrix
- Internal and regulatory audits

4.4.2 Jet perforating gun loading operations

Standard Operating Procedures for loading of perforating guns are set out in the following sections:

1. Planning and Preparation
2. Explosives Handling
3. Loading Techniques
4. Clean-up

1. Planning and Preparation

Attention to detail and proper planning will determine the pace and safety level for the loading operation. The following information should be obtained prior to loading:

- Length of interval(s) to be shot
- Type of charges and detonating cord, shot density, and size of gun(s) required
- Estimated length of detonating cord required for loading
- Requirements for selective fire or tandem guns
- Temperature, pressure, and fluid level considerations
- Special requirements of the client

Once the specifics of a perforating job are known, checks of inventory records shall be conducted and then all materials required for the loading process can be assemble, including the following:

- Gun hollow carriers, strips, wires, clips, tape
- Blaster's Galvanometer, shooting wire, and any required approved hand tools
- Firing heads, bottom noses, tandem subs, o-rings
- Detonating cord cutting device
- Other equipment and tools

2. Explosives Handling

After all preparations have been performed, explosive devices are obtained from the magazines to assemble the jet perforating guns.

All explosive devices are stored/retrieved from the magazines in their sealed original packages. Boxes will be opened in the loading area just before loading the jet perforating guns.

All magazine movements are strictly controlled and tracked as per internal procedures and regulatory requirements dictated in the Explosives Regulations 2013.

3. Loading Techniques

After retrieving explosives from the magazines and once they are prepared in the loading area of the GLF, approved personnel will proceed to load the jet perforating guns as follows:

Shaped charge strips will be retrieved from the hollow carriers. Detonating cord will be measured and cut to be installed at the center of the strip.

Figure 15. Installation of detonating cord

After detonating cord is installed, shaped charges are carried to the loading table and individually installed on the strip as per internal procedures.

Figure 16. Installation of shaped charges

Once the gun assembly is completed, detonating cord is inspected for signals of damage. Shaped charges are inspected and the loaded gun is compared to the loading plan. If everything is in order, loaded gun is now installed inside the hollow carrier.

Figure 17. Installation inside hollow carrier

The final steps are align the charges with the hollow carrier scallops and install all subs and adapters. The final product will be labeled as per regulatory requirements and stored in the storage area inside the GLF or in the additional storage (type 4 magazine) for jet perforating guns, until shipped to the client's well site.

Figure 18. Jet perforating gun

4. Clean up

After the loading process is complete and loaded guns have been transported to the storage area, loading area is cleaned up. Hand tools shall be stored back in toolboxes. Approved personnel shall immediately return unused explosives to the magazines.

Surplus material, as detonating cord not to be used for loading operations, shall be packed and labeled as surplus to be stored in the magazines (designated area for waste material) for future disposal at an approved facility as explained in 4.3.4 Explosive waste material.

All records shall be updated.

4.4.3 Shipping

All jet perforating guns will be shipped for ground transportation to be deployed to a location specified for the client, where the client will take responsibility for maritime transportation to the offshore rig.

Perforating guns will be transported in accordance with Explosive Regulations 2013, Part 9 and Transportation of Dangerous Goods Regulations (SOR2016-95) and internal procedures using one of the following transportation methods:

- Trailer / Cube Van / Deck Truck / Flat Bed
- Logging / Perforating Trucks
- Pickup Truck (in box, on transport racks or closed compartment)

4.4.4 Potential sources of pollution during operation

The operational stage of the project will involve potential sources of pollution during this period including noise, domestic waste material and litter from human activities, explosive waste material and accidental release of hydrocarbons from generator leaks or re-fueling activities.

Noise

The use of fuel generator as power supply for the site, may result in an increase in noise. Impacts related to it, are expected to be minimal due to the remote location of the site in relation with any populated areas, and will be further reduced by implementing following mitigation measurements:

- The usage of a generator with an enclosure acoustically treated to minimize sound levels as low as 64 dB(A), in compliance with all applicable provincial and municipal noise regulations and bylaws.
- Generator maintenance plan.

Domestic waste material and litter

Operations will result in the generation of a minimal amount of domestic waste. Such materials will be collected and disposed of in accordance with Provincial Waste Management Regulations.

Explosive waste material

The usage of pre-manufactured explosive devices in gun loading procedures results in no loose explosive material releases to the environment. All waste explosive material is reduced to small detonating cord pieces, shaped charges unloaded from misfired guns from the rig site, or guns unloaded because of change of plan from client side. All these are encapsulated explosive devices which are repacked and labeled for disposal as per internal procedures and local regulations.

Once the quantity of surplus material exceeds 5 Kg NEQ, will be shipped to be disposed for a licensed approved company (Hard-Rock NL) for final disposal.

Disposal certificates for explosive material will be filed and retained as per internal procedures and local regulatory requirements.

Accidental release of hydrocarbons

Spill of diesel could be resulted from a generator leakage or re-fueling operations. In order to mitigate the accidental release of hydrocarbons to the soil, following measurements will be taken:

- Generator maintenance plan
- No fuels will be stored on site
- Usage of spill berm under the generator
- Spill kits to be maintained on site
- Spill response training for personnel

4.4.5 Potential Causes of Resource Conflicts

The land is new for usage and the only company on vicinity is Cape Broyle Composting Ltd, which occupies the area just north of the proposed site, not finding any potential cause of resource conflict.

4.4.6 Decommissioning / Rehabilitation

Operations are estimated to be carried out for two years. After that period, business will be assessed in order to determine to continue with operations or not.

Upon completion of operations, site rehabilitation shall be carried out in accordance with the following:

- All explosive material will be packed and transported for sale or final disposal as per Explosives Regulations 2013.
- All organic overburden that was originally removed during construction phase and stored on site will be reinstalled over the disturbed surfaces.

4.5 Occupations

The site construction and operation phases of the project are expected to employ the following occupations, in accordance with the National Occupational Classification, 2016.

Construction Phase:

- 1 site foreman/supervisor – 7302
- 2 heavy equipment operator – 7521

Operations Phase:

- 5 wireline field supervisor – 8222
- 5 wireline operator – 8232

4.5.1 Hiring Practices

All work be carried out by direct hiring using the proponent's own employees. No contracting out is anticipated at this time.

All hiring is handle by Human Resources department under internal hiring policies and procedures.

4.6 Project Related Documents

Baker Hughes loading operations are supported by the following documentation:

4.6.1 Internal Procedures

- Explosives Handling, Storage and Usage Procedure
- Explosives Storage Procedure – Magazines
- Explosives Loading and Storage Areas Procedure
- Explosives Disposal Work Instruction
- Explosives Gun Loading Facility Work Instruction
- Wireline Explosives Safety Procedure
- Point of Use Assembly Work Instruction

4.6.2 Local Regulations and Standards

- Explosives Regulations 2013 (NRCan-ERD)
- Guidelines for Jet Perforating Gun Assembly Facilities (NRCan-ERD)
- CAN/BNQ 2910-500/2015 Explosives – Magazines for Industrial Explosives
- CAN/BNQ 2910-510/2015 Explosives – Quantity Distances

4.6.3 Site Specific Procedures and Protocols

- Site Security Plan
- Fire Safety Plan
- Key Control Plan
- Site Magazine Procedure
- Approved Authorized Personnel List

5.0 APPROVAL OF THE UNDERTAKING

Permits and approvals required to proceed with the undertaking will include approvals from the following agencies:

- Department of Fisheries and Land Resources (Crown Lands Division)
- Department of Fisheries and Land Resources (Forestry Division)
- Department of Fisheries and Land Resources (Fish and Wildlife Division)
- Department of Municipal Affairs and Environment
- Department of Natural Resources
- Service NL
- Service NL (under Protected Road Zoning Regulations for site access)
- Department of Transportation and Works
- Additional referral agencies as required by the above organizations.
- Natural Resources Canada – Explosives Regulatory Division (NRCan-ERD)

6.0 SCHEDULE

Proposed schedule:

- Registration Document Submission – December, 2019
- Government Review and Decision – February, 2020
- Construction Phase – March, 2020
- Operations Phase – April/May, 2020

7.0 FUNDING

Funding for this project will be solely provided for Baker Hughes Company.

8.0 SUBMISSION

DATE:_____

SIGNATURE:_____

NAME: Jennifer Parsons
Area Manager, Eastern Canada