Offshore Labrador Seafloor and Seep Sampling Program 2014-2019

Project Description

Aivek Stantec Limited Partnership

Prepared on behalf of:
TGS-NOPEC Geophysical Company ASA
and
Multi Klient Invest AS
(A Wholly Owned Subsidiary of Petroleum Geo-Services ASA)

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File No: 121511247

Final Report

February 4, 2014

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Abbreviations

C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CTD	Conductivity, temperature at depth
MBE	Multi-Beam Echosounder
MKI	Multi Klient Invest AS
SARA	Species at Risk Act
SBP	Sub-bottom profiler
TGS	TGS-NOPEC Geophysical Company ASA

1.0 Introduction

1.1 Background

TGS-NOPEC Geophysical Company ASA (TGS) and Multi Klient Invest AS (MKI), a wholly owned subsidiary of Petroleum Geo-Services ASA (PGS), are proposing to conduct seafloor and seep sampling exploration activities offshore Newfoundland and Labrador in the Labrador Sea. TGS will be the operator of the program.

Exploration activities are to be conducted in the Newfoundland and Labrador offshore area from the tip of Labrador to the Orphan Basin to identify those areas that have the potential to contain oil-bearing structures/basins. The proposed Project is a multi-year program (2014 to 2019) to be conducted within the Study / Project Area illustrated in Figure 1-1 (coordinates are provided in Table 1.1) and includes the following non-invasive research activities: sampling of natural seabed seeps, conducting seabed heat flow measurements, collection of shallow seabed cores, high-resolution bathymetry, sub-bottom profiles and collection of metocean data (specifically, basic conductivity, temperature and depth (CTD) data). The Project Area is synonymous with the Study Area for activities in 2014 to 2019. Given the restricted nature of the proposed Project (casting and retrieving fishing lines, lowering and raising a core sampler and lowering and raising a CTD meter), interactions with the environment and commercial fisheries will be limited.

TGS provides multi-client geoscience data to oil and gas exploration and production companies worldwide. In addition to extensive global geophysical and geological data libraries that include multi-client seismic data, magnetic and gravity data, digital well logs, production data and directional surveys, TGS also offers advanced processing and imaging services, interpretation products, permanent reservoir monitoring and data integration solutions. PGS acquires offshore seismic data for oil and gas companies.

1.2 Regulatory Framework

The activities proposed for this Project can be summarized as sampling of potential natural seabed seeps, collecting shallow seabed cores, conducting seabed heat flow measurements and collection of metocean data. According to the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB 2012)), an environmental assessment must be conducted on any proposed technical programs in the Newfoundland and Labrador Offshore Area. The limited nature of the proposed activities would suggest the requirement for a C-NLOPB review under the Accord legislation only. That is, based on the activities as described, an environmental assessment pursuant to the *Canadian Environmental Assessment Act, 2012* is not required.

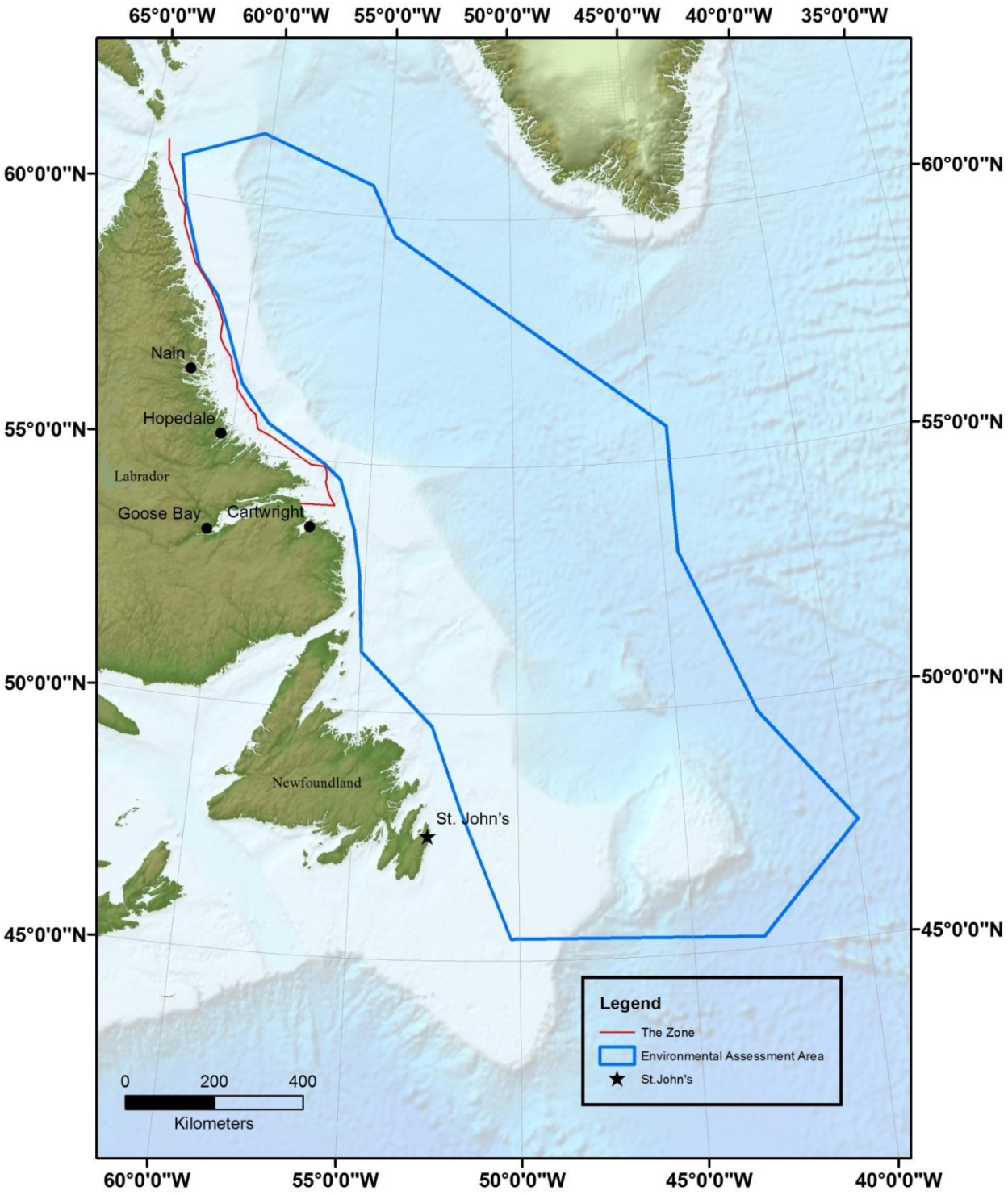

Figure 1-1 Multi-year Study / Project Area

Table 1.1 Multi-year Study / Project Area Coordinates (NAD 83, zone 22)

x (meters)	y (meters)
-180842.928	6798936.072
3669.673	6845685.895
249354.917	6728313.998
298094.094	6614423.47
908328.494	6187706.995
934190.099	5905716.038
1112734.638	5547632.282
1339521.016	5306423.086
1130638.826	5039352.285
557704.817	5033384.223
442322.274	5327311.305
380652.294	5511326.568
221006.619	5678432.321
216033.234	5860458.23
203599.77	5956941.908
173262.119	6067848.405
137453.743	6103159.442
11129.752	6194172.396
-47556.197	6284190.673
-84856.588	6422948.129
-102263.438	6483126.093
-142547.86	6455796.073
-174874.866	6694494.976

2.0 The Proposed Project

TGS is proposing to collect the following data in 2014:

- sampling of potential natural seabed seeps (by collecting water samples);
- conducting seabed heat flow measurements using a thermal probe for shallow seabed core locations;
- collection of seabed cores using a gravity core method;
- multi-beam bathymetry; and,
- sub-bottom profiling.

No metocean data will be collected in the first year (2014). Any combination of the data could be collected in 2015 to 2019.

2.1 Detection of Natural Seabed Seeps

Natural seeps accounted for 160,000 tonnes of the 260,000 tonnes of petroleum released into the marine environment in North America from 1990 to 1999 (National Academy of Sciences 2002). TGS is proposing to conduct a sampling program to identify areas of potential natural seabed seeps.

Samples to detect the presence of oil from natural seabed seeps will be collected with an AGI (GORE) or similar sampling kit. The sampler is hydrophobic (i.e., repels water) and can collect hydrocarbons from very thin oil layers in the water. The deployment / retrieval mechanism is basically fishing line (folding casting device, weighted bobbers and fishing line and hardware); the sampling containers are deployed by casting them out from the vessel. Laboratory analysis (by thermal desorption / gas chromatography/mass spectrometry) can detect approximately 100 compounds from C6 to C35, including key biomarkers (AGI 2013).

As TGS is proposing to collect samples along a pre-identified sampling design, rather than from a known oil seep, it is proposed that the sampler will be cast from the bow of the vessel, allowing the sampler to ride the bow wave of the vessel for five minutes as the vessel maintains a speed of 3.7 to 5.6 km/h (2 to 3 knots).

2.2 Heat Flow Measurements

The temperature of the substrate can give an indication of the potential for hydrocarbons beneath the surface. Heat flow measurements will be taken using a thermal probe mounted to the exterior of a gravity core barrel. The thermistors are placed along the length of the core barrel on an outrigger made of stainless steel double bands. This arrangement can indicate through temperature measurements whether a thermal gradient occurs within the substrate. Heat flow measurements are anticipated to be collected at up to 300 locations in 2014 with potential for additional sampling in subsequent years.

Fine, soft sediments (e.g., clays and silts) are required to achieve good penetration by the heat-flow probes. Prior to releasing the gravity corer to sample the substrate, a sub-bottom profiler will be used to determine if any subsurface hazards are present in the sampling area.

2.3 Core Collection

Substrate cores will be collected up to a depth of 3 m using a gravity corer. The gravity corer will be lowered to within 50 m of the substrate. Once positioned (and thermal probe acclimation is completed), the corer will be triggered to release and penetrate into the substrate. Once the core is retrieved, temperature will be recorded at set depths within the core. These temperature measurement supplement the data obtained from the thermistors. Gravity core samples are anticipated to be collected at up to 300 locations.

2.4 High-resolution Bathymetry

A Multi-beam Echosounder (MBE) will be used to collect data providing high-resolution bathymetry along a narrow strip. These types of data allow differentiation between pockmarks and iceberg plough marks on the seafloor. In addition, the resolution of the MBE data permits the identification of additional smaller pockmarks that cannot be resolved with existing seismic data. The MBE has also previously been used to image gas plumes rising from an active seep locality.

2.5 Sub-bottom Profiling

Data collected by a Sub-bottom Profiler (SBP) can image between 5 to 40 m of sediments below the seabed, with a typical 15 cm resolution between reflections. The SBP is a crucial instrument for identifying shallow gas anomalies (acoustic blanking), and any other anomalies in the layering of the reflections close to the seabed. Subsurface hazards, which can damage the sampling equipment, can also be identified on the SBP data with their characteristic hyperbolic reflections above the seabed.

The SBP is mounted on the hull of the vessel and consists of an array of transducers driven by a SES-2000 medium-100 top end system with up to 50 kW combined on all channels. The SBP is designed for offshore applications down to 2,000m water depth, with primary high frequency bandwidth of 90 to 115k Hz and a secondary low frequency bandwidth of 2 to 22 kHz; this is within the threshold (less than 246 dB measured 1 m from the energy source) stated in the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2012).

2.6 Study / Project Area

The Study / Project Area for the multi-year geotechnical data acquisition program is illustrated in Figure 1-1. The 2014 program focuses on the Labrador offshore area, specifically the Hopedale Basin, Saglek Basin, St. Anthony Basin and deepwater area of the Labrador Sea.

2.7 Vessel

As the geochemical data acquisition program is designed to collect information to be used in a basin model, accurate positioning data are key. The data will be collected using a vessel with dynamic positioning capabilities. The vessel will also be required to be able to deploy and retrieve the various sampling equipment proposed as part of the geochemical data acquisition program. And given the Study / Project Area (see Figure 1-1), the vessel will also be required to work in the harsh conditions of the Labrador offshore area and the northern Grand Banks / Orphan Basin / Flemish Pass / Cap areas.

TGS will ensure that a certified vessel will be used that is capable of working in Labrador Sea conditions. TGS will ensure the selected vessel will have equipment and protocols and procedures in place for prevention of pollution by oil, sewage and garbage in accordance with the Canadian Shipping Act and international standards and certification authorities. At no time will a survey vessel enter or attempt to conduct any survey work in restricted or protected areas.

TGS will consult with the FFAW on the location of their members who fish in the area and contact the local FFAW representative to provide information on the vessel movements during the survey program.

2.8 Schedule

TGS are proposing to conduct the natural seabed seep sample collection, heat probe and gravity core sample collection components of the research program in the open water / ice-free season of 2014. The program is anticipated to require 30 to 45 days to conduct all sample collection; TGS have scheduled an eight-week period to conclude the program, allowing for weather delays. Future programs (2015 to 2019) will be conducted in open / ice-free waters.

3.0 Environmental Setting

Given the generally non-intrusive nature of the proposed project, Project-environment interactions are anticipated to be few. If Project-environment interactions occur, the components of the environment most likely to be potentially affected by the proposed Project are species at risk, fish habitat (sediment) and commercial fisheries (vessel conflict).

The 2014 survey will be conducted both along the Labrador Shelf and in deeper waters in the Labrador Sea. Sea surface temperatures are warmest in August and coldest in March. Air temperatures are warmest in July-August and coldest in January-February. The average number of foggy days is highest from May to August. Seasonal sea or pack ice can occur from November to July, with the maximum southern extent occurring from February to the middle of March. Icebergs can occur from March to July, especially in the region nearest the Grand Banks (Husky Energy 2010; RPS Energy 2012).

A number of species at risk (as listed under the *Species at Risk Act* (SARA) or assessed as at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)) have the potential to occur throughout the proposed Study / Project Area (Figure 1-1), either as sporadic visitors or regular inhabitants. These include the following species listed on SARA Schedule 1: blue whale (Endangered); North Atlantic right whale (Endangered); leatherback sea turtle (Endangered); Ivory Gull (Endangered); white shark (Endangered); northern wolffish (Threatened); spotted wolffish (Threatened); Atlantic wolffish (Special Concern); fin whale - Atlantic population (Special Concern); Sowerby's beaked whale (Special Concern) and polar bear (Special Concern). Barrow's Goldeneye (Special Concern) and Harlequin Duck (Special Concern) are two primarily coastal species that could occur in the Study / Project Area. Eskimo Curlew (Endangered) is thought to be extinct.

Species assessed as at risk by COSEWIC (but are not listed on SARA Schedule 1) that could occur in the Study / Project Area include Atlantic cod - Newfoundland and Labrador population (Endangered), porbeagle shark (Endangered), cusk (Threatened), shortfin mako shark (Threatened), blue shark - Atlantic population (Special Concern), basking shark - Atlantic population (Special Concern), American plaice - Newfoundland and Labrador population (Threatened), roughhead grenadier (Special Concern), roundnose grenadier (Endangered), Atlantic salmon (various populations) (Endangered, Threatened, Special Concern), Acadian redfish (Threatened), deepwater redfish (Threatened). Spiny dogfish (Special Concern), harbour porpoise (Special Concern), killer whale (Special Concern), loggerhead sea turtle (Endangered), beluga whale (various populations) (Endangered, Threatened, Special Concern), bowhead whale (Eastern Canada – West Greenland population) (Special Concern), thorny skate (Special Concern), smooth skate - Funk Island population (Endangered) (note Hopedale Channel and Nose of the Grand Banks populations have been assessed by COSEWIC as Data Deficient; there is also a Flemish Cap population that is outside Canadian jurisdiction, but within the multi-year Study / Project Area), American eel (Endangered), northern bottlenose whale (Davis Strait-Baffin

Bay-Labrador Sea population) (Special Concern) and Atlantic bluefin tuna (Grand Banks of Newfoundland only) (Special Concern).

The Labrador Sea / Grand Banks / Orphan Basin / Flemish Cap is a highly productive ecosystem, with a spring phytoplankton bloom that starts in March and peaks in the spring, followed by a zooplankton bloom; there is another phytoplankton bloom that peaks in the fall

(C-NLOPB 2010). Corals are found in deeper waters (>200 m). Northern shrimp, snow crab and Greenland halibut are important commercial fish species occurring within the Study / Project Area. Coral aggregations found in the Labrador Sea (location of the 2013 survey) are located between Makkovik Bank and Belle Island Bank, Saglek Bank and Hatton Basin (C-NLOPB 2010) (note that the 2014 program will not be conducted in these areas).

Commercial fisheries in the Study / Project Area are focused primarily on northern shrimp, which accounts for approximately 85 percent of the harvest in NAFO 2GHJ (Husky Energy 2010), and approximately 60 percent of the harvest in 3KLMN and 2J (RPS Energy 2012). Shrimp spawn in the late summer and fall and are harvested using mobile gear (trawl). Snow crab mate in late winter and spring and are an important component in 3KLMN and 2J; they are harvested using fixed gear (crab pots). Greenland halibut is the other species most often harvested in the Study / Project Area and spawn during December to April; they are harvested using both fixed gear (gillnets and longlines) and mobile gear (otter trawls). These three species account for approximately 95 percent of the harvested fish in the Study / Project Area (C-NLOPB 2010, 2011; Husky Energy 2010).

The southern portion of the Study / Project Area includes the Orphan Basin, Flemish Pass / Cap and the northern Grand Banks. Ongoing oil and gas activities in these areas include exploration drilling, production platforms and seismic surveys.

DFO Research Vessel fall surveys were conducted for NAFO Areas 2H (first half of October 2013), 2H and 2J (second half of October 2013), 2J + 3K (first two weeks of November 2013), 3K (last two weeks of November 2013) and 3K + 3L Deep (first two weeks of December 2013); surveys are typically conducted in the same locations at similar times of the year (D. Power, pers. comm.). Other potential marine vessels in the Study / Project Area are DND and cruise ships. TGS will contact DFO prior to the start of their research program to determine if there are any research vessels in the area. TGS will contact DND to determine if there are any naval exercised scheduled during the proposed research program.

The Study Area is used by approximately 30 bird species. The Hawke Channel, edge of the Labrador Shelf and Funk Island have high densities during the breeding season, with many birds sharing breeding space. In the southern portion of the Study Area, the Flemish Pass, Orphan Basin and Sackville Spur have been identified as important areas to different bird species / groups.

Marine mammals (including baleen and toothed whales and seals) are common in the Study Area, especially in the summer, and polar bear are found in the northern portion of the Study Area. A number of these species (including polar bear) are considered to be at risk species by either SARA and/or COSEWIC.

Sensitive areas include a Marine Protected Area at Torngat Mountains National Park, Gilbert Bay, Gannett Islands Ecological Reserve, Important Bird Areas (none of which are inside the Study Area), the Bonavista Cod Box, the Placentia Bay-Grand Banks Large Ocean Management Area (and potential Ecological and Biological Sensitive Areas).

4.0 Health, Safety And Environmental Management

TGS is committed to leading the industry in minimizing the impact of its activities on the environment. This commitment is achieved by assessing our impact on those environments, planning operations to minimize those impacts, monitoring our performance against those plans, complying with applicable laws, regulations and guidance, monitoring the environmental performance of our contractors, and seeking means for continuous improvement.

TGS will ensure the selected vessel will have equipment and protocols and procedures in place for prevention of pollution by oil, sewage and garbage in accordance with the Canadian Shipping Act and international standards and certification authorities. Solid wastes, recyclables, hazardous materials and non-biodegradable materials will be stored and returned to shore for proper handling and disposal. At no time will a survey vessel enter or attempt to conduct any survey work in restricted or protected areas.

Transport Canada will conduct a Safety Inspection of the vessel in accordance with requirements of the C-NLOPB. TGS will have a representative on board the vessel to accompany Transport Canada during their survey.

TGS is committed to providing a safe and healthy workplace for its employees, contractors and clients while protecting the environment in which they work. TGS is dedicated to the continuous improvement of health, safety and security standards for its people and insists on the same policy from its contractors.

The company has defined safe operating procedures in the HSE Management System that are designed to meet or exceed all appropriate legal requirements and, in the absence of any defined standards, to meet or better generally-accepted, industry-wide "best operating practices". The company will actively participate with all client/contractor associations and relevant authorities in developing standards and promoting the image of the industry.

A high level of safety awareness shall be maintained by means of safety meetings, internal auditing, review meetings and general communications. All employees are actively encouraged to participate in the conduct and management of safety by means of achieving defined objectives and standards, which are regularly reviewed and appraised.

TGS requires all employees and contractors to be accountable for and committed to their own health and safety as well as for those with whom they work. Line management has the responsibility for the communication and implementation of TGS health and safety policies. Line management shall also ensure that employees have the appropriate training to enable compliance with health and safety requirements.

5.0 Stakeholder Consultation

TGS will to consult with the C-NLOPB during the preparation of the environmental assessment to ensure that all potential issues are addressed by the environmental assessment. The official start of the consultation process is initiated with the submission of this Project Description.

TGS proposes to meet with the FFAW/One Ocean in St. John's prior to the submission of the environmental assessment to provide details on the proposed Project to the commercial fishing community. TGS will also contact via phone or email any local FFAW staff representative as suggested / identified by the FFAW Petroleum Industry liaison.

TGS will also meet (preferably via teleconference) with the Nunatsiavut Government to provide information on the proposed Project, as the multi-year Study / Project Area parallels the Nunatsiavut Zone (The Zone). The Project will not include any sampling within The Zone.

6.0 References

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