APPENDIX Q

Additional Spill Response Information

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1.0 OVERVIEW OF EQUINOR CANADA'S 2017 OIL SPILL RESPONSE PLAN AND SPILL IMPACT MITIGATION ASSESSMENT

1.1 Oil Spill Response Plan

An overview of the Oil Spill Response Plan (OSRP) developed by Equinor Canada for the 2017 exploration drilling program is provided below and is intended to provide an overview of typical content in an OSRP, however, the content in the OSRP for this Project is subject to change.

- Objective
- OSRP overview and scope
- Regulatory context (e.g. C-NLOPB and federal legislation)
- Offshore oil spills (e.g. types of oil spills including blowouts and batch spills, fate of spilled oil, etc.)
- Oil spill response personnel (e.g. offshore and onshore personnel, contact resources, mutual aid, Tier 2 response equipment agreement)
- Oil spill response management (e.g. approach, incident command system, notification, response tiers, etc.)
- Offshore response actions (e.g. immediate actions, response options, monitoring, waste management, response options, etc.)
- Environmental considerations (e.g. seabird distributions, monitoring, handling, other wildlife, fisheries, socioeconomic considerations, environmental effects monitoring, etc.)
- Health and safety considerations (e.g. procedures, requirements, communications, meetings, risks, work permits, personal protective equipment (PPE), etc.)
- Oil spill response training (e.g. offshore and onshore personnel)
- Appendices:
  - Contact list (e.g. Equinor Canada emergency personnel, key contactors, oil spill consultants and contractors, government agencies, other offshore operators' emergency personnel, and Grand Banks offshore platforms and support vessels)
  - Notification procedures
  - Oil spill equipment
  - Vessel specifications
  - Oil spill fate
  - Oil spill trajectories
  - Oil spill waste management
  - Surveillance and observation procedures
  - Sorbent boom procedures
  - Sampling
  - Seabird handling procedures
  - Offshore seabird observation protocol

1.2 Spill Impact Mitigation Assessment

An overview of the SIMA developed by Equinor Canada for the 2017 exploration drilling program is provided below and is intended to provide an overview of typical content in a SIMA, however, the content in the SIMA for this Project is subject to change (Coelho et al. 2017):

- Background – Overview of the SIMA process and objective.
- Project Overview – Overview of the geological area of interest, physical environment and spill scenarios.
- Response Options – Response options are evaluated (i.e., benefits and limitations) for each spill scenario identified. The SIMA developed for the 2017 exploration drilling program identified the following response options: natural attenuation, on-water mechanical recovery, on-water in-situ burning, surface dispersant application, and subsea dispersant injection.
- Resources of Concern – Key resources are identified using physical, biological and socioeconomic data about the Project Area, which is outlined in the EIS. The SIMA developed for the 2017 exploration drilling program identified the following resources of concern: birds, fish, marine mammals, sea turtles, corals and sponges, commercial fisheries and responder safety.
- Risk Assessment – A risk assessment is completed by taking into consideration the response options, spill scenarios and resources of concern.

2.0 SPILL RESPONSE TACTICS

Table 16.1 of the EIS contains select information and environmental effects considerations for various spill response options. Additional information associated with mechanical containment and recovery, chemical dispersion and in-situ burning is provided in this Appendix for information.

2.1 Mechanical Containment and Recovery

As described in the SIMA (Coelho et al. 2017) on-water mechanical recovery typically involves the use of vessels, booms, and skimmers to contain and remove oil from the water surface. Once oil has been collected and removed, it must be stored in tanks on vessels, or in floating temporary storage devices such as towable bladders. Vessels pulling skimmers usually travel at speeds on the order of 1 knot, so the rate of oil encountered is relatively low. Once the oil storage devices are full, they must be returned to a shore operations base for offloading and recycling or disposal. Although there have been some advances in using night vision devices to support nighttime operations, on-water mechanical recovery is typically conducted only during the day, and in conditions with relatively good visibility. Monitoring to determine the effectiveness of mechanical recovery is limited to visual observations.

On-water mechanical recovery is hampered by weather restrictions, limitation to daylight operations, time required for deployment, and relatively low operational efficiency. Once equipment has been deployed, the low encounter rate and need to dispose of captured oil limit the effectiveness of this technique (Federal Interagency Solutions Group, 2010). Beyond the encounter rate limitations, weather conditions and day length would also be critical to examine for this area. For example, open water booming with associated oil skimming operations begins to fail in sea states with waves over approximately 2 m. In the Flemish Pass area, wave heights often approach this value during summer and are typically significantly higher in the winter. A shorter day length may reduce the hours of operation in the winter months, however with the use of remote sensing equipment it may extend operational hours. Even when sea states are conducive for on-water mechanical recovery operations, encounter rates in this region would tend to be low, likely yielding low recovery rates.

2.2 Chemical Dispersion

Dispersants do not remove oil from the environment and are meant to assist in the natural dispersion of oil from sea surface to the water column, which results in accelerated microbial degradation of spilled oil (Lee et al. 2013; AORSRT-JIP 2014; Coelho et al. 2017). Oil degradation is dependent on many factors including the biotic (e.g. microbial growth, enzymatic activity), abiotic (e.g. water temperature, water salinity, wind and wave energy, oxygen, nutrient levels), and quantity and type of hydrocarbons spilled (Coelho et al. 2017). Many of these factors are applicable regardless of the spill response option implemented.

Chemical dispersion, whether by surface application or subsea dispersant injection (SSDI), is generally the most effective means of removing significant quantities of oil from the surface quickly, thereby producing higher levels of environmental protection than other response strategies (Coelho et al. 2017). Since the chemical dispersants can be applied from aircraft or relatively fast vessels, the encounter rate for contacting surface oil is much faster than with other surface response methods (Coelho et al. 2017). By promoting dissipation of oil in the water column, dispersant-use reduces the potential for surface oil to reach ecologically sensitive areas (e.g., EBSAs, shoreline environments), but also temporarily results in elevated exposure of organisms to in-water concentrations of oil in the immediate area of treatment. However, research and monitoring has shown that these exposures are rapidly mitigated by effects of dilution and microbial degradation of the dispersed oil (Coelho et al. 2017). When used properly, dispersants can rapidly reduce the volume of oil on the sea surface and accelerate the natural bioremediation process.

Dispersant application can also reduce volatile organic compounds at surface, improving the safety of the working environment for responders.

Coelho et al. (2017) notes that the toxicity of dispersed oil in the water column is related to three factors:

1. Whether the concentration exceeds known acute or chronic toxicity thresholds for the oil type that was spilled
2. The length of time that the concentrations persist above toxic thresholds
3. The toxicological sensitivity of the species exposed to oil above the acute or chronic toxicity thresholds

The overall toxicity of dispersed oil is determined primarily by the toxicity of the oil, although through increased dissolution, dispersants make the oil more available to organisms in the water column. Exposure time and sensitivity of aquatic organisms (which can vary amongst life stages) also affect toxicity and effects (Coelho et al. 2017). Dispersed oil rapidly dilutes (Cormack and Nichols 1977; McAuliffe et al. 1980; Daling and Indrebo 1996; French McCay and Payne 2001; French McCay et al. 2006), and concentrations above known toxicity thresholds do not persist for more than a few hours after effective dispersant application. Thus, the potential for acute impacts to the environment from dispersed oil is limited in duration and space. In contrast, a surface slick has the potential to impact marine mammals and birds for many days and strand on sensitive shorelines.

Following surface application under typical conditions, concentrations of dispersed oil in the water column may approach 30 to 50 ppm in the upper 10 m of the water column, with concentrations diminishing to below 10 ppm within the first hour and to less than 1 ppm within a few hours. Thus, for surface dispersant application, exposures to organisms are relatively short-lived, and occur only in the upper few metres of the water column (Coelho et al. 2017). SSDI increases dispersed oil concentrations in deeper regions of the water column, potentially increasing interaction of benthic species with dispersed oil. However, in both surface application and SSDI, dispersion of oil results in accelerated microbial degradation of spilled oil (Lee et al. 2013; Coelho et al. 2017).

Research related to dispersants continues to evolve, and some research papers conclude that cold water inhibits dispersant effectiveness, while others conclude the opposite. A recent study that focused on the biodegradation of crude oil, with and without dispersants, in arctic waters with temperatures of -1°C concluded that there was evidence that the dispersant initially stimulated oil biodegradation and that the dispersant did not inhibit biodegradation (McFarlin et al. 2014).

Surface dispersant application typically involves using aircraft, spray-boom vessels, or booms mounted on the drilling installation to spray dispersants directly on the water surface (Coelho et al. 2017). Due to the application method, and with sufficient wave action, which is common in the Project Area, oil should disperse into the upper 10 metres (m) of the water column rapidly (Coelho et al. 2017). Surface application of dispersants is typically limited to daylight hours due to safety considerations (Nedwed at al. 2012).

Subsea injection is used when oil is released from a subsea fixed point and typically completed from a vessel equipped with dispersant storage, pumps and tubing that deliver dispersants to the release point (Coelho et al. 2017). Due to the injection occurring at the seafloor, the dispersed oil will dilute vertically and horizontally over a greater volume of water; this rapid dilution results in lower concentrations of dispersed oil compared to surface application (Coelho et al. 2017). Subsea injection has advantages compared to surface application such as, but not limited to, application not limited to daylight hours, reduction in the amount of oil coming to surface which may reduce response workers to potential volatile components and also reduces exposure to marine and migratory birds, reduced amounts of dispersants required and more precise application (Nedwed at al. 2012).

Spill response measures such as mechanical recovery and ISB are limited by environmental conditions (e.g. wave height), while dispersants are more effective in these conditions (Nedwed at al. 2012). As described in Coelho et al. (2017), the limitations on effectiveness of surface dispersant application in the study area are primarily related to weather, and the conditions in which aircraft, spray-vessels or platform-mounted spray boom can be used safely. Aerial application requires daylight, and good visibility, while vessel-mounted spray brooms require a safe sea state. High wind and wave conditions not only affect the safety of surface dispersant operations, they also affect the efficacy of dispersants. At wave heights above 4 m, breaking waves entrain oil in the water column, and prevent appropriate interaction between the oil and the dispersant.

In general, dispersant use has a net environmental benefit for migratory birds that could encounter surface oil. However, dispersant use in close proximity to various species may reduce surface tension at the feather-water interface thereby reducing the capacity of insulation provided by feathers (refer to Section 16.7.5.3 for a discussion of effects of oil on thermoregulation). The magnitude of these effects depends on the proximity of wildlife during dispersant application as well as the effectiveness of the dispersant on the surface oil (National Research Council 2005).

Equinor Canada will not use dispersants without prior regulatory approval. If dispersant use is advisable in the event of a spill (as informed by a SIMA process), Equinor Canada will seek approval from the C-NLOPB Chief Conservation Officer, in accordance with the Accord Acts. With the amendments made to the *Canada-Newfoundland and Labrador Atlantic Accord*

Implementation Act through the implementation of the *Energy Safety and Security Act*, the C-NLOPB will be able to conditionally approve the use of one or more of the spill treating agent products listed in the *Regulations Establishing a List of Spill-treating Agents* (*Canada Oil and Gas Operations Act*) to respond to an oil spill.

Corexit® 9500A, the primary spill treating agent used during the Deepwater Horizon incident spill response effort, along with Corexit® EC9580A, are currently the only spill treating agents approved for use in Canada. The intended use for Corexit® EC9580A is to treat substrates.

Prior to approval of these spill treating agents, ECCC conducted scientific testing focusing on assessing toxicity and effectiveness. Both Corexit® 9500A and Corexit® EC9580A were found to be highly effectives spill treating agents and determined to have low toxicity in aquatic toxicity tests (Environment Canada 2016). In recognition that there is a potential for increased exposure to components of oil by aquatic organisms following the use of dispersants, ECCC stressed the need for consideration of net environmental benefits when making a determination for approval of dispersant use during a spill (Environment Canada 2016). The SIMA will therefore play a key role in advising dispersant use and approval conditions, taking into account site-specific and incident-specific considerations.

2.3 In Situ Burning

On-water ISB is similar to on-water mechanical recovery in that it involves collection and concentration of oil on the surface using vessels and booms (Coelho et al. 2017). A key difference is that the booms used to collect oil must be fire resistant. Once oil is collected (and concentrated until it reaches a thickness that will support combustion), it is ignited using flares, torches, or improvised ignition devices. The collected oil will burn as long as an oil thickness of 2 – 5 mm continues to be maintained (IPIECA, 2016). Like mechanical recovery, in order to implement ISB as a response option, various factors must be met, including ideal wind and wave conditions, minimum thickness of oil to support combustion, and containment of the oil by booming. Herding of the oil is often required, which involves the application of chemical herders to the surface oil. There is one herder approved for use in Canada pursuant to the *Regulations Establishing a List of Spill-treating Agents* (*Canada Oil and Gas Operations Act*) (SOR/2016-108). If ISB is implemented as a response measure, weather conditions present must be favourable. However, if the burn had to be extinguished due to changing weather conditions, safety reasons, or an insufficient oil thicknesss, an incomplete burn situation would occur. If incomplete burning occurs and oil remains present on the sea surface, other response measures may have to be employed.

As described in the SIMA (Coelho et al. 2017) ISB has many of the same limitations that on-water mechanical recovery has with respect to speed, weather, and daylight. Oil must first be collected using vessels and booms so the encounter rate is relatively low. In addition, specialized “fire boom” must be used, which is not widely available in Eastern Canada.

In this region, the most significant limitation is wave height. ISB is more sensitive to wave height than mechanical recovery since the booms must concentrate oil to a much greater thickness to burn and this wave action is disruptive to combustion. Effective ISB requires wave heights typically below 1 m and wind speeds below 10 knots (IPIECA 2016). On-water ISB has been used once as a response method, for the DWH incident, on sea states that were essentially flat (Federal Interagency Solutions Group, 2010). For the summer season, wave heights in the Flemish Pass region are typically +1.8 m, so it is unlikely that ISB operations could be maintained on a daily basis. For the winter season, high wave heights and wind conditions would not typically support ISB.

Even when sea states are conducive for ISB operations, ISB encounter rates in this region would tend to be low, likely yielding low recovery rates. For the purposes of this SIMA, ISB is included as an option for the Tier 3 summer event. However, weather conditions would not support the Tier 3 winter event and logistic constraints will also eliminate ISB from consideration for any season Tier 1 event.

There are environmental aspects associated with ISB that must be considered when determining the most effective and efficient spill response measure, including, but not limited to, atmospheric emissions, residual oil residue, in-water toxicity, potential effects on surface microlayer of water. These are described below.

Atmospheric Emissions

During ISB, smoke plumes would be produced, which consist of small carbon particles that disperse into the atmosphere, and air monitoring may be required due to the proximity of response workers. However, the plumes the plumes are anticipated to dissipate before reaching any land masses (Coelho et al. 2017).

When ISB occurs, the burned oil is typically converted to the following (Ferek et al. 1997):

- 85 to 95% - carbon dioxide and water
- 5 to 15% - not efficiently burned due to lack of oxygen and becomes particulate
- 1 to 3% - combustion by-products (e.g., nitrogen dioxide, sulphur dioxide, carbon monoxide)

The Newfoundland Offshore Burn Experiment (NOBE) was completed in the Grand Banks area in August 1993, and in conjunction with various Canadian and American regulatory agencies (e.g., ECCC, CCG, United States Environmental Protection Agency (USEPA), United States Coast Guard (USCG)), operators (e.g., Imperial Oil Limited, Hibernia Management Development Company Ltd.) and petroleum associations / institutes (e.g., American Petroleum Institute, Canadian Association of Petroleum Producers) (Fingas et al. 1994). More than 200 sensors or samplers were deployed to collect quantitative data associated with the NOBE, which determined that emissions produced were less than anticipated (Fingas et al. 1994). The measured parameters were determined to be below occupational health exposure levels within 150 m from the burn (Fingas et al. 1994).

Burn Residue

When ISB occurs, there is typically an oil residue that remains on the surface. A controlled test burn during a tanker incident in Alaska spill resulted in a burn residue that remained on the sea surface and was easily removed (Allen 1990); however, burn residues from a tanker incident in Italy were found to sink (Moller 1992). There was another test burn completed in Alaska and it was observed that the burn residue floated initially and sank when cool (Buist 1995). According to the National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration, burn residues have little to no acute aquatic toxicity, however, benthos may be affected from smothering (NOAA 2018).

Direct Temperature Effect

The NOBE collected temperature data at several points on the fire-resistant boom using thermocouples and concluded that there was no increase in water temperatures, even though the temperatures at the top of the boom reached 1000°C (Fingas et al. 1994).

Water Column Toxicity

The NOBE analyzed water under the burn and determined that concentrations of parameters of concern were low and similar to background levels (Fingas et al. 1994). Toxicity testing of the water was also completed but was too low to be measured using currently available toxicity tests (Fingas et al. 1994). Environment Canada, however, completed additional experiments in a laboratory testing and concluded that toxicity of water under the burn area increased. It was determined that the increase was similar to the toxicity of an unburned oil slick (Daykin et al. 1994).

Effect on the Surface Microlayer

The Alaska Department of Environmental Conservation (ADEC), USCG and USEPA developed the In Situ Burning Guidelines for Alaska, and outlined the importance of the surface microlayer, which is the upper millimetre or less of the water surface that is deemed habitat for many sensitive life stages of marine organisms (e.g., fish eggs/larvae) (ADEC et al. 2008). Most of studies on the surface microlayer have been completed in areas nearshore, however, some studies have focused on areas offshore and found that densities of larvae were similar to those found in nearshore environments (ADEC et al. 2008). If ISB occurs the area would be relatively small, compared to the remainder of the offshore environment, and therefore it is expected that a rapid renewal of the surface microlayer from adjacent areas would occur, and the long-term net loss of biomass would likely be minimal or non-existent (ADEC et al. 2008).

3.0 SPILL RESPONSE CONTRACTORS AND AGENCIES

Section 16.1.2.3.2 of the EIS contains information regarding spill response contractors and agencies, however, additional information is provided on the East Coast Response Corporation (ECRC) and the mutal aid agreement.

3.1 ECRC

ECRC is a certified response organization under the Canada Shipping Act, 2001, which is privately owned through membership agreements with individual operators including Equinor Canada. ECRC provides marine oil spill response services acting under the direction of an On-Scene Commander of the “responsible party”, providing a plan of action, equipment, resources, and operational management in the clean-up effort. ECRC maintains oil spill response equipment in six ECRC locations, including one in St. John’s, Newfoundland and Labrador (NL).

As detailed in the C-NLOPB’s Schedule of Wells (C-NLOPB 2018), Equinor Canada has executed drilling activities offshore NL since 2008; all but one of which were outside the 200 NM EEZ. Equinor Canada has several contractual arrangements established to ensure full Tier 2 oil spill response capability, within the Canada EEZ and on the high seas on the outer Canadian continental shelf (outside of the EEZ). In addition to Equinor Canada’s current valid agreement with ECRC, specific contractual arrangements are in place that provide access to Tier 2 oil spill response equipment from the Grand Banks Production Operators and ECRC qualified subcontractors for deploying and operating this equipment.

Equinor Canada recognizes that the geographic area of responsibility for ECRC, as a Transport Canada approved response organization under the CSA precludes ECRC sub-contracted personnel and ECRC owned equipment from mobilizing for spills originating outside the EEZ, unless specifically authorized by Transport Canada to do so. However, specific arrangements are in place with ECRC for the mobilization of equipment and personnel to locations outside the EEZ. Under specific contractual arrangements, ECRC maintains and stores the operator-owned

Tier 2 equipment without limitations associated with the CSA regarding location of use. Support vessels used to deploy the equipment would be under direct contract to Equinor Canada and therefore not limited by any aspect of the CSA. From a personnel perspective, ECRC would use qualified subcontractors as supervisors on Equinor Canada-provided vessels to deploy and supervise the use of operator-owned Tier 2 equipment, with the assistance of vessel crews. These subcontractors are contracted through a third-party arrangement, and not directly through ECRC, and therefore they may be deployed outside the EEZ. Post-spill management by ECRC that occurs onshore is unaffected by the location of the spill (i.e. inside or outside of the EEZ).

3.2 Mutual Aid Agreement

Equinor Canada is a participating operator to a mutual aid agreement between active operators in the Grand Banks. The agreement allows operators to provide assistance to each other in the event of an emergency. The current parties in the mutual aid agreement include Hibernia Management Development Company Ltd., Suncor Energy, Husky Energy, ExxonMobil Canada Ltd and Equinor Canada. Assistance provided by other operators will depend on the situation, however, it may include providing weather and/or oceanographic information, MedEvac support, personnel, vessels, equipment and other resources to assist during an emergency response operation. To utilize other operators' resources in the event of an emergency, a notice and informal request is required to be made, which is typically by telephone. Formal written confirmation is also completed by the operator's Incident Commander. Under the mutual aid agreement each operator agrees to use reasonable effort to make the available designated resources available, however, resources will only be provided to the extent that the responding operator's operation is not jeopardized, or its personnel or facilities are put at risk.

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