Tilt Cove Exploration Drilling Program

Chapter 8 – Atmospheric Environment and GHG VC

Prepared for:
Suncor Energy

Prepared by:
Stantec Consulting Ltd.
141 Kelsey Drive
St. John's, NL A1B 0L2
Tel: (709) 576-1458
Fax: (709) 576-2126

File No: 121417383

April 2023

Table of Contents

LIST OF TABLES

8.0 ATMOSPHERIC ENVIRONMENT

The constituents of the atmospheric environment are essential to sustain life and maintain the health and well-being of humans, marine ecosystems, wildlife, vegetation and other biota. The atmospheric environment is also a pathway for the transport of air contaminants to marine, freshwater, terrestrial and human environments.

The EIS guidelines indicate the Atmospheric Environment includes greenhouse gas, air quality, noise and lighting. These components include::

- Emissions to the atmosphere from the Project which may present a pathway for humans and biota to be exposed to air contaminants
- Releases of GHGs and their accumulation in the atmosphere which contribute to global climate change and may affect emission reduction targets for GHGs that have been set or are being developed federally and provincially
- Emissions of sound, where unwanted sound (noise) has potential to affect nearby receptors
- Lighting, as it has potential to affect nearby receptors

Atmospheric emissions of air contaminants and GHGs will be generated by the following key Project-related activities:

- Fuel combustion from engines associated with the MODU, supply vessels, and helicopters (i.e., exhaust emissions)
- Potential flaring during well test activity, in the event that well testing is required

Emissions from these key activities will include air contaminants (carbon monoxide [CO], sulphur oxides [SO_X], nitrogen oxides [NO_X], particulate matter [PM], volatile organic compounds [VOCs]) and GHGs (carbon dioxide [CO_2], methane [CH_4], and nitrous oxide [N_2O]).

To compare the potential point source air contaminants from operations, the criteria air contaminants for this Project were estimated and compared with data from the National Pollutant Release Inventory (NPRI) for the producing assets in the area. The reporting program for criteria air contaminants (CO, SOX, NO_X, PM, and VOCs). GHGs (CO_2, CH_4, and N_2O) are discussed in Section 8.4.2.

The potential environmental effects on air quality, ambient sound quality, and lighting during Project activities have been acknowledged. Ambient sound quality and lighting components of the atmospheric environment are typically assessed based on the effects on sensitive human-based receptors using quantitative measures such as percent highly annoyed (as per Health Canada (2017) Guidelines) for sound quality, and light trespass, glare, and sky glow (as per the International Commission on Illumination) for artificial lighting. However, due to the remote nature and marine setting of the proposed Project, the Project is not anticipated to cause a substantive change in air contaminants, sound emissions or lighting as it relates to human receptors. As a result, potential changes in the air contaminants, acoustic environment and lighting are not considered further in this chapter. The potential effects of sound and lighting on other receptors (e.g., marine fish and marine birds) are addressed elsewhere in the EIS, in the relevant VC

chapters. However, information on air contaminant point source emissions from Project activities are presented in Section 8.1.

Given the importance of climate change, GHGs have been included as a VC due to release of GHGs and their accumulation in the atmosphere. GHGs influence global climate and may affect Canada's and NL's ability to meet emission reduction targets for GHGs that have been set or are being developed federally and provincially.

8.1 POTENTIAL PROJECT AIR QUALITY EMISSIONS

Information is provided in the following sections on the air quality emissions potentially generated by the Project and the current regulatory standards are provided for context.

8.1.1 Regulatory Standards

Since the Project is located offshore, there are no air quality regulations that apply directly to the Project or to the offshore environment. The provincial and the federal air quality regulations are discussed below for context. Suncor will comply with all applicable guidance and regulations that are released during the term of this project.

Ambient air quality in the province of NL is regulated by the *Air Pollution Control Regulations (2004)*, administered under the Environmental Protection Act (O.C. 2004-232). Ambient air quality standards for several air contaminants are prescribed in Schedule A of the Regulation.

The National Ambient Air Quality Objectives (NAAQOs) under the *Canadian Environmental Protection Act* were established by the federal government in the early 1970s to protect human health and the environment by setting objectives for the following common air pollutants, among others: CO, nitrogen dioxide (NO_2), ozone (O_3), SO_2, and total suspended particulates. The objectives are denoted as "Desirable", "Acceptable" and "Tolerable" ranges for ground-level concentrations of air contaminants. As O_3 is a secondary species that would not be directly emitted from Project activities, it has not been considered in the assessment.

More recently the Canadian Ambient Air Quality Standards (CAAQS) are being implemented to reduce emissions and ground-level concentrations of various air contaminants nationally. The CAAQS have been endorsed by the CCME for SO_2, fine particulate matter ($PM_{2.5}$), O_3, and more recently, for NO_2. These CAAQS are adopted for the 2020 to 2025 period and are lowered beyond 2025.

The CCME has yet to publish a guidance document on the procedures and methods that one should follow to determine if measured concentrations of SO_2 or NO_2 exceed the CAAQS. However, it is our understanding of the federal guidance that model predictions should not be directly compared to the CAAQS, because these are intended to be compared with measured ambient air quality data and are not considered directly applicable to industrial fence-line concentrations (Canadian Council of Ministers of the Environment [CCME] 2019).

The Canada Wide Standards are based on intergovernmental agreements developed under CCME Canada-wide Environmental Standards Sub-Agreement, which operates under the broader CCME Canada-wide Accord on Environmental Harmonization. The Canada Wide Standards are intended to address key environmental protection and health risk issues that require concerted action across Canada.

The Canada Wide Standards represent cooperation toward a common goal, but confer no specific authority to any federal, provincial, or territorial government.

Marine engines are subject to NO_X limits set by the International Maritime Organization (IMO) of the United Nations, with Tier II limits applicable in 2011 and Tier III limits applicable in 2016 in Emission Control Areas, which include the Canadian coast to the 200-nm (370 km) limit. On January 1, 2015, the sulphur limit in fuel in the Emission Control Areas in large marine diesel engines was reduced from 1.0% to 0.1% in accordance with the *Vessel Pollution and Dangerous Chemicals Regulations* under the *Canada Shipping Act*.

8.1.2 MODU Emissions

As described in Chapter 2, over the term of the Project, 12 to 16 wells could be drilled. The length of drilling and associated activities may be 45 to 120 days for each well drilled with the potential to occur year-round (360 days). For the purposes of estimating emissions from the operation of the MODU, the TransOcean Barents semi-submersible drill rig data was used. Emissions were estimated using 2018 fuel consumption data provided by Suncor (i.e., 16,200 m^3 of diesel fuel annually). The TransOcean Barents uses dynamic positioning to maintain the MODU in position and has eight Rolls Royce (Bergen Diesel) engines with a rated power of 7,066 hp, 720 rpm, each driving one Alconza/NIR 10092A-10QLV 6,235 kVA AC generator (TransOcean Barents Specifications; TransOcean 2019).

Emission factors from the European Environment Agency (EEA) (2016) were used to estimate atmospheric emissions from MODU operations. The emission factors used and the emission estimates are provided in Table 8.1. The following assumptions were applied in the estimation of emissions from the operation of the MODU:

- The sulphur content of the fuel will be 0.1%
- Evaporation in diesel engines is negligible, and therefore only exhaust emissions have been considered
- Annual fuel consumption will be consistent with 2018 operational data, at approximately 16,200 m^3 of diesel per year

Table 8.1 Estimates of Air Contaminant Emissions from MODU Operations

Air Contaminant	Emission Factor (kg/tonne)	Emissions (tonne/year)[a]
CO	7.4	112
NOx	78.5	1,192
SO_2	2	30.4
TPM	1.5	22.8
VOC	2.8	42.5

Note:
[a] Assumed that drilling could occur up to 360 days per year

8.1.3 Vertical Seismic Profiling Emissions

The potential interactions between the atmospheric environment and VSP are primarily from the combustion of fuel from the vessels. Emissions from VSP vessels would be similar in magnitude as those from the other vessels (refer to Section 8.1.5.1).

8.1.4 Well Testing and Flaring Emissions

Atmospheric emissions may be generated from flaring activity if well flow testing is carried out. If hydrocarbons are discovered during an exploration drilling program, well evaluation and possible testing would be conducted to help determine the commercial potential of the reservoir and the viability of a prospect. Well flow testing requires flaring to safely dispose of gases or other hydrocarbons that come to surface. Flaring will be via one of two horizontal burner booms, to either a high efficiency burner head for liquids, or simple open-ended gas flare tips for gases. High efficiency combustion equipment will be used that maximizes complete combustion, thereby reducing the likelihood of black smoke in flaring activity and drop-out of un-combusted hydrocarbons liquids on to the sea surface.

Well flow testing, if it is conducted, has a duration that is typically short (limited to a period of 36-hrs) and occurs at the end of the drilling program. The activity within this period will vary and it is likely that flaring will be required intermittently. The duration of flaring activities for operational purposes, such as flushing or bleeding, with low flow rates, is typically 36-hours per flaring event. The amount of time flaring, if required, in a well flow test operation will be reduced where possible but will require sufficient time to collect necessary datasets. If well flow testing is required, testing would be conducted over the one-month period (after drilling is complete) on every third well, or one well a year, depending upon the hydrocarbons discovered.

Emissions from well testing (flaring) were estimated using the volume of fuel flared and emission factors / guidance from the Australian Government National Pollutant Inventory (2010). The emission factors and the emission estimates are provided in Table 8.2. The following assumptions were applied in the estimation of emissions from well testing and flaring:

- The maximum volume of oil brought to the surface during a 36-hour well test would be 10,000 barrels (bbls), which would result in approximately 113,267 m^3 of gas flared
- If required, only every third well would require well flow testing, for a maximum of only one well per year

Table 8.2 Estimates of Air Contaminant Emissions from Well Testing and Flaring

Air Contaminant	Emission Factor (g/GJ)	Emissions (tonne/year)[a]
CO	70.8	0.32
NO_x	15.5	0.07
SO_2	-	-
TPM	27.4	0.12
VOC	32.0	0.14

Note:
[a] Assumed that only one well would be tested annually

8.1.5 Supply and Servicing

The Project will involve marine vessel and helicopter use, including support traffic to, from, and within the Project Area at all times of the year during the life of the Project. Supply and servicing activities may affect the atmospheric environment as a result of the emissions from vessel and helicopter use within, and during transit to and from, the Project Area.

8.1.5.1 Supply and Standby Vessels

The MODU operations will be supported by two full-time support vessels (standby and supply). The MODU will be located somewhere within the area of the EL. The furthest distance a supply vessel will travel is from the onshore supply base to the most distant boundary of the EL, which is 300 km. The supply vessel emissions will depend on the type of vessel, the age of the vessel and the transit speed. It has been estimated based on information provided by Suncor that, on average, two support vessels will combust approximately 6,243 tonnes of fuel per year (3,872 t consumed by supply vessel, 2,372 t consumed by standby vessel).

Atmospheric emissions from the supply and standby vessels were estimated based on fuel consumption and emission factors from the US EPA (US EPA 2009), The emission factors used and the emission estimates from the operation of the vessels are presented in Table 8.3. The following assumptions were made when estimating the emissions from vessels:

- There will be the equivalent of two full-time support vessels
- The vessels will combust marine diesel
- The sulphur content of the fuel will be 0.1% in accordance with the *Vessel Pollution and Dangerous Chemicals Regulations* under the *Canada Shipping Act, 2001*
- Evaporation in diesel engines is negligible, and therefore only exhaust emissions have been considered
- Emissions will meet IMO-relevant regulations and emission limits under MARPOL

Table 8.3 Estimates of Air Contaminant Emissions from Vessels

Air Contaminant	Emission Factor (kg/tonne)	Emissions (tonne/year)[a]
CO	7.4	46.2
NO_X	78.5	490
SO_2	2	12.5
TPM	1.5	9.36
VOC	2.8	17.5

Note:
[a] Assumed that drilling could occur up to 360 days per year

8.1.5.2 Helicopters

It is anticipated for helicopters to transport crew to and from the MODU, 6 out of 7 days a week, for a total of 313 round trips per year. The furthest distance that the helicopter will travel from St. John's to the MODU is 300 km, based on the most distant boundary of the EL. On average, Suncor estimates a helicopter would consume 584 tonnes per year of helifuel.

Atmospheric emissions from the helicopters were estimated using fuel consumption and emission factors from Swiss regulatory sources (Swiss Confederation 2015). The emission factors and emission estimates for the operation of helicopters are provided in Table 8.4. The following assumptions were made when estimating the emissions from helicopters:

- Each one-way trip will take one cruising hour
- There are 1,252 landings / take-offs per year
- Evaporation in diesel engines is negligible, and therefore only exhaust emissions have been considered
- The sulphur content of aviation fuel is assumed to be 4,000 ppm, or 4 g/kg
- All sulphur is converted to SO_2

Table 8.4 Estimates of Air Contaminant Emissions from Helicopters

Air Contaminant	Emission Factor		Emissions (tonne/year)[a]
	g/ landing and take-off	kg/hr (during transit)	
CO	524.5	1.1	1.35
NO_X	1,066	10.6	8.0
SO_2	790	5.88	4.67
TPM	28.9	0.271	0.21
VOC	419.1	0.91	1.09

Note:
[a] Assumed that drilling could occur up to 360 days per year

8.1.6 Summary

The total estimated air contaminant emissions from Project activities are presented in Table 8.5.

Table 8.5 Estimates of Air Contaminant Emissions from the MODU, Support Vessels, Helicopter and Well Testing (Flaring)

Source	MODU	Vessels	Helicopters	Well Testing	Total Emissions (per year including well testing)
CO (tonnes per year)	160	46.2	1.35	0.32	208
NO_X (tonnes per year)	1,690	490	7.96	0.07	2,188
SO_2 (tonnes per year)	47.5	12.5	4.67	-	64.7
TPM (tonnes per year)	32.5	9.36	0.21	0.12	42.2
VOCs (tonnes per year)	61.2	17.5	1.09	0.14	80.0

The total annual emissions from the Project were estimated based on the assumption that three to four wells could be drilled per year and drilling could occur up to 360 days per year, with one well being tested per year, if required.

Criteria air contaminant information obtained from the National Pollutant Release Inventory (NPRI) for the 2019 and 2021 reporting years (ECCC 2022c) for offshore production platforms in NL is presented in Table 8.6. Most of the annual air contaminant emission estimated from this Project were lower than the nearby platform air contaminants for CO, TPM, and VOCs comparable to those reported from the nearby production platforms for NOx (Hibernia and Hebron) and SO_2 was estimated for the MODU based on the combustion of diesel with 0.1% sulphur content by weight and assumes that all is converted to SO_2, whereas existing production platforms would be primarily combusting natural gas. The SO_2 release threshold criteria for NPRI reporting is 20 tonnes; therefore, the production platforms would not report if under this threshold. It is assumed this is for why SO_2 was not reported.

Table 8.6 Project Predicted and Nearby Platform Reported Annual Air Contaminant Emissions (National Pollutant Release Inventory 2019 (for Terra Nova) and 2021 – Preliminary Data)

Project/Platform	Annual Emissions (tonnes/year)						
	CO	NO_X	SO_2	TPM	PM_{10}	$PM_{2.5}$	VOC
Suncor (MODU)	112	1,192	30.4	22.8	-	-	42.5
SeaRose FPSO	380	2,394	-	90.6	90.4	90.3	396
Terra Nova FPSO*	441	2,347	-	121	117	117	336
Hibernia	1,549	1,054	-	152	152	152	418
Hebron	722	1,124	-	60.0	59.7	59.5	657

Note: *2019 is the last representative year for comparison.
ECCC 2022c
Project emissions include those from the MODU.

8.2 GREENHOUSE GASES SCOPE OF ASSESSMENT

8.2.1 Regulatory and Policy Setting

Greenhouse Gas Emission Reduction Targets and Regulatory Criteria

Suncor (2022) has a corporate GHG emission goal of reducing their emissions by 10 megatonnes by 2030 across their value chain. This is a step towards the longer-term objective of net zero by 2050. Suncor's strategy is to be Canada's leading energy company by growing our business in low GHG fuels, electricity, and hydrogen while sustaining and optimizing our existing hydrocarbon business and transforming our GHG footprint. This strategy is enabled by our expertise, long-life resources, integrated business model, strong connection to customers, and world-class environment, social and governance (ESG) performance. To achieve this goal, Suncor is focusing on:

- Reducing scope 1 and 2 emissions through base business improvements
- Growing low-emissions energy businesses in renewable fuels, electricity, and hydrogen to address scope 2 and 3 emissions
- Working with others to reduce value chain emissions, including scope 3.

In addition to Suncor's internal targets, Newfoundland and Labrador has provincial and Canada has federal GHG emission reduction targets. The provincial Climate Change Action Plan (Gov NL 2019) identifies the following GHG reduction target:

- A 30% reduction in provincial GHG emissions below 2005 levels by 2030.

The Government of NL has also passed a motion committing the province to achieve net zero carbon emissions by 2050 (Newfoundland and Labrador Oil and Gas Industrial Association 2020).

On a federal level, Canada has committed to GHG emission reduction targets as follows (ECCC 2022a):

- 40% to 45% reduction of national GHG emissions below 2005 levels by 2030, replacing the former target of a 30% reduction of national GHG emissions below 2005 levels by 2030 (the 2015 submission to the United Nations Framework Convention on Climate Change, under the Paris Agreement)
- Legislation for net zero emissions by 2050

To support the initiatives and facilitate achieving the GHG reduction targets, the federal government developed the Pan-Canadian Approach to Pricing Carbon Pollution, providing flexibility to provinces and territories to develop carbon pollution pricing systems of their own, and outlining the required criteria for these systems (ECCC 2021). For provinces and territories that have not implemented jurisdictional carbon pollution pricing systems that would meet the federal benchmark requirements, they are required to comply with the federal carbon pollution pricing system.

The Province of NL created the Made-in-Newfoundland and Labrador Carbon Pricing Plan (Newfoundland and Labrador Department of Municipal Affairs and Environment 2018), which was approved by the federal government in October 2018 to meet the requirements of the Pan-Canadian Approach to Pricing Carbon Pollution. The plan consists of a hybrid system containing performance standards for large emitting facilities and large-scale electricity generation, and a carbon tax on fuel combustion, as outlined below:

- Emission reduction targets from a baseline emission intensity for industrial facilities emitting more than 15,000 tonnes carbon dioxide equivalent (CO_2e) annually under NL's *Management of Greenhouse Gas Regulations* (NL Reg. 116/18, amended by 80/21). This requires the industrial facilities to reduce their GHG emissions under their baseline in the fourth year of production and to reduce the emissions by 12% under their baseline in year 8 of production and subsequent years.
- Carbon tax imposed by authority under NL's *Revenue Administration Act (2011)* and the *Revenue Administration Regulations* (NL Reg. 73/11, amended by 17/22). The carbon price was introduced on January 1, 2019 at $20 per tonne of CO_2e. In 2022, the price increased to $50 per tonne of CO_2e.

Offshore exploration drilling activities are subject to the NL *Management of Greenhouse Gas Reporting Regulations* (NL Reg. 14/17, amended by 18/21) (Section 4.2) under the *Management of Greenhouse Gas Act* (2016). Depending on the annual quantity GHG emissions released to the atmosphere, the Project may be required to report annual GHG emissions to the provincial government.

8.2.2 The Influence of Consultation and Engagement on the Assessment

There has been ongoing consultation and engagement on exploration drilling offshore eastern Newfoundland. This has been occurring either through Suncor directly, or through EA processes involving other projects and proponents. Key issues and concerns related to the GHGs and potential environmental effects have been identified through consultation and engagement. The conversations were general and around climate change (both its effects on operational considerations (e.g., ice management) and as well as in relation to cumulative effects).

8.2.3 Potential Effects, Pathways, and Measurable Parameters

Routine Project activities have the potential to interact directly with the atmospheric environment in the release of GHGs such as carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O).

The key potential environmental changes and possible environmental effects on the atmospheric environment are summarized in Table 8.7, along with the identification of key parameters through which these Project-related changes and effects may be reflected.

Table 8.7 Potential Effects, Effects Pathways, and Measurable Parameters for Atmospheric Environment

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
GHGs released to the atmosphere	• Change in GHG emissions	• An increase in emissions of GHGs (CO_2, CH_4, N_2O) in unit of tonnes of carbon dioxide equivalent (CO_2e) per year. Emissions are related to carbon dioxide equivalent by multiplying the emissions by the species' global warming potential (GWP), as follows (see Section 8.4.2): – 1 for CO_2 – 25 for CH_4 – 298 for N_2O

8.2.4 Boundaries

The following sections define the spatial and temporal context within which potential environmental effects on GHGs are assessed and provide the definition of a significant residual adverse environmental effect. These have been established to direct and focus the environmental effects assessment for the VC.

8.2.4.1 Spatial Boundaries

Because GHGs are long-lived in the atmosphere and the environmental effects related to GHGs are global and cumulative in nature, the spatial boundary for purposes of assessment is the global area under the Earth's atmosphere.

8.2.4.2 Temporal Boundaries

Suncor proposes to commence exploration drilling as early as Q2 2024, pending regulatory approval (activities may occur any time over the lease period). Between 12 to 16 exploration and delineation / appraisal wells could be drilled over the term of the Project, contingent on the drilling results of the initial well. It is anticipated that the duration of each well driving event will vary from 45 to 120 days for each well and associated activities with the potential to occur almost year-round using a semi-submersible rig. Well testing (if required, dependent on drilling results) could also occur at any time during the temporal scope of this EIS on a maximum of four wells. VSP operations will take approximately one day per well. The temporal scope of the Project extends to end 2029 to allow for operations in which the operator is diligently pursuing a well or conducting any other activities covered in the EIS.

8.2.5 Residual Effects Characterization

Table 8.8 outlines the definitions used to characterize environmental effects as part of this assessment for GHGs. These descriptions will be used throughout the chapter for characterization and evaluation of potential residual environmental effects on the atmospheric environment from routine Project activities.

Table 8.8 Characterization of Residual Effects on GHGs

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual environmental effect relative to baseline	**Positive** – a residual environmental effect that moves measurable parameters in a direction beneficial to the atmospheric environment relative to baseline **Adverse** – a residual environmental effect that moves measurable parameters in a direction detrimental to the atmospheric environment relative to baseline **Neutral** – no net change in measurable parameters for the atmospheric environment relative to baseline
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Negligible** – no GHG emissions **Low** – less than 10,000 tonnes CO_2e/yr **Moderate** – between 10,000 and 500,000 tonnes CO_2e/yr **High** – greater than 500,000 tonnes CO_2e/yr
Geographic Extent	The geographic area in which a residual environmental effect occurs	**Global:** Because GHGs are long-lived in the atmosphere and the environmental effects related to GHGs are global and cumulative in nature, the spatial boundary for purposes of assessment is the global area under the Earth's atmosphere.
Frequency	Identifies how often the residual effect occurs and how often during the Project	**Unlikely event** – effect is unlikely to occur **Single event** – effect occurs once **Multiple irregular event** – effect occurs at no set schedule **Multiple regular event** – effect occurs at regular intervals **Continuous** – effect occurs continuously

Table 8.8 Characterization of Residual Effects on GHGs

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short term** – for duration of the activity, or for duration of accidental event **Medium term** – beyond duration of activity up to end of Project, or for duration of threshold exceedance of accidental event – weeks or months **Long term** – beyond Project duration of activity, or beyond the duration of threshold exceedance for accidental events - years **Permanent** – recovery to baseline conditions unlikely
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** will recover to baseline conditions before or after Project completion **Irreversible –** permanent
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed** – the atmospheric environment is relatively undisturbed or not adversely affected by human activity or is likely able to assimilate the additional change **Disturbed** – the atmospheric environment has been substantially previously disturbed by GHG emissions from human development or the atmospheric environment is likely not able to assimilate the additional change

8.2.6 Significance Definition

Significant residual environmental effects are considered to be those that could cause a change in a VC that would alter its status or integrity beyond an acceptable and sustainable level. Criteria for effects significance with respect to a GHGs are defined below.

The Government of Canada agreed in 2016 to reduce GHG emissions by 30% below 2005 levels by 2030, as part of the Paris Agreement. In June 2017, the House of Commons reconfirmed Canada's commitment to the Paris Agreement. Closely related to these decisions, recent guidance from the federal government has become available for the Strategic Assessment of Climate Change that applies to federal impact assessments; this guidance explains how to consider the GHG emissions of a designated project (ECCC 2021) in light of addressing public policy beyond the scope of a single project. The focus of this guidance is on the quantification of GHG emissions, upstream emissions, best available technologies, and climate change resilience. The requirement is to establish whether a designated project will hinder or contribute to meeting Canada's commitments to reduce GHG emissions by 40% to 45% below 2005 levels by 2030, and help to achieve a low carbon economy by 2050.

Instead of setting a specific significance criterion for a change in GHG emissions and determining whether and how it can be met, the assessment presented herein will consider this guidance by comparing approximate GHG emissions from the Project to total reported emissions for Newfoundland and Labrador and Canada, we well as to both provincial and federal emission reduction targets. In addition, the quantity of Project-related GHG emissions will be categorized following CEA Agency (2003) guidance as follows:

- Less than 10,000 tonnes CO_2e/yr is considered “low” (since below this level, reporting to the federal program would not be required)
- Between 10,000 and 500,000 tonnes CO_2e/yr is considered “medium”
- Greater than 500,000 tonnes CO_2e/yr is considered “high”

As per the CEA Agency guidance, where the GHG emissions are considered to be either “medium” or “high”, a GHG Management Plan must be prepared. To stay consistent with the magnitude definitions in the other VC chapters, the CEA Agency’s definition of “medium” magnitude will be referred to herein as “moderate” in magnitude.

8.3 PROJECT INTERACTIONS WITH GREENHOUSE GASES

Table 8.9 identifies, for each potential effect, the physical activities that might interact with the atmospheric environment to result in the identified environmental effect. These interactions are indicated by check mark and are discussed in detail in Section 8.4, in the context of effects pathways, standard and project-specific mitigation / enhancement, and residual effects. A justification for no effect is provided in the text following the table.

Table 8.9 Project-Environment Interactions with the Atmospheric Environment

Physical Activities	Environmental Effects
	Change in GHG Levels
Presence and operation of a MODU (including drilling, associated safety zone, lights, and sound)	✓
Geophysical (including VSP), Geological, Geotechnical, and Environmental Surveys	✓
Discharges (e.g., drill muds / cuttings, liquid discharges)	–
Well Testing and Flaring (including air emissions)	✓
Well Decommissioning, Suspension and Abandonment	✓
Supply and Servicing Operations (including helicopter transportation and Project supply vessel operations)	✓
Notes: ✓ = Potential interaction – = No interaction	

Discharges not related to atmospheric emissions (e.g., drill muds / cuttings, liquid discharges) are not expected to result in environmental effects on the atmospheric environment. Atmospheric discharges have been assessed under each specific Project activity.

8.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON GREENHOUSE GASES

The following section assesses the environmental effects on GHGs as identified though potential interactions noted in Table 8.6, and the mitigation measures employed to prevent or reduce the potential adverse effects. The assessment of environmental effects on GHGs is provided in this section, with the determination of significance provided in Section 8.5.

8.4.1 Project Pathways

Atmospheric emissions will be generated by the following Project-related activities:

- Fuel combustion from engines associated with the MODU, supply vessels, fixed and mobile deck equipment, and helicopters (i.e., exhaust emissions)
- Potential flaring during well test activity, in the event that well testing is required

Emissions from these key activities will include CO_2, CH_4, and N_2O. These emissions have the potential to increase global atmospheric GHG concentrations and to affect global climate change.

8.4.2 Characterization of Residual Project-related Environmental Effects

Routine project operations that have the potential to cause environmental effects are discussed in the following sections. Only those with direct interactions, as indicated in Table 8.9, are discussed for each environmental effect.

Emissions of GHGs (CO_2, CH_4, and N_2O) would be released regularly during each phase of the Project from the operation of vessels and associated equipment. Emissions were estimated for the following key Project activities that may cause GHGs to be released to the atmosphere:

- Presence and Operation of the MODU
- Geophysical (including VSP), Geological, Geotechnical and Environmental Surveys
- Well Testing and Flaring
- Supply and Servicing

Emissions of GHGs from diesel and produced gas combustion in Project equipment and vessels were estimated considering approximate equipment and vessel working hours per year for each Project scenario, fuel consumption rate, and GHG emission factors from the National Inventory Report (ECCC 2022b). The equipment and vessel working hours were used with the fuel consumption rate to determine the total volume of diesel or gas combusted. Volume-based diesel combustion factors or energy-based produced gas flaring factors were then applied to estimate emissions of CO_2, CH_4, and N_2O.

Emissions of each of the included GHGs are multiplied by their 100-year global warming potential (GWP) as determined by the Intergovernmental Panel on Climate Change (IPCC) and are reported as carbon dioxide equivalent (CO_2e). The CO_2e is calculated from CO_2, CH_4, and N_2O emissions and their respective GWP as follows:

$$CO_2e = CO_2 \times GWPCO_2 + CH_4 \times GWPCH_4 + N_2O \times GWPN_2O$$

GWPs were obtained from the Fourth Assessment Report published by the Intergovernmental Panel on Climate Change (IPCC) (IPCC 2007), as presented in Table 8.10.

Table 8.10 Global Warming Potentials

Greenhouse Gas	100-year GWP
CO_2	1
CH_4	25
N_2O	298
Source: IPCC 2007	

In this assessment, the total GHG emissions as CO_2e are compared to the CEA Agency guidance criteria of “low”, “medium”, and “high” (CEA Agency 2003). Criteria of the CEA Agency guidance categories and the draft federal guidance on the Strategic Assessment of Climate Change are described in Section 8.2.6. The magnitude is also compared to the provincial and national annual reported GHG emissions, and GHG reduction targets.

The change in greenhouse gases related to each Project activity are further described in the following subsections.

8.4.2.1 Mitigation

Mitigation measures that will be implemented to help avoid or reduce the Project-related quantities of GHGs released to the atmosphere include:

- Flaring on the MODU will not occur during routine operations
- High-efficiency burners (flare tip) will be used when flaring is required
- High-efficiency equipment will be used for power generation
- Air emission sources associated with vessels will adhere to applicable limits set out in Canada’s V*essel Pollution and Dangerous Chemicals Regulations* under the *Canada Shipping Act, 2001*
- Sulphur content in diesel fuel used for the Project will meet the *Sulphur in Diesel Fuel Regulations* and will comply with the sulphur limits in fuels for large marine diesel engines, per the *Vessel Pollution and Dangerous Chemicals Regulations*
- The Project will use ultra-low sulphur diesel fuel wherever practicable and available as it will reduce the potential for adverse local air quality effects.
- Well testing, if required, will be subject to Suncor’s well test assurance process, which is designed to promote safe and efficient well test operations.

8.4.2.2 Presence and Operation of a MODU

The MODU operations description and the assumptions used to estimate the GHG emissions are consistent with those presented for potential Project emissions in Section 8.1.2.

Volume-based diesel combustion emission factors were applied to estimate emissions of CO_2, CH_4, and N_2O from MODU operations. The volume of diesel combusted annually for the TransOcean Barents MODU was estimated from 2018 operational data to be approximately 16,200 m^3 of diesel fuel. The GHG emission

factors were obtained from the National Inventory Report (ECCC 2022b). The emission factors used and the emission estimates are provided in Table 8.11.

Table 8.11 GHG Emission Estimates from MODU Operations

Air Contaminant	Emission Factor (g/L)[a]	Emission Rate (tonne CO_2e/yr)[b]
CO_2	2,681	43,295
CH_4	0.25	102
N_2O	0.072	346
Total GHG Emissions	—	43,744

Notes:
[a] ECCC 2022b. National Inventory Report 1990-2020: Greenhouse Gases Sources and Sinks Part 2
[b] Assumed that drilling could occur up to 360 days per year

8.4.2.3 Vertical Seismic Profiling

The potential interactions between GHGs and VSP are primarily from the combustion of fuel from the vessels. Emissions of GHGs from VSP vessels would be similar in magnitude as those from the other assessed vessels (refer to Section 8.4.2.5).

8.4.2.4 Well Testing and Flaring

The well testing and flaring description and the assumptions used to estimate the GHG emissions are consistent with those presented for potential Project emissions in Section 8.1.4.

The GHG emissions from well testing and flaring were based on the maximum volume of gas flared during each test (approximately 10,000 barrels) and emission factors obtained from the National Inventory Report (ECCC 2022b). The emission factors used and the emission estimates are provided in Table 8.12.

Table 8.12 GHG Emission Estimates from Well Testing and Flaring

Air Contaminant	Emission Factor (g/m^3)[a]	Emission Rate (tonne CO_2e/yr)[b]
CO_2	2,494	282
CH_4	6.4	18.1
N_2O	0.06	2.03
Total GHG Emissions	—	303

Notes:
[a] ECCC 2022b
[b] Assumed that only one well would be tested annually

8.4.2.5 Supply and Servicing

The Project will involve vessel and helicopter use, including support traffic to, from, and within the Project Area at all times of the year during the life of the Project. Emissions from combustion of fuel from supply and servicing activities while in transit can cause a change in GHG emissions. GHG emissions from supply and servicing have been presented separately for vessels and helicopters in the following subsections.

8.4.2.5.1 Supply Vessels

The Project vessel (supply and standby) activities description and the assumptions used to estimate the GHG emissions are consistent with those presented for potential Project emissions in Section 8.1.5.1.

GHG emissions from the supply and standby vessels were estimated based on assumed fuel consumption (approximately 6,243 tonnes of fuel per year) and emission factors from the National Inventory Report (ECCC 2022b). The emission factors used and the emission estimates are provided in Table 8.13.

Table 8.13 GHG Emission Estimates from Vessels

Air Contaminant	Emission Factor (g/L)[a]	Emission Rate (tonne CO_2e /year)[b]
CO_2	2,681	17,803
CH_4	0.25	41.8
N_2O	0.072	142
Total GHG Emissions	-	17,987

Notes:
[a] ECCC 2022b. National Inventory Report 1990-2020: Greenhouse Gases Sources and Sinks Part 2
[b] Assumed that drilling could occur up to 360 days per year

8.4.2.5.2 Helicopter

The Project helicopter activities description and the assumptions used to estimate the GHG emissions are consistent with those presented for potential Project emissions in Section 8.1.5.2.

GHG emissions from the operation of helicopters were estimated using number of trips (313 roundtrips per year) and travel time (2 hours roundtrip) and emission factors from the National Inventory Report (ECCC 2022b). The emission factors used and the emission estimates are provided in Table 8.14.

Table 8.14 GHG Emission Estimates from Helicopters

Air Contaminant	Emission Factor (g/L)[a]	Emission Rate (tonne CO_2e / year)[b]
CO_2	2,560	1,196
CH_4	0.029	0.34
N_2O	0.071	9.90
Total GHG Emissions	2,560	1,206

Notes:
[a] ECCC 2022b. National Inventory Report 1990-2020: Greenhouse Gases Sources and Sinks Part 2
[b] Assumed that drilling could occur up to 360 days per year

8.4.2.6 Summary

The total estimated GHG emissions from the Project activities are presented below in Table 8.15.

Table 8.15 Estimated GHG Emissions for the MODU, Support Vessels, Helicopter and Well Testing (Flaring)

Source	MODU	Vessels	Helicopters	Well Testing	Total Emissions
CO_2 (tonnes CO_2e per year)	43,295	17,803	1,196	282	62,576
CH_4 (tonnes CO_2e per year)	102	41.8	0.34	18.1	162
N_2O (tonnes CO_2e per year)	346	142	9.90	2.03	501
Total Annual GHG Emissions (tonnes CO_2e per year)	43,744	17,987	1,206	303	63,239

Over the term of the EL, there could be between zero and four wells drilled per year. This EIS assumes only one-third of the drilled wells will be tested, or approximately one per year. With those assumptions, the annual GHG emissions resulting from Project activities (drilling, vessel traffic, helicopter traffic, and well testing) could range from 0 to approximately 63 kt CO_2e/yr; approximately 44 kt CO_2e are attributed to the MODU, and the rest are from vessels, helicopters, and flaring. Because GHG emissions from vessels, helicopters, and test flaring are not included in the National Inventory Report totals, only emissions from the MODU are considered for comparison to the provincial and federal emissions. The emissions from the MODU represent approximately 0% to 0.46% of the total reported provincial GHG emissions for 2020 (9,500,000 tonnes CO_2e) and approximately 0% to 0.01% of the 2020 national emissions (672,000,000 tonnes CO_2e) (ECCC 2022b).

The GHG emissions from the MODU operations are compared to provincial and federal GHG targets in Table 8.16.

Table 8.16 GHG Emissions in Comparison to Provincial and Federal Targets

	Predicted Annual Project Emissions	2030 GHG Targets	
		Provincial[a]	Federal[b]
	44 kt	6.9 MT	513 MT
Project Contribution to GHG Targets	—	0.63%	0.01%

Notes:
[a] Gov NL 2019; [b] ECCC 2022b

The total GHG emissions from Project activities are estimated to be approximately 63 kt CO_2e/yr. This estimate is in the “medium” magnitude category using the CEA Agency criteria. To stay consistent with the magnitude definitions in the other VC chapters, the CEA Agency’s definition of “medium” magnitude will be referred to herein as “moderate” in magnitude.

GHG emissions to the atmosphere are considered to be irreversible, as effects related to the release of GHG emissions from Project operation would not be reversible for at least 100 years.

Suncor will adhere to federal and provincial compliance and reporting requirements for emissions as applicable.

8.4.3 Summary of Project Residual Environmental Effects

In summary (Table 8.17), the predicted residual environmental effects on the change in GHGs resulting from planned Project activities are predicted to be adverse, moderate in magnitude, within the RAA, of short-term to medium-term duration, occurring regularly, irregularly or continuous (depending on activity) during drilling operations, and irreversible. This prediction is made with a high level of certainty.

Table 8.17 Summary of Residual Environmental Effects on GHGs

Residual Effect	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in GHGs							
Presence and Operation of a MODU	A	M	G	MT	C	IR	D
Geophysical (including VSP) Surveys	A	M	G	ST	IR	IR	D
Geological, Geotechnical and Environmental Surveys	A	M	G	ST	IR	IR	D
Discharge	—	—	—	—	—	—	—
Well Testing and Flaring	A	M	G	ST	IR	IR	D
Well Decommissioning, Suspension and Abandonment	A	M	G	ST	IR	IR	D
Supply and Servicing	A	M	G	MT	R	IR	D

KEY:
See Table 8.5 for detailed definitions
N/A: Not Applicable

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
G: Global

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term
P: Permanent

Reversibility:
R: Reversible
I: Irreversible

Frequency:
UL: Unlikely
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

8.5 DETERMINATION OF SIGNIFICANCE

With the application of proposed mitigation and environmental protection measures, the residual environmental effects of a change in GHGs from Project activities and components, using the magnitude scale of low, medium, and high, as defined in Section 8.2.5, the Project is considered to have a medium (moderate) magnitude. Emissions of GHGs from Project activities would be low in comparison to provincial and national emissions.

With mitigation and environmental protection measures, the residual environmental effects on the atmospheric environment are predicted to be not significant.

8.6 PREDICTION CONFIDENCE

This prediction of a not significant effect is made with a high level of confidence based on a good understanding of the general effects of Project activities on GHGs, and the effectiveness of mitigation measures discussed in Section 8.4.2.1.

8.7 FOLLOW-UP AND MONITORING

Based on the information presented in the EIS, and the conclusion of the effects assessment, no specific follow-up or monitoring related to the atmospheric environment is considered necessary in relation to the Project.

8.8 REFERENCES

Australian Government (2010). Emission Estimation Technique Manual for Oil and Gas Extraction and Production. Version 1.2.

CCME (Canadian Council of Ministers of the Environment). No Date. Air Quality Report. Available at: https://ccme.ca/en/air-quality-report.

CCME (Canadian Council of Ministers of the Environment). 2019. Guidance Document on Air Zone Management. PN 1593, ISBN 978-1-77202-050-2.

CEA (Canadian Environmental Assessment) Agency. 2003. Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners. Available at: https://www.acee-ceaa.gc.ca/Content/A/4/1/A41F45C5-1A79-44FA-9091-D251EEE18322/Incorporating_Climate_Change_Considerations_in_Environmental_Assessment.pdf. Accessed: July 4, 2019.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and CNSOPB (Canada-Nova Scotia Offshore Petroleum Board). 2017. Drilling and Production Guidelines. Available at: https://www.cnlopb.ca/wp-content/uploads/guidelines/drill_prod_guide.pdf. Accessed: July 3, 2019.

ECCC (Environment and Climate Change Canada). 2021. Technical Guide Related to the Strategic Assessment of Climate Change: Guidance on quantification of net GHG emissions, impact on caron sinks, mitigation measures, net-zero plan and upstream GHG assessment. Draft. August 2021.

ECCC (Environment and Climate Change Canada). 2022a. 2030 Emissions Reduction Plan – Canada's Next Steps for Clean Air and a Strong Economy. Available at: https://www.canada.ca/en/environment-climate-change/news/2022/03/2030-emissions-reduction-plan--canadas-next-steps-for-clean-air-and-a-strong-economy.html

ECCC (Environment and Climate Change Canada). 2022b. National Inventory Report 1990-2022: Greenhouse Gas Sources and Sinks in Canada, Canada's Submission to the United Nations Framework Convention on Climate Change, Part 2. 337 pp. Available at: https://unfccc.int/ghg-inventories-annex-i-parties/2022.

Gov NL (Government of Newfoundland and Labrador). 2019. The Way Forward on Climate Change in Newfoundland and Labrador. Available at: https://www.exec.gov.nl.ca/exec/occ/publications/The_Way_Forward_Climate_Change.pdf.

Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environment assessment: Noise. January 2017. Available online at: https://iaac-aeic.gc.ca/050/documents/p80054/119378E.pdf.

IPCC (Intergovernmental Panel on Climate Change). 2007. AR4 Climate Change 2007: Synthesis Report Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. Available at: https://www.ipcc.ch/report/ar4/syr/.

Newfoundland and Labrador Department of Municipal Affairs and Environment. 2018. Made-in-Newfoundland and Labrador Carbon Pricing Plan. 7 pp. Available at: https://www.gov.nl.ca/ecc/files/publications-nl-carbon-pricing-plan.pdf

Newfoundland and Labrador Oil and Gas Industrial Association. 2020. NOIA Supports Newfoundland and Labrador Net Zero by 2050 Commitment. Accessed July 14, 2021. Available at: https://www.noia.ca/2020/06/noia-supports-newfoundland-and-labrador-net-zero-by-2050-commitment/#:~:text=On%20June%2010%2C%202020%2C%20the%20House%20of%20Assembly,carbon%20emissions%20by%202050%20in%20Newfoundland%20and%20Labrador.

Office of the Legislative Counsel NL. 2004. Schedule A Table 1: Table I (Ambient Air Quality Standards at Reference Conditions) of the *Air Pollution Control Regulations, 2004* under the *Environmental Protection Act* (O.C. 2004-232). Available at: https://www.assembly.nl.ca/legislation/sr/regulations/rc040039.htm#SchedA_

Suncor (Suncor Energy Inc.) 2022. 2022 Climate Report. Available at: https://www.suncor.com/sustainability-reporting. Accessed July 2022.

Swiss Confederation. 2015. Guidance on the Determination of Helicopter Emissions. Available at: file:///C:/Users/rjeffery/Downloads/guidance_on_the_determinationofhelicopteremissions.pdf. Accessed: July 5, 2019.

US EPA (United States Environmental Protection Agency). 2009. Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories. Available at: https://www.epa.gov/moves/current-methodologies-preparing-mobile-source-port-related-emission-inventories-final-report. Accessed: July 5, 2019.