AECOM

Chapter 6

Greenhouse Gas Emissions

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6. Greenhouse Gas Emissions

6.1 Introduction

Greenhouse Gas (GHG) was selected as an Environmental Component because of the potential for the proposed Project to generate emissions that may contribute to climate change. Operational activities that could generate GHGs include road, rail, and marine traffic; operation of equipment to move containers; diesel power generation; and air conditioning and refrigeration leakage.

The port authority recognizes that minimizing GHG emissions from Port activities is important. Therefore, a study of GHG emissions from the proposed Project is required to be submitted with the PER Application. GHG emissions were also confirmed to be a key area of review for the PER process by Aboriginal groups and the public during early engagement for the proposed Project. During the Preliminary Comment Period on the scope of technical and environmental studies for the proposed Project, the majority of respondents supported the need to conduct a GHG Study. The port authority does not have technical guidelines for the assessment of GHG effects from projects that are subject to the PER process.

This chapter summarizes the GHG Study conducted to estimate changes in GHG emissions as a result of operational activities from the proposed Project. Construction activities also have the potential to generate GHG emissions, but were not considered in this section. The study included emission estimates for the following scenarios:

- **Base Case**: Existing facility and supply chain (e.g., rail, truck, and marine vessels) operating at normal operating level.
- **Project Case**: Proposed Project, including increase of equipment and capacity for the facility and the supply chain operating at normal operating level..
- **No-Project Case**: Future increases in throughput without the proposed Project.. This case allows a comparison between the Project Case and anticipated changes to equipment and throughput expected in 2020 without expansion if Centerm operates at a sustainable maximum level.

It is not possible to describe how the proposed Project might directly affect climate change due to the global scale involved and the uncertainty in apportioning the effects of emissions from the proposed Project from other sources as causal factors contributing to global climate change. Instead, a proxy for relative effect was used by comparing GHG emissions levels from the proposed Project to other anthropogenic sources to ascertain degree of magnitude and whether it is within sector norms. This comparative method is consistent with guidance by the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment (2003). Providing context for the project's GHG emissions compared to provincial, national, and global totals allows for characterization of the contribution of the proposed Project. Therefore, the project GHG emissions are considered in the context of provincial, national, and global GHG emission totals.

6.2 Scope of Review

The scope of review of effects of GHGs emissions is listed in Table 6-1, which includes the following:

- **Project Interactions**: The components and activities of the proposed Project that are part of the review
- **Potential Effects**: The effects associated with the project interactions that are characterized
- **Study Area**: The geographic extent within which impacts are considered

- **Indicators**: The existing state of GHGs and the potential change that could occur as a result of project effects
- **Guidelines and Threshold References**: The thresholds or limits that are used to characterize the change to GHGs as a result of project effects

Table 6-1: Scope of Review – GHGs

Project Interaction	Potential Effects of the Proposed Project	Study Area	Indicators	Guidelines and Threshold References
Operation: ▪ Road traffic, rail operations, and marine vessels ▪ Use of mobile equipment on-site to move containers ▪ Diesel power generation (marine) ▪ Air conditioning/ refrigeration leakage	Increase in atmospheric GHGs	Project emissions from sources within the Site. Supply chain emissions from marine activity in the Inner Harbour to the western boundary of the port authority's jurisdiction for Burrard Inlet; truck transportation to Highway 1; and rail transportation to Coquitlam	Carbon dioxide equivalents (CO_2e)	Comparison of Project GHG levels to provincial, national, and global levels of CO_2e

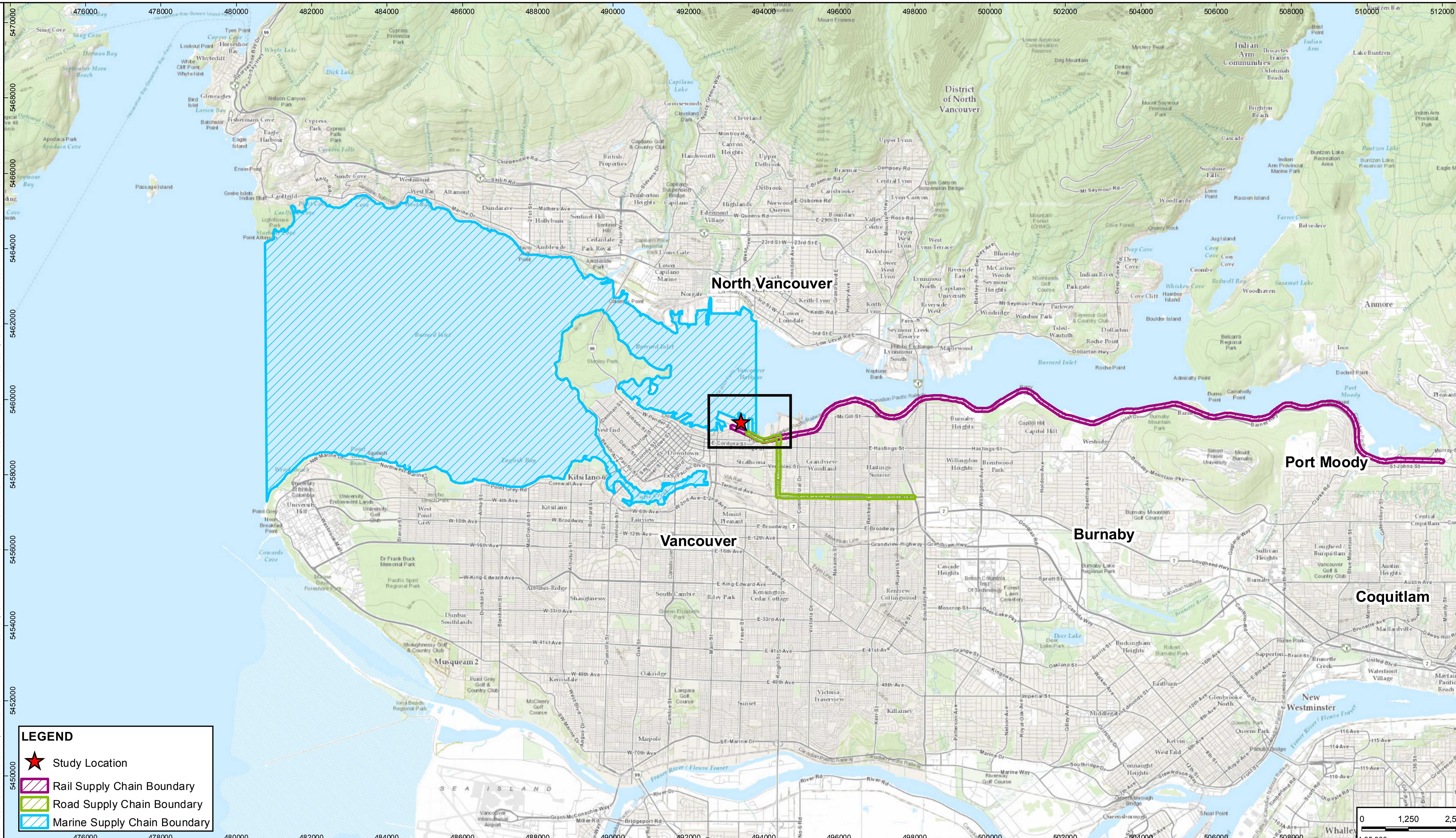
6.2.1 Geographical Study Scope

The GHG Study considers both facility and indirect emissions associated with the proposed Project. Facility emissions are those that are emitted at the Terminal and are under control of the Terminal (Terminal Emissions). Indirect emissions are those that are associated with the proposed Project, but are not emitted at the Terminal. These include emissions related to transporting containers by ship, truck, and rail to and from the Terminal (Supply Chain emissions) and other indirect emissions such as purchased electricity. The proposed Project would not normally report indirect emissions under a GHG emission reporting scheme such as the National Pollutant Release Inventory or the British Columbia *Greenhouse Gas Industrial Reporting and Control Act* because it would lead to "double counting." However, for the GHG Study, direct and indirect emissions are included to characterize the total impact of the increased production from the expansion of Centerm.

The geographic boundaries for characterizing GHG effects (GHG Study Area) are based on the source of the emissions. For Terminal Emissions, the geographic scope is the Terminal site. The geographic boundaries of Supply Chain Emissions are described in Table 6-2. The GHG Study Area boundaries are shown on Figure 6-1.

Table 6-2: Emission Inventory Boundary

Emission Source	Boundary Details
Container Trucks	Trucking to 13 km from the Site (return distance from the Terminal to Highway 1 and E 1st Ave). Emissions are based on an operating time estimate for the fleet. For example, in the base case, the supply chain basis is 16 minutes per truck, 27 trucks per hour for 18 hours per day.
Trains	Train locomotive emissions are estimated based on travel to and from the Coquitlam Container Yard. The return track distance approximately 40 km long.
Container Ships	Vessel emissions are restricted to those that occur in Vancouver Harbour. Emissions are estimated based on an upper estimate of the time a vessel will take while traversing Vancouver Harbour (1 hour) and docking (1 hour of maneuvering).



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No.	Date	Revision	Dr'n	Ch'd
C	2016/07/25	ISSUED FOR REVIEW	DL	NB
B	2016/07/19	ISSUED FOR REVIEW	DL	NB
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APPROVED	MM
DATE	18/11/2016
SCALE	1:95,000
PMV SCALE	

CENTERM EXPANSION PROJECT
ENVIRONMENTAL STUDY
AIR QUALITY & GREENHOUSE GAS STUDY AREA
SUPPLY CHAIN EMISSION SOURCE BOUNDARIES
Figure 6-1

SIZE	MXD.	SHEET	REV.
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6.3 Regulatory Standards and Guidelines

The GHG Study was conducted in accordance with the British Columbia Best Practices Methodology for Quantifying Greenhouse Gas Emissions (BC MOE 2014a) (GHG Best Practices) and the guidelines for Incorporating Climate Change Considerations in Environmental Assessments (Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment 2003).

In Canada, ECCC requires reporting of GHG emissions from facilities that emit more than 50,000 tonnes of CO_2e; in British Columbia, industrial facilities that emit more than 10,000 tonnes of CO_2e are required to report to the Provincial regulatory body. Neither jurisdiction has limits or reduction targets on GHGs for Port operations.

The proposed Project GHG emissions are considered in the context of provincial, national, and global GHG emission totals. This comparative method is consistent with guidance by the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment (2003). Providing context for the proposed Project's GHG emissions compared to provincial, national, and global totals allows for a characterization of the proposed Project's impact.

6.4 Study Methods

GHG emissions occur as a result of fuel combustion but can also occur as a fugitive emission from sources such as air conditioning units and refrigeration equipment. Sources of GHG emissions include diesel fuel combustion, gasoline fuel combustion, purchased electricity consumption, and, to a smaller extent, refrigerant leakage. The quantity of GHG emissions correlates to the amount of fuel and electricity consumed by the various equipment used in operations and activity level (level of use) (e.g., number of hours, distance).

GHG calculations involve multiplying the published emission factors for equipment by the duration of time the equipment operated (or in some cases distance travelled) to determine the GHG emissions for that equipment. The GHG emissions for the equipment are then summed to reach the total emissions for an operational activity and then for each scenario as a whole (Base Case and proposed Project Case).

Equipment, activities and activity levels used in the estimates are listed in Section 2.3.1. Some of the key assumptions in estimating fuel volumes include:

- Diesel for non-road vehicles is based on actual reported volumes.
- Gasoline for terminal support vehicles is based on number of vehicles, operating hours per day, and a fuel consumption rate.
- Air conditioning and refrigeration leakage is based on number of units, typical charge capacity, and leakage rates.
- Electricity is based on reported consumption.
- Diesel for rail is based on tonnage and distance moved.
- Diesel for marine activity is based on number of vessel calls, operating hours per call, and engine power.
- Diesel for container trucks is based on number of vehicles, operating hours per day, and a fuel consumption rate.

Emission factors and calculation methods used for the GHG Study were drawn principally from the GHG Best Practices. The GHG Best Practices represent a "robust and continually improving catalogue of emission factors and emissions calculation methodologies" that aligns with methodology from the World Resources Institute and the Climate Registry. In addition to the GHG Best Practices, GHG emissions from equipment were taken from the following:

- *Fuel Efficiency Benchmarking in Canada's Trucking Industry* (Natural Resources Canada 2015)

- Rail Trends 2015 (Railway Association of Canada 2015)
- *Canada's Greenhouse Gas Inventory 1999-2002* (ECCC 2004)
- *BC Ocean Going Vessel Emissions Inventory* (BC Chamber of Shipping 2007)
- The Climate Registry Default Emission Factors (The Climate Registry 2015)

Regional, provincial, federal, and global emissions were used as a comparison tool to characterize the impact of the proposed Project. The most recent available provincial, federal, and global emissions estimates are shown in Table 6-3.

Table 6-3: Provincial, Federal, and Global Emissions

Year	Lower Fraser Valley (kt CO_2e) [1]	British Columbia Emissions (kt CO_2e) [2]	Canada Emissions (kt CO_2e) [3]	Global Emissions (kt CO_2e) [4]
2013	-	64,030	726,000	-
2012	-	63,450	715,000	44,815,000
2011	-	62,330	709,000	44,190,000
2010	23,660[4]	62,050	707,000	42,968,000
2009	-	62,560	699,000	41,237,000
2008	-	66,270	741,000	41,525,000
2005	-	67,750	749,000	38,782,000
2000	-	68,590	745,000	33,886,000
1990	-	57,160	613,000	30,423,000

Note that values are presented in kilotonnes (1 kt = 1,000,000 kg).

[1] *2010 Lower Fraser Valley Air Emissions Inventory and Forecast and Backcast, Final Report and Summarized Results (Metro Vancouver 2013); Metro Vancouver accounted for 63.3 percent of these emissions, or approximately 14,977 kilotonnes of CO_2e.*

[2] *Includes the following GHG source categories: Energy, Industrial Process, Solvent & Other Product Use, Agriculture, Waste and LULUCF; LULUCF sector emissions are included in the provincial inventory to be consistent with provincial emission reduction targets under the BC Climate Action Plan (BC MOE 2014b).*

[3] *Includes the following GHG source categories: Energy, Industrial Process, Solvent & Other Product Use, Agriculture, and Waste; LULUCF sector emissions are not included to be consistent with UNFCCC reporting guidelines at the national level (ECCC 2014).*

[4] *Includes the following GHG source categories: Energy, Industrial Process, Agriculture, and Waste; emissions from the Solvent & Other Product use sector reported at the national level are included in the Industrial Process sector at the global level; LULUCF sector emissions are not included in the NIR tables summarizing the provincial GHG totals because emissions from this sector are not included in national inventory totals per UNFCCC reporting guidelines (ECCC 2014, World Resources Institute, CAIT 2.0. 2015).*

6.5 Existing Conditions

The GHG emissions inventory for the Base Case is provided in Table 6-4. Supply Chain Emissions under the Base Case are only slightly greater than Terminal Emissions. The three largest contributors to GHG emissions are non-road vehicles (e.g., rubber-tired gantry cranes), rail locomotives, and marine vessels – each with approximately the same magnitude of emissions. The majority of rail and marine emissions are Supply Chain Emissions.

Of the total marine emissions, slightly more than half occurred while transiting to the Terminal, one third occur once at berth, running the vessel's auxiliary engine, and maneuvering makes up the remainder.

Table 6-4: GHG Emission Estimates for Base Case

Source	Type	Base Case (tonnes CO_2e/year)
Terminal Emissions		
Non-road equipment	Diesel fuel combustion	9,171
Terminal support vehicles	Gasoline fuel combustion	3,429
Air conditioning and refrigeration	Refrigerant leakage	650
Marine (vessels at berth)	Diesel fuel combustion	3,076
Rail (on-site)	Diesel fuel combustion	109
Container trucks (on-site)	Diesel fuel combustion	1,095
Supply Chain Emissions		
Electricity	Purchased electricity consumption	85
Rail (off-site)	Diesel fuel combustion	7,294
Marine (in transit)	Diesel fuel combustion	5,190
Container trucks (off-site)	Diesel fuel combustion	1,460
	Total Terminal Emissions	17,530
	Total Supply Chain Emissions	14,029
	Total Emissions	31,559

6.6 No-Project Case

The No-Project Case considers anticipated changes to the operation of the Terminal by the time the proposed Project would have been completed and operational. Due to the short timeline of the proposed Project, no equipment changes are anticipated (for example, due to retiring equipment at the end of their useful life) in the No-Project Case. This case allows a comparison to be made between the proponent proceeding with the project or managing future increases in throughput without the proposed Project. A horizon year of 2019 was selected for this analysis.

If the proposed Project does not proceed, emissions are expected to increase from the Base Case due to an increased demand for container handling capacity. To accommodate this increase in demand, the Terminal would operate at or above its sustainable maximum capacity, introducing operational inefficiencies.

The GHG emissions inventory for the No-Project Case is provided in Table 6-5. Supply chain emissions under the No-Project Case are approximately 40% greater than that of direct emissions. As with the other scenarios, the three largest contributors to GHG emissions are non-road vehicles (e.g., rubber-tired gantry cranes), rail locomotives, and marine vessels. Rail emissions, for the No-Project case, have a much greater contribution share than the Base Case. Both marine and the majority of rail emissions are supply chain emissions, which leads to the larger portion of supply chain versus terminal emissions.

Of the marine emissions, approximately half occurred during the “in transit” mode of vessel operation. Once at berth, running the vessel’s auxiliary engines accounts for just over one-third of the total emissions. Maneuvering makes up the remainder.

Table 6-5: GHG Emission Estimates for No-Project Case

Source	Type	No-Project Case (tonnes CO_2e/year)
Terminal Emissions		
Non-road equipment	Diesel fuel combustion	10,467
Terminal support vehicles	Gasoline fuel combustion	3,429
Air conditioning and refrigeration	Refrigerant leakage	962
Marine (vessels at berth)	Diesel fuel combustion	3,845
Rail (on-site)	Diesel fuel combustion	161
Container trucks (on-site)	Diesel fuel combustion	1,487
Supply Chain Emissions		
Electricity	Purchased electricity consumption	251
Rail (off-site)	Diesel fuel combustion	10,765
Marine (in transit)	Diesel fuel combustion	6,487
Container trucks (off-site)	Diesel fuel combustion	1,982
	Total Terminal Emissions	20,352
	Total Supply Chain Emissions	19,484
	Total Emissions	39,836

6.7 Project Case Emissions

6.7.1 Project Emissions Comparison to Existing Conditions

The GHG emissions inventory for the proposed Project Case and the increase over the Base Case is provided in Table 6-6.

Table 6-6: GHG Emission Estimates for Base Case and Proposed Project Case

Source	Type	Base Case (tonnes CO_2e/year)	Proposed Expansion (tonnes CO_2e/year)	Estimated Increase (tonnes CO_2e/year)
Terminal Emissions				
Non-road equipment	Diesel fuel combustion	9,171	10,467	1,296
Terminal support vehicles	Gasoline fuel combustion	3,429	3,429	-
Air conditioning and refrigeration	Refrigerant leakage	650	962	312
Marine (vessels at berth)	Diesel fuel combustion	3,076	3,845	769
Rail (on-site)	Diesel fuel combustion	109	388	279
Container trucks (on-site)	Diesel fuel combustion	1,095	1,818	723
Supply Chain Emissions				
Electricity	Purchased electricity consumption	85	267	182
Rail (off-site)	Diesel fuel combustion	7,294	17,241	9,947
Marine (in transit)	Diesel fuel combustion	5,190	10,017	4,827
Container trucks (off-site)	Diesel fuel combustion	1,460	2,424	964
	Total Terminal Emissions	17,530	20,909	3,379
	Total Supply Chain Emissions	14,029	29,949	15,920
	Total Emissions	31,559	50,858	19,299

The majority of the increase in Terminal Emissions comes from the diesel-powered gantry cranes and the internal transfer vehicles.

Electrification of equipment will be incorporated into the proposed Project where feasible. While full electrification would greatly reduce GHG emissions at the Project site, full electrification was determined to be unfeasible. This is discussed in Section 4.6.2.

The total emissions from the proposed Project are heavily influenced by supply chain emissions. Supply chain emissions represent approximately 85 percent of the total emissions increase. This is due to an increase in capacity for container throughput as a result of increased terminal efficiency, and the corresponding increases in marine service, rail and trucking. The total proposed Project emissions represent a 60 percent increase in the generation of GHGs from the Base Case. However, from a perspective of emissions intensity, there is a slight decrease even although there is an increase in GHG emissions. The emissions intensity is measured as GHG emissions per TEU processed. The Base Case emissions intensity is 56.5 kg CO_2e/TEU. The Project Case emissions intensity is 55.0 kg CO_2e/TEU. This represents a 3 percent change to GHG emissions intensity performance.

6.7.2 Project Emissions Comparison to No-Project Case

The GHG emissions inventory for the proposed Project compared to the No-Project Case is provided in Table 6-7.

Table 6-7: GHG Emission Estimates for No-Project Case and Proposed Project

Source	Type	No-Project Case (tonnes CO_2e/year)	Proposed Expansion (tonnes CO_2e/year)	Estimated Increase (tonnes CO_2e/year)
Terminal Emissions				
Non-road equipment	Diesel fuel combustion	10,467	10,467	-
Terminal support vehicles	Gasoline fuel combustion	3,429	3,429	-
Air conditioning and refrigeration	Refrigerant leakage	962	962	-
Marine (vessels at berth)	Diesel fuel combustion	3,845	3,845	-
Rail (on-site)	Diesel fuel combustion	161	388	226
Container trucks (on-site)	Diesel fuel combustion	1,487	1,818	331
Supply Chain Emissions				
Electricity	Purchased electricity consumption	251	267	16
Rail (off-site)	Diesel fuel combustion	10,765	17,241	6,476
Marine (in transit)	Diesel fuel combustion	6,487	10,017	3,530
Container trucks (off-site)	Diesel fuel combustion	1,982	2,424	441
Total Terminal Emissions		20,352	20,909	558
Total Supply Chain Emissions		19,484	29,949	10,464
Total Emissions		39,836	50,858	11,022

There are only very small changes to Terminal Emissions between the proposed Project and the No-Project Case due to increased rail and container truck on-site activity. Supply chain emissions are higher in the proposed Project primarily due to the increase in rail emissions. The total Project emissions are 22 percent over the No-Project Case. On an emissions intensity basis, the increase is only 5 percent.

6.8 Potential Project Effects and Mitigation Measures

GHG emissions for the proposed Project effects would occur from the same type of sources as under existing conditions, but at different levels. GHG emissions were calculated using the same methods and assumptions as those under the existing conditions, but at different activity levels. The activities are described in Section 2.3.1 and are further detailed in the following sections where Terminal activities effect GHG emissions.

6.8.1 Container Operations Facility

In the proposed Project, the Ballantyne Heritage building will be expanded by approximately 1,200 m^2 to provide at least 4,000 m^2 of floor space for a new combined operations and administration facility. The design phase will include an energy efficiency study and demonstration of best available technology not entailing excessive cost. While larger buildings lead to greater electrical, heating, and cooling demand and greater indirect emissions from purchased electricity, the larger central operations and administration building would also allow for consolidation (and removal) of various smaller buildings around the Site, which leads to more efficient electrical, heating, and cooling systems.

6.8.2 Container Yard

In the proposed Project, the container yard would be reconfigured to allow for greater handling capacity. Currently 14 of the 19 rubber-tired gantries are used at once, and the reconfiguration would allow an increase to 16 rubber-tired gantry operations. Internal transfer vehicle activity would increase to accommodate the additional container handling capacity. Both rubber-tired gantry and internal transfer vehicle increases would lead to greater emissions from diesel fuel combustion. Additionally, the berth currently has six quay cranes. The expansion would add a quay crane. With one more electrical crane in operation, emissions from purchased electricity would increase. The reconfiguration of the container yard would optimize container handling to minimize diesel consumption from the rubber-tired gantries and internal transfer vehicles.

Reconfiguration of the container yard (and other parts of the Terminal would also include changes to lighting, leading to changes in emissions from purchased electricity. All new high-mast lighting will use the more energy efficient LED fixtures.

6.8.3 Marine Emissions

A berth extension is planned to allow the berthing and processing of two ships simultaneously, as well as for accommodating larger vessels. While this may lead to a second ship at berth, the extension would also reduce the need for vessel repositioning.

Additional (and larger) vessels would lead to increased marine diesel fuel combustion emissions. The port authority will be implementing shore power for berth 5 and is considering future implementation of shore power at berth 6. This would considerably reduce marine vessel GHG emissions while in port by switching from diesel (approximately 690 tonnes CO_2e/GWh) to BC Hydroelectricity (10 tonnes CO_2e/GWh).

6.8.4 Rail Operations

The proposed Project would increase the capacity of the intermodal yard by adding a fifth 914 m parallel rail track. The increased rail traffic would lead to greater emissions from locomotive diesel combustion. While overall GHG emissions may increase due to higher throughput, the fifth rail would also allow for more efficient handling procedures. The additional track would reduce the number of train shunts and short trips needed to build unit trains of 3,658 m in length.

The intermodal yard would also be equipped with five rail-mounted gantry cranes to handle the increased capacity. This would replace the two diesel-fueled cranes currently in use. While this would lead to greater emissions from purchased electricity, diesel combustion would no longer be used for rail loading. The change from diesel fuel to electricity for rail loading would greatly improve the productivity and GHG emissions intensity considering purchased electricity has a lower GHG intensity than diesel combustion.

6.8.5 Summary of Potential Residual Effects

The mitigation measures and residual effects of the proposed Project in relation to GHG emissions are summarized in Table 6-8.

Table 6-8: Summary of Potential Project Effects

Potential Adverse Effects	Project Components	Mitigation Measures	Potential Residual Effects
Increase in annual GHG emissions	Container Operations Facility	The design phase will include an energy efficiency study and demonstration of best available technology not entailing excessive cost.	The proposed Project will result in an increase in GHG emissions of 19,299 tonnes CO_2e/year (up from 31,559 CO_2e/year) that cannot be practically mitigated. The increase is effectively due to the increase in containers processed. However, on an intensity basis based on containers processed, the Base Case emissions intensity is 57.4 kg CO_2e/TEU. The Project Case emissions intensity is 55.6 kg CO_2e/TEU. This represents a 3% improvement to GHG emissions performance.
	Container Yard	Addition of electrified crane; reconfiguration of the container yard to optimize container handling to minimize diesel consumption from the rubber-tired gantries and internal transfer vehicles	
	Rail Operations	Increased efficiency in handling procedures	
	Marine Operations	Implementation of shore power at berth 5 and potential implementation of shore power at berth 6.	

6.8.6 Characterization of Significance of Residual Effects

The proposed Project would result in an increase in GHG emissions of 19,299 tonnes CO_2e/year from the Base Case that cannot be practically mitigated. To provide context for the magnitude of the increase, GHG emissions for the proposed Project are compared to existing provincial, national, and global GHG emission totals (Table 6-9).

Table 6-9: Comparison of Project Emissions to Provincial, Federal, and Global Emissions

	Baseline	Proposed Expansion	Estimated Increase
% of 2013 BC Emissions	0.049%	0.079%	0.030%
% of 2013 Canada Emissions	0.004%	0.007%	0.002%
% of 2012 Global Emissions	0.00007%	0.000011%	0.00004%

The following provides a summary of the overall residual effect of GHG emissions, based on the summary provided in Table 6-8.

Magnitude: Total GHG emissions after expansion would be less than 0.1 percent of provincial totals, less than 0.01 percent of national totals, and less than 0.0001 percent of global levels. Based on efficiency for numbers of containers processed, the Project Case emissions intensity represents a 3 percent improvement to GHG emissions performance.

Geographic Extent: GHG emissions from the proposed Project would mix and join the global atmospheric pool of GHGs.

Duration: GHG emissions would occur throughout the operational life of the proposed Project. While GHG emissions from the proposed Project would not persist beyond its operational life, the effects of the emissions (i.e., contribution to climate change) would.

Frequency: The majority of activities that generate GHG emissions would be intermittent (e.g., crane operations); however, the Terminal operates 24 hours per day and GHG emissions are generated continuously. The residual effect is therefore continuous throughout the operational life of the proposed Project.

Reversibility: GHG emissions have a gradual and long-term effect on climate change. In the long term, GHG emissions can be removed by natural sinks and sequestration projects. The residual effect is therefore partially reversible.

6.8.7 Industry Benchmarking

The proposed Project GHG emissions can be compared to other existing container ship ports to benchmark the Project's estimated GHG emissions performance. Emission inventories for 2014 from the ports of Los Angeles and New York/New Jersey were analyzed to extract comparable data for GHG emissions per container processed (TEU). Benchmarking emissions intensity (kg CO_2e/TEU) is required since the Los Angeles and New York/New Jersey ports are much larger than the Centerm facility.

Without an independent study to normalize activity data and inventory assumptions across ports, the total overall port emissions intensity is difficult to compare. This is especially true for rail and container truck emissions. The geographic boundary for rail varies considerably between ports. This affects the line haul emissions estimates. Furthermore, the split between containers processed by rail or truck affects the overall emissions profiles. Instead, to benchmark the selected ports, a comparison of emissions of the individual source categories of marine vessels and container handling equipment is presented. The emissions intensities are shown in Table 6-10.

Table 6-10: Comparison of Project Emissions to Los Angeles and New York/New Jersey Ports

	Centerm Project Emissions Intensity (kg CO_2e / TEU)	Los Angeles Port 2014 Emissions Intensity (kg CO_2e / TEU)	New York/New Jersey Port Emissions Intensity (kg CO_2e / TEU)
Container Handling Equipment	15.2	18.5	20.0
Marine Vessels	15.2	12.0	13.8

Notes:

Container handling equipment includes both non-road equipment (e.g., rubber-tired gantries) and terminal support vehicles.

Emissions from the 'in transit' mode of operation for the benchmarked ports have been normalized to account for the different distances travelled by the container ships at each port.

The comparison shows that the proposed Project emissions performance is within the same range as the other benchmarked ports. Performance of container handling equipment is slightly higher for the Project, potentially due to the smaller size of the Centerm facility. A larger port may have a greater number of container movements with greater distances travelled per container movement.

The marine vessel performance for the Project is slightly lower, potentially due to the larger size of container ships processed at the other benchmarked ports. The Los Angeles port processes ships with capacities up to 13,000 TEUs and the New York/New Jersey port up to 9,000 TEUs, whereas the Centerm facility processes ships with a capacity of 4,000 TEUs with the proposed Project being able to accept ships to 6,000 TEUs. A larger ship has lower total power demand per TEU in both main engines and auxiliary engines.

6.9 Monitoring and Follow-Up

The largest component of GHG emissions associated with the proposed Project is from non-road diesel combustion, specifically the rubber-tired gantry cranes and the internal transfer vehicles. The consumption of non-road diesel is monitored by the port authority's Non-Road Diesel Emissions Program. The program aims to reduce emissions associated with non-road equipment and cargo-handling equipment operating within its jurisdiction. Under the program, port operations must submit annual reports and operations are charged a fee for diesel used in older inefficient equipment. While the program is primarily intended for monitoring and reducing particulate matter, it can also be used for characterizing GHG emissions levels.

No additional monitoring or follow-up programs are proposed for the GHG characterization.