6.8 Greenhouse Gas Emissions

Greenhouse gases are air pollutants that trap solar energy in the atmosphere and contribute to global warming and climate change. Greenhouse gases are emitted and removed from the atmosphere by a combination of natural and human (anthropogenic) processes.[1] This section describes the estimated greenhouse gas emissions resulting from construction and operation of the proposed export terminal.

6.8.1 Greenhouse Effect

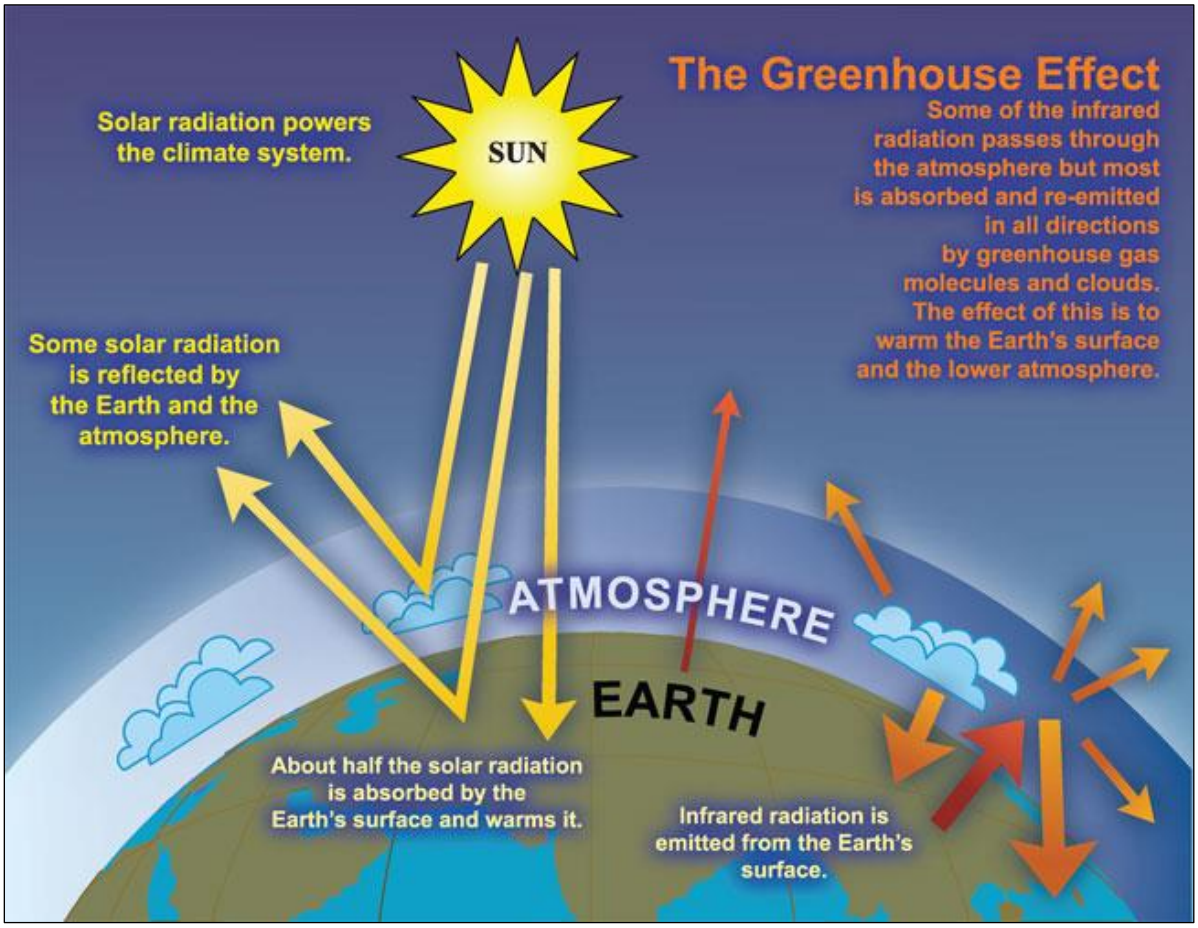
Earth retains outgoing thermal energy and incoming solar energy in the atmosphere, thus maintaining temperature levels suitable for life. This retention of energy by the atmosphere is known as the greenhouse effect.[2] When solar radiation reaches Earth, most of the solar radiation is absorbed by Earth's surface, reflected by Earth's surface and atmosphere, or—to a lesser degree—absorbed by Earth's atmosphere. Factors such as the reflectivity of Earth's surface, the abundance of water vapor, and the extent of cloud cover affect the degree to which solar radiation may be absorbed or reflected. Figure 6.8-1 shows the energy flows to and from Earth and the role the greenhouse effect plays in maintaining heat in the atmosphere.

[1] Examples of natural sources include decomposition of organic matter and aerobic respiration. Anthropogenic greenhouse gas emissions are predominantly from the combustion of fossil fuels, although other sources including industrial processes, land-use change (e.g., deforestation), agriculture, and waste management are also significant sources of greenhouse gases.

[2] The Intergovernmental Panel on Climate Change (2013) defines the greenhouse effect as follows:

> The infrared radiative effect of all infrared-absorbing constituents in the atmosphere. Greenhouse gases, clouds, and (to a small extent) aerosols absorb terrestrial radiation emitted by the Earth's surface and elsewhere in the atmosphere. These substances emit infrared radiation in all directions, but, everything else being equal, the net amount emitted to space is normally less than would have been emitted in the absence of these absorbers because of the decline of temperature with altitude in the troposphere and the consequent weakening of emission. An increase in the concentration of greenhouse gases increases the magnitude of this effect; the difference is sometimes called the enhanced greenhouse effect. The change in a greenhouse gas concentration because of anthropogenic emissions contributes to an instantaneous radiative forcing. Surface temperature and troposphere warm in response to this forcing, gradually restoring the radiative balance at the top of the atmosphere.

Figure 6.8-1. Model of the Natural Greenhouse Effect



Source: Intergovernmental Panel on Climate Change 2007.

The extent to which a given greenhouse gas[3] traps energy in the atmosphere and contributes to the overall greenhouse effect is characterized by its global warming potential (GWP).[4] Some gases are more effective at trapping heat, while others may be longer-lived in the atmosphere. The reference gas against which others are compared is carbon dioxide, and GWP is expressed in terms of carbon dioxide-equivalent (CO_2e). The unit CO_2e represents both a gas's ability to trap heat and the rate at

[3] The Intergovernmental Panel on Climate Change (2013) defines greenhouse gas as follows:

Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Beside CO_2, N_2O and CH_4, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

[4] The Intergovernmental Panel on Climate Change (2013) defines Global Warming Potential (GWP) as follows: An index, based on radiative properties of greenhouse gases, measuring the radiative forcing following a pulse emission of a unit mass of a given greenhouse gas in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide. The GWP represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in causing radiative forcing. The Kyoto Protocol is based on GWPs from pulse emissions over a 100-year time frame, and this time frame has remained the standard within the scientific community.

which it breaks down in the atmosphere. Most analyses use 100 years as the period of reference for GWPs, and this analysis conforms to that convention. For example, 1 unit of carbon dioxide has a 100-year GWP of 1, whereas an equivalent amount of methane has a GWP of 25.

Table 6.8-1 presents the 100-year GWPs from the IPCC Fourth Assessment Report for the greenhouse gases included in the study.[5]

Table 6.8-1. Global Warming Potentials

Greenhouse Gas	100-Year Global Warming Potential
Carbon dioxide	1
Methane	25
Nitrous oxide	298

Notes:
Source: Intergovernmental Panel on Climate Change 2007.

The predominant gases in Earth's atmosphere, nitrogen and oxygen (which together account for nearly 90% of the atmosphere), exert little greenhouse effect. Some naturally occurring gases, such as carbon dioxide, methane, and nitrous oxide, trap outgoing energy and contribute to the greenhouse effect. Additionally, manufactured pollutants, such as hydrofluorocarbons,[6] can contribute to the greenhouse effect. Most air pollutants[7] (e.g., sulfur dioxide and particulate matter) are short-lived in the atmosphere and therefore have more of a local or regional impact on air quality and the environment. Most greenhouse gases (e.g., carbon dioxide, methane, nitrous oxide) are long-lived and become globally mixed in the atmosphere, and therefore affect the atmosphere similarly regardless of where they are emitted.[8]

Atmospheric concentrations of greenhouse gases have increased since the Industrial Revolution, but the natural reservoirs of the climate system (e.g., oceans, soils, and forests) that remove certain greenhouse gases (e.g., carbon dioxide, methane, nitrous oxide) from the atmosphere do not have the capacity to store all of the additional emissions. Additionally, concentrations of long-lived, manufactured greenhouse gases —such as hydrofluorocarbons—have increased in recent decades. As the atmospheric concentrations of greenhouse gases increase, the atmosphere's ability to retain heat increases as well. Since reliable instrumental record keeping of temperatures in the U.S. began in 1895, the U.S. average temperature has risen by approximately 1.3 to 1.9 degrees Fahrenheit (°F) (U.S. Global Change Research Program 2014). Furthermore, U.S. average temperatures throughout

[5] While additional greenhouse gases (HFCs, PFCs, SF_6) were considered for this analysis as per the Council on Environmental Quality (2014) guidance, carbon dioxide, methane, and nitrous oxide are the greenhouse gases emitted from the fossil fuel combustion and the upland and wetland land-cover change activities considered in this study.

[6] Hydrofluorocarbons are any of a class of partly chlorinated and fluorinated hydrocarbons, used as an alternative to chlorofluorocarbons in foam production, refrigeration, and other processes.

[7] Per the U.S. Environmental Protection Agency (EPA) Report on the Environment (ROE) (U.S. Environmental Protection Agency 2016a), air pollutant is defined as

> Any substance in air that could, in high enough concentration, harm human health and the environment and cause property damage. Air pollutants can include almost any natural or artificial composition of matter capable of being airborne—solid particles, liquid droplets, gases, or a combination thereof. Air pollutants are often grouped in categories for ease in classification; some of the categories are sulfur compounds, volatile organic compounds, particulate matter, nitrogen compounds, and radioactive compounds.

[8] Some greenhouse gases like tropospheric ozone have relatively short atmospheric lifetimes and more of a local impact.

the 21st century are expected to increase at a faster pace, by 2.5°F to 11°F above preindustrial levels by 2100 (U.S. Global Change Research Program 2014).

Most of the observed increase in global average temperatures since the mid-20th century is likely due to the observed increase in anthropogenic greenhouse gas concentrations (Intergovernmental Panel on Climate Change 2007). Any local contribution to this observed increase in anthropogenic greenhouse gas concentration in turn contributes to the increase in global average temperature. The impacts of higher global surface temperatures include widespread changes in Earth's climate system. This may affect weather patterns, biodiversity, human health, and infrastructure.

6.8.2 Regulatory Setting

Laws and regulations relevant to greenhouse gases are summarized in Table 6.8-2.

Table 6.8-2. Regulations, Statutes, and Guidelines for Greenhouse Gases

Regulation, Statute, Guideline	Description
Clean Air Act of 1963 (42 USC 7401)	In 2007, the U.S. Supreme Court ruled GHGs are air pollutants under the Clean Air Act. *Massachusetts et al. v. Environmental Protection Agency*, 549 U.S. 497 (2007).[a]
Greenhouse Gas Reporting Program (40 CFR 98)	Owners and operators of certain facilities that directly emit GHG as well as for certain suppliers are subject to mandatory GHG reporting requirements. For suppliers, the GHGs reported are the quantity that would be emitted from combustion or use of the products supplied. In general, facilities emitting 25,000 metric tons or more of GHGs from certain sectors are subject to annual reporting.
The President's Climate Action Plan (2013)	Sets forth plan for cutting carbon pollution, preparing for the impacts of climate change, and leading international efforts to address climate change (Executive Office of the President 2013).
United States Intended Nationally Determined Contribution Submittal to the United Nations Framework Convention on Climate Change	The United States and other nations submitted Intended Nationally Determined Contribution to the United Nations in 2015. The United States intends to achieve an economy-wide target of reducing its greenhouse gas emissions by 26 to 28% below its 2005 level in 2025 and to make best efforts to reduce its emissions by 28% (United Nations Framework Convention on Climate Change n.d.).

Notes:

[a] In 2009, EPA proposed the Endangerment Finding and the Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. The Endangerment Findings determined that the current and projected concentrations for carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorinated chemicals, and sulfur hexafluoride posed a threat to the health and welfare of current and future generations (U.S. Environmental Protection Agency 2009). This sets the legal foundation for regulating GHG emissions from sources of these six well-known GHGs, such as vehicles, industrial facilities, and power plants.

USC = United States Code; CFR = Code of Federal Regulations; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas

6.8.3 Study Area

The study areas are the same for both the On-Site Alternative and Off-Site Alternative. The study areas consist of the project areas, those areas in the vicinity of the project that could be affected by greenhouse gases resulting from construction and operation of the proposed export terminal, and the lower Columbia River from the project area to the mouth of the river. These study areas are consistent with the Corps *NEPA Scope of Analysis Memorandum for Record* (MFR) (2014) and adjusted to reflect emissions related to the proposed export terminal.

6.8.4 Methods

This section describes the sources of information and methods used to evaluate the greenhouse gas emissions associated with the construction and operation of the proposed export terminal. The *NEPA Greenhouse Gas Emissions Technical Report* (ICF International 2016a) provides detailed descriptions of the methods summarized below.

6.8.4.1 Information Sources

The following sources of information were used to identify the existing conditions relevant to greenhouse gas emissions in the study areas.

- *NEPA Air Quality Technical Report* (ICF International 2016b)
- *NEPA Energy Technical Report* (ICF International 2016c)
- *NEPA Rail Transportation Technical Report* (ICF International 2016d)
- *NEPA Vessel Transportation Technical Report* (ICF International 2016e)
- *NEPA Vegetation Technical Report* (ICF International 2016f)

To estimate the greenhouse gases emitted as a result of the processes described in the above referenced reports, analysts used those reports' estimates of fuel consumption and vehicle operation (referred to as *activity data*[9]) and combined that data with greenhouse gas emissions factors to estimate greenhouse gas emissions for the proposed export terminal.

The greenhouse gas emissions factors were drawn from the following sources based on representative and reputable U.S. Environmental Protection Agency (EPA), regional, and industry sources.

- California Air Resources Board (2011)
- Clean Cargo Working Group (2014)
- Energy Information Agency (1994)
- U.S. Environmental Protection Agency (1996, 2009, 2014, 2015)

[9] An activity is a practice or ensemble of practices that take place on a delineated area over a given period. *Activity data* are data on the magnitude of a human activity resulting in emissions or removals taking place during a given period of time (e.g., data on energy use, data on equipment used during construction of the proposed export terminal) (Intergovernmental Panel on Climate Change 2006).

6.8.4.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the proposed export terminal on greenhouse gas emissions. This section also describes the method for estimating the greenhouse gas emissions from each emissions source.

Scope of the Analysis

The greenhouse gas emissions analysis considers the following elements.

- **Analysis period.** To be consistent with activity data from the other resources, this analysis considers construction, operation, transportation, and fossil fuel combustion emissions from 2018 through 2038.
- **Emissions in the project area.** Greenhouse gas emissions in the project area are estimated for the construction and operation of the proposed export terminal. These are described in Section 6.8.4, *Methods*. Greenhouse gas emissions are measured in CO_2e, which is based on the global warming potential factors consistent with the Intergovernmental Panel on Climate Change Fourth Assessment Report (2007) for carbon dioxide, methane, and nitrous oxide.[10]

Emissions Outside the Project Area

Greenhouse gas emissions are estimated from the proposed export terminal that are outside the project area but within the study area. These are also described below in *Method for Impact Analysis*. Greenhouse gas emissions calculations are characterized in terms of CO_2e.

Method for Assembling an Emissions Time Series

Because greenhouse gases accumulate in the atmosphere, this assessment characterizes greenhouse gases over the full analysis period (2018 to 2038) for each year, as well as for each alternative. The time series was estimated from the following data.

The activity data characterizing export terminal operations represent conditions in 2028, when the facility is expected to be fully operational. These activity data do not reflect the export terminal startup, in which the coal throughput increases from zero immediately after construction in 2020, to full capacity of 44 million metric tons by 2028. Emissions estimates are proportional to throughput and can be expressed as emissions per unit of coal throughput.

6.8.5 Affected Environment

The affected environment related to greenhouse gas emissions in the study areas is described below.

- **Project area for the On-Site Alternative**. Existing greenhouse gas emissions in the project area are primarily related to the ongoing hazardous waste cleanup activities, emissions generated from electricity consumption for the Applicant's administration building, and emissions from on-site vehicles.

[10] The U.S. Greenhouse Gas Emissions Inventory covers six greenhouse gases; however, since the proposed export terminal does not include refrigeration, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride were not included in the estimate of greenhouse gas emissions.

- **Project area for the Off-Site Alternative.** Greenhouse gas emissions in the project area for the Off-Site Alternative are primarily related to the rural residential land uses and small-scale farming.
- **Reynolds Lead and BNSF Spur.** Approximately 7 trains per day each consisting of approximately 78 cars typically pass between the BNSF Spur. Baseline traffic on the Reynolds Lead in the project areas in Cowlitz County is about 2 trains per day.
- **Columbia River.** Greenhouse gas emissions on the Columbia River are primarily related to vessel traffic. The *NEPA Vessel Transportation Technical Report* provides estimates of existing vessel traffic by vessel type.

6.8.5.1 Method for Impact Analysis

This section provides an overview of the method for calculating greenhouse gas emissions in the study areas for each source. More information about each method is described in the *NEPA Greenhouse Gas Emissions Technical Report*.

Sources of Emissions

Greenhouse gas emissions were estimated from construction, operation, and transportation for the following activities related to the proposed export terminal.

- **Upland and wetland land-cover change.** The removal of vegetation, disturbance of surface soil, and infilling of wetlands associated with clearing and grading during construction of the terminal would affect carbon stocks, carbon sequestration, and wetland emissions. Upland and wetland vegetation and soil store and sequester carbon dioxide (remove carbon dioxide from the atmosphere); consequently, their removal would increase greenhouse gas emissions. Wetlands also emit carbon dioxide and methane, consequently, their removal would partially decrease greenhouse gas emissions.
- **Export terminal construction activities.** Construction of the terminal would generate greenhouse gas emissions from operation of construction equipment and transport of employees and construction materials to the project area.
- **Employee commuting.** Construction and operation of the terminal would generate greenhouse gas emissions from construction workers commuting to the project area, and during operations, daily employee commuting to and from the project area.
- **Rail transport.** Operation of the terminal would require rail transport to and from the export terminal on the BNSF Spur and Reynolds Lead, and in the project areas.
- **Export terminal operations.** Operation of the terminal would generate greenhouse gas emissions from equipment such as loaders, maintenance vehicles, and cranes.
- **Vessel idling and tugboat use at the export terminal.** Operation of the terminal would generate greenhouse gas emissions from vessel maneuvering into and then idling at the loading area. Additionally, tugboats assisting in vessel maneuvering would generate greenhouse gas emissions.
- **Vessel transport.** Operation of the terminal would generate greenhouse gas emissions from vessels transporting coal from the project area to the mouth of the Columbia River.

- **Export terminal electricity consumption.** Operation of the terminal would consume electricity, generating greenhouse gas emissions from off-site power plants supplying that electricity.

6.8.6 Impacts

This section describes the greenhouse gas emissions that would result from construction and operation of the proposed export terminal. Detailed emissions by alternative are available in the *NEPA Greenhouse Gas Emissions Technical Report*.

6.8.6.1 On-Site Alternative

This section describes the greenhouse gas emissions that could occur in the study areas as a result of construction and operation of the export terminal at the On-Site Alternative location. Aggregated results of each of the emissions sources described previously is also presented. Details of the emissions associated with each source are available in the *NEPA Greenhouse Gas Emissions Technical Report.*

Construction

Results of the greenhouse gas analysis indicate construction activities would emit 23,598 metric tons of CO_2e (Table 6.8-3). Initial construction was assumed to occur over an 18-month period (2018 to 2020). Consequently, except for vegetation removal, soil disturbance, and wetland loss, the total greenhouse gas construction-related emissions from 2018 to 2020 would be 1.5 times the initial 12-month period (Table 6.8-3). Emissions related to the carbon stock loss associated with vegetation removal, soil disturbance, and wetland loss would all occur in the first year.

Operations

Greenhouse gas emissions from the proposed export terminal operations would be primarily driven by rail transport of coal, vessel idling and tugboat use at the terminal, and vessel transport of coal (Table 6.8-4). The greenhouse gas emissions are presented in terms of the 2028 emissions (the assumed first year of full export capacity operation for the export terminal) and total emissions from 2021 (when export operation begins) to 2038.

Table 6.8-3. Construction Greenhouse Gas Emissions (metric tons of CO_2e)—On-Site Alternative

Source	Greenhouse Gas Emissions (metric tons of CO_2e)
Vegetation Removal, Soil Disturbance, and Wetland Loss[a]	
Emissions During 12 Months of Construction Period	11,771
Total Emissions 2018–2020	11,821
Construction Equipment	
Emissions During 12 Months of Construction Period	5,349
Total Emissions 2018–2020[b]	8,024
Construction Worker Commuting	
Emissions During 12 Months of Construction Period	465
Total Emissions 2018–2020[b]	698
Construction Trucks	
Emissions During 12 Months of Construction Period	1,081
Total Emissions 2018–2020[b]	1,621
Construction Barges	
Emissions During 12 Months of Construction Period	955
Total Emissions 2018–2020[b]	1,433
Subtotal Construction Emissions	
Emissions During 12 Months of Construction Period	19,622
Total Emissions, 2018–2020	23,598

Notes:

[a] Vegetation removal, soil disturbance, and wetland loss emissions represent the total emissions resulting from proposed export terminal emissions sources, including (1) loss of accumulated carbon stocks during construction; (2) lost sequestration from removed vegetation that increases emissions; and (3) reduction in carbon dioxide and methane emissions from permanently filled wetlands.

[b] Construction emissions occur over an 18-month period prior to the operation of the export terminal; therefore, emissions from 2021 through 2038 are zero. Given the 18-month period for construction, total construction emissions are those for the 12-month period multiplied by 1.5.

Table 6.8-4. Terminal Operation Greenhouse Gas Emissions (metric tons of CO_2e)—On-Site Alternative

Source	Greenhouse Gas Emissions (metric tons of CO_2e)
Vegetation Removal, Soil Disturbance, and Wetland Loss[a]	
Annual Emissions, 2028	17
Total Emissions, 2021–2038	300
Export Terminal Equipment Operations	
Annual Emissions, 2028	903
Total Emissions, 2021–2038	12,894
Vessel Idling and Tugboat Use	
Annual Emissions, 2028	7,338
Total Emissions, 2021–2038	104,740
Rail Operation (Project Area)	
Annual Emissions, 2028	1,414
Total Emissions, 2021–2038	20,184
Employee Commuting	
Annual Emissions, 2028	275
Total Emissions, 2021–2038	3,922
Rail Transport (Reynolds Lead and BNSF Spur)	
Annual Emissions, 2028	5,321
Total Emissions, 2021–2038	75,836
Vessel Transport	
Annual Emissions, 2028	47,721
Total Emissions, 2021–2038	682,202
Electricity Consumption	
Annual Emissions, 2028	177
Total Emissions, 2021–2038	3,191
Subtotal Operations Emissions	
Annual Emissions, 2028	63,167
Total Emissions, 2021–2038	903,269

Notes:

[a] Vegetation removal, soil disturbance, and wetland loss emissions represent the total emissions resulting from export terminal emissions sources, adjusted for 1) lost sequestration from removed vegetation that increases emissions; and 2) reduction in carbon dioxide and methane emissions from permanently filled wetlands.

Total Greenhouse Gas Emissions

Table 6.8-5 presents the total combined emissions from construction (beginning in 2018) and operations (from 2021 through 2038).[11]

Table 6.8-5. Total Greenhouse Gas Emissions (metric tons of CO_2e)—On-Site Alternative

Period	Emissions
Project Area Emissions	
Annual Emissions, 2028	9,947
Total Emissions, 2018–2038	165,637
Emissions Generated beyond Project Area[a]	
Annual Emissions, 2028	53,219
Total Emissions, 2018–2038	761,229
Total	
Annual Emissions, 2028	63,167
Total Emissions, 2018–2038	926,866

Notes:
[a] Emissions from electricity consumption are included as emissions beyond the project area. While the consumption of electricity takes place in the project area, the emissions associated with this consumption take place outside the project area.

6.8.6.2 Off-Site Alternative

This section describes the greenhouse gas emissions that could occur in the study areas as a result of construction and operation of the proposed export terminal at the Off-Site Alternative location. This section presents the aggregated results of each of the emissions sources described previously. Details of the emissions associated with each source are available in the *NEPA Greenhouse Gas Emissions Technical Report.*

Construction

Construction of the proposed export terminal at the Off-Site Alternative location would result in greenhouse gas emissions of 47,613 metric tons of CO_2e (Table 6.8-6). Initial construction was assumed to occur over an 18-month period (2018 to 2020). Consequently, except for vegetation removal, soil disturbance, and wetland loss, the total greenhouse gas construction-related emissions from 2018 to 2020 would be 1.5 times the initial 12-month period. Emissions related to the carbon stock loss associated with vegetation removal, soil disturbance, and wetland loss would all occur in the first year.

[11] Although this analysis only looks at emissions over the 21-year time horizon specified in Section 6.8.4.2, *Impact Analysis,* actual emissions from operating the terminal would continue throughout the lifetime of the export terminal.

Table 6.8-6. Construction Greenhouse Gas Emissions (metric tons of CO_2e)—Off-Site Alternative

Source	Greenhouse Gas Emissions (metric tons of CO_2e)
Vegetation Removal, Soil Disturbance, and Wetland Loss[a]	
Emissions During 12 Months of Construction Period	35,908
Total Emissions 2018–2020[b]	35,836
Construction Equipment	
Emissions During 12 Months of Construction Period	5,349
Total Emissions 2018–2020[c]	8,024
Construction Worker Commuting	
Emissions During 12 Months of Construction Period	465
Total Emissions 2018–2020[c]	698
Construction Trucks	
Emissions During 12 Months of Construction Period	1,081
Total Emissions 2018–2020[c]	1,621
Construction Barges	
Emissions During 12 Months of Construction Period	955
Total Emissions 2018–2020[c]	1,433
Subtotal Construction Emissions	
Emissions During 12 Months of Construction Period	43,759
Total Emissions, 2018–2020	47,613

Notes:

[a] Vegetation removal, soil disturbance, and wetland loss emissions represent the total emissions resulting from proposed export terminal emissions sources, including 1) loss of accumulated carbon stocks during construction; 2) lost sequestration from removed vegetation that increases emissions; and 3) reduction in carbon dioxide and methane emissions from permanently filled wetlands.

[b] Emissions are lower compared to the 12-month construction period as a result of a reduction in carbon dioxide and methane emissions from permanently filled wetlands.

[c] Construction emissions occur over an 18-month period prior to the operation of the terminal; therefore, emissions from 2021 through 2038 are zero. Given the 18-month period for construction, total construction emissions are those for the 12-month period multiplied by 1.5.

Operations

Operation of the proposed export terminal at the Off-Site Alternative location would result in annual greenhouse gas emissions of 62,414 metric tons of CO_2e in 2028.

Greenhouse gas emissions during operations would be primarily driven by rail transport of coal, vessel idling and tugboat use at the terminal and vessel transport of coal (Table 6.8-7). The greenhouse gas emissions are presented in terms of the 2028 emissions (the assumed first year of full export capacity) and total emissions from 2021 (when export operations begin) to 2038.

Table 6.8-7. Terminal Operation Greenhouse Gas Emissions (metric tons of CO_2e)—Off-Site Alternative

Source	Greenhouse Gas Emissions (metric tons of CO_2e)
Vegetation Removal, Soil Disturbance, and Wetland Loss	
Annual Emissions, 2028[a]	−24
Total Emissions, 2021–2038[a]	−430
Export Terminal Equipment Operations	
Annual Emissions, 2028	903
Total Emissions, 2021–2038	12,894
Vessel Idling and Tugboat Use	
Annual Emissions, 2028	7,338
Total Emissions, 2021–2038	104,740
Rail Operations (Project Area)	
Annual Emissions, 2028	1,414
Total Emissions, 2021–2038	20,184
Employee Commuting	
Annual Emissions, 2028	275
Total Emissions, 2021–2038	3,922
Rail Transport (Reynolds Lead and BNSF Spur)	
Annual Emissions, 2028	5,695
Total Emissions, 2021–2038	81,177
Vessel Transport	
Annual Emissions, 2028	46,634
Total Emissions, 2021–2038	666,540
Electricity Consumption	
Annual Emissions, 2028	177
Total Emissions, 2021–2038	3,191
Subtotal Operations Emissions	
Annual Emissions, 2028	62,414
Total Emissions, 2021–2038	892,218

Notes:
[a] Emissions are negative as a result of a reduction in carbon dioxide and methane emissions from permanently filled wetlands.

Total Greenhouse Gas Emissions

Table 6.8-8 presents the total combined emissions from construction (beginning in 2018) and operation (from 2021 through 2038).

Table 6.8-8. Total Greenhouse Gas Emissions (metric tons of CO_2e)—Off-Site Alternative

Period	Emissions
Project Area Emissions	
Annual Emissions, 2028	9,907
Total Emissions, 2018–2038	188,922
Emissions Generated Beyond Project Area[a]	
Annual Emissions, 2028	52,507
Total Emissions, 2018–2038	750,908
Total	
Annual Emissions, 2028	62,414
Total Emissions, 2018–2038	939,830

Notes:
[a] Emissions from electricity consumption are included as emissions beyond the project area. While the consumption of electricity takes place in the project area, the emissions associated with this consumption take place outside the project area.

6.8.6.3 Emissions in Context

To provide a frame of reference for the emissions estimates, the projected annual greenhouse gas emissions from the proposed export terminal at the On-Site Alternative and Off-Site Alternative locations are compared to the following emissions sources and targets.

- **Equivalent additional passenger cars added to the road**. This comparison is made to put emissions in context to a common metric.
- **The Washington State GHG target under EPA's Clean Power Plan**. While the emissions sources included in this analysis fall outside the scope of emissions covered under the Clean Power Plan, a comparison was made to the Clean Power Plan to provide context for emissions from the proposed export terminal.
- **The Washington State statewide GHG reduction target, and projected statewide emissions**. Comparing emissions to statewide projected emissions puts the proposed export terminal in a broader context and compares emissions of the terminal to all emissions sources in Washington State.
- **The U.S. Intended Nationally Determined Contribution target**. Compares emissions to a national target.

The total emissions associated with the On-Site Alternative would be 926,866 metric tons of CO_2e from 2018 to 2038, while total emissions for the Off-Site Alternative during this time would be 939,830 metric tons of CO_2e. The additional emissions from the Off-Site Alternative are primarily due to a greater amount of vegetation removal, soil disturbance, and wetland loss. Annual emissions would be nearly identical for both alternatives when the terminal reaches full export capacity in 2028. Total emissions of the On-Site Alternative would reach 63,167 metric tons of CO_2e in 2028, equivalent to 13,343 additional passenger cars on the road (U.S. Environmental Protection Agency 2016b).

In 2015, EPA finalized state-specific targets to reduce carbon dioxide emissions in the power sector to 32% below 2005 levels by 2030. The statewide mass-based carbon dioxide performance goal for Washington State is approximately 10.74 million short tons (9.74 million metric tons) (U.S.

Environmental Protection Agency 2016b). The 2028 total emissions for either alternative would be approximately 0.6% of that total.

Revised Code of Washington (RCW) 70.235.020, Limiting Greenhouse Gas Emissions, requires annual greenhouse gas emissions to be reduced to 1990 levels (88.4 million metric tons of CO_2e) by 2020, and 25% below 1990 levels by 2035 (66.3 million metric tons of CO_2e). Washington State goals for 2020 and 2035 represent a reduction of 3.3 million metric tons of CO_2e and 25.4 million metric tons of CO_2e, respectively, below the 2011 state emissions levels (91.7 million metric tons of CO_2e). Annual greenhouse gas emissions associated with the proposed export terminal under both the On-Site Alternative and Off-Site Alternative would total approximately 0.06 million metric tons of CO_2e, or about 2% and 0.2% of the 2020 and 2035 emissions reduction goals, respectively. Emissions from the proposed export terminal would represent approximately 0.1% of projected statewide emissions in Washington in 2035 (114.2 million metric tons of CO_2e) (Washington State Department of Ecology 2010).

Included in the U.S. Intended Nationally Determined Contribution, the United States has set an emissions reduction target to reduce emissions by 26 to 28% below 2005 emissions (6,680 million metric tons of CO_2e) by 2025 (United Nations Framework Convention on Climate Change n.d.; U.S. Environmental Protection Agency 2016). This policy would, therefore, reduce annual emissions to a level of 4,943 to 4,810 million metric tons of CO_2e by 2025. This level of emissions in 2025 is 1,165 to 1,298 million metric tons of CO_2e below 2014 annual emissions of 6,108 million metric tons of CO_2e (U.S. Environmental Protection Agency 2016). Greenhouse gas emissions associated with the proposed export terminal would be equivalent to 0.005% of this target range of reductions. If the targets were reached through consistent annual reductions, the United States would have to reduce annual emissions by 106 to 118 million metric tons of CO_2e each consecutive year, beginning in 2015.

6.8.6.4 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the On-Site Alternative project area. A limited-scale future expansion scenario proposed by the Applicant was evaluated, as described in Chapter 3, *Alternatives*. Under this scenario, uses could result in an estimated annual increase of 1,242 metric tons of CO_2e relative to current conditions in Cowlitz County for locomotive combustion, vessel combustion, and truck transport (Table 6.8-9).

Table 6.8-9. No-Action Alternative Maximum Annual Average Emissions in Cowlitz County

Source	Maximum Annual Average Emissions (metric tons of CO_2e)
Locomotive Combustion	593
Vessel Combustion	411
Haul Trucks	238
Total	1,242

6.8.7 Required Permits

No permits related to greenhouse gas emissions would be required for the proposed export terminal.