2021 AIR EMISSION INVENTORY

Prepared For:

South Carolina Ports Authority

Prepared By:

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ABBREVIATIONS

AVFT	Alternative Vehicle and Fuel Technology
BC	Black Carbon
BCDCOG	Berkely Charleston Dorchester Council of Governments
BSFC	Brake Specific Fuel Consumption
CCAMN	Charleston Community Air Monitoring Network
CCRAB	Charleston Community Research to Action Board
CFR	Code of Federal Regulations
CH_4	Methane
CHE	Container Handling Equipment
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CST	Columbus Street Terminal
SC DHEC	South Carolina Department of Health and Environmental Control
EF	Emission Factor
EPA	Environmental Protection Agency
g	Grams
GHG	Greenhouse Gas
HC	Hydrocarbons
HDV	Heavy Duty Vehicles
HLT	Hugh K. Leatherman Terminal
hp	Horsepower
hr or h	Hour
IMO	International Maritime Organization
IPD	Inland Port Dillon
IPG	Inland Port Greer
kW	Kilowatt
kn	Knots
L	Liters
LLAF	Low Load Adjustment Factor
MDO	Marine Diesel Oil
MGO	Marine Gas Oil
MOVES4	MOtor Vehicle Emission Simulator
mph	Miles per hour
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
NCT	North Charleston Terminal
OGV	Ocean-Going Vessels
PM	Particulate Matter
PM_{10}	Particulate Matter (less than 10 μm in diameter)
$PM_{2.5}$	Particulate Matter (less than 2.5 μm in diameter)
Ro-Ro	Roll-on/Roll-off

rpm	Revolutions per minute
RTG	Rubber-Tired Gantry
SCPA	South Carolina Ports Authority
SO_2	Sulfur Dioxide
STB	Surface Transportation Board
TEU	Twenty-Foot Equivalent Unit
tpy	Tons per Year
ULSD	Ultra-Low Sulfur Diesel
UPT	Union Pier Terminal
VOC	Volatile Organic Compounds
VT	Veterans Terminal
WWT	Wando Welch Terminal

1.0 INTRODUCTION

1.1 PORT OF CHARLESTON

The South Carolina Port Authority (SCPA) terminals are located throughout Charleston Harbor, a natural tidal estuary formed around the convergence of the Cooper, Ashley, and Wando Rivers. The City of Charleston is located west of Charleston Harbor, between the Ashley and Cooper Rivers, as well as on Daniel Island between the Cooper and Wando Rivers. James Island and Morris Island are south of the harbor, with Mt. Pleasant and Sullivan's Island to the east and North Charleston to the north. The entrance channel accesses the Atlantic Ocean to the southeast between Morris Island and Sullivan's Island. In the calendar year 2021, the SCPA operated six (6) Port of Charleston terminals and two inland ports:

- Columbus St
- North Charleston
- Union Pier
- Veterans
- Wando Welch
- Hugh K. Leatherman (Hugh Leatherman)
- Inland Port Dillon, located in Dillon County
- Inland Port Greer, located in Greenville / Spartanburg County

1.2 SCPA COMMITMENT TO IMPROVED AIR QUALITY

Sources of U.S. Environmental Protection Agency (EPA) regulated air pollutant emissions at ports include pollutant emissions from fossil fuel use by ships and supporting harbor craft, fossil fuel fired cargo handling equipment, fossil fuel fired locomotives, and fossil fuel fired container trucks. Air pollutant emissions from these sources include carbon monoxide (CO), oxides of nitrogen including nitrogen dioxide (NO_X/NO_2), particulate emissions (PM), sulfur dioxide (SO_2), volatile organic compounds (VOC), and black carbon (BC). These activities also produce greenhouse gas (GHG) emissions that include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Ozone, a pollutant also regulated by the U.S. EPA, is formed in the atmosphere from NO_X/NO_2 and VOCs.

SCPA recognizes the importance of maintaining good air quality in surrounding communities and is focused on improving air quality by committing to implementing a variety of emissions-reducing programs. SCPA participates in several air working groups, including the Charleston Community Air Monitoring Network (CCAMN), Charleston Community Research to Action Board (CCRAB), Berkely Charleston Dorchester Council of Governments (BCDCOG) Air Quality Coalition and the North Charleston Air Monitoring Group, a collaboration that includes the SCPA, the South Carolina Department of Health and Environmental Control (SC DHEC) and the BCDCOG, with the goal of actively engaging in the well-being of communities by addressing air quality concerns. SCPA participates in the Clean Truck Program which requires trucks serving SCPA container terminals to have post-1993 engines. SCPA has also installed two pollutant air monitoring stations, one located at the Union Pier terminal, and the other located at the Hugh Leatherman Terminal. To track progress in reducing overall pollutant emissions from SCPA operations, SCPA has committed to preparing periodic emission inventory reports.

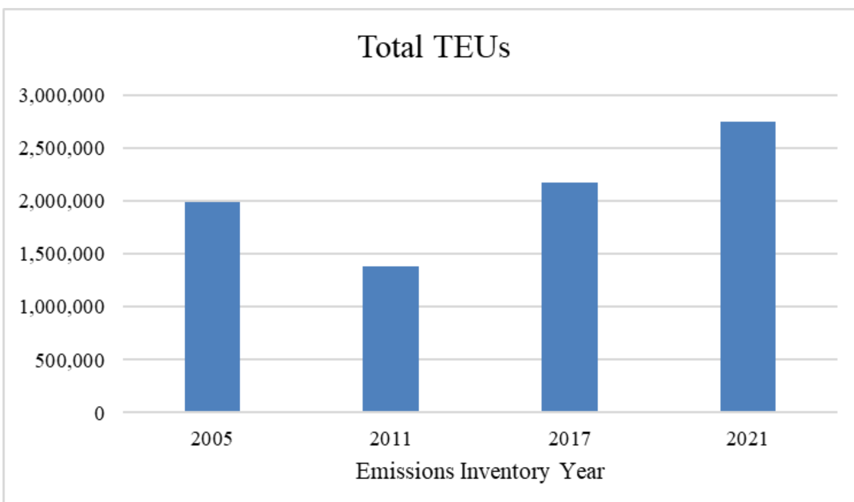
1.3 SCPA EMISSION INVENTORIES

SCPA air emission inventories play a vital role in understanding and managing the environmental impact of SCPA operations. An emission inventory is a study or compilation of pollutant emissions. The purpose of emissions inventories is to locate air pollution sources, to define the type and size of sources, to define the type and quantity of emissions from each source, to determine pollutant frequency and duration, and to determine the relative contributions to air pollution from classes of sources and from individual sources. These inventories provide crucial data on the types and quantities of air pollutants emitted by port activities, such as ship and supporting harbor craft emissions, cargo handling equipment, rail, and truck traffic. By quantifying emissions of various pollutants, SCPA can assess various operations and identify areas for improvement. SCPA prepared a baseline inventory in 2005, with follow up inventories using data from 2011 and 2017. The emission inventory detailed in this report quantifies SCPA emissions occurring in 2021. This emission inventory was prepared in general accordance with

U.S. EPA's *Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions, April 2022*. Additional sources referred to in preparation of this report are included in the Reference section of this report.

This emissions inventory presents a discussion of changes to SCPA facilities and operations with the potential to affect air pollutant emissions, provides detailed calculations of pollutant emissions due to SCPA activities and operations, compares pollutant emissions from past emissions inventories, provides a discussion of SCPA pollutant emissions in a regional context, and evaluates potential emission reduction strategies.

To put the 2017 and 2021 emissions comparison in context, overall trade of containerized goods shipped through SCPA calculated as twenty-foot equivalents (TEUs) increased 21% from 2017 to 2021. Total rail moves increased 22% over the same time (Figure 1).



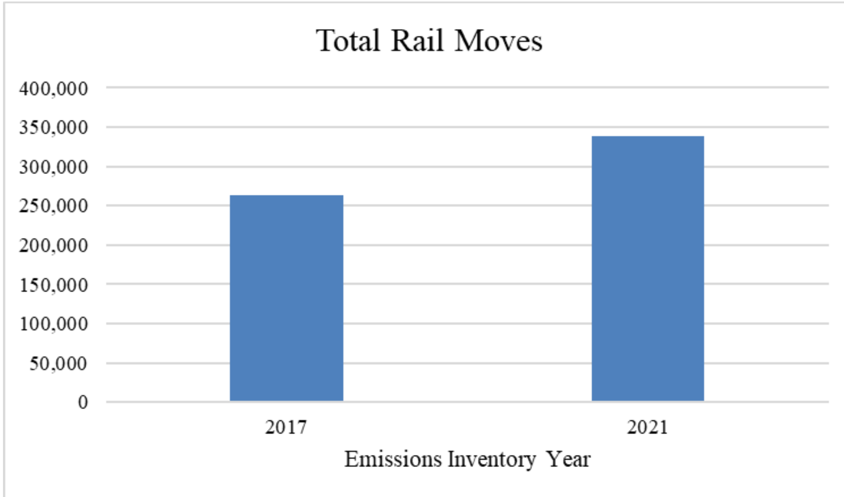


Figure 1: **SCPA TEU and Intermodal Rail Moves**

2.0 2021 EMISSIONS SUMMARY RESULTS

2.1 CHANGES SINCE THE 2017 INVENTORY

Since the 2017 Air Emissions Inventory, a major change to overall SCPA operations was the addition of one terminal and two inland ports. The Hugh Leatherman Terminal opened in March 2021. Inland Port Dillon and Inland Port Greer were also added since the previous inventory. These additions introduce potential emission sources including rail, heavy duty vehicles (HDV), non-road engines including container handling equipment (CHE), harbor craft, and ocean-going vessels (OGV). However, with the addition of the inland ports, rail service can now be used to transport containers inland as opposed to on-road trucking. The use of rail in lieu of trucking generally results in less pollutant emissions to the air. Specific changes as a result of these additions as well as other differences between the 2017 and 2021 emissions inventories are included, as applicable, with each major emissions source type detailed in Section 6 of the report.

2.2 2021 EMISSIONS SUMMARY

Starting with the 2021 Emissions Inventory, port emissions include two inland ports in addition to the terminals. Also, BC and CO_2e were considered for the first time along with the previously included pollutants: NO_x, CO, PM_{10}, $PM_{2.5}$, HC, and SO_2. Tables 1 through 3 and Figures 2 through 9 below detail the results of the 2021 Emission Inventory. To better contextualize these results, emissions were considered per a standard value, the twenty-foot equivalent unit (TEU). The TEU is based on a 20-foot shipping container and is used throughout the shipping industry to standardize ship capacities. Overall, total emissions decreased from 2017 to 2021 for the pollutants available for direct comparison. On an individual pollutant basis, total emissions increased for CO and decreased for NO_X, PM_{10}, $PM_{2.5}$, HC, and SO_2. Ocean-going vessels contributed the most to overall emissions followed by heavy-duty vehicles.

Table 1: **2021 Emission Summary (tons)**

Source Category	NO_x	CO	PM_{10}	$PM_{2.5}$	HC	SO_2	BC	CO_2e
Ocean-Going Vessels	1,321.36	161.14	23.28	21.42	81.07	58.32	0.75	80,655.68
Harbor Craft	179.60	41.25	3.31	3.20	3.68	0.17	2.47	18,759.42
Heavy Duty Vehicle - Trucks	483.57	231.23	29.62	14.40	18.87	0.57	7.53	175,470.78
Rail	299.93	43.98	10.86	10.54	18.17	0.15	7.69	16,878.26
Container Handling Equipment	191.40	57.83	8.78	8.51	10.38	0.25	6.55	85,864.85
Total	2,475.85	535.42	75.84	58.07	132.17	59.46	24.99	377,628.99

Table 2: **2021 TEU Inventory (TEUs)**

Source Category	TEUs
Ocean-Going Vessels	2,751,442
Harbor Craft	2,751,442
Heavy Duty Vehicle - Trucks	607,737
Rail	2,143,706
Container Handling Equipment	2,751,442

Table 3: **2021 Emission Summary (ton/TEU)**

Source Category	NO_x	CO	PM_{10}	$PM_{2.5}$	HC	SO_2	BC	CO_2e
Ocean-Going Vessels	4.80E-04	5.86E-05	8.46E-06	7.79E-06	2.95E-05	2.12E-05	2.73E-07	2.93E-02
Harbor Craft	6.53E-05	1.50E-05	1.20E-06	1.16E-06	1.34E-06	6.18E-08	8.97E-07	6.82E-03
Heavy Duty Vehicle - Trucks	2.26E-04	1.08E-04	1.38E-05	6.72E-06	8.80E-06	2.67E-07	3.51E-06	8.19E-02
Rail	4.94E-04	7.24E-05	1.79E-05	1.73E-05	2.99E-05	2.53E-07	1.27E-05	2.78E-02
Container Handling Equipment	6.96E-05	2.10E-05	3.19E-06	3.09E-06	3.77E-06	8.95E-08	2.38E-06	3.12E-02
Total	1.33E-03	2.75E-04	4.45E-05	3.61E-05	7.33E-05	2.19E-05	1.97E-05	1.77E-01

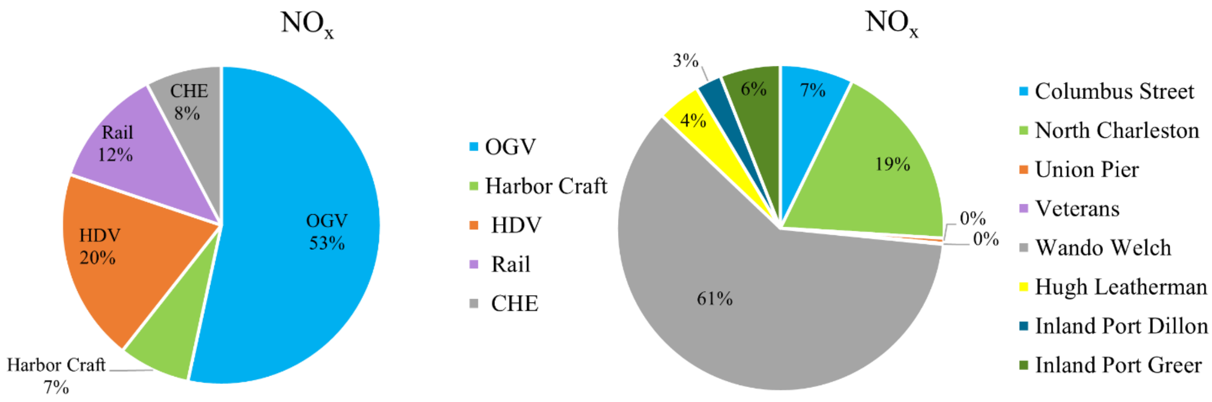


Figure 2: **NO_X by Source Category and Terminal**

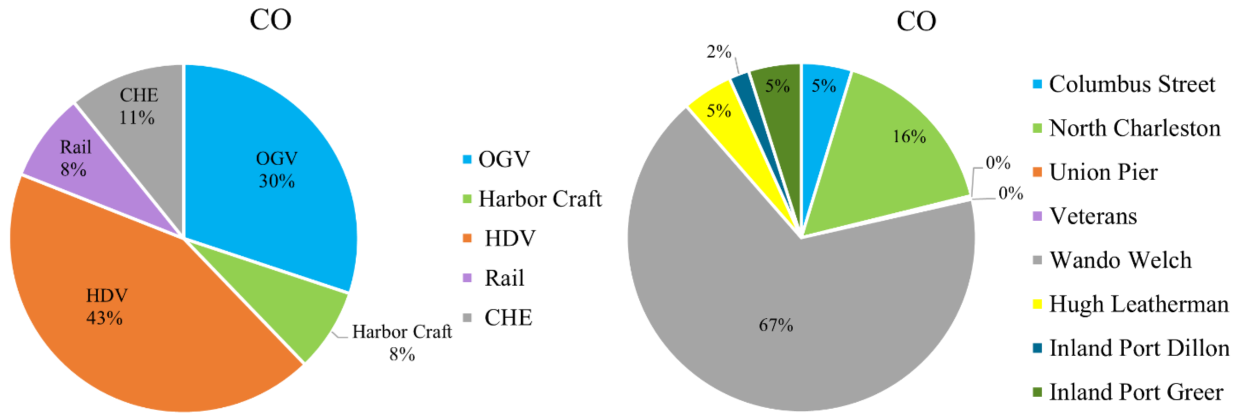


Figure 3: **CO by Source Category and Terminal**

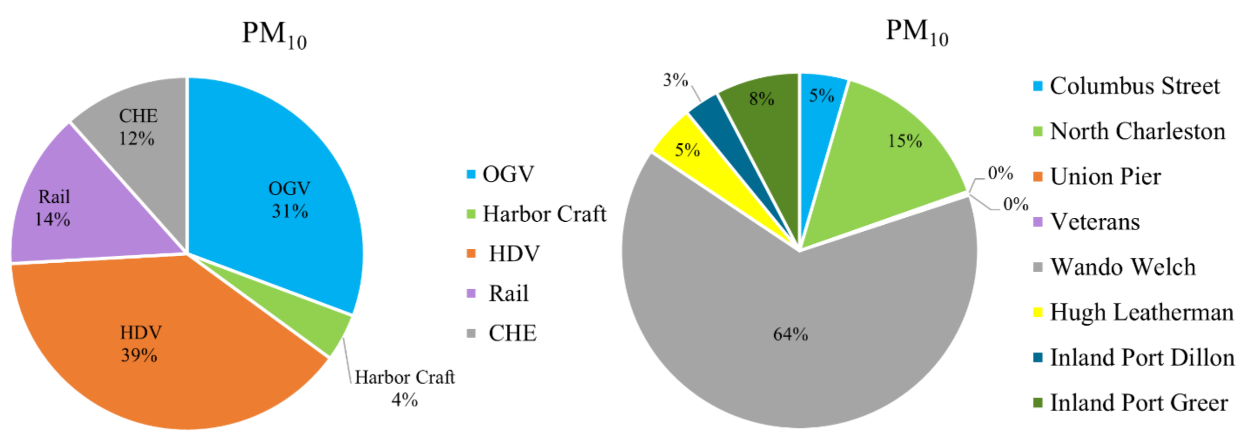


Figure 4: **PM_{10} by Source Category and Terminal**

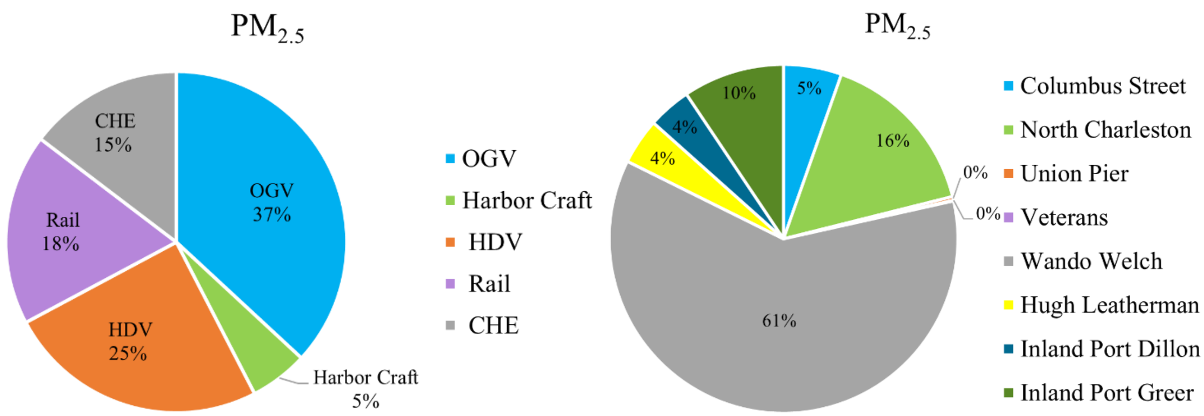


Figure 5: **$PM_{2.5}$ by Source Category and Terminal**

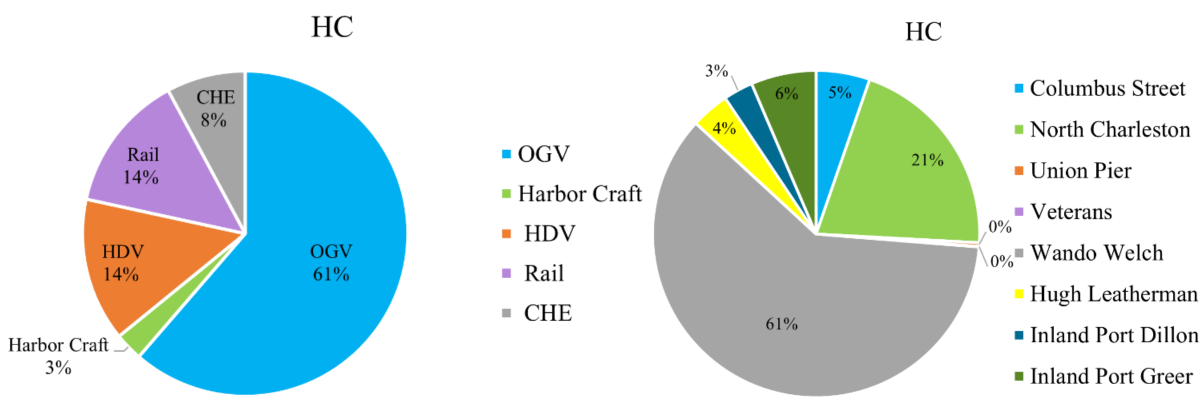


Figure 6: **HC by Source Category and Terminal**

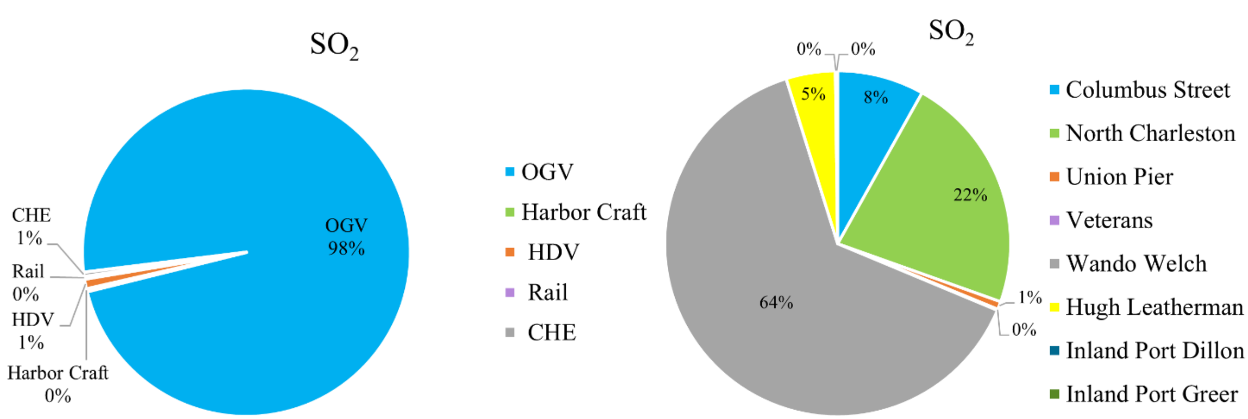


Figure 7: **SO_2 by Source Category and Terminal**

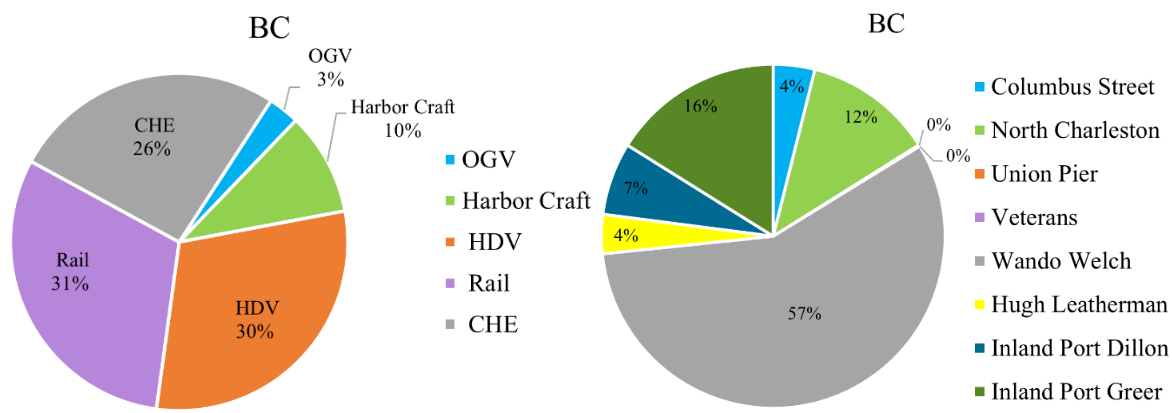


Figure 8: ***BC by Source Category and Terminal***

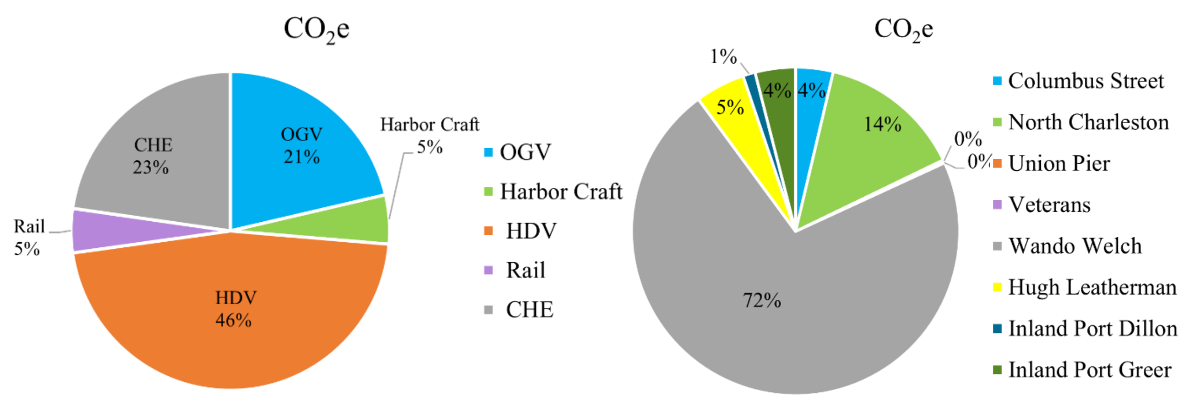


Figure 9: **CO_2e by Source Category and Terminal**

Emissions On and Off Terminal

Historically, port mobile sources have two main geographic areas for activities, on-terminal and off-terminal. On-terminal emissions include sources physically operating at or on the terminals. These include container handling equipment, some rail switching activities, vessels hotelling at berth, harbor craft assisting with vessel docking, and heavy-duty vehicle activity while located in the terminals. Off-terminal emissions include sources related to SCPA operations where emissions occur outside of the physical terminal boundaries. These include rail activity including switching and long-haul operations outside of the terminal boundaries, vessels traveling to the terminals, relevant harbor craft activity other than at the dock, and heavy-duty vehicle activities outside of the terminal boundaries. For the purposes of categorizing emissions, emissions occurring within the boundaries of the inland ports will be considered on-terminal. Figure 10 shows a graphical representation of emissions considered on-terminal vs. off-terminal in 2021. Note that CO_2e has been excluded from the figure to allow all other pollutants to be meaningfully visualized. Table 4 provides the numerical results used to produce Figure 10.

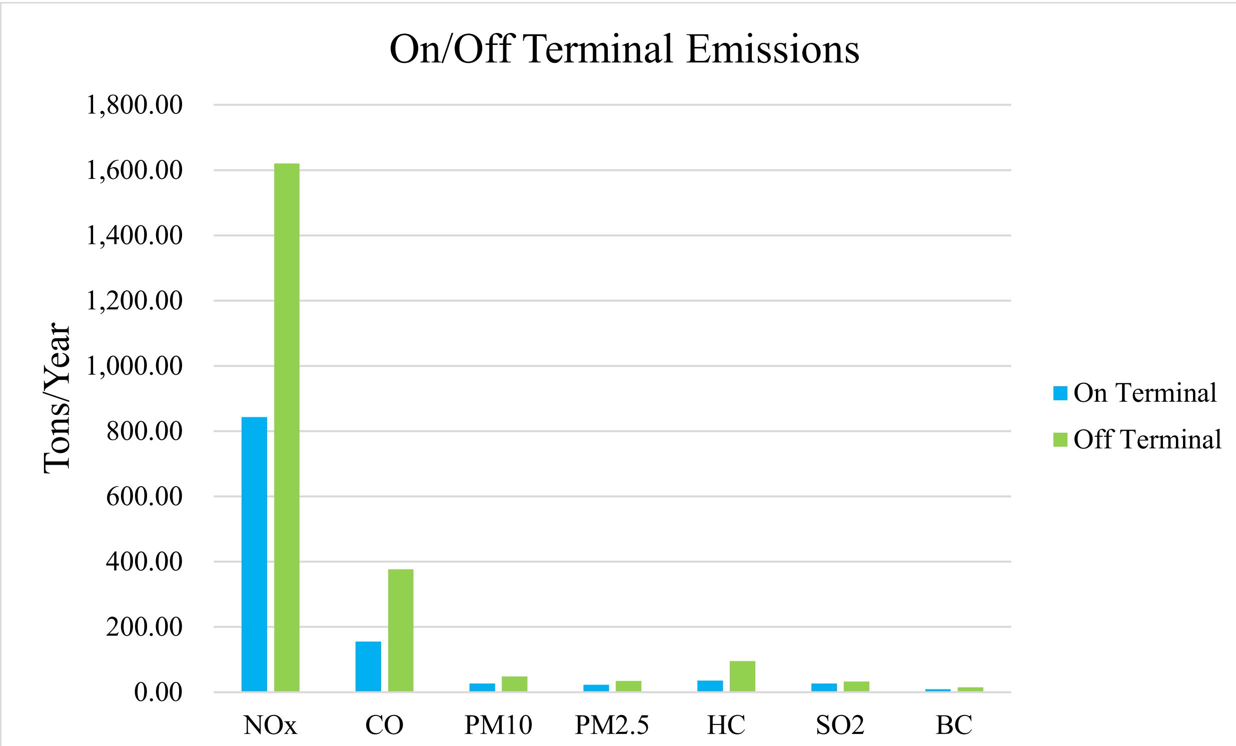


Figure 10: **On and Off Terminal Emissions Comparison**

Table 4: **2021 Activity Summary**

2021 Emissions by Terminal		Total Emissions								On Terminal								Off Terminal							
SCPA Total		**Emissions Summary tons/year**								**Emissions Summary tons/year**								**Emissions Summary tons/year**							
Terminal		**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**HC**	**SO_2**	**BC**	**CO_2e**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**HC**	**SO_2**	**BC**	**CO_2e**	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**HC**	**SO_2**	**BC**	**CO_2e**
Columbus Street	CST	178.23	25.00	3.39	3.10	6.99	4.82	0.96	13,778.78	88.55	11.36	1.93	1.80	3.28	2.95	0.54	7,561.49	89.68	13.63	1.46	1.30	3.71	1.87	0.42	6,217.29
North Charleston	NCT	461.69	87.47	11.36	9.03	26.99	13.27	2.99	52,638.84	140.80	23.99	3.99	3.47	5.61	4.47	1.31	21,298.86	320.89	63.48	7.38	5.57	21.38	8.81	1.69	31,339.98
Union Pier	UPT	12.59	1.46	0.22	0.20	0.48	0.44	0.03	976.39	7.93	0.82	0.14	0.13	0.27	0.30	0.01	646.02	4.66	0.63	0.08	0.07	0.21	0.14	0.01	330.37
Veterans	VT	2.29	0.29	0.04	0.04	0.08	0.06	0.01	160.30	1.24	0.13	0.02	0.02	0.04	0.04	2.40E-03	87.50	1.04	0.16	0.02	0.02	0.04	0.02	0.01	72.79
Wando Welch	WWT	1,490.49	356.95	48.50	34.98	79.62	37.98	14.03	267,098.32	512.05	100.58	17.30	14.29	21.58	17.47	5.59	103,748.73	978.44	256.37	31.21	20.69	58.04	20.51	8.44	163,349.59
Hugh Leatherman	HLT	106.37	24.91	3.56	2.45	4.97	2.74	0.90	18,280.93	44.03	6.72	1.29	1.00	1.64	1.77	0.21	5,699.81	62.34	18.19	2.27	1.45	3.33	0.97	0.69	12,581.12
Inland Port Dillon	IPD	64.02	9.96	2.40	2.30	3.85	0.03	1.68	4,509.12	14.89	2.64	0.57	0.53	1.11	0.01	0.38	1,676.04	49.13	7.31	1.83	1.77	2.74	0.03	1.29	2,833.07
Inland Port Greer	IPG	147.28	25.96	5.78	5.41	8.49	0.09	3.96	14,825.48	34.59	9.19	1.59	1.35	2.20	0.03	0.99	8,327.49	112.69	16.77	4.19	4.07	6.29	0.06	2.97	6,498.00
Total		**2,462.96**	**531.99**	**75.26**	**57.51**	**131.46**	**59.44**	**24.56**	**372,268.15**	**844.09**	**155.43**	**26.83**	**22.58**	**35.72**	**27.04**	**9.03**	**149,045.94**	**1,618.87**	**376.56**	**48.42**	**34.93**	**95.74**	**32.41**	**15.52**	**223,222.21**
OGV																									
Columbus Street	CST	129.61	13.47	2.16	1.99	5.39	4.78	0.14	7,873.46	64.57	6.17	1.26	1.17	2.23	2.93	0.06	5,004.41	65.05	7.30	0.89	0.82	3.16	1.85	0.08	2,869.05
North Charleston	NCT	311.27	39.10	5.13	4.72	20.93	13.13	0.15	16,837.63	82.55	7.53	1.79	1.65	2.81	4.42	0.05	7,376.09	228.72	31.57	3.34	3.07	18.12	8.71	0.10	9,461.55
Union Pier	UPT	11.26	1.11	0.19	0.17	0.45	0.44	0.01	711.29	7.46	0.71	0.13	0.12	0.25	0.30	4.77E-03	506.19	3.80	0.40	0.06	0.05	0.19	0.14	1.75E-03	205.09
Veterans	VT	1.72	0.16	0.03	0.02	0.06	0.06	7.45E-04	100.70	1.11	0.09	0.02	0.02	0.03	0.04	5.15E-04	73.20	0.61	0.06	0.01	0.01	0.03	0.02	2.30E-04	27.50
Wando Welch	WWT	808.81	100.90	14.70	13.53	51.23	37.22	0.42	51,145.90	291.94	28.75	6.95	6.40	10.78	17.23	0.20	28,753.42	516.87	72.15	7.75	7.13	40.45	19.98	0.23	22,392.49
Hugh Leatherman	HLT	58.68	6.41	1.08	0.99	3.00	2.69	0.03	3,986.69	33.61	3.07	0.72	0.66	1.15	1.76	0.02	2,937.38	25.07	3.34	0.36	0.33	1.85	0.93	0.01	1,049.31
Inland Port Dillon	IPD	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inland Port Greer	IPG	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**1,321.36**	**161.14**	**23.28**	**21.42**	**81.07**	**58.32**	**0.75**	**80,655.68**	**481.24**	**46.32**	**10.87**	**10.01**	**17.26**	**26.68**	**0.34**	**44,650.69**	**840.12**	**114.82**	**12.40**	**11.42**	**63.81**	**31.64**	**0.42**	**36,004.99**
Harbor Craft																									
Columbus Street	CST	33.32	7.65	0.61	0.59	0.68	0.03	0.46	3,480.15	11.33	2.60	0.21	0.20	0.23	0.01	0.16	1,183.25	21.99	5.05	0.40	0.39	0.45	0.02	0.30	2,296.90
North Charleston	NCT	42.45	9.75	0.78	0.76	0.87	0.04	0.58	4,433.61	11.16	2.56	0.21	0.20	0.23	0.01	0.15	1,166.04	31.28	7.18	0.58	0.56	0.64	0.03	0.43	3,267.57
Union Pier	UPT	1.14	0.26	0.02	0.02	0.02	1.08E-03	0.02	119.18	0.41	0.09	0.01	0.01	0.01	3.83E-04	5.56E-03	42.31	0.74	0.17	0.01	0.01	0.02	6.96E-04	0.01	76.87
Veterans	VT	0.57	0.13	0.01	0.01	0.01	5.40E-04	0.01	59.59	0.14	0.03	2.52E-03	2.44E-03	2.81E-03	1.30E-04	1.88E-03	14.30	0.43	0.10	0.01	0.01	0.01	4.10E-04	0.01	45.29
Wando Welch	WWT	96.64	22.20	1.78	1.72	1.98	0.09	1.33	10,094.81	30.15	6.93	0.56	0.54	0.62	0.03	0.41	3,149.58	66.49	15.27	1.22	1.19	1.36	0.06	0.91	6,945.23
Hugh Leatherman	HLT	5.48	1.26	0.10	0.10	0.11	0.01	0.08	572.08	1.64	0.38	0.03	0.03	0.03	1.55E-03	0.02	171.62	3.83	0.88	0.07	0.07	0.08	3.63E-03	0.05	400.46
Inland Port Dillon	IPD	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inland Port Greer	IPG	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**179.60**	**41.25**	**3.31**	**3.20**	**3.68**	**0.17**	**2.47**	**18,759.42**	**54.83**	**12.59**	**1.01**	**0.98**	**1.12**	**0.05**	**0.75**	**5,727.10**	**124.77**	**28.66**	**2.30**	**2.23**	**2.56**	**0.12**	**1.71**	**13,032.31**
Non-Road Engines																									
Columbus Street	CST	3.38	1.02	0.14	0.14	0.16	2.41E-03	0.10	772.70	3.38	1.02	0.14	0.14	0.16	2.41E-03	0.10	772.70	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
North Charleston	NCT	22.31	7.51	1.03	1.00	1.19	0.03	0.77	10,029.47	22.31	7.51	1.03	1.00	1.19	0.03	0.77	10,029.47	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Union Pier	UPT	0.05	0.02	3.77E-03	3.65E-03	2.21E-03	2.47E-04	2.81E-03	94.11	0.05	0.02	3.77E-03	3.65E-03	2.21E-03	2.47E-04	2.81E-03	94.11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Veterans	VT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Wando Welch	WWT	128.98	38.49	5.92	5.74	7.05	0.17	4.42	60,173.56	128.98	38.49	5.92	5.74	7.05	0.17	4.42	60,173.56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Hugh Leatherman	HLT	2.77	0.65	0.16	0.15	0.15	4.04E-03	0.12	1,434.05	2.77	0.65	0.16	0.15	0.15	4.04E-03	0.12	1,434.05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inland Port Dillon	IPD	2.65	0.73	0.12	0.11	0.14	2.79E-03	0.09	949.91	2.65	0.73	0.12	0.11	0.14	2.79E-03	0.09	949.91	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inland Port Greer	IPG	18.37	5.98	0.83	0.80	0.98	0.02	0.62	7,050.20	18.37	5.98	0.83	0.80	0.98	0.02	0.62	7,050.20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Railway Company CHE		12.89	3.43	0.58	0.56	0.71	0.02	0.43	5,360.84	12.89	3.43	0.58	0.56	0.71	0.02	0.43	5,360.84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**191.40**	**57.83**	**8.78**	**8.51**	**10.38**	**0.25**	**6.55**	**85,864.85**	**191.40**	**57.83**	**8.78**	**8.51**	**10.38**	**0.25**	**6.55**	**85,864.85**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
On-Road Engines																									
Columbus Street	CST	3.10	1.47	0.18	0.09	0.12	3.70E-03	0.05	1,133.07	0.46	0.19	0.02	0.01	0.03	2.66E-04	3.74E-03	81.73	2.64	1.29	0.16	0.08	0.10	3.43E-03	0.04	1,051.34
North Charleston	NCT	58.06	27.58	3.55	1.72	2.32	0.07	0.87	19,997.02	12.17	5.06	0.64	0.31	0.65	0.01	0.10	2,235.20	45.89	22.51	2.92	1.41	1.67	0.06	0.77	17,761.82
Union Pier	UPT	0.14	0.07	0.01	4.16E-03	0.01	1.69E-04	2.20E-03	51.81	0.02	0.01	7.30E-04	4.72E-04	1.09E-03	1.11E-05	1.54E-04	3.41	0.12	0.06	0.01	3.69E-03	4.43E-03	1.58E-04	2.05E-03	48.40
Veterans	VT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Wando Welch	WWT	386.91	185.14	23.58	11.53	15.03	0.46	6.06	141,770.75	60.97	26.41	3.87	1.61	3.14	0.04	0.55	11,672.17	325.94	158.73	19.71	9.92	11.89	0.42	5.51	130,098.58
Hugh Leatherman	HLT	32.71	15.59	1.98	0.97	1.28	0.04	0.51	11,907.12	6.01	2.62	0.39	0.16	0.31	3.77E-03	0.06	1,156.75	26.70	12.98	1.59	0.81	0.97	0.04	0.45	10,750.37
Inland Port Dillon	IPD	0.37	0.19	0.04	0.01	0.02	2.81E-04	4.42E-03	86.26	0.37	0.19	0.04	0.01	0.02	2.81E-04	4.42E-03	86.26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inland Port Greer	IPG	2.27	1.18	0.27	0.07	0.10	1.71E-03	0.03	524.75	2.27	1.18	0.27	0.07	0.10	1.71E-03	0.03	524.75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**483.57**	**231.23**	**29.62**	**14.40**	**18.87**	**0.57**	**7.53**	**175,470.78**	**82.27**	**35.66**	**5.24**	**2.18**	**4.24**	**0.05**	**0.75**	**15,760.27**	**401.30**	**195.57**	**24.38**	**12.22**	**14.64**	**0.52**	**6.78**	**159,710.51**
Rail																									
Columbus Street	CST	8.82	1.38	0.30	0.29	0.63	4.73E-03	0.21	519.40	8.82	1.38	0.30	0.29	0.63	4.73E-03	0.21	519.40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
North Charleston	NCT	27.60	3.54	0.87	0.84	1.67	0.01	0.61	1,341.10	12.60	1.33	0.32	0.31	0.73	4.48E-03	0.23	492.06	15.00	2.22	0.55	0.53	0.94	0.01	0.39	849.04
Union Pier	UPT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Veterans	VT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Wando Welch	WWT	69.14	10.22	2.53	2.45	4.34	0.04	1.79	3,913.30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	69.14	10.22	2.53	2.45	4.34	0.04	1.79	3,913.30
Hugh Leatherman	HLT	6.73	0.99	0.25	0.24	0.42	3.47E-03	0.17	380.99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.73	0.99	0.25	0.24	0.42	3.47E-03	0.17	380.99
Inland Port Dillon	IPD	61.00	9.04	2.24	2.18	3.69	0.03	1.59	3,472.94	11.87	1.72	0.41	0.40	0.95	0.01	0.29	639.87	49.13	7.31	1.83	1.77	2.74	0.03	1.29	2,833.07
Inland Port Greer	IPG	126.65	18.80	4.68	4.54	7.41	0.07	3.31	7,250.53	13.96	2.03	0.49	0.47	1.12	0.01	0.35	752.53	112.69	16.77	4.19	4.07	6.29	0.06	2.97	6,498.00
Total		**299.93**	**43.98**	**10.86**	**10.54**	**18.17**	**0.15**	**7.69**	**16,878.26**	**47.24**	**6.46**	**1.52**	**1.47**	**3.43**	**0.02**	**1.07**	**2,403.86**	**252.70**	**37.52**	**9.34**	**9.06**	**14.73**	**0.13**	**6.62**	**14,474.39**

(1) For harbor craft, the division between terminal emissions is based on the number of vessel calls per terminal in 2021. The division between on-terminal and off-terminal emissions is based on the relative percentages between these categories for each terminal from the 2017 inventory. For Hugh Leatherman an overall average value was used.

(2) For rail, emissions were broken down based on operator and location. All Palmetto Railway Operations at the Charleston Yard were associated with the Columbus St. on-terminal operations. Palmetto Railway Operations at the North Charleston Yard were included in the North Charleston on-terminal emissions. For the CSX Bennett Yard and Norfolk Southern Seven Mile Yard, emissions were distributed between the terminals based on the ratio of containers shipped from each terminal. All CSX and Norfolk Southern emissions were included as off-terminal. For the new inland ports, switching emissions from the facilities were included as on-terminal; long-haul emissions are aggregated under off-terminal.

2.3 HISTORICAL EMISSIONS COMPARISONS

To contextualize the 2021 emissions inventory, it must be compared to previous years. In Tables 5 through 10 and Figures 11 through 15 below, the port activity and emissions are compared to past emissions inventories from 2005, 2011 and 2017. Note that CO_2e is new to the emissions inventory and has been excluded from the figures to allow all other pollutants to be meaningfully visualized.

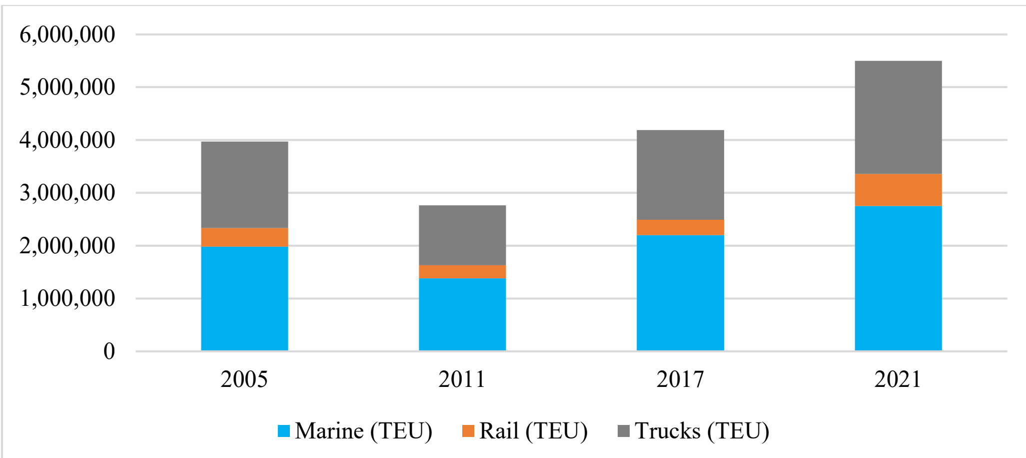


Figure 11: **TEU Comparisons Between Inventories**

Table 5: **2021 Activity Summary**

Transport Service	TEUs	Calls to Terminal per Year	Transport Capacity / Note
Marine	2,751,442	1,574 vessel calls	1,748 Average TEUs exchanged/vessel
Rail	607,737	4,007 trains[(1)]	360 TEU per long-haul train
Heavy Duty Vehicles	2,143,706	1,495,100 truck moves	Trip time for the main terminals for non-dual transaction is 45 minutes. Trip time for the main terminals for dual transactions is 60 minutes; 65% of truck moves are dual transactions. Trip time for the inland ports is 9 minutes. Idle time varies by location.

[(1)] Includes rail activity to inland port.

Table 6: **2017 Activity Summary**

Transport Service	TEUs	Calls to Terminal per Year	Transport Capacity / Note
Marine	2,200,000	1,724 vessel calls	1,276 Average TEUs exchanged/vessel
Rail	294,186 23% of berth volume directed to rail	817 trains	360 TEU per long-haul train
Heavy Duty Vehicles	1,694,000 77% of berth volume directed to trucks	895,113 truck moves	On-terminal stop idle 6%. Creep idle 20% and moving 74%. Trip time 0.75 hour. Average truck transaction, 23 minutes; 65% of truck moves are dual transactions.

Table 7: **2011 Activity Summary**

Transport Service	TEUs	Calls to Terminal per Year	Transport Capacity / Note
Marine	1,382,060	1,704 vessel calls	811 Average TEUs exchanged/vessel
Rail	284,771 18% of berth volume directed to rail	691 trains	360 TEU per long-haul train
Heavy Duty Vehicles	1,133,289 82% of berth volume directed to trucks	850,637 truck moves	On-terminal idle 20%. Creep idle 20% and moving 60%. Truck trip time 1 hour.

Table 8: **2005 Activity Summary**

Transport Service	TEUs	Calls to Terminal per Year	Transport Capacity / Note
Marine	1,984,887	2,014 vessel calls	986 Average TEUs exchanged/vessel
Rail	348,746 18% of berth volume directed to rail	969 trains	360 TEU per long-haul train
Heavy Duty Vehicles	1,636,141 82% of berth volume directed to trucks	959,387 truck moves	On-terminal idle 20%. Creep idle 20% and moving 60%. Truck trip time 1 hour.

Table 9: **Emissions Summary 2005, 2011, 2017, and 2021 in Tons**

Source Category	NOx (tons)	CO (tons)	PM_{10} (tons)	$PM_{2.5}$ (tons)	HC (tons)	SO_2 (tons)	BC (tons)	CO_2e (tons)
2005 Emissions Summary								
OGV	1,492.00	145.30	116.80	101.90	96.60	1,076.00	--	--
Tugs	133.90	25.70	3.10	3.00	2.80	6.50	--	--
Trucks	3,024.70	1,021.50	106.90	103.70	133.60	72.60	--	--
Rail	54.10	6.40	1.20	1.20	1.90	2.90	--	--
CHE	284.50	119.40	18.20	17.70	20.20	36.20	--	--
2005 Total	**4,989.20**	**1,318.50**	**246.20**	**227.50**	**255.10**	**1,194.20**	**--**	**--**
2011 Emissions Summary								
OGV	1,560.40	174.00	187.70	170.40	94.20	1,493.20	--	--
Tugs	194.20	21.80	12.30	11.90	9.40	0.10	--	--
Trucks	540.80	128.70	22.20	21.60	21.90	0.60	--	--
Rail	42.20	6.30	1.60	1.50	2.40	0.00	--	--
CHE	114.40	62.40	7.80	7.60	9.60	0.20	--	--
2011 Total	**2,451.90**	**393.10**	**231.60**	**213.00**	**137.50**	**1,494.10**	**--**	**--**
2017 Emissions Summary								
OGV	1,775.40	217.50	150.80	138.90	120.20	62.60	--	--
Tugs	94.00	18.70	1.90	1.90	5.90	1.80	--	--
Trucks	633.10	173.30	32.10	29.50	37.20	1.14	--	--
Rail	37.60	6.10	0.80	0.80	2.10	0.02	--	--
CHE	119.75	40.97	5.35	5.19	7.94	0.18	--	--
2017 Total	**2,659.80**	**456.50**	**190.90**	**176.20**	**173.30**	**65.70**	**--**	**--**
2021 Emissions Summary								
OGV	1,321.36	161.14	23.28	21.42	81.07	58.32	0.75	80,655.68
Tugs	147.28	34.79	2.70	2.62	2.73	0.13	2.01	14,723.11
Pilot Boats	32.32	6.46	0.61	0.59	0.96	0.04	0.45	4,036.31
Trucks	483.57	231.23	29.62	14.40	18.87	0.57	7.53	175,470.78
Rail	299.93	43.98	10.86	10.54	18.17	0.15	7.69	16,878.26
CHE	191.40	57.83	8.78	8.51	10.38	0.25	6.55	85,864.85
2021 Total	**2,475.85**	**535.42**	**75.84**	**58.07**	**132.17**	**59.46**	**24.99**	**377,628.99**

Table 10: **Emissions Summary 2005, 2011, 2017, and 2021 in Tons/TEU**

Source Category	NOx (tons/ TEU)	CO (tons/ TEU)	PM_{10} (tons/ TEU)	$PM_{2.5}$ (tons/ TEU)	HC (tons/ TEU)	SO_2 (tons/ TEU)	BC (tons/ TEU)	CO_2e (tons/ TEU)
2005 Emissions Summary								
OGV	7.52E-04	7.32E-05	5.88E-05	5.13E-05	4.87E-05	5.42E-04	--	--
Tugs	6.75E-05	1.29E-05	1.56E-06	1.51E-06	1.41E-06	3.27E-06	--	--
Trucks	1.85E-03	6.24E-04	6.53E-05	6.34E-05	8.17E-05	4.44E-05	--	--
Rail	1.55E-04	1.84E-05	3.44E-06	3.44E-06	5.45E-06	8.32E-06	--	--
CHE	1.43E-04	6.02E-05	9.17E-06	8.92E-06	1.02E-05	1.82E-05	--	--
2005 Total	2.97E-03	7.89E-04	1.38E-04	1.29E-04	1.47E-04	6.16E-04	--	--
2011 Emissions Summary								
OGV	1.13E-03	1.26E-04	1.36E-04	1.23E-04	6.82E-05	1.08E-03	--	--
Tugs	1.41E-04	1.58E-05	8.90E-06	8.61E-06	6.80E-06	7.24E-08	--	--
Trucks	4.77E-04	1.14E-04	1.96E-05	1.91E-05	1.93E-05	5.29E-07	--	--
Rail	1.70E-04	2.53E-05	6.43E-06	6.03E-06	9.65E-06	0.00E+00	--	--
CHE	8.28E-05	4.51E-05	5.64E-06	5.50E-06	6.95E-06	1.45E-07	--	--
2011 Total	2.00E-03	3.26E-04	1.76E-04	1.62E-04	1.11E-04	1.08E-03	--	--
2017 Emissions Summary								
OGV	8.07E-04	9.89E-05	6.85E-05	6.31E-05	5.46E-05	2.85E-05	--	--
Tugs	4.27E-05	8.50E-06	8.64E-07	8.64E-07	2.68E-06	8.18E-07	--	--
Trucks	3.74E-04	1.02E-04	1.89E-05	1.74E-05	2.20E-05	6.73E-07	--	--
Rail	1.28E-04	2.07E-05	2.72E-06	2.72E-06	7.14E-06	6.80E-08	--	--
CHE	5.44E-05	1.86E-05	2.43E-06	2.36E-06	3.61E-06	8.18E-08	--	--
2017 Total	1.41E-03	2.49E-04	9.35E-05	8.65E-05	9.00E-05	3.01E-05	--	--
2021 Emissions Summary								
OGV	4.80E-04	5.86E-05	8.46E-06	7.79E-06	2.95E-05	2.12E-05	2.73E-07	2.93E-02
Tugs	5.35E-05	1.26E-05	9.81E-07	9.51E-07	9.91E-07	4.85E-08	7.32E-07	5.35E-03
Pilot Boats	1.17E-05	2.35E-06	2.21E-07	2.14E-07	3.48E-07	1.33E-08	1.65E-07	1.47E-03
Trucks	2.26E-04	1.08E-04	1.38E-05	6.72E-06	8.80E-06	2.67E-07	3.51E-06	8.19E-02
Rail	4.94E-04	7.24E-05	1.79E-05	1.73E-05	2.99E-05	2.53E-07	1.27E-05	2.78E-02
CHE	6.96E-05	2.10E-05	3.19E-06	3.09E-06	3.77E-06	8.95E-08	2.38E-06	3.12E-02
2021 Total	1.33E-03	2.75E-04	4.45E-05	3.61E-05	7.33E-05	2.19E-05	1.97E-05	1.77E-01

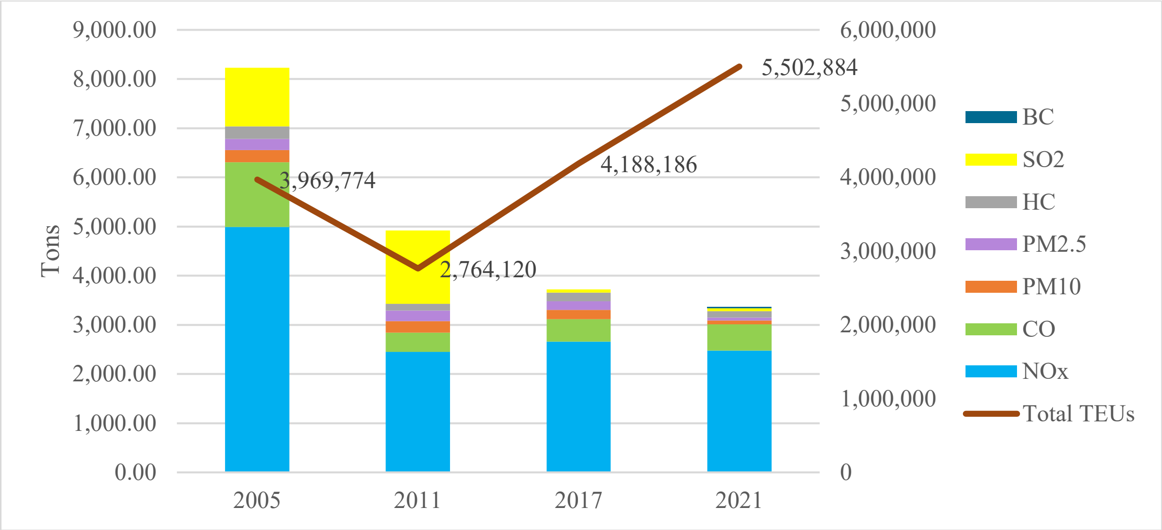


Figure 12: **Historical Emission Summary Comparison with Total Annual TEUs**

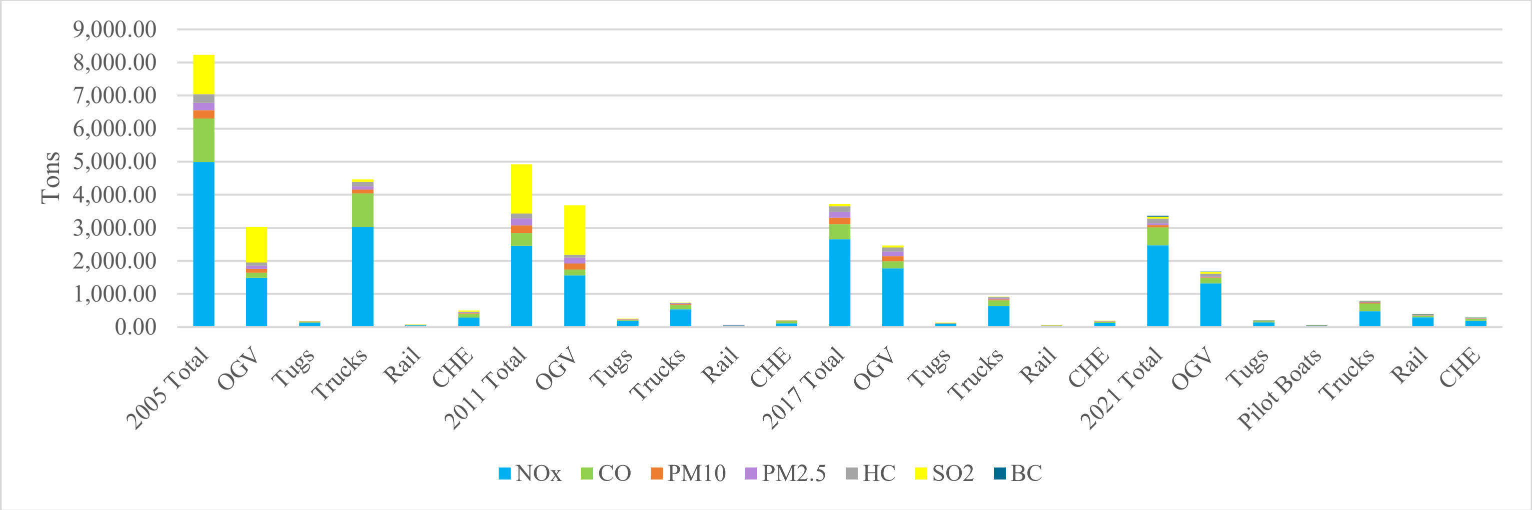


Figure 13: **Historical Emission Comparison by Source Category**

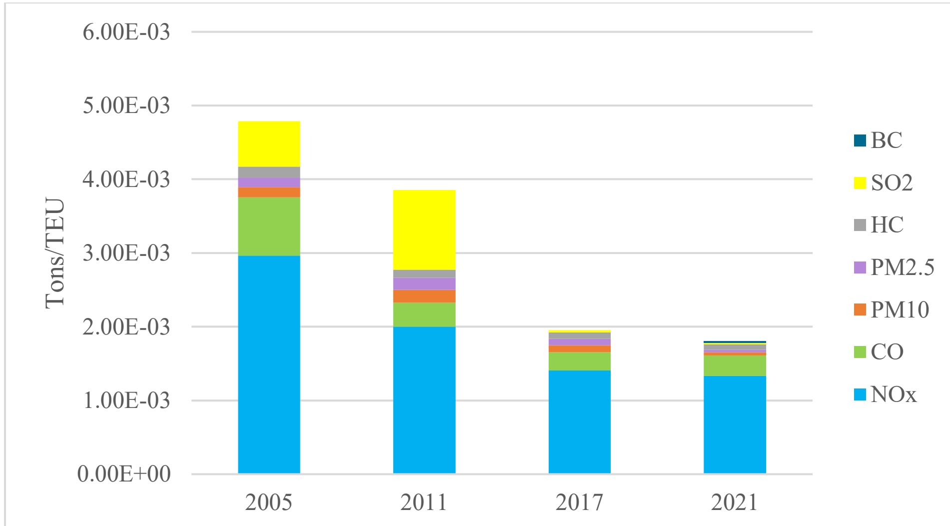


Figure 14: **Historical Emission Summary Comparison per TEU**

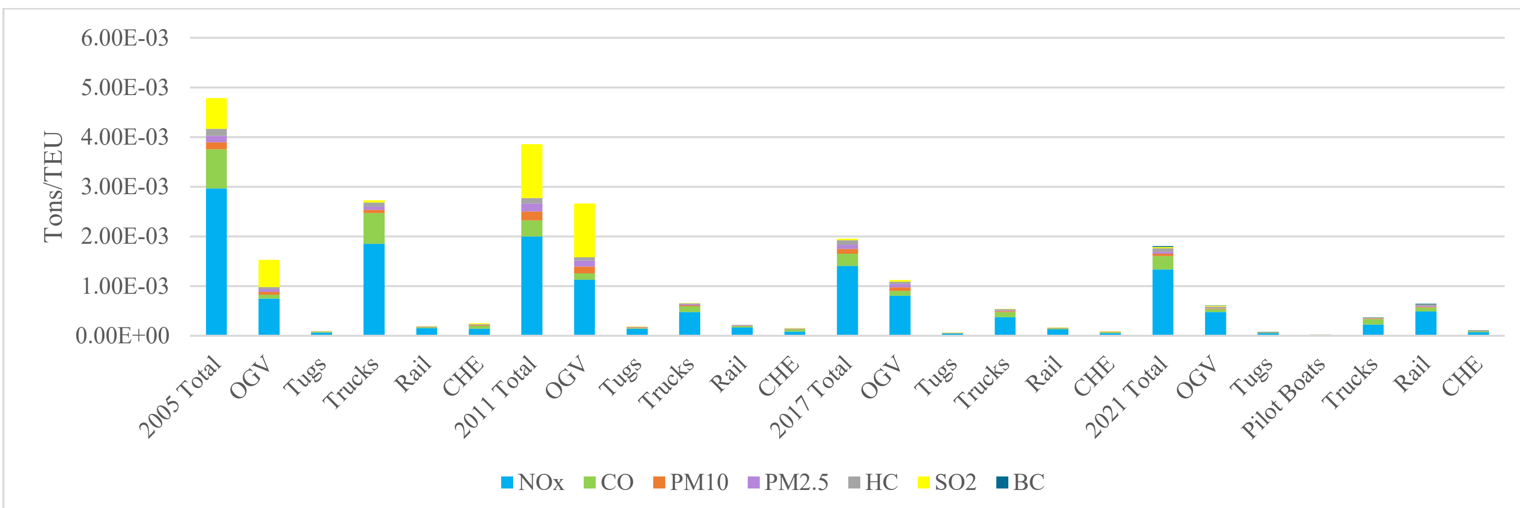


Figure 15: **Historical Emission Comparison by Source Category per TEU**

3.0 GEOGRAPHIC SCOPE

Facility emissions and emissions associated with the supply chain are included in the emissions inventory. Facility emissions are those emissions released within the terminal or inland port boundaries due to SCPA operations and activities. Operations and activities that generate facility emissions include cargo transfer equipment, and on-terminal emissions of on-road container / transport trucks. Supply chain emissions occur outside of facility boundaries and originate from the transport of containers and bulk cargo to and from the SCPA terminals, as well as transport between SCPA terminals and the two inland ports. Supply chain sources of pollutant emissions include OGV, truck, and rail.

3.1 FACILITY

Paper, pulp, kraft liner board, logs, lumber, agricultural commodities, and clay are all transported through the SCPA ports. The current infrastructure includes the six terminals and two inland ports, with rail switching activities managed by Palmetto Railways and two intermodal rail yards managed by CSX and Norfolk Southern. There are also many private terminals for federal facilities, fuel storage, bulk, yachts, chemical, shipyard and scrap steel located in and around the SCPA terminals. Only emissions from the SCPA facilities and SCPA supply chain are included in the 2021 emission inventory. The figures below show the location of each terminal and inland port, as well as rail and truck routes throughput South Carolina. This section provides a brief description of each terminal as it relates to this emissions inventory.

Figure 16: **Port of Charleston Terminals** (SC Ports Authority, 2024)

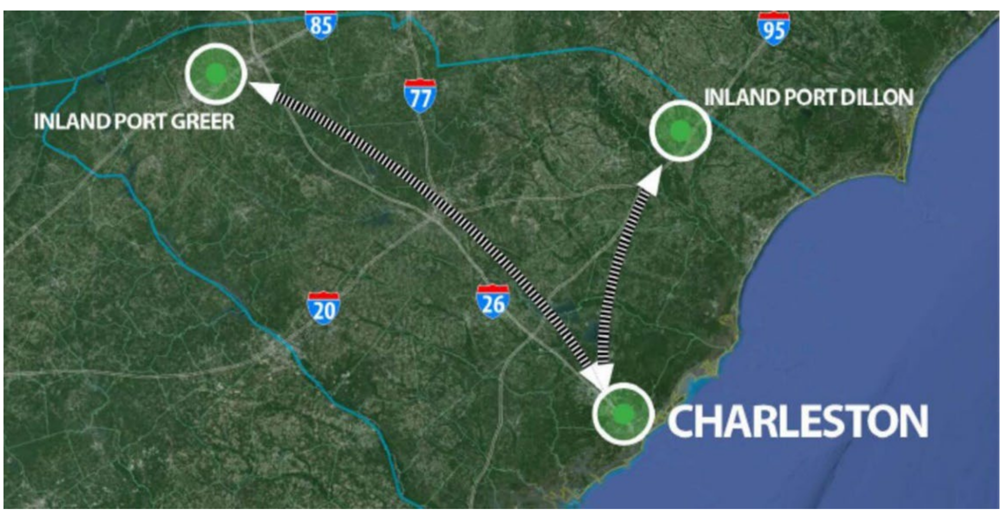


Figure 17: **Inland Ports** (Bolster, 2016)

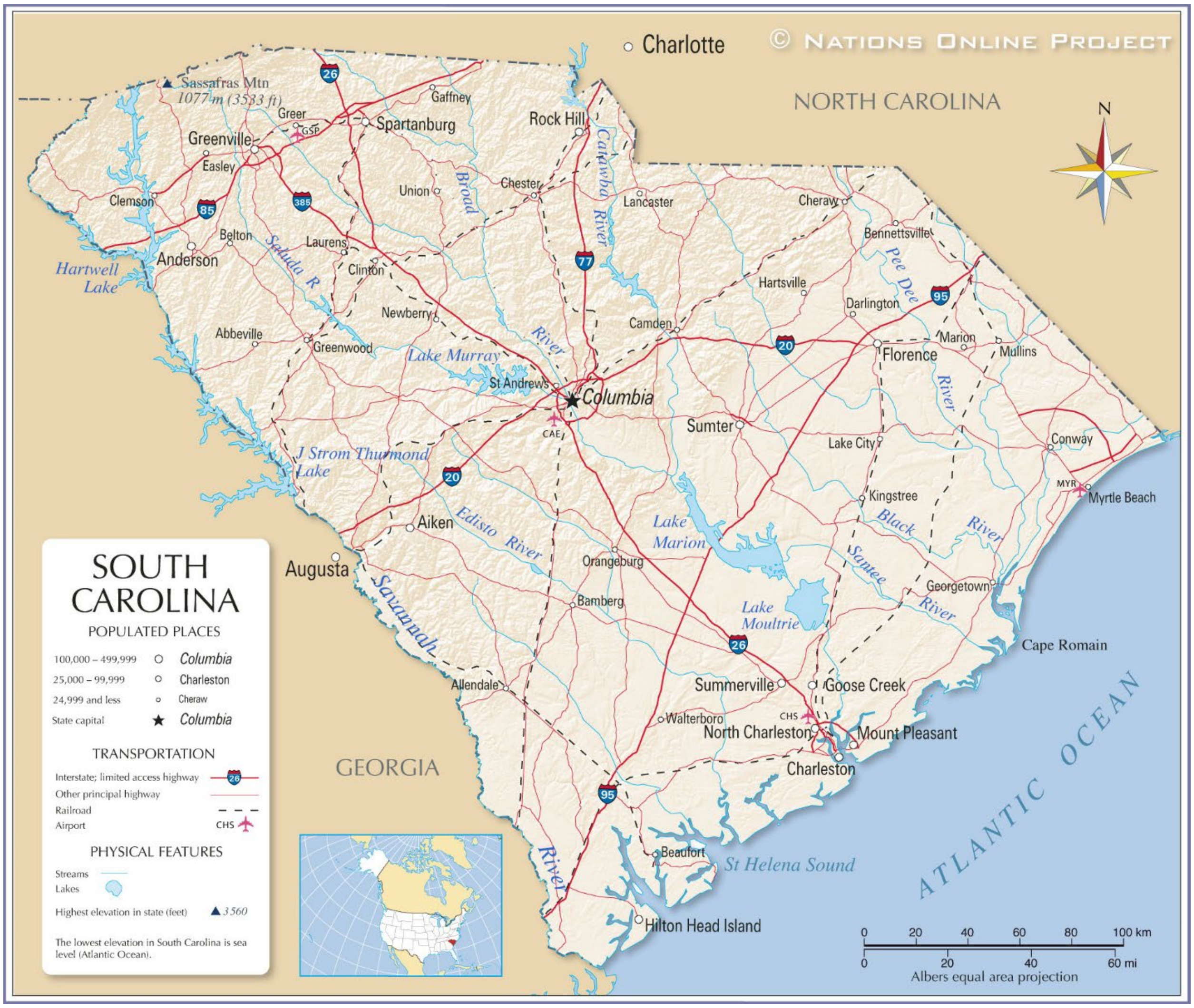


Figure 18: **South Carolina Railway System and Highway Routes** (nationsonline.org, n.d.)

Columbus Street Terminal

The Columbus Street Terminal (CST) is located on the Cooper River side of the Charleston peninsula, downriver of the US Highway 17 bridge at 30 Johnson Street. CST is a combination breakbulk and Roll-on/Roll-off (Ro-Ro) cargo terminal. Columbus Street offers non-container clients berth space for up to 5 ships, direct lift capabilities between rail and the vessel, and on-dock rail-served warehouses. Rail dray services are provided by Palmetto Rail.

Figure 19: **Columbus Street Terminal** (Columbus Street Terminal – SSA Marine, n.d.)

North Charleston Terminal

The North Charleston Terminal (NCT) is located on the Cooper River north of I-526 at 1000 Remount Road. The terminal covers a total of 201 acres, including 132 acres of container yard, and operates 14 interchange lanes. NCT has a TEU capacity of 500,000. Rail dray services are provided by Palmetto Rail.

NCT is equipped with five ship-to-shore cranes, ten Rubber-Tired Gantry (RTG) cranes, and twenty-two container handlers. NCT handles about 22% of the port's total container volume and specializes in handling container ships 8,000 TEU and smaller.

Figure 20: **North Charleston Terminal** (Errico Griffis, 2024)

Union Pier Terminal

The Union Pier Terminal (UPT) is one of Charleston's dedicated breakbulk handling facilities and a main cruise terminal. The terminal is approximately 65 acres in size and is located on the Cooper River side of the Charleston peninsula at 32 Washington Street.

UPT handles traditional non-container (breakbulk) commodities such as forest products, metals, equipment, and project cargo. Multiple rail lines serve a warehouse and dockside open storage areas. Rail dray services are provided by Palmetto Rail.

The cruise ship terminal currently allows up to 104 cruise ships per year for same-day ports of call. In 2021, there were only two same-day ports of call due to the COVID-19 pandemic.

Figure 21: **Union Pier Terminal** (SC Ports Authority, 2024)

Wando Welch Terminal

The Wando Welch Terminal (WWT) is located on the east side of the Wando River at 400 Long Point Road, Mount Pleasant. Access between the terminal and I-526 is provided by Long Point Road. The terminal covers a total of 400 developed acres, 245 acres of the developed acres are container yard. WWT also has 1,274 reefer slots, 29 interchange lanes, and four container ship berths. WWT offers near dock rail access and rail dray services are provided by Palmetto Rail.

WWT is South Carolina Port's largest container terminal and moves approximately 78% of the port's annual container volume. WWT handles container vessels of all sizes, and its cranes and wharf have a maximum capability of handling vessels up to 20,000 TEU.

Figure 22: **Wando Welch Terminal** (SC Ports Authority, 2021)

Veterans Terminal

Veterans Terminal (VT) is located on the Cooper River south of I-526 at 1150 North Port Drive. The terminal covers a total of 110 acre fully secured dedicated bulk, break-bulk, Ro-Ro, and project cargo. VT has two piers, 952 and 1,250 feet in length. VT does not provide direct rail services.

Figure 23: **Veterans Terminal** (Wikimapia, n.d.)

Hugh K. Leatherman Terminal

The Hugh K. Leatherman Terminal (HLT) opened in March 2021 along the Cooper River in North Charleston, S.C., marking the country's first container terminal to open in more than a decade. Phase One of the Leatherman Terminal added 700,000 TEUs of annual throughput capacity and one berth. HLT has a 1,400-foot berth capable of handling a 20,000-TEU vessel, five ship-to-shore cranes, 25 hybrid rubber-tired gantry cranes, eight empty container handlers, and a refrigerated container yard. Rail dray services are provided by Palmetto Rail.

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Figure 24: **Hugh Leatherman Terminal** (SC Ports Authority, 2024)

Inland Port Dillon

Inland Port Dillon (IPD) is located approximately 200 miles north-northwest of the Port of Charleston. IPD is approximately 40 acres and gives importers and exporters in the eastern Carolinas an option for connecting supply and demand. Inland Port Dillon contains 2 RTGs and is serviced by CSX rail.

Figure 25: **Inland Port Dillon** (SC Ports Authority, 2024)

Inland Port Greer

Inland Port Greer (IPG) is located approximately 190 miles northwest of the Port of Charleston. IPG is approximately 91 acres and gives importers and exporters in the eastern Carolinas an option for connecting supply and demand. Inland Port Dillon contains 7 RTG cranes and is serviced by Norfolk Southern rail.

Figure 26: **Inland Port Greer** (SC Ports Authority, 2024)

3.2 FACILITY EMISSIONS

In accordance with the current U.S. EPA Ports Emissions Inventory Guidance, facility emissions capture mobile marine, non-road, on-road (highway), and rail sources within the geographic boundary selected. Similar to previous inventories, SCPA is maintaining the Charleston Tri-County area as the primary geographic boundary, depicted in Figure 28 below, in order to better compare between years. In addition, emissions from Inland Ports Dillion and Greer as well as the rail network that connects these inland ports to the Charleston Tri-County boundary are also included in this analysis to provide a more complete picture of the SCPA's emissions. The seaside boundary begins at approximately 12 nautical miles from the Charleston Harbor jetties. This distance was the previous location of the sea buoy prior to dredging the harbor; however, the buoy has since been moved to a new location. The previous distance has been used in this emissions analysis to provide consistency with past inventories. The facility emission sources included in the air emissions inventory are listed in Table 11.

The Charleston Tri-County Area, which includes Berkley, Charleston, and Dorchester counties, is classified as attainment/unclassifiable for all National Ambient Air Quality Standards (NAAQS).

Figure 27: **Charleston Harbor** (SC Ports Authority, 2024)

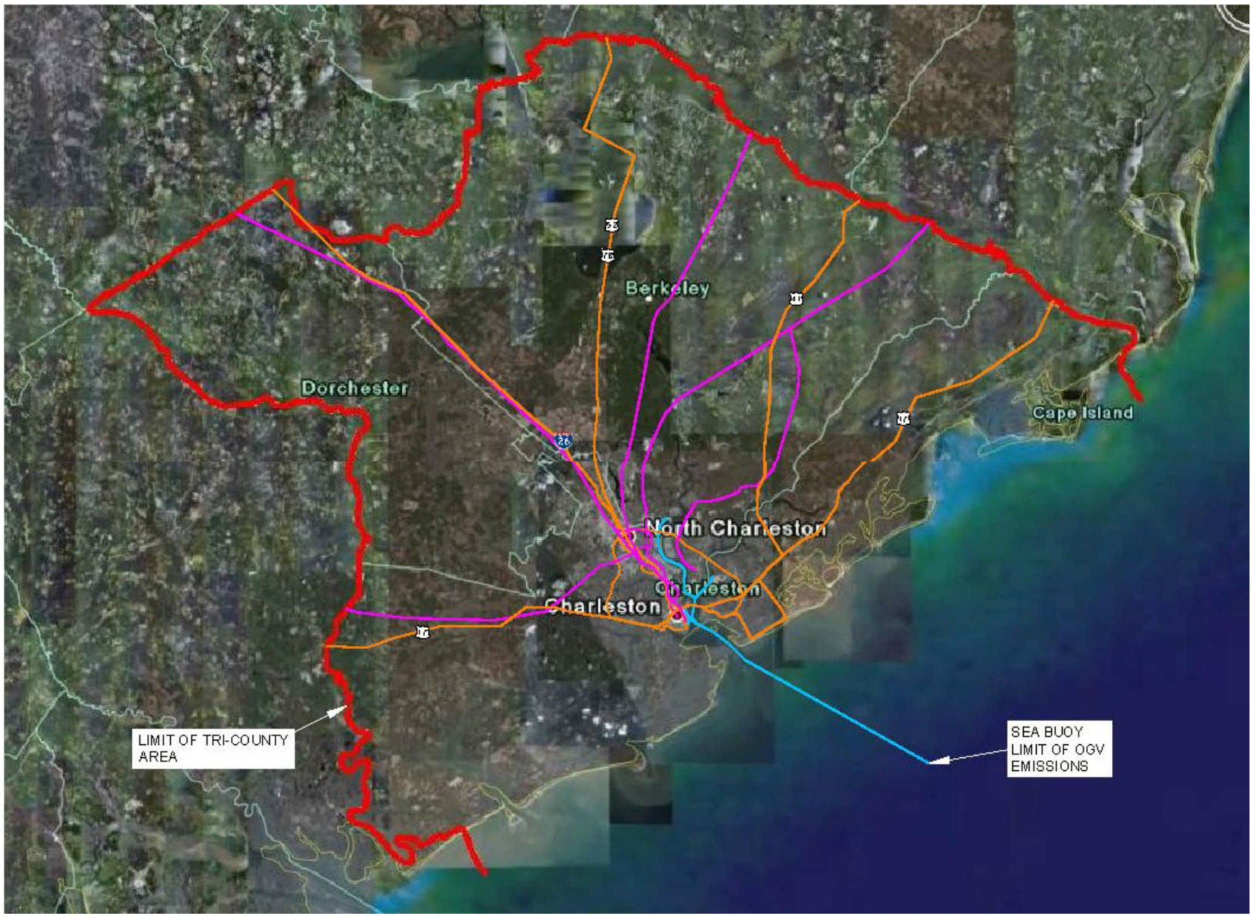

Figure 28: **Charleston Tri-County Boundary** (AECOM, 2018)

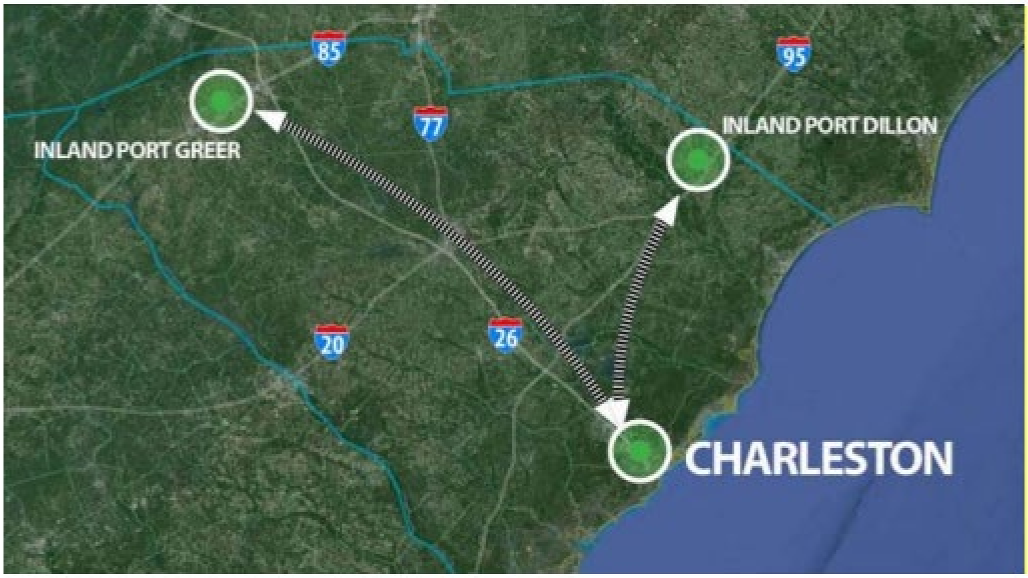

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Figure 29: **Inland Port Locations in Greer & Dillon South Carolina** (South Carolina Department of Transportation, 2020)

Table 11: **Facility Emission Sources and Boundaries**

Sources	**Geographic Boundary**
Yard Trucks Container Handlers Rubber Tired Gantry Cranes Truck Cranes Forklifts	Terminal Boundaries (Including Inland Ports)
Vessels Harbor Craft	Vessels at Berth Near-Terminal Maneuvering Activities for Harbor Craft
Heavy Duty Trucks	Site Boundary (Including Inland Ports)
Train Switching Railway Cargo Handling Equipment	Site Boundary (Including Inland Ports)

3.3 SUPPLY CHAIN

Supply Chain Emissions pertain to emissions that occur outside of the facility boundary, but that are a result of marine, heavy duty vehicle, and rail emissions sources that are related to the facility. The Supply Chain emission sources included in the 2021 AEI are listed in Table 12.

Table 12: **Supply Chain Emission Sources and Boundaries**

Sources	Geographic Boundary
OGVs transiting to SCPA	12 nautical miles from the Charleston Harbor jetties to the six terminals.
Heavy Duty Trucks	Travel to and from the terminals (truck gates) and to offsite railyards, local Charleston, Ashley P West of 26, and the Charleston Tri-County Boundary.
Rail	Travel between the Charleston Tri-County Boundary and the CSX Bennett and the Norfolk Southern Seven Mile intermodal yards. Rail activity to and from the inland ports.

4.0 EMISSIONS SOURCES

While the categories of potential emission sources generally stay the same for port operations, the overall emissions are impacted by changes in operations such as procedural changes, changes in overall efficiency, and expansion of operations.

Consistent with the previous emission inventory, the following sources are excluded from the current inventory:

- On-road passenger vehicles;
- Military vessel or equipment operations;
- Miscellaneous crew boats;
- Recreational boating;
- Commercial fishing or other waterfront activity not associated within the operation of SCPA terminals;
- Coastwise vessels not calling on SCPA terminals in Charleston; and
- Dredging or construction equipment.

This inventory includes the following sources that were not included in previous inventories:

- Yard trucks
  - Yard trucks (terminal tractors) are specifically identified in the 2022 U.S. EPA Ports Emissions Inventory Guidance as cargo handling equipment.
- Pilot boats
  - Emissions from pilot boats were calculated in the previous 2017 Inventory but were excluded from the overall summary information.

4.1 PRIMARY SOURCES

A table of the primary emission sources is included below in Table 13. All information included provides an average representation of the specific source.

Table 13: **Primary Emission Sources**

Primary Source	Equipment Type	Count	Average Age - Tier	Fuel	Average Rated Power as Applicable
Marine	OGVs	1,574 Calls per year	Varies	Marine Gas Oil (MGO) or Marine Diesel Oil (MDO)	Total Installed Propulsion - 40,000 kW
	Tugs	28,435 Total Engine Hours	Tier 2	Diesel	Total Installed Propulsion - 5,288 hp
	Pilot Boats	17,600 Total Engine Hours	Tier 3	Diesel	Total Installed Propulsion - 2,250 hp
Rail	Locomotives	Switching Locomotives	Tier 0	Diesel	Switching - 2,216 hp
		Long-haul Locomotives			Long-haul - 4,048 hp
On-Road	Heavy Duty Vehicles	1,488,931 Truck Arrivals	Default MOVES4 Emission Factors for Combination Long-haul Trucks	Diesel	Default MOVES4 Emission Factors for Combination Long-haul Trucks
Non-Road	Yard Trucks[(1)]	-	-	Diesel	200 hp
	RTG Cranes	109	Tier 4	Diesel	468 hp
	Truck Cranes	4	Tier 1 / Tier 4	Diesel	440 hp
	Container Handler, Full	29	Tier 3	Diesel	331 hp
	Container Handler, Empty	46	Tier 3	Diesel	256 hp
	Forklifts	17	-	Diesel	170 hp
	Railway Cargo Handling Equipment	13	-	Diesel	304 hp

[(1)] Yard Truck information was provided for the entire fleet, so equipment count information is not available.

4.2 EMISSIONS VARIABILITY

The volume and frequency of emissions varies with typical SCPA operations. Operations for vessels, tugs, and pilot boats are 24/7, 365 days per year, but terminal operations follow a more standard workday schedule. Terminal operations generally run six (6) days per week, but in 2021, operations from September through the end of the year were more often seven (7) days per week.

Emissions from cargo handling equipment and other non-road engines vary with the loads and time of use required. Emissions from on-road engines (heavy duty vehicles) vary with the number of vehicles required as well as traffic conditions. Overall, on-terminal emissions are expected to be lowest during the night when container movement activity is suspended. However, vessels at berth also generate hotelling emissions during this time. Additionally, harbor craft are most active overnight.

For all emission sources, differences in fuel and engine type affects emissions.

4.3 POLLUTANTS OF CONCERN

Pollutants considered for this inventory included all pollutants characterized during previous inventories as well as a few new pollutants. The primary source of all pollutants from all sources is fuel combustion. Particulate emissions from tire wear and break wear are included in the calculations for on-road vehicles. Greenhouse gas pollutants have been excluded from previous inventories but have been added to this inventory. Additionally, black carbon has been added as a newly considered pollutant. Volatile organic compounds (VOC), a criteria pollutant, has not historically been included in the emissions inventory and has not been included in the 2021 inventory. The following pollutants are included in this inventory:

- Nitrogen Oxides, NO_X;
- Carbon Monoxide, CO;
- Hydrocarbons (HC);
- Black Carbon (BC);
- Particulate matter 10 micrometers or less in diameter, PM_{10};
- Particulate matter 2.5 micrometers or less in diameter, $PM_{2.5}$;
- Sulfur Dioxides, SO_2;
- CO_2e (CO_2, CH_4, N_2O)

5.0 EMISSIONS ESTIMATES

Emissions were estimated per source according to the methodologies specified in the U.S. EPA Ports Emissions Inventory Guidance (April 2022). Estimates were prepared on a tonnage basis as well as ton pollutant per TEU basis. Detailed descriptions on the sources of input information and calculation methodologies are provided in Section 6.

5.1 2021 EMISSIONS SUMMARY

A summary of the emissions estimates for 2021 are provided below in Table 14.

Table 14: **2021 Emissions Summary by Terminal**

SCPA Total	2021 Emissions Summary (ton)							
Terminal	NO_x	CO	PM_{10}	$PM_{2.5}$	HC	BC	SO_2	CO_2e
Columbus Street	178.23	25.00	3.39	3.10	6.99	0.96	4.82	13,778.78
North Charleston	461.69	87.47	11.36	9.03	26.99	2.99	13.27	52,638.84
Union Pier	12.59	1.46	0.22	0.20	0.48	0.03	0.44	976.39
Wando Welch	1,490.49	356.95	48.50	34.98	79.62	14.03	37.98	267,098.32
Veterans	2.29	0.29	0.04	0.04	0.08	0.01	0.06	160.30
Hugh Leatherman	106.37	24.91	3.56	2.45	4.97	0.90	2.74	18,280.93
Inland Port Dillon	64.02	9.96	2.40	2.30	3.85	1.68	0.03	4,509.12
Inland Port Greer	147.28	25.96	5.78	5.41	8.49	3.96	0.09	14,825.48

6.0 ESTIMATION METHODOLOGIES

The methodology used for emission estimates varied based on source types. Each of the following sections contains detailed information on how the calculations were performed. The major sections are as follows:

- Ocean-Going Vessels
- Harbor Craft – includes tugboats and pilot boats
- Rail
- On-Road Engines – includes heavy duty vehicles
- Non-Road Engines

6.1 MARINE – OGV

The ocean-going vessels (OGVs) emissions source category represents a broad category of vessel types which can be used to transport cargo or people. This inventory includes emissions from OGVs which docked at any one of the six SCPA terminals during 2021. The vessel types include container ships, cruise ships, breakbulk, Ro-Ro vessels, auto carriers, barges, chemical tankers, offshore support/drillships, bulk carriers, and a few miscellaneous ship types. Compared to the previous 2017 inventory, chemical tankers, offshore support/drillships, bulk carriers, and miscellaneous ships are new vessel types. Figure 30 below shows a breakdown of port calls by vessel type for 2021.

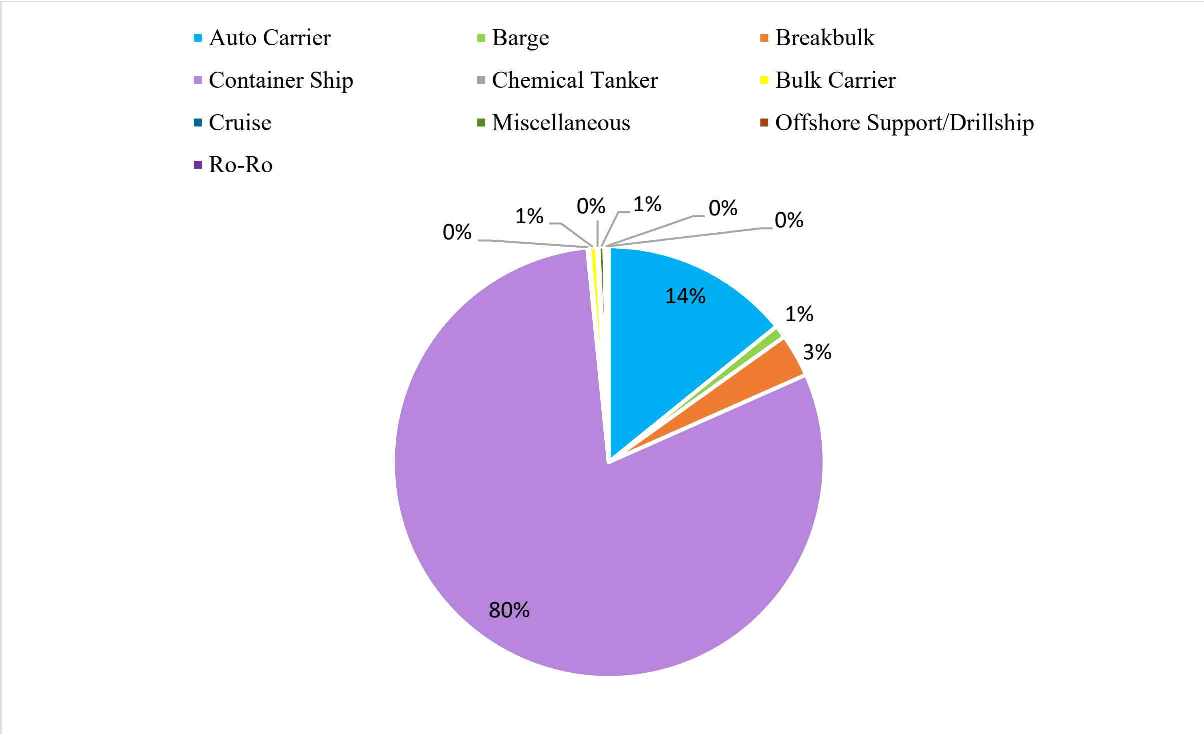

Figure 30: **Calls by Vessel Type**

There are three (3) different sources of emissions from OGVs; propulsion engines, auxiliary engines, and boilers. As the name implies, propulsion engines supply power to move the vessels. Auxiliary engines are used to supply electrical power, and boilers supply heat for fuel and water on board. Bow thrusters are another type of engine, which may be present to assist during the maneuvering operating mode discussed below. As explained by the U.S. EPA Ports Emissions Inventory Guidance, engine loads from thrusters are typically included in the overall auxiliary engine loads for calculation purposes. Additionally, there are different operating modes an OGV will typically go through when making the trip from sea to terminal. Each mode has different engine supply needs. The various modes covered by the U.S. EPA Ports Emissions Inventory Guidance and their applicability to this inventory are described below:

- Transit: This mode includes vessel movements outside of the breakwater. The breakwater is a physical structure that separates the inland waterway from the open ocean. For the purposes of this emission inventory, the "breakwater" is the entrance channel eddies. Although the inventory includes movements outside of the breakwater, these movements are in the restricted speed zone operating mode below.

- Maneuvering: This mode describes vessel movements between the breakwater and the terminal and is normally tug assisted. Propulsion engines, auxiliary engines, and boilers are all expected to be operating during this mode.
- Restricted Speed Zone: This mode describes vessel movements at speeds between those typical of the transit and maneuvering operating modes. Movements outside of the breakwater and inside of the breakwater are in this mode. Propulsion engines and auxiliary engines are expected to be operating during this mode.
- Hotelling: This mode describes when an OGV is berthed at the terminal. Auxiliary engines and boilers are expected to be operating during this mode.
- Anchorage: This mode includes OGVs at anchor. Anchorage is excluded from this inventory because anchorage is minimal and occurs outside of the port boundaries being considered.

Figure 31: **Two 14,000-TEU ships passing one another in Charleston Harbor** (SC Ports Authority, 2019)

6.1.1 Emission Factors and Calculation Methodology

The calculation methodology used to calculate emissions from all sources of OGVs followed Section 3 of the U.S. EPA Ports Emissions Inventory Guidance. In simple terms, the emissions from each source were calculated using Equation 3.1 below where E is the source emissions in grams, P is the engine power in kW, A is the operating activity in hours, EF is an emission factor in grams per kW-h, and LLAF is a low load adjustment factor. Note that the low load adjustment factor is only relevant for propulsion engine activities and is always one (1) for auxiliary engines and boilers.

$$E(g) = P(kW) * A(hr) * EF\left(\frac{g}{kW-h}\right) * LLAF$$

A 2021 ship call list was used to determine relevant vessels for the inventory. Overall, 1,574 port calls for 578 unique vessels were included in the inventory. The ship call list included information on ship names and International Maritime Organization (IMO) numbers which allowed the vessels to be looked up in the S&P Global Maritime Portal (Portal). Note that for the discussion below, all sources of information are discussed in general. If there were gaps in required information, then alternative approaches, such as the use of default information, were used.

The Portal was used to look up each vessel's total installed power for propulsion engines. For the auxiliary engines and boilers, Tables E.1 and E.2 of the U.S. EPA Ports Emissions Inventory Guidance were used for the operating power used during each type of operating mode. These factors are specified by ship type and ship size or capacity. The necessary size information varies by ship type. For example, container ships are subdivided by TEU capacity, cruise ships are subdivided by gross tonnage, and breakbulk vessels are subdivided by deadweight tonnage. The Portal was used to gather the necessary capacity information for each vessel. The values in the tables have presumed load information incorporated into the power factors, making a separate adjustment factor unnecessary. Although the Portal included information on auxiliary engines for some vessels, it was decided to use Table E.1 exclusively for auxiliary engine power because of the incorporation of the load factors. See Appendix 1 for a table of auxiliary engine and boiler operating load values.

To determine the correct emission factors to use for each vessel and emission source, specific vessel information was required including the keel-laid year, fuel type, and engine type. The Portal was used to gather the keel-laid year for each vessel. All auxiliary engines were assumed to use marine diesel oil (MDO). All propulsion engines were assumed to use MDO or marine gas oil (MGO). All auxiliary engines were assumed to be medium-speed diesel engines. The Portal was used to verify the propulsion engine type for each vessel. The vast majority were diesel engines except for one steam turbine. The speed type for each diesel-powered propulsion engine was determined based on the engine revolutions per minute (rpm) speed as specified by Table 3.3 of the U.S. EPA Ports Emissions Inventory Guidance. The Portal was used to gather the rpm information for each vessel. Additionally, it was assumed that all propulsion engines were C3 engines, with displacements per cylinder greater than 30 liters (L), unless found otherwise. The tables and other information in Section 3 of the U.S. EPA Ports Emissions Inventory Guidance were used to determine the emission factors. See Appendix 1 for a table of emission factors for MGO and MDO engines.

Historically, barges have been included as OGVs. However, barges are not typically self-propelled and instead use tugs to provide propulsion power. Barges are expected to have auxiliary engines, but no boilers. Tugs typically have C1 and C2 engines. In these cases where the ship call list included barge tugs or other vessels with C1 and C2 engines, the methodology discussed in the harbor craft section of the inventory was used. All tugs were assumed to have barges, and barge and tug emissions were both categorized as barge emissions. No information was available on the barge auxiliary engines, so the emissions factors used for the corresponding tug auxiliary engines were used for corresponding barge auxiliary engine. However, the emissions were still categorized in the ocean-going vessels section.

As previously mentioned, the emission factors for propulsion engines are not separated by operating mode. However, low load adjustment factors are required to account for differences in emission rates for the various operating modes. Low load adjustment factors from Table 3.10 of the U.S. EPA Emissions Inventory Guidance were used for the inventory. To determine the propulsion engine load factors to use in conjunction with Table 3.10, Equations 3.13 and 3.14 were used. These equations require the inputs of the vessel's total installed propulsion power, average speeds in the mode of interest, and maximum vessel speed. The average speeds for each mode are discussed in the activity section below. The maximum vessel speeds were either taken from the Portal when available or were estimated using the default values available in Table C.1. Low load adjustment factors are applied when the load factor is less than 20%. See Appendix 1 for a table of low load adjustment factors.

6.1.2 Activity Characterization

After establishing a vessel's emission factors, the hours spent in each operating mode need to be determined. For reduced speed zone operations and maneuvering operations, time spent in each mode for a round trip operation was specified by vessel type. The times were determined using distance information and speed information, which were assumed to be the same as the 2017 inventory. See Appendix 1 for a table describing OGV activity. It should be noted that since 2017, the sea buoy has been moved farther away from the port, but for the purpose of the inventory the location has been presumed to be unchanged. This was done to maintain comparability between emissions estimations. To determine the hotelling hours, information from the ship call list was used. For each port call, the start and end times for the ship movements were included. For a standard port call, the hotelling time was taken as the difference between the end time of a vessel movement into the terminal and the start time of the corresponding vessel movement out of the terminal.

The majority of vessel calls included in the ship call data were standard, meaning the vessel traveled from the sea to the terminal and then back out to the sea. However, there were also many vessel trips which included shifts where a vessel would travel from the sea to a terminal and would then travel to one or several other terminals before going back out to sea. In these cases, adjustments needed to be made to account for differences in the standard activity assumptions. Any additional shifting activity was considered as maneuvering.

When a vessel traveled between an SCPA terminal and a non-SCPA terminal, no adjustments were made to the standard activity assumptions. This is because, excluding the additional non-SCPA terminal, the vessel would still need to complete the reduced speed zone, maneuvering, and hotelling activities of a standard trip. Any additional maneuvering time was excluded because this maneuvering time would not have occurred if the non-SCPA terminal was not present.

When a vessel shifted between SCPA terminals, the emissions from reduced speed zone operations, standard maneuvering, and the additional maneuvering between terminals was split between the two terminals. There were also instances where shifts occurred, presumably between berths, at the same terminal. In these cases, all shift time was counted toward the vessel's total hotelling time.

6.1.3 Example Calculation

An example calculation for a standard ship call for NO_X is shown below with data and results in Table 15.

Table 15: **OGV Annual Emission Example Calculation**

Mode	Source	Hours in Mode per Call (Round Trip)	Rated Power (kW)	Load Factor	Low Load Adjustment Factor	NOx Emission Factor (g/kWh)	Annual Tons
Outside Breakwater	Main	1.86	57,200	11.28 %	1.17	16.0	2.48E-01
	Auxiliary	1.86	1,420	N/A	1	12.2	3.56E-02
	Boiler	N/A	N/A	N/A	1	2.0	N/A
Inside Breakwater	Main	2.45	57,200	2.91%	2.92	16.0	2.10E-01
	Auxiliary	2.45	1,420	N/A	1	12.2	4.68E-02
	Boiler	N/A	N/A	N/A	1	2.0	N/A
Maneuveri ng	Main	1.00	57,200	0.31%	4.63	16.0	1.47E-02
	Auxiliary	1.00	2,600	N/A	1	12.2	3.50E-02
	Boiler	1.00	450	N/A	1	2.0	9.92E-04
Hotelling	Main	N/A	N/A	N/A	N/A	16.0	N/A
	Auxiliary	32.2	970	N/A	1	12.2	4.20E-01
	Boiler	32.2	450	N/A	1	2.0	3.20E-02

The first step to calculate the emissions for a ship call is to calculate the source emissions for each mode. There are three main source types: main, auxiliary, and boiler. The auxiliary and boiler sources follow the same calculation methodology.

In the example calculations below the Maneuvering Mode from the data above was utilized where applicable.

Main Engines

$$NO_X\left(\frac{tons}{yr}\right)=\frac{Emission\ Factor\left(\frac{g}{kW-hr}\right)*Operation(hr)*Load\ Factor*Low\ Load\ Adj.Factor*Rated\ Power\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=\frac{16.0\ \left(\frac{g}{kW-hr}\right)*1\ (hr)*0.31\ \%*\ 4.63\ *57{,}200\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = 1.47E-02\ (\frac{tons}{yr})$$

Auxiliary Engines

$$NO_X\left(\frac{tons}{yr}\right) = \frac{Emission\ Factor\ \left(\frac{g}{kW-hr}\right)*Operation(hr)*Rated\ Power\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = \frac{12.2\ \left(\frac{g}{kW-hr}\right)*1\ (hr)*2{,}600\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = 3.50E-02\ (\frac{tons}{yr})$$

Boilers

$$NO_X\left(\frac{tons}{yr}\right) = \frac{Emission\ Factor\ \left(\frac{g}{kW-hr}\right)*Operation(hr)*Rated\ Power\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = \frac{2.0\ \left(\frac{g}{kW-hr}\right)*1\ (hr)*450\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = 9.92E-04\ (\frac{tons}{yr})$$

Once all source emissions are calculated for each mode, these values can be summed to calculate the total emissions for that mode.

$$NO_X\left(\frac{tons}{yr}\right) = Main\ Engine\ Emissions\ \left(\frac{tons}{yr}\right) + Auxilliary\ Engine\ Emissions\ \left(\frac{tons}{yr}\right) + Boiler\ Emissions\ \left(\frac{tons}{yr}\right)$$

$$NO_X\left(\frac{tons}{yr}\right) = 1.47E-02\ \left(\frac{tons}{yr}\right) + 3.50E-02\left(\frac{tons}{yr}\right) + 9.92E-04\left(\frac{tons}{yr}\right)$$

$$NO_X\left(\frac{tons}{yr}\right) = 5.07E-02\ (\frac{tons}{yr})$$

Finally, all mode emissions can be summed to determine the emissions from each ship call.

$$NO_X\left(\frac{tons}{yr}\right) = Outside\ Breakwater\ Emissions\ \left(\frac{tons}{yr}\right) + Inside\ Breakwater\ Emissions\ \left(\frac{tons}{yr}\right) + Maneuvering\ Emissions\ \left(\frac{tons}{yr}\right) + Hotelling\ Emissions\ (\frac{tons}{yr})$$

$$NO_X\left(\frac{tons}{yr}\right) = 2.84E-01\ \left(\frac{tons}{yr}\right) + 2.57E-01\left(\frac{tons}{yr}\right) + 5.07E-02\left(\frac{tons}{yr}\right) + 4.52E-01\left(\frac{tons}{yr}\right)$$

$$NO_X\left(\frac{tons}{yr}\right) = 1.04E + 00\ (\frac{tons}{yr})$$

6.1.4 Major Changes from Previous Inventory

There were several major differences between the previous inventory and current inventory for OGVs. Firstly, additional ship types were included based on the ship types specified by the ship call list and the Portal. Also, the methodology used was significantly different than the previous inventory. In the current methodology there is much more specific vessel information required to assign emission factors. In the previous guidance, emission factors were more generalized. For example, NO_X emission factors for propulsion engines and auxiliary engines are broken down by a vessel's keel-laid year, which is a change from the previous guidance. This introduces the potential to reduce overall emissions estimates if newer vessels are utilized. Although the previous guidance included NO_X adjustment factors based on ship ages, these were applied generally to the entire set of ship data instead of being assigned individually by vessel in the previous inventory. Additionally, the default operating loads for auxiliary engines and boilers are broken down by ship type and ship size in the current guidance. In the previous guidance, boiler and auxiliary engine loads were only broken down by ship type. This change could increase or decrease emissions estimates depending on the breakdown of overall ship sizes. The previous inventory also considered operations occurring outside and inside of the breakwater to be maneuvering, but this inventory classified these operations as restricted speed zone operations in accordance with the current guidance. Finally, the fuel type assumptions were different between inventories. The previous inventory assumed the main propulsion engines, auxiliary engines, and boilers operated on residual oil, residual and marine diesel fuel, and heavy fuel oil, respectively. This inventory assumed diesel propulsion engines, auxiliary engines, and boilers utilized marine gas oil or marine diesel oil in accordance with the current guidance.

The addition of the Hugh Leatherman Terminal was a major operational change that occurred between inventories.

6.2 MARINE – HARBOR CRAFT

Information for current harbor craft operating practices was provided by the Moran Towing Corporation and the Charleston Branch Pilots Association. McAllister Towing also provides tug services to vessels calling on SCPA. Tugboats (tugs) assist the ocean-going vessels with maneuvering operations for inbound and outbound operations. Every ship that comes into the port is required to be driven by a harbor pilot. The pilot boats are used to take the harbor pilots to and from the ships as they come into and leave the port.

The inventory includes emissions for propulsion engines, also referred to in this report as main engines, and auxiliary engines. Propulsion engines are used for moving the vessel, while auxiliary engines are used to supply power for non-propulsion purposes. Note that fire pump engines were excluded from the inventory, which is consistent with the approaches of previous inventories.

Figure 32: **McAllister towing in Charleston Harbor** (McAllister Towing, n.d.)

6.2.1 Emission Factors

The emission calculations follow the methodology in Section 4 of the U.S. EPA Ports Emissions Inventory Guidance (U.S. EPA Ports Guidance). Emission factors were also sourced from the U.S. EPA Ports Guidance. As explained in Section 4.5 of the U.S. EPA Guidance, and as was assumed in the previous 2017 inventory, all harbor craft engines are assumed to use ultra-low sulfur diesel (ULSD).

The 2017 inventory used other emission factor sources such as EPA certification testing by engine models and 40 CFR Part 1042. However, using alternative emission factors was not recommended by the current guidance methodology, so the U.S. EPA Ports Guidance was used exclusively to source emission factors. A comparison of average emission factors for harbor craft from previous inventories is presented below in Table 16.
To determine which emission factors to apply to each engine, specific engine information such as engine type (main or auxiliary), engine tier, displacement per cylinder, engine power, and engine category was required as depicted in Table 17 below.

Table 16: **Historical Harbor Craft Emission Factors**

Emission Factors (g/kW-hr)										
Pollutant	HC	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
2011 Report	0.475	1.100	9.800	0.619	0.601	0.007	--	--	--	--
2017 Report	0.249	1.569	7.368	0.195	0.189	0.007	--	--	--	--
2021 Average	0.180	1.387	6.315	0.150	0.146	0.006	685.673	0.004	0.034	0.112

Table 17: **Harbor Craft Emission Factors by Engine (ULSD)[1]**

Engine Data										**Emission Factors (g/kW-hr)[3]**										
Vessel ID	**Engine Manufacturer**	**Engine Model**	**Type**	**Model Year**	**Engine Tier**	**Displacement per Cylinder (L)**	**Engine Power (hP)**	**Engine Power (kW)**	**Engine Category[2]**	**BSFC[4]**	**HC**	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$[5]**	**SO_2[6]**	**CO_2[7]**	**CH_4[8]**	**N_2O[9]**	**BC[10]**
James A. Moran 1236510	John Deere	6068	Auxiliary	2011	2	1.1	133	99	1	213	0.320	0.80	5.40	0.199	0.1928	6.25E-03	679.47	0.0064	3.32E-02	0.1485
James A. Moran 1236510	MTU	16V 4000, M63L	Main	2011	2	4.8	3004	2240	1	213	0.190	1.10	6.00	0.119	0.1152	6.25E-03	679.47	0.0038	3.32E-02	0.0887
Elizabeth Turecamo 9205055	EMD	16-645E7B	Main	1998	Uncontrolled	10.6	3070	2289	2	213	0.134	2.48	13.36	0.210	0.2036	6.25E-03	679.47	0.0027	3.32E-02	0.1568
Elizabeth Turecamo 9205055	John Deere	4045AFM85	Auxiliary	1998	Uncontrolled	1.1	133	99	1	213	0.320	1.70	10.00	0.420	0.4073	6.25E-03	679.47	0.0064	3.32E-02	0.3137
Wyatt Moran 9920265	John Deere	4045AFM85	Auxiliary	2021	3	1.1	133	99	1	213	0.130	0.80	4.02	0.080	0.0776	6.25E-03	679.47	0.0026	3.32E-02	0.0598
Wyatt Moran 9920265	Caterpillar	3512E-HD	Main	2021	4	4.9	2550	1902	1	213	0.040	1.10	1.30	0.030	0.0291	6.25E-03	679.47	0.0008	3.32E-02	0.0224
Jeffrey McAllister	John Deere	4045AFM85	Auxiliary	2016	3	1.1	133	99	1	213	0.130	0.80	4.02	0.080	0.0776	6.25E-03	679.47	0.0026	3.32E-02	0.0598
Jeffrey McAllister	EMD	8-710 G7B	Main	2016	3	11.6	2500	1864	2	213	0.070	2.00	5.97	0.110	0.1067	6.25E-03	679.47	0.0014	3.32E-02	0.0822
Moira McAllister	Caterpillar	3516 B-HD	Main	2003	1	4.9	2500	1864	1	213	0.270	1.80	9.20	0.190	0.1842	6.25E-03	679.47	0.0054	3.32E-02	0.1419
Moira McAllister	Caterpillar	3304	Auxiliary	2003	Uncontrolled	1.8	146.2	109	1	213	0.270	1.50	10.00	0.230	0.2230	6.25E-03	679.47	0.0054	3.32E-02	0.1717
Donal G. McAllister	EMD	16-645-E5	Main	2002	1	10.6	3000	2237	2	213	0.134	2.48	10.55	0.210	0.2036	6.25E-03	679.47	0.0027	3.32E-02	0.1568
Donal G. McAllister[11]	--	--	Auxiliary	2002	--	--	382	285	--	213	0.2871	1.5691	10.0806	0.2917	0.2829	6.25E-03	679.47	0.0057	3.32E-02	0.2178
Capt. Jim McAllister	Caterpillar	3516E	Main	2019	4	4.9	3385	2524	1	213	0.040	1.10	1.30	0.030	0.0291	6.25E-03	679.47	0.0008	3.32E-02	0.0224
Capt. Jim McAllister	Caterpillar	C7.1	Auxiliary	2019	3	1.2	160.9	120	1	213	0.110	0.90	4.77	0.070	0.0679	6.25E-03	679.47	0.0022	3.32E-02	0.0523
Fort Sumter, Fort Moultrie	MTU	12V2000	Main	2013	2	2	1450	1081	1	213	0.190	1.10	6.00	0.119	0.1152	6.25E-03	679.47	0.0038	3.32E-02	0.0887
Fort Ripley	Volvo Penta	IPS1050	Main	2014	3	2.1	800	597	1	213	0.100	1.10	4.69	0.070	0.0679	6.25E-03	679.47	0.0020	3.32E-02	0.0523
Fort Johnson	Cummins	QSL9	Main	2015	3	1.5	400	298	1	213	0.100	1.10	4.69	0.070	0.0679	6.25E-03	679.47	0.0020	3.32E-02	0.0523
Fort Sumter, Fort Moultrie, Fort Ripley	Northern Lights	M944W	Auxiliary	2014	3	0.8	43.5	32	1	248	0.410	1.53	2.32	0.180	0.1746	7.27E-03	791.12	0.0082	3.87E-02	0.1344

(1) Engine information was provided by Moran and the Pilots Association. If information was not provided, representative information was determined. McAllister engine information was gathered from the company website, the 2017 emissions inventory, or other sources as available.

(2) Engine category was determined according to Table 4.2 from the U.S. EPA Ports Emissions Inventory Guidance, Section 4.3.2 (April 2022).

(3) Emission factors are from Appendix H of the U.S. EPA Ports Emissions Inventory Guidance (April 2022), unless otherwise noted.

(4) BSFC is 248 g/kW-hr for engines <37 kW and 213 g/kW-hr for engines ≥ 213 kW for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.2 (April 2022).

(5) PM2.5 emission factors are assumed to be 97% of PM10 emission factors for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.3 (April 2022).

(6) SO2 emission factors are equal to BSFC x 15x10-6 (ULSD sulfur weight ratio) x 0.97753 (sulfur % converted to SO2) x 2 (molecular weight ratio of sulfur to SO2) for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.7 (April 2022).

(7) CO2 emission factors are equal to BSFC x 3.19 g CO2/g fuel for C1 and C2 diesel engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.6 (April 2022).

(8) CH4 emission factors are assumed to be 2% of HC emission factors for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.4 (April 2022).

(9) N2O emission factors are equal to BSFC x 0.000156 g N2O/g fuel for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.5 (April 2022).

(10) BC emission factors are assumed to be 77% of PM2.5 emission factors for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.3 (April 2022).

(11) Auxiliary engine information was not available for Donal G. McAllister. Default engine power information was taken from Table G.1 of the U.S. EPA Ports Emissions Inventory Guidance, Appendix G (April 2022). The engine model year was assumed based off the Main Engine model year. Emission factors were taken from Table H.6, Appendix H of the inventory guidance or were calculated as specified above.

6.2.2 Activity Characterization

The Moran Towing Corporation and McAllister Towing provide tug services for vessels docking at SCPA terminals. The power needs of tug operations vary depending on the operation. Time is spent applying considerable loads to the main engines during inbound operations, outbound operations, and turning operations, but is also spent idling without applying loads to the main engines. Two tugs are typically required for one job, but three tugs may be required in poor weather conditions. The meetup locations vary depending on the terminal and are presented below in Table 18.

The typical operations of the pilot boats have been the same for about the past twenty (20) years, with approximately 7,000 hours of annual operational time. Approximately 70% of pilot boat jobs occur between 6 pm and 6 am, but operations occur 24/7, 365 days a year. The Pilots Association has four (4) pilot boats. The pilot boats will stay out all day instead of coming back to dock between jobs.

Table 18: **Tug Meetup Locations**

Meeting Location	Destination Terminal
Rebellion Reach	Columbus Street
Horse Reach	Wando Welch
Drum Island Reach	Veterans
North Charleston Reach	North Charleston
Horse Reach	Hugh K Leatherman

For the pilot boats, the approximate annual hours of operation for each engine were provided by the Pilots Association. It is estimated that 70% to 80% of the engine operation time is spent on SCPA jobs. Conservatively, the 80% estimation was applied to the total operating hours for each engine. For the Moran tugs, the total hours of operation for each engine were provided by the Moran Towing Corporation. It is estimated that 70% of the main engine operating time is spent on SCPA jobs, which was applied to the total operating hours for each main engine. For McAllister tugs, estimates of engine operating hours were not available. Because different tugs were operating at the port in 2021 than were operating in 2017, the default operating hours available in the Ports Emissions Inventory Guidance were used in lieu of attempting to scale the operating hours from the previous inventory with current production information. From the previous 2017 inventory, it was estimated that 50% of tug jobs supported SCPA operations, which was applied to the default operating hour assumptions used for the McAllister tugs. A comparison of tug activity between inventories is provided below in Table 19.

Table 19: **Harbor Craft Annual Activities**

Reporting Year	Hour Type	Annual Hours
2021 Tugs	Main Engine	17,638
2017 Tugs	Main Engine	14,250
2011 Tugs	Sail / Dock	14,253
2005 Tugs	Sail / Dock	13,699

Table 20 below summarizes the activity information for all harbor craft vessels considered in this inventory.

Table 20: **Harbor Craft Engine Activity Information**[1]

			Main Engine(s)					Auxiliary Engine(s)				
Company	**Vessel ID**	**Vessel Year**	**Engine Count**	**HP**	**kW**	**Load Factor**[2]	**Annual Operating Hours (Total)**[3]	**Engine Count**	**HP**	**kW**	**Load Factor**[2]	**Annual Operating Hours (Total)**[3]
Moran	James A. Moran 1236510	2011	2	3004	2240	0.50	3977	2	132.8	99	0.43	1660
Moran	Wyatt Moran 9920265	2021	2	2550	1902	0.50	3710	2	132.8	99	0.43	1771
Moran	Elizabeth Turecamo 9205055	1998	2	3070	2289	0.50	4060	2	132.8	99	0.43	1750
Pilots Association	Fort Sumter	2000	2	1450	1081	0.51	3200	2	43.5	32	0.43	1600
Pilots Association	Fort Moultrie	2000	2	1450	1081	0.51	3200	2	43.5	32	0.43	1600
Pilots Association	Fort Ripley	2014	3	800	597	0.51	4800	2	43.5	32	0.43	1600
Pilots Association	Fort Johnson	2004	2	400	298	0.51	1600	0	--	--	--	--
McAllister	Moira McAllister	2003	2	2500	1864	0.50	1683	2	146.2	109	0.43	1404
McAllister	Jeffrey McAllister	2016	2	2500	1864	0.50	1683	2	132.8	99	0.43	1404
McAllister	Donal G. McAllister	1967	1	3000	2237	0.50	841.5	--	382.2	285	0.43	702
McAllister	Capt. Jim McAllister	2019	2	3385	2524	0.50	1683	3	160.9	120	0.43	2106

[1] Engine information was provided by Moran and the Pilots Association. If information was not provided, representative information was determined. McAllister engine information was gathered from the company website, the 2017 emissions inventory, or other sources as available.

[2] Load factors are from Table 4.4 of the U.S. EPA Ports Emissions Inventory Guidance, Section 4.6 (April 2022).

[3] Operating hours were not available for the McAllister tugboats. Default operating hours from Table G.1. of the U.S. EPA Ports Emissions Inventory Guidance, Appendix G (April 2022) were applied as well as an assumption that the tugboats serve SCPA terminals 50% of the time. This assumption is from the 2017 Emissions Inventory.

6.2.3 Example Calculations

To calculate emissions, the emission factors in g/kW-hr from Table 17 were combined with the corresponding vessel activity information in Table 20. An example calculation for the NO_X emissions from the James A. Moran tug is shown below.

Auxiliary Engines

$$NO_X\left(\frac{tons}{yr}\right)=\frac{Emission\ Factor\ \left(\frac{g}{kW-hr}\right)*Total\ Operating\ Hours\ (hr)*Load\ Factor*Single\ Engine\ Power\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=\frac{5.40\ \left(\frac{g}{kW-hr}\right)*1{,}660\ (hr)*0.43*99\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=0.42\ (\frac{tons}{yr})$$

Main Engines

$$NO_X\left(\frac{tons}{yr}\right)=\frac{Emission\ Factor\ \left(\frac{g}{kW-hr}\right)*Total\ Operating\ Hours\ (hr)*Load\ Factor*Single\ Engine\ Power\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=\frac{6.00\ \left(\frac{g}{kW-hr}\right)*3{,}977\ (hr)*0.50*2{,}240\ (kW)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=29.46\ (\frac{tons}{yr})$$

Total

$$NO_X\left(\frac{tons}{yr}\right)=Auxiliary\ Engines\ \left(\frac{tons}{yr}\right)+Main\ Engines\ (\frac{tons}{yr})$$

$$NO_X\left(\frac{tons}{yr}\right)=0.42\ \left(\frac{tons}{yr}\right)+29.46\ Main\ Engines\ \left(\frac{tons}{yr}\right)=29.88\ (\frac{tons}{yr})$$

6.2.4 Major Changes from Previous Inventory

Since the 2017 inventory, no major changes have taken place for pilot boat operations. The vessels and their engines have remained the same, and the volume of operations have not changed. The harbor deepening projects have not had a significant impact on pilot boat activities.

There have been several changes for the Moran tugs since the previous inventory. The Mark tug, which had Tier 2 main engines was replaced with the Wyatt Moran, which has Tier 4 main engines, in 2021. Additionally, the company proposes that jobs are completed more quickly because ships are easier to turn since the deepening projects took place. Each terminal has a turning basin, and the basins were enlarged as a consequence of the harbor being deepened.

6.3 RAIL

Rail operations located within and extending from the port are managed by three companies: Palmetto Railways, Norfolk Southern, and CSX. Palmetto Railways oversees switching operations (short line rail) at the Charleston and North Charleston Rail Yards. CSX controls both switching and long-haul rail for the Bennett Yard and Inland Port Dillion. Switching and long-haul operations at Seven Mile Yard and Inland Port Greer are managed by Norfolk Southern.

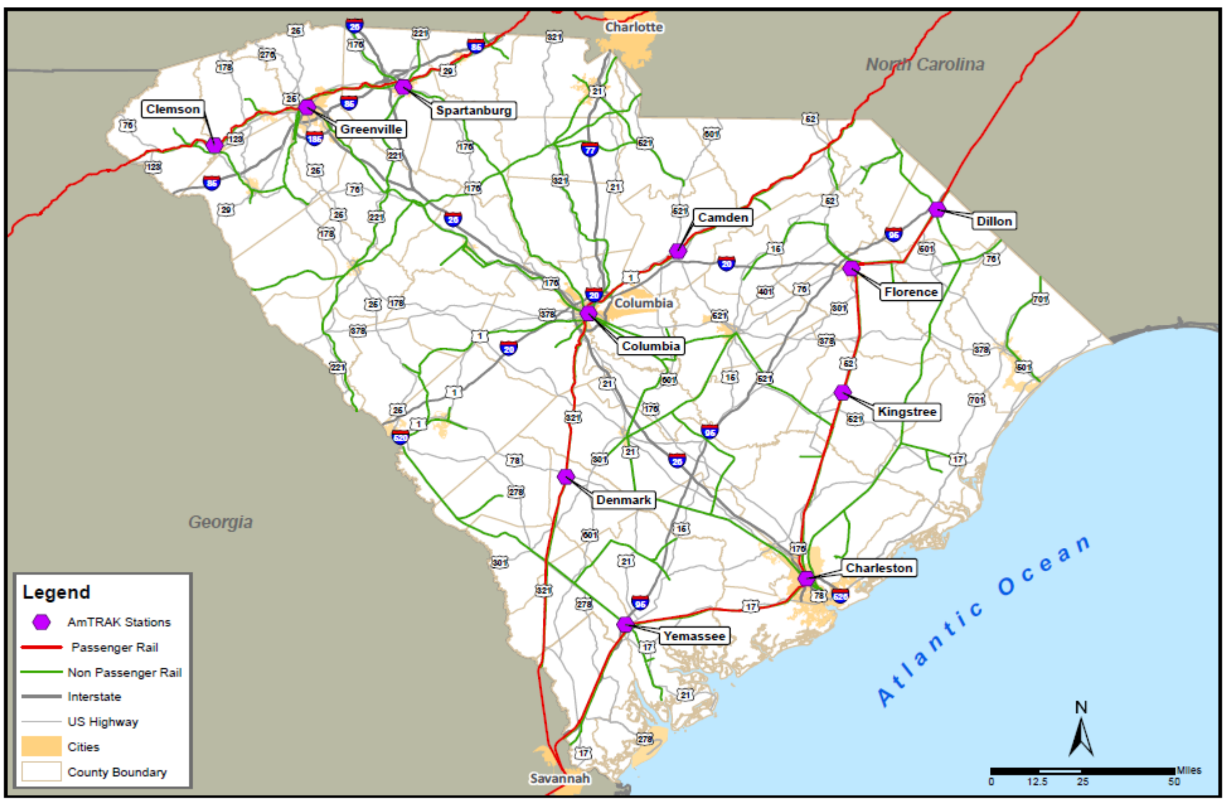

Figure 33: **Map of Rail Lines in South Carolina** (South Carolina Department of Transportation, 2020)

6.3.1 South Carolina Multimodal Transportation Plan

The U.S. EPA, in the Port Emissions Inventory Guidance, defines long-haul rail operations as the delivery or pickup of cargo for long distance trips to other locations. Switching operations involve the sorting of railcars, movement of empty rail cars, and the building of trains. Switching locomotives are predominantly older locomotives compared to long-haul locomotives. In some cases, locomotives can be used in both switching and long-haul operations.

Figure 34: **Palmetto, Norfolk Southern, and CSX Railways** (Palmetto Railways, 2024)

Emissions from both switching and long-haul operations were included in this inventory. Palmetto Railways provided specific information on all available operations. For Norfolk Southern and CSX, data from the 2021 Surface Transportation Board's (STB's) R-1 Reports was used in combination with information provided for the 2017 Emissions Inventory.

For long-haul operations a breakdown of total TEUs moved was not available for the rail yards operated by CSX and Norfolk Southern. To estimate TEUs moved by each facility, the total count of TEUs sent to intermodal operations in 2021 for all SCPA operations was divided between the rail yards using a ratio calculated from the 2017 Emissions Inventory. At existing rail yards, previous estimates of 360 TEUs and 4 engines per train for long-haul operations were utilized along with the estimated TEU counts to determine the number of train trips in 2021 at each rail yard.

Since 2017, Inland Ports Dillon and Greer commenced operation. SCPA personnel provided site specific data for these operations. In cases where specific information wasn't available, railway-specific data from the 2017 Emissions Inventory was utilized.

For switching operations, data provided by Palmetto Railways was utilized in the calculations for the Charleston and North Charleston Yards. Switching operations managed by Norfolk Southern and CSX were estimated using hours of operation from the Charleston and North Charleston Rail Yards and historical data from the 2017 Emissions Inventory.

6.3.2 Emission Factors

Emission factors for this section were gathered from the latest version of the U.S. EPA's Ports Emissions Inventory Guidance. Emission factors, provided in Table 21 below, were available based on locomotive operation.

Table 21: **Rail Emission Factors**

Emission Factors[1]		**Emission Factors (g/hp-h)**										
Engine Type	**Tier Level**	**NO_x**	**PM_{10}**	**HC**	**CO**	**$PM_{2.5}$[2]**	**BSFC[3]**	**SO_2[4]**	**CO_2[5]**	**CH_4[6]**	**N_2O[7]**	**BC[8]**
Line-Haul	Uncontrolled	13.00	0.32	0.48	1.28	0.31	154	4.52E-03	491.26	0.04	0.01	0.23
Line-Haul	Tier 0	8.60	0.32	0.48	1.28	0.31	154	4.52E-03	491.26	0.04	0.01	0.23
Line-Haul (Class II/III)[9]	Tier 0	8.60	0.32	0.48	1.28	0.31	176	5.16E-03	561.44	0.04	0.01	0.23
Line-Haul	Tier 0+	7.20	0.20	0.30	1.28	0.19	154	4.52E-03	491.26	0.04	0.01	0.14
Line-Haul	Tier 1	6.70	0.32	0.47	1.28	0.31	154	4.52E-03	491.26	0.04	0.01	0.23
Line-Haul	Tier 1+	6.70	0.20	0.29	1.28	0.19	154	4.52E-03	491.26	0.04	0.01	0.14
Line-Haul	Tier 2	4.95	0.18	0.26	1.28	0.17	154	4.52E-03	491.26	0.04	0.01	0.13
Line-Haul	Tier 2+	4.95	0.08	0.13	1.28	0.08	154	4.52E-03	491.26	0.04	0.01	0.06
Line-Haul	Tier 3	4.95	0.08	0.13	1.28	0.08	154	4.52E-03	491.26	0.04	0.01	0.06
Line-Haul	Tier 4	1.00	0.015	0.04	1.28	0.01	154	4.52E-03	491.26	0.04	0.01	0.01
Switcher	Uncontrolled	17.40	0.44	1.01	1.83	0.43	211	6.19E-03	673.09	0.05	0.02	0.31
Switcher	Tier 0	12.60	0.44	1.01	1.83	0.43	211	6.19E-03	673.09	0.05	0.02	0.31
Switcher	Tier 0+	10.60	0.23	0.57	1.83	0.22	211	6.19E-03	673.09	0.05	0.02	0.16
Switcher	Tier 1	9.90	0.43	1.01	1.83	0.42	211	6.19E-03	673.09	0.05	0.02	0.30
Switcher	Tier 1+	9.90	0.23	0.57	1.83	0.22	211	6.19E-03	673.09	0.05	0.02	0.16
Switcher	Tier 2	7.30	0.19	0.51	1.83	0.18	211	6.19E-03	673.09	0.05	0.02	0.13
Switcher	Tier 2+	7.30	0.11	0.26	1.83	0.11	211	6.19E-03	673.09	0.05	0.02	0.08
Switcher	Tier 3	4.50	0.08	0.26	1.83	0.08	211	6.19E-03	673.09	0.05	0.02	0.06
Switcher	Tier 4	1.00	0.015	0.08	1.83	0.01	211	6.19E-03	673.09	0.05	0.02	0.01

(1) Emission factors from the U.S. EPA Ports Emissions Inventory Guidance, Tables 8.2 and 8.3 (April 2022), unless otherwise noted.
(2) $PM_{2.5}$ emission factors are calculated as 97% of PM_{10} emission factors in accordance with the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.1 (April 2022).
(3) BSFC values are taken from the U.S. EPA Ports Emissions Inventory Guidance, Table 8.4 (April 2022).
(4) SO_2 emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.6 (April 2022).
(5) CO_2 emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.3 (April 2022).
(6) CH_4 emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.4 (April 2022).
(7) N_2O emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.5 (April 2022).
(8) BC emission factors are calculated as 73% of $PM_{2.5}$ emission factors in accordance with the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.4 (April 2022).
(9) Line-haul emission factors above are for Class I locomotives. Class II and III line-haul locomotives should use Tier 0 line-haul emission factors (U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.1 (April 2022)).

6.3.3 Activity Characterization

The activity data in Tables 22 and 23 below was used to complete the emission estimate calculations.

Table 22: **Container to Rail Activities**

	Description
1,531,669	SCPA Container movements in 2021
2,751,442	SCPA TEUs moved in 2021
22%	Percentage of TEUs to Intermodal
1.80	Factor for mix between 20', 40', and 45' containers for unit number
338,314	Total containers sent to trains
607,737	Total TEUs sent to trains
40	Long-haul Average Speed (mph)
35	Long-haul Average Dist to Tri-County Border (mi)
119	Long-haul Average Dist from Tri-County Border to Inland Port Dillon (mi)
183	Long-haul Average Dist from Tri-County Border to Inland Port Greer (mi)

Table 23: **Rail Activities**

Rail Inventory Item	Rail Company	Yard	Activity Type	Average Engine hp[(1)]	Engine Load[(2)]	Engine Build Date[(3)]	Engine Class[(4)]	EPA Tier Certification[(5)]	Number of TEUs per Train[(6)]	Total Number of TEUs[(7)]	Engines per Train[(8)]	Train Count Estimate[(9)]	Hours[(10)]
1	Palmetto Railways	Charleston Yard	Switching	1000	10%	1975	Switcher	Tier 0+	N/A	N/A	1	17	102
2	Palmetto Railways	Charleston Yard	Switching	1000	10%	1977	Switcher	Tier 0	N/A	N/A	1	203	4,300
3	Palmetto Railways	Charleston Yard	Switching	1000	10%	1977	Switcher	Tier 0	N/A	N/A	1	93	558
4	Palmetto Railways	Charleston Yard	Switching (road engine used in switching activity)	3500	10%	1994 est.	Class I	Tier 1+	N/A	N/A	2	301	350
5	Palmetto Railways	Charleston Yard	Switching (road engine used in switching activity)	4000	10%	2004 est.	Class I	Tier 2	N/A	N/A	2	26	32
6	Palmetto Railways	North Charleston Yard	Switching	2000	10%	1965	Switcher	Uncontrolled	N/A	N/A	1.5	365	1,095
7	Palmetto Railways	North Charleston Yard	Switching	2000	10%	1967	Switcher	Uncontrolled	N/A	N/A	1.5	365	1,095
8	CSX	Bennett Yard	Switching	2269	10%	1970s	Switcher	Tier 0	N/A	N/A	1	N/A	3,766
9	CSX	Bennett Yard	Long-haul	3752	28%	1990s/2000s	Class I	Tier 0/0+	360	201,418	4	559	490
10	CSX	Inland Port Dillon	Switching	2269	10%	1970s	Switcher	Tier 0	N/A	N/A	1	N/A	3,766
11	CSX	Inland Port Dillon	Long-haul	3752	28%	1990s/2000s	Class I	Tier 0/0+	126	52,125	4	415	1,233
12	Norfolk Southern	Seven Mile Yard	Switching	2668	10%	Multiple	Switcher	Tier 0/0+	N/A	N/A	1	N/A	3,766
13	Norfolk Southern	Seven Mile Yard	Long-haul	4344	28%	Multiple	Class I	Tier 0/0+	360	406,319	4	1129	988
14	Norfolk Southern	Inland Port Greer	Switching	2668	10%	Multiple	Switcher	Tier 0/0+	N/A	N/A	1	N/A	3,766
15	Norfolk Southern	Inland Port Greer	Long-haul	4344	28%	Multiple	Class I	Tier 0/0+	539	287,832	4	534	2,444

(1) For Palmetto Railways units, average engine hp was provided by the company. For CSX and Norfolk Southern units, average engine hp was estimated from the 2021 STB R-1 Report, Schedule 710. For Norfolk Southern, both multiple purpose units and switching units were considered to be switching units.

(2) Average load factors from Section 8.4.3 of the U.S. EPA Port Emissions Inventory Guidance (April 2022), since detailed information to determine load factors is not available.

(3) Engine build dates for Palmetto Railways were provided by the company. For CSX and Norfolk Southern, this information was taken from the previous 2017 Emissions Inventory.

(4) Engine class information for Palmetto Railways was provided by the company. CSX and Norfolk Southern are both Class I railroad companies.

(5) EPA Tier Certification information for Palmetto Railways was provided by the company. For CSX and Norfolk Southern, this information was taken from the previous 2017 Emissions Inventory.

(6) Number of TEUs per train for Bennett Yard and Seven Mile Yard is from previous 2017 Emissions Inventory. For inland ports, this is based on information from SCPA personnel.

(7) Number of TEUs for Bennett Yard and Seven Mile are based on the total number of TEUs sent to rail. A breakdown between the two yards was not available, so the ratio of container movements from the 2017 Emissions Inventory between the yards was used. For Inland Ports, this is based on information from SCPA personnel.

(8) For Palmetto Railways units, number of engines per train were provided by the company. For CSX and Norfolk Southern four (4) engines are assumed for long-haul operations and one (1) engine is assumed for switching operations.

(9) For Palmetto Railways units, number of trains were provided by the company. For CSX and Norfolk Southern long-haul operations, number of trains is estimated based on the total number of containers moved and the number of containers per train.

(10) For Palmetto Railways units, hours were provided by the company. For CSX and Norfolk Southern long-haul operations, hours were based on the total number of trains, an average speed of 40 mph, and the distance per trip. For CSX and Norfolk Southern switching operations, an average of the total switching hours for Charleston Yard and North Charleston Yard was used.

The U.S. EPA's Port Emissions Inventory Guidance advises that in cases where company-specific information is not available, average national load factors can be utilized. For switching operations, the average load factor is 10%, and for line-haul operations an average of 28% was utilized.

6.3.4 Example Calculations

To calculate an emissions estimate, the emission factors in Table 21 were combined with the rail inventory data in Table 23. In the example calculation below, Rail Inventory Item 1 from Table 23 was utilized to calculate carbon monoxide emissions.

$$Total\ Annual\ Emissions = Engines\ Per\ Train * \ Annual\ Operating\ Hours * Average\ Engine\ Horsepower * \ Engine\ Load\ (\%) * Emission\ Factor\ \left(\frac{g}{hp-hr}\right) * \frac{1\ lb}{453.59\ g} * \frac{1\ ton}{2000\ lb}$$

$$Total\ Annual\ CO\ Emissions \ = 1\,\frac{engine}{train} * 102\ \frac{hours}{year} * 1000\ hp * 10\%\ engine\ load * 1.83\,\frac{g}{hp-hr} * \frac{1\ lb}{453.59\ g} * \frac{1\ ton}{2000\ lb} = 0.02\ \frac{ton}{year}$$

6.3.5 Major Changes from Previous Inventory

The addition of the Inland Ports to rail operations is the primary driver of emissions estimate changes between the 2017 and 2021 Emissions Inventories. Due to the greater distance of travel to these Inland Ports, the hours of long-haul operation are significantly longer than that of the existing Bennett and Seven Mile Yards.

6.4 ON-ROAD – HEAVY DUTY VEHICLES

On-road engine emissions from heavy duty vehicles include vehicles used to haul containers and breakbulk over roads to and from the SCPA terminals. In 2021, approximately 78% of TEUs were transported via truck vs approximately 22% of TEUs being transported by rail. In 2021, approximately 1.5 million truck trips were used to transport containers and breakbulk items to and from the SCPA terminals. These trips had an average turn time of 53 minutes at the main terminals. At the inland ports, the average turn time was 9 minutes. Updated breakdown information of the various vehicle types serving the terminals was not available. Therefore, the breakdowns from the 2017 inventory were used as shown below in Table 24. For Hugh Leatherman, SCPA Personnel advised for the Wando Welch breakdowns to be used.

Table 24: **Container Truck Type by Terminal**

Truck Type	Columbus St		North Charleston		Wando Welch		Hugh Leatherman	
	2017	2021	2017	2021	2017	2021	2017	2021
Bobtail	1%	1%	12%	12%	5%	5%	--	5%
Chassis	1%	1%	15%	15%	5%	5%	--	5%
Loads & Empties	98%	98%	73%	73%	90%	90%	--	90%

To develop the emissions inventory, the following data was collected or assumed:

1. The number of truck moves that occurred per terminal or inland port in 2021;
2. The average time spent and distance traveled per vehicle at each terminal and inland port (including idling time);
3. The cumulative travel from the port to and from the vehicles intended destination.

This information combined with factors generated using MOVES4 was used to calculate emissions for heavy duty vehicles at the terminals and inland ports. Trucks operate approximately 13 hours per day, from 05:00 to 18:00, 6 days per week. Beginning in September 2021, there was intermittent port operation on Sundays. For the purposes of the calculations, operation was assumed to occur on average for 5 weekdays and 1 weekend day per week. The emission factors developed from MOVES4 do not vary significantly based on weekend or weekday operation. Based on information from SCPA personnel, it is assumed that truck engines remain on during their time on-terminal.

Table 25: **Truck Turn Time and Operations**

Operation	Container	Breakbulk
Engine Off	0%	0%
Idle	Varies by Terminal	Varies by Terminal
Moving (10 mph)	Varies by Terminal	Varies by Terminal

In previous inventories, shuttle trips for embarkation and debarkation operations for cruises were included. However, in 2021, only two (2) cruise ships made stops at SCPA terminals. These trips were also not for general embarkation or debarkation, so no shuttle rides have been accounted for.

Figure 35: **Motor Carriers Utilized at Terminals** (SC Ports Authority, 2024)

6.4.1 Emission Factors

U.S. EPA's most updated version of the Motor Vehicle Emission Simulator (MOVES4) was used to develop emission factors for on-road engines, or heavy-duty vehicles. MOVES4 can produce specific emission factors for many different combinations of input information such as vehicle types, fuel types, month, type of day (weekend or weekday), hour of the day, emission process, road type, and vehicle speed. For this inventory, emission factors for each pollutant of interest were generated in grams per mile for movement activities and in grams per hour for idling activities.

To keep consistent methodology to the previous inventory, a single January hour and a single July hour were modeled to capture the hottest and coldest times expected. The results were then averaged to produce overall emission factors for each set of conditions modeled. Weekend days and weekdays were modeled separately for this inventory. A weighted average was used with the assumption that each week would contain five (5) weekdays and one (1) weekend day.

MOVES4 contains default information on various inputs such as meteorological data, fuel formulations, vehicle activities, vehicle model years, and many more. It is recommended that when more specific information is available that it should be used in place of the default information. In the 2017 inventory, select data from the 2014 National Emissions Inventory (NEI) was used for modeling. Greenville County was used as a surrogate county for all counties included in the geographic range of the inventory. For this inventory, the 2022 NEI was used for the replacement of the same default information as the 2017 inventory. Greenville county was determined to still be a suitable surrogate for all SCPA terminals. Additionally, it was determined that this was an acceptable surrogate to use for both inland ports.

The MOVES4 modeling was performed using the following inputs and assumptions:

- Geographic Bounds – Greenville County as a surrogate county;
- Vehicle Type – Diesel Fuel Combination Long-Haul Trucks;
- Road type – urban restricted and urban unrestricted and off-network; and

- U.S. EPA 2022 NEI county data for fuel supply, fuel formulation, fuel usage fraction, and Alternative Vehicle Fuels and Technology (AVFT).

The temperature and relative humidity data used for the January hour and July hour discussed previously was taken from the 2022 NEI for Greenville, SC. The hottest annual hourly temperature and coldest annual hourly temperatures were chosen to be modeled regardless of when they occurred in the year. These values are presented below in Table 26.

Table 26: **Average Relative Humidity and Temperature**

Parameter	January	July
Relative Humidity	93.54%	54.95%
Temperature	35.91 °F	87.27 °F

6.4.2 Activity Characterization

A summary of the annual activity information used in this inventory is provided below in Tables 27 through 29. Estimates for the distances trucks travel around each terminal and the inland ports were provided by SCPA personnel. To calculate the on-terminal travel emissions, a speed of ten (10) miles per hour was assumed. The number of container truck arrivals in 2021 was provided by SCPA personnel. The number of breakbulk arrivals per year was not available. Therefore, the values from the previous inventory were scaled based on the tonnage of dry bulk handled between 2017 and 2021. The breakdown of destinations by vehicle type in Table 30 were assumed to be the same as the 2017 inventory except for the percentage of Loads & Empties sent to offsite railyards, which was updated based on the rail data available. The remaining percentages for Loads & Empties were adjusted accordingly. For the inland ports, it was assumed that all containers travel between the port via rail. Also, it was determined to exclude additional "off-terminal" truck travel at the inland ports due to the variability of the vehicle originations or destinations. Therefore, only "on-terminal" emissions have been included in the scope for the inland ports.

Table 27: **Heavy Duty Annual Activities**

Activity Variable		**Baseline Case**
Truck Moves/Year		1,488,931
Working days/week		6
Trucks/hour, (averages for WWT, and NCT, and HLT)		23-232
Facility	Idling (%)	3-98%
	Facility Transit Total (min)	9-53

Table 28: **Heavy Duty Annual Activities by Terminal and Truck Type**

Terminal	# of Container Truck Arrivals/Year	# of Breakbulk Arrivals/Year
Columbus Street	--	8,569
North Charleston	212,668	69
Union Pier	--	383
Veterans	--	--
Wando Welch	980,208	137
Hugh Leatherman	95,430	--
Inland Port Dillon	20,162	--
Inland Port Greer	171,304	--

Table 29: **Cruise Ship Shuttle Operations**

Activity	Mini Bus (Embark)	Motor Coach (Debark)
Cruise Ship Calls	2	
Average Shuttle Ride per Call	0	0
Shuttle Ride per Year	0	0
Total Embark/Debark	0	

Table 30: **Heavy Duty Destination by Truck Type**

	Truck Type	**% split 2021**	**Origin/Destination**
Containerized	Loads & Empties	22.0%	Offsite Railyards
		16.6%	Local Charleston
		61.4%	Out of Tri-County
	Bobtails	100.0%	Ashley P west of 26
	Chassis	100.0%	Offsite Railyards
Breakbulk	Breakbulk	0.0%	Offsite Railyards
		50.0%	Local Charleston
		50.0%	Out of Tri-County

Table 31: **Heavy Duty Travel Distance to Off-Site Destination**

			Distance (miles) to/from Terminal					
Destination	**Cargo Type**	**Truck Type**	**Columbus Street**	**North Charleston**	**Union Pier**	**Veterans**	**Wando Welch**	**Hugh Leatherman**
Offsite Railyards	Containerized	Loads & Empties	6.00	5.50	7.00	--	12.75	6.85
Local Charleston			14.30	9.75	15.30	--	16.50	9.30
Out of Tri-County			50.00	40.00	51.00	--	52.00	48.00
Ashley P west of 26		Bobtail	11.30	6.75	12.30	--	13.50	6.30
Offsite Railyards		Chassis	6.00	5.50	7.00	--	12.75	6.85
Offsite Railyards	Breakbulk		6.00	5.50	7.00	4.00	12.75	6.85
Local Charleston			14.30	9.75	15.30	25.00	16.50	9.30
Out of Tri-County			50.00	40.00	51.00	45.00	52.00	48.00
Typical Routes, Terminal to Tri-County Boundary			Via I-26 West	Virginia Ave to I-526, merges with Highway 17A and I-26	Morrison Drive to I-26 W	Rivers Ave to I-26	I-526 to I-26, with approx. 3-5% taking Hwy 17	Via I-26 West

6.4.3 Example Calculations

Example calculations are provided below for NO_X off-terminal emissions for container trips during morning rush hour traveling to local Charleston for North Charleston Terminal and on-terminal emissions for container trucks for North Charleston Terminal.

On-Terminal Non-Idle Operations:

The on-terminal non-idle (moving) emissions are calculated using the MOVES4 emission factors for NO_X assuming a travel speed of ten (10) miles per hour on unrestricted urban roads, an assumption of 1.25 on-terminal vehicle miles traveled (VMT) per vehicle, and an estimate of 212,668 container truck visits per year.

$$NO_X\left(\frac{tons}{yr}\right)=\frac{Emission\ Factor\ \left(\frac{g}{VMT}\right)*On-Terminal\ Miles\ Per\ Truck*Total\ Vehicle\ Trips}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=\frac{11.854\ \left(\frac{g}{VMT}\right)*1.25\ (miles)*212{,}668\ (vehicles)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=3.5\ (\frac{tons}{yr})$$

The on-terminal idle emissions are calculated using the MOVES4 emission factors for NO_X for idling on off-network roads, an assumption of 45.5 idling minutes per truck, and an estimate of 212,668 container truck visits per year. The overall assumption is that trucks spend on average 53 minutes per terminal trip. With the assumption that each truck travels 1.25 miles on-terminal per trip at ten (10) miles per hour, the estimated total moving time is 7.5 minutes. Therefore, the idling time is assumed to be the remaining 45.5 minutes of the on-terminal time.

$$NO_X\left(\frac{tons}{yr}\right)=\frac{Emission\ Factor\ \left(\frac{g}{hr}\right)*On-Terminal\ Idle\ Time\ Per\ Truck\ (hr)\ *Total\ Vehicle\ Trips}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=\frac{48.895\ \left(\frac{g}{hr}\right)*0.76\ (hr)*212{,}668\ (vehicles)}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right)=\ 8.7\ (\frac{tons}{yr})$$

To determine the off-terminal emissions, container truck trips are split into three (3) categories: Loads & Empties, Chassis, and Bobtails. From there, each type is further split by weekday morning rush hour travel, weekday evening rush hour travel, or non-rush hour travel and by origin/destination assumptions, speed assumptions, and road types. Before the trip types are separated, the total number of truck visits to the terminal is doubled to account for travel both to and from the terminal. The example calculation below is for Loads & Empties traveling to local Charleston during the morning rush hour.

$$NO_X\left(\frac{tons}{yr}\right)=\frac{Emission\ Factor\ \left(\frac{g}{VMT}\right)*VMT\ per\ vehicle\ \ *Total\ Vehicle\ Trips}{453.592\ \frac{g}{lb}*2{,}000\ \frac{lb}{ton}}$$

For Urban Unrestricted Roads

$$NO_X\left(\frac{tons}{yr}\right) = \frac{9.350\left(\frac{g}{VMT}\right) * 3.00\,VMT\ * 6{,}499\ (vehicles)}{453.592\ \frac{g}{lb} * 2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = \ 0.2\ (\frac{tons}{yr})$$

For Urban Restricted Roads

$$NO_X\left(\frac{tons}{yr}\right) = \frac{4.270\left(\frac{g}{VMT}\right) * 6.75\,VMT\ * 6{,}499\ (vehicles)}{453.592\ \frac{g}{lb} * 2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = \ 0.2\ (\frac{tons}{yr})$$

6.4.4 Major Changes from Previous Inventory

As with some of the other emissions sources already discussed, the addition of the Hugh Leatherman Terminal, Inland Port Dillon, and Inland Port Greer affected the heavy-duty vehicle calculations. Additionally, the idling time methodology discussed in the example calculation has been updated since the previous inventory. No cruise ship shuttles were included due to the nature of cruising in 2021. Finally, the MOVES program has gone through several updates since the previous inventory, which introduces additional variability in calculation methodology.

6.5 NON-ROAD ENGINES

A variety of mobile equipment is used at the SCPA terminals and offsite railyards to support port operations. While some pieces of equipment, such as the large container cranes are electric, the majority of equipment is diesel-powered and therefore produce air pollutant emissions. Non-road equipment considered in this inventory include forklifts, miscellaneous railway cargo handling equipment, empty and full container handlers, rubber-tired gantry (RTG) cranes, and truck cranes. Additionally, yard trucks, also known as terminal tractors, have been included for completeness, although this equipment type has been excluded from previous inventories. All equipment is assumed to use ULSD as fuel.

6.5.1 Calculation Methodology

All emission factors were generated with U.S. EPA's MOVES4 program. In the previous 2017 inventory, EPA engine certification test results were used in combination with MOVES4 emission factors. However, utilizing MOVES4 exclusively is consistent with the calculation methodology recommended by the U.S. EPA Ports Emissions Inventory.

The MOVES4 non-road model was used in the Default Scale, which is the only scale option for non-road estimations. The model was run for Charleston County, SC and included all months of 2021. The model produced emission factors in g/hp-hr for each equipment type selected for a range of horsepower bins. For each pollutant, separate factors were generated for each month and day type, which includes weekdays and weekend days. For each combination of pollutant, day type, equipment type, and horsepower bin, the monthly emission factors were averaged together. From there, a weighted average of the weekday and weekend monthly emission factors was taken assuming 5 weekdays and 1 weekend day per week for each set of conditions. For 2021, the terminals operated six (6) days per week for a majority of the year. Starting in September, the terminals began operating seven (7) days a week. However, there is no significant difference between weekend and weekday emission factors. Emission factors were then assigned to the relevant equipment by equipment category type and horsepower bin.

Additionally, the emission calculations include load factors, which were taken from the U.E. EPA Ports Emissions Inventory Guidance for each equipment category type. The MOVES4 emission factors, load factors, and activity characterization for the relevant equipment were used in combination to calculate the annual non-road engine emissions.

6.5.2 Emission Factors

The MOVES4 emission factors generated via the methodology discussed in the previous section are presented below in Table 32.

Table 32: **MOVES4 Non-road Emission Factors**

Equipment Type	MOVES Equipment Name[1]	SCC[2]	Fuel Type	Load Factor[3]	Horsepower Range	MOVES Emission Factors[4]											
						Brake-Specific Fuel Consumption	HC	CO	NOX	PM[5]	PM10	PM2.5	SO2	CO2	CH4	N2O[6]	BC[7]
					(hp)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)	(g/hp-hr)
Yard Truck	Terminal Tractors	2270003070	Nonroad Diesel	0.39	175 < hp <= 300	168.283	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015
Crane, RTG	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	300 < hp <= 600	166.468	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
Crane, RTG	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	600 < hp <= 750	166.468	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
Crane, RTG / Hybrid	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	100 < hp <= 175	166.468	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
Crane, Truck	Cranes	2270002045	Nonroad Diesel	0.43	175 < hp <= 300	166.468	0.057	0.164	0.778	0.036	0.036	0.035	0.001	530.865	0.004	0.024	0.027
Crane, Truck	Cranes	2270002045	Nonroad Diesel	0.43	300 < hp <= 600	166.468	0.133	0.701	2.820	0.108	0.108	0.105	0.002	530.627	0.009	0.024	0.081
Crane, Truck	Cranes	2270002045	Nonroad Diesel	0.43	600 < hp <= 750	166.468	0.126	0.947	2.775	0.115	0.115	0.111	0.002	530.649	0.008	0.024	0.086
Container Handler, Empty	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	175 < hp <= 300	166.468	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
Container Handler, Full	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	175 < hp <= 300	166.468	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
Container Handler, Full	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	300 < hp <= 600	166.468	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
Forklifts	Forklifts	2270003020	Nonroad Diesel	0.59	100 < hp <= 175	168.283	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
Forklifts	Forklifts	2270003020	Nonroad Diesel	0.59	175 < hp <= 300	168.283	0.013	0.049	0.178	0.012	0.012	0.012	0.001	536.788	0.001	0.025	0.009
Machine Lift	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	300 < hp <= 600	166.468	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
Reach Stacker	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	175 < hp <= 300	166.468	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
Side Loader	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	100 < hp <= 175	166.468	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051

(1) Names assigned according to Table 6.1 of the U.S. EPA Ports Emissions Inventory Guidance, Section 6.3.1 (April 2022).

(2) SCC codes assigned according to Table 6.2 of the U.S. EPA Ports Emissions Inventory Guidance, Section 6.3.1 (April 2022).

(3) Load factor assigned according to Table 6.4 of the U.S. EPA Ports Emissions Inventory Guidance, Section 6.4 (April 2022).

(4) Emission factors are from U.S. EPA's MOVES Program, Version 4.0.1. Emission factors are for Charleston County, SC for 2021.

(5) Total PM emission factors are not available. Assumes PM = PM10.

(6) Emission factors for N_2O are calculated according to Equation 6.2 in the U.S. EPA Ports Emissions Inventory Guidance, Section 6.5.2 (April 2022).

(7) Emission factors for Black Carbon (BC) are calculated according to Equation 6.3 in the U.S. EPA Ports Emissions Inventory Guidance, Section 6.5.3 (April 2022).

6.5.3 Activity Characterization

The equipment information available varied by equipment type. Assumptions were made as necessary to fill information gaps as explained below. A summary of the activity characterization data is provided in Table 33 below.

All yard trucks included in this inventory are owned by TICO. There are two categories of yard trucks utilized during SCPA operations, which are leased and un-leased. At the terminals, leased yard trucks remain on site. The standard non-leased yard trucks serve various operations in the area and are not used exclusively for SCPA operations. The number and types of yard trucks present at the SCPA terminals can change daily based on need. For the emissions inventory, SCPA personnel were able to provide operating hours and fuel usage for the leased yard trucks. TICO was able to provide fuel usage data for the non-leased yard trucks for applicable terminals as well as total run hours for SCPA operations. Specific engine information was not available, so 200 horsepower was chosen as a representative power rating for all units based on comparable engine ratings

For forklifts, SCPA personnel provided equipment model numbers, lift capacities, and horsepower ratings. Annual run hours were not available, so these were estimated based on the 2017 inventory. The average operating hours utilized in the previous inventory by equipment size were scaled with overall SCPA container volumes handled in 2017 and 2021.

For container handlers and RTG cranes, SCPA personnel provided engine tiers, horsepower ratings, operating hours, and fuel usage. No information was provided for truck cranes or miscellaneous railway equipment. However, it was assumed that these were still present from the 2017 inventory. Therefore, the horsepower ratings from the 2017 inventory were utilized in combination with the operating hours, which were scaled with operations as discussed above for the forklifts.

Table 33: **Non-road Engine Activity Characterization Summary**

Equipment	Equipment Count	Average Horsepower	2021 Total Operating Hours
SCPA			
Yard Trucks[1]	--	200	524,969
Forklifts	17	170	11,733
Container Handler, Full	29	331	47,037
Container Handler, Empty	46	256	91,686
Crane, Truck	4	440	5,815
RTG Cranes[2]	109	468	330,653
Railway Companies			
Machine Lift	6	380	31,015
Reach Stacker	4	300	20,677
Side Loader	1	155	5,169
Forklift	2	155	10,338

(1) Yard truck information was provided for the entire fleet, so equipment count information is not available.

(2) Values for RTG Cranes include hybrid models.

6.5.4 Example Calculations

An example calculation for NO_X emissions for an RTG Crane is provided below utilizing the data shown in Table 34.

Table 34: **Non-road Engine Example Calculation Data**

Equipment ID	Equipment Type	Horsepower	Load Factor	2021 Operating Hours	NO_X Emission Factor (g/hp-hr)
H-41-009	Crane, RTG	611	0.43	2,885	1.703

$$NO_X\left(\frac{tons}{yr}\right) = \frac{Emission\ Factor\ \left(\frac{g}{hp-hr}\right) * Operating\ Hours\ (hr) * Load\ Factor * Single\ Engine\ Power\ (hp)}{453.592\ \frac{g}{lb} * 2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = \frac{1.703\ \left(\frac{g}{hp-hr}\right) * 2{,}885\ (hr) * 0.43 * 611\ (hp)}{453.592\ \frac{g}{lb} * 2{,}000\ \frac{lb}{ton}}$$

$$NO_X\left(\frac{tons}{yr}\right) = 1.42\,(\frac{tons}{yr})$$

6.5.5 Major Changes from Previous Inventory

The major changes made to the calculation methodology are the inclusion of yard trucks and the exclusive utilization of MOVES4 as the source of all emission factors. A major operational change that has been made is the addition of Inland Port Dillon and Inland Port Greer. The calculations presented in Appendix A show the emissions generated from the non-road engines present at the inland ports in 2021.

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APPENDIX 1

2021 EMISSIONS CALCULATIONS

OCEAN GOING VESSELS

2021 EMISSIONS CALCULATIONS

OGV Engine Emission Factors [1]

			Emission Factors (g/kWh)										
	Keel-laid Year (or NO_x Tier)	**Engine Type**	BSFC[2]	HC[3]	CO[3]	NO_x[4]	PM_{10}[5]	$PM_{2.5}$[6]	SO_2[7]	CO_2[8]	CH_4[9]	N_2O[10]	BC[11]
Main Engines (C3)	Any	Steam Turbine	300	0.1	0.2	2.0	0.16	0.15	0.59	961.80	0.002	0.075	4.42E-03
		Gas Turbine	300	0.1	0.2	5.7	0.01	0.01	0.59	961.80	0.002	0.075	2.76E-04
	1999 and earlier	Slow-Speed Diesel	185	0.6	1.4	17.0	0.18	0.17	0.36	593.11	0.012	0.029	5.07E-03
		Medium-Speed Diesel	205	0.5	1.1	13.2	0.19	0.17	0.40	657.23	0.010	0.029	5.15E-03
	2000-2010 (Tier I)	Slow-Speed Diesel	185	0.6	1.4	16.0	0.18	0.17	0.36	593.11	0.012	0.029	5.07E-03
		Medium-Speed Diesel	205	0.5	1.1	12.2	0.19	0.17	0.40	657.23	0.010	0.029	5.15E-03
	2011-2015 (Tier II)	Slow-Speed Diesel	185	0.6	1.4	14.4	0.18	0.17	0.36	593.11	0.012	0.029	5.07E-03
		Medium-Speed Diesel	205	0.5	1.1	10.5	0.19	0.17	0.40	657.23	0.010	0.029	5.15E-03
	2016 and later (Tier III)	Slow-Speed Diesel	185	0.6	1.4	3.4	0.18	0.17	0.36	593.11	0.012	0.029	5.07E-03
		Medium-Speed Diesel	205	0.5	1.1	2.6	0.19	0.17	0.40	657.23	0.010	0.029	5.15E-03
Auxiliary Engines	1999 and earlier	Medium-Speed Diesel	217	0.4	1.1	13.8	0.19	0.17	0.42	695.70	0.008	0.029	5.21E-03
		High-Speed Diesel	217	0.4	0.9	10.9	0.19	0.17	0.42	695.70	0.008	0.029	5.21E-03
	2000-2010 (Tier I)	Medium-Speed Diesel	217	0.4	1.1	12.2	0.19	0.17	0.42	695.70	0.008	0.029	5.21E-03
		High-Speed Diesel	217	0.4	0.9	9.8	0.19	0.17	0.42	695.70	0.008	0.029	5.21E-03
	2011-2015 (Tier II)	Medium-Speed Diesel	217	0.4	1.1	10.5	0.19	0.17	0.42	695.70	0.008	0.029	5.21E-03
		High-Speed Diesel	217	0.4	0.9	7.7	0.19	0.17	0.42	695.70	0.008	0.029	5.21E-03
	2016 and later (Tier III)	Medium-Speed Diesel	217	0.4	1.1	2.6	0.19	0.17	0.42	695.70	0.008	0.029	5.21E-03
		High-Speed Diesel	217	0.4	0.9	2.0	0.19	0.17	0.42	695.70	0.008	0.029	5.21E-03
Boiler	Any	Boiler	300	0.1	0.2	2.0	0.20	0.19	0.59	961.80	0.002	0.075	5.57E-03

[1] Fuel type for all C3 marine vessel engines is assumed to be marine gas oil (MGO) or marine diesel oil (MDO) in accordance with the guidance provided in the U.S. EPA Ports Emissions Inventory Guidance (April 2022). All auxiliary engine types can be assumed to be medium-speed diesel (MSD).

[2] BSFC values from the U.S. EPA Ports Emissions Inventory Guidance, Table 3.6 (April 2022).

[3] HC and CO emission factors are from the U.S. EPA Ports Emissions Inventory Guidance, Table 3.8 (April 2022).

[4] NO_X emission factors from the U.S. EPA Ports Emissions Inventory Guidance, Table 3.5 (April 2022). According to Table 3.5, Tier III main engines operating at less than 25% load should be assigned Tier II emission factors for NO_X.

[5] PM_{10} emission factors for slow-speed diesel main engines, medium-speed diesel main engines, auxiliary engines, and boilers are calculated according to Equation 3.3 in Section 3.5.3 of the U.S. EPA Ports Emissions Inventory Guidance (April 2022), assuming operations occur within the ECA. PM_{10} emission factors for steam turbine main engines and gas turbine main engines are from Table 3.7 of the Ports Emissions Inventory Guidance.

[6] $PM_{2.5}$ emission factors are calculated as 92% of PM10 emission factors for all engine types in accordance with the U.S. EPA Ports Emissions Inventory Guidance, Section 3.5.3 (April 2022).

[7] SO_2 emission factors are calculated according to Section 3.5.7 of the U.S. EPA Ports Emissions Inventory Guidance (April 2022), assuming operations occur within the ECA.

[8] CO_2 emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 3.5.6 (April 2022).

[9] CH_4 emission factors are calculated as 2% of HC emission factors for all engine types in accordance with the U.S. EPA Ports Emissions Inventory Guidance, Section 3.5.4 (April 2022).

[10] N_2O emission factors are from the U.S. EPA Ports Emissions Inventory Guidance, Table 3.9 (April 2022).

[11] BC (Black Carbon) emission factors are calculated as 3% of $PM_{2.5}$ emission factors for all engine types in accordance with the U.S. EPA Ports Emissions Inventory Guidance, Section 3.5.3 (April 2022).

Low Load Adjustment Factors for Main (C3) Engines[1]

Propulsion Engine Load Factor	NO_x[2]	HC[3]	CO	PM[4]	CO_2	SO_2 (0.1% fuel sulfur content)
0%	4.63	21.18	9.68	7.29	3.28	9.54
1%	4.63	21.18	9.68	7.29	3.28	9.54
2%	4.63	21.18	9.68	7.29	3.28	9.54
3%	2.92	11.68	6.46	4.33	2.44	6.38
4%	2.21	7.71	4.86	3.09	2.01	4.79
5%	1.83	5.61	3.89	2.44	1.76	3.85
6%	1.60	4.35	3.25	2.04	1.59	3.21
7%	1.45	3.52	2.79	1.79	1.47	2.76
8%	1.35	2.95	2.45	1.61	1.38	2.42
9%	1.27	2.52	2.18	1.48	1.31	2.16
10%	1.22	2.20	1.96	1.38	1.25	1.95
11%	1.17	1.96	1.79	1.30	1.21	1.78
12%	1.14	1.76	1.64	1.24	1.17	1.63
13%	1.11	1.60	1.52	1.19	1.14	1.51
14%	1.08	1.47	1.41	1.15	1.11	1.41
15%	1.06	1.36	1.32	1.11	1.08	1.32
16%	1.05	1.26	1.24	1.08	1.06	1.24
17%	1.03	1.18	1.17	1.06	1.04	1.17
18%	1.02	1.11	1.11	1.04	1.03	1.11
19%	1.01	1.05	1.05	1.02	1.01	1.05
≥20%	1.00	1.00	1.00	1.00	1.00	1.00

[1] Values are from the U.S. EPA Ports Emissions Inventory Guidance, Table 3.10 (April 2022).

[2] NO_X adjustment factors apply to N_2O emissions.

[3] HC adjustment factors apply to CH_4 emissions.

[4] PM adjustment factors apply to PM_{10}, $PM_{2.5}$, and BC emissions.

Default OGV Auxiliary Engine and Boiler Operating Loads[1]

		Auxiliary Engines				Boilers			
Ship Type	**Subtype**	**Transit (kW)[2]**	**Maneuvering (kW)**	**Hotelling (kW)**	**Anchorage (kW)**	**Transit (kW)[2]**	**Maneuvering (kW)**	**Hotelling (kW)**	**Anchorage (kW)**
Container Ship	1,000 TEU	300	550	340	300	0	120	120	120
	2,000 TEU	820	1320	600	820	0	290	290	290
	3,000 TEU	1230	1800	700	1230	0	350	350	350
	5,000 TEU	1390	2470	940	1390	0	450	450	450
	8,000 TEU	1420	2600	970	1420	0	450	450	450
	12,000 TEU	1630	2780	1000	1630	0	520	520	520
	14,500 TEU	1960	3330	1200	1960	0	630	630	630
	Largest	2160	3670	1320	2160	0	700	700	700
Cruise	2,000 Ton	450	580	450	450	0	250	250	250
	10,000 Ton	450	580	450	450	0	250	250	250
	60,000 Ton	3500	5460	3500	3500	0	1000	1000	1000
	100,000 Ton	11480	14900	11480	11480	0	500	500	500
	Largest	11480	14900	11480	11480	0	500	500	500
Breakbulk[3]	5,000 DWT	60	90	120	60	0	0	0	0
	10,000 DWT	170	250	330	170	0	75	75	75
	Largest	490	730	970	490	0	100	100	100
Ro-Ro	5,000 Ton	600	1700	800	600	0	200	200	200
	Largest	950	2720	1200	950	0	300	300	300
Auto Carrier[4]	4,000 Vehicles	500	1125	800	500	0	268	268	268
	Largest	500	1125	800	500	0	268	268	268
Barge[5]	All	267	267	267	267	--	--	--	--
Chemical Tanker	Smallest	80	110	160	80	0	125	125	125
	Small	230	330	490	230	0	250	250	250
	Handysize	230	330	490	230	0	250	250	250
	Handymax	550	780	1170	550	0	250	250	250
Offshore Support/Drillship	All	320	320	320	320	0	0	0	0
Miscellaneous	All	190	190	190	190	0	0	0	0
Bulk Carrier	Small	190	310	280	190	0	50	50	50
	Handysize	190	310	280	190	0	50	50	50
	Handymax	260	420	370	260	0	100	100	100
	Panamax	420	680	600	420	0	200	200	200
	Capesize	420	680	600	420	0	200	200	200
	Capesize Largest	420	680	600	420	0	200	200	200

(1) Values are from the U.S. EPA Ports Emissions Inventory Guidance Appendix E, Tables E.1. and E.2. (April 2022), unless otherwise noted.

(2) For Reduced Speed Zone operations, transit values will be used in accordance with Section 3.6.3 of the U.S. EPA Ports Emissions Inventory Guidance (April 2022).

(3) Category is called "General Cargo" in source material.

(4) Category is called "Vehicle Carrier" in source material.

(5) Barge values are equal to the Average Installed Auxiliary Power (kW) for barges from Table G.1 times the Auxiliary Engine Load Factor for barges from Table 4.4. No distinction is made between operating modes for barges. (U.S. EPA Ports Emissions Inventory Guidance (April 2022)). No boilers are assumed for barges.

OGV Movement Activity

Terminal	Vessel Type	Distance (naut miles)[1]				Speed (kn)[2]				Time In Mode - Round Trip (hrs)			
		Cruise/Transit[3]	Reduced Speed Zone		Maneuver	Cruise/Transit[3]	Reduced Speed Zone		Maneuver	Cruise/Transit[3]	Reduced Speed Zone		Maneuver
			Outside BW	Inside BW			Outside BW	Inside BW			Outside BW	Inside BW	
	Auto Carrier					--	13.6	9.2	4	0	1.81	1.57	1.00
	Container Ship					--	13.2	8.4	4	0	1.86	1.71	1.00
	Barge					--	9.0	6.0	4	0	2.73	2.40	1.00
	Ro-Ro					--	11.6	9.0	4	0	2.12	1.60	1.00
	Cruise					--	14.3	11.2	4	0	1.72	1.29	1.00
Union Pier	Offshore Support/Drillship	0	12.3	7.2	2.0	--	13.2	8.4	4	0	1.86	1.71	1.00
	Miscellaneous					--	13.2	8.4	4	0	1.86	1.71	1.00
	Chemical Tanker					--	13.2	8.4	4	0	1.86	1.71	1.00
	Bulk Carrier					--	12.4	10.3	4	0	1.98	1.40	1.00
	Breakbulk					--	12.4	10.3	4	0	1.98	1.40	1.00
	Auto Carrier					--	13.6	9.2	4	0	1.81	1.72	1.00
	Container Ship					--	13.2	8.4	4	0	1.86	1.88	1.00
	Barge					--	9.0	6.0	4	0	2.73	2.63	1.00
	Ro-Ro					--	11.6	9.0	4	0	2.12	1.76	1.00
	Cruise					--	14.3	11.2	4	0	1.72	1.41	1.00
Columbus Street	Offshore Support/Drillship	0	12.3	7.9	2.0	--	13.2	8.4	4	0	1.86	1.88	1.00
	Miscellaneous					--	13.2	8.4	4	0	1.86	1.88	1.00
	Chemical Tanker					--	13.2	8.4	4	0	1.86	1.88	1.00
	Bulk Carrier					--	12.4	10.3	4	0	1.98	1.53	1.00
	Breakbulk					--	12.4	10.3	4	0	1.98	1.53	1.00
	Auto Carrier					--	13.6	9.2	4	0	1.81	2.24	1.00
	Container Ship					--	13.2	8.4	4	0	1.86	2.45	1.00
	Barge					--	9.0	6.0	4	0	2.73	3.43	1.00
	Ro-Ro					--	11.6	9.0	4	0	2.12	2.29	1.00
	Cruise					--	14.3	11.2	4	0	1.72	1.84	1.00
Wando Welch	Offshore Support/Drillship	0	12.3	10.3	2.0	--	13.2	8.4	4	0	1.86	2.45	1.00
	Miscellaneous					--	13.2	8.4	4	0	1.86	2.45	1.00
	Chemical Tanker					--	13.2	8.4	4	0	1.86	2.45	1.00
	Bulk Carrier					--	12.4	10.3	4	0	1.98	2.00	1.00
	Breakbulk					--	12.4	10.3	4	0	1.98	2.00	1.00
	Auto Carrier					--	13.6	9.2	4	0	1.81	3.35	1.00
	Container Ship					--	13.2	8.4	4	0	1.86	3.67	1.00
	Barge					--	9.0	6.0	4	0	2.73	5.13	1.00
	Ro-Ro					--	11.6	9.0	4	0	2.12	3.42	1.00
	Cruise					--	14.3	11.2	4	0	1.72	2.75	1.00
North Charleston	Offshore Support/Drillship	0	12.3	15.4	2.0	--	13.2	8.4	4	0	1.86	3.67	1.00
	Miscellaneous					--	13.2	8.4	4	0	1.86	3.67	1.00
	Chemical Tanker					--	13.2	8.4	4	0	1.86	3.67	1.00
	Bulk Carrier					--	12.4	10.3	4	0	1.98	2.99	1.00
	Breakbulk					--	12.4	10.3	4	0	1.98	2.99	1.00
	Auto Carrier					--	13.6	9.2	4	0	1.81	3.35	1.00
	Container Ship					--	13.2	8.4	4	0	1.86	3.67	1.00
	Barge					--	9.0	6.0	4	0	2.73	5.13	1.00
	Ro-Ro					--	11.6	9.0	4	0	2.12	3.42	1.00
	Cruise					--	14.3	11.2	4	0	1.72	2.75	1.00
Veterans	Offshore Support/Drillship	0	12.3	15.4	2.0	--	13.2	8.4	4	0	1.86	3.67	1.00
	Miscellaneous					--	13.2	8.4	4	0	1.86	3.67	1.00
	Chemical Tanker					--	13.2	8.4	4	0	1.86	3.67	1.00
	Bulk Carrier					--	12.4	10.3	4	0	1.98	2.99	1.00
	Breakbulk					--	12.4	10.3	4	0	1.98	2.99	1.00
	Auto Carrier					--	13.6	9.2	4	0	1.81	2.07	1.00
	Container Ship					--	13.2	8.4	4	0	1.86	2.26	1.00
	Barge					--	9.0	6.0	4	0	2.73	3.17	1.00
	Ro-Ro					--	11.6	9.0	4	0	2.12	2.11	1.00
	Cruise					--	14.3	11.2	4	0	1.72	1.70	1.00
Hugh Leatherman	Offshore Support/Drillship	0	12.3	9.5	2.0	--	13.2	8.4	4	0	1.86	2.26	1.00
	Miscellaneous					--	13.2	8.4	4	0	1.86	2.26	1.00
	Chemical Tanker					--	13.2	8.4	4	0	1.86	2.26	1.00
	Bulk Carrier					--	12.4	10.3	4	0	1.98	1.84	1.00
	Breakbulk					--	12.4	10.3	4	0	1.98	1.84	1.00

[1] The distances used, excluding the Hugh Leatherman Terminal, are from Table 6-3 of the 2017 Emission Inventory. Since the previous inventory was completed, the location of the sea buoy has changed. This would change the distance in the reduced speed zone, outside of the breakwater from 12.3 nautical miles to 16 nautical miles. However, for the sake of comparison between inventories, this distance has not been updated. The reduced speed zone distance inside the breakwater for the Hugh Leatherman Terminal was provided by SCPA personnel. It was assumed that the other distances were the same as the other terminals.

[2] All speeds were assumed to be the same as the previous 2017 Emissions Inventory. The speeds for the Hugh Leatherman terminal were assumed to be the same as those of other terminals. Breakbulk vessels were not included in the previous 2017 Emissions Inventory, so speeds were assumed to be the same as Bulk Carriers. Offshore Support/Drillships, Chemical Tankers, and Miscellaneous vessels were not included in the previous 2017 Emissions Inventory, so speeds were assumed to be the same as Container Ships.

[3] OGVs do not operate in cruising/transit mode within the boundary of consideration for the project.

Emissions by Ship Type

Ship Type	Pollutant	Union Pier Total (ton)	Columbus Street Total (ton)	Wando Welch Total (ton)	Veterans Total (ton)	Hugh Leatherman Total (ton)	North Charleston Total (ton)	Total (ton)
Container Ship	HC	0.08	0.14	51.07	0.03	2.87	20.88	75.07
	CO	0.15	0.28	100.30	0.06	6.07	38.87	145.74
	NO_X	1.25	2.61	803.45	0.61	54.97	309.71	1,172.59
	PM_{10}	0.02	0.05	14.61	0.01	1.02	5.10	20.81
	$PM_{2.5}$	0.02	0.04	13.44	0.01	0.93	4.69	19.14
	SO_2	0.05	0.12	37.08	0.03	2.55	13.10	52.92
	CO_2	67.82	171.53	50,018.96	40.96	3,696.63	16,479.69	70,475.59
	CH_4	1.60E-03	2.75E-03	1.02E+00	5.39E-04	5.74E-02	4.18E-01	1.50E+00
	N_2O	3.54E-03	9.25E-03	2.66E+00	2.19E-03	2.00E-01	8.58E-01	3.73E+00
	BC	5.69E-04	1.31E-03	4.03E-01	3.03E-04	2.80E-02	1.41E-01	5.74E-01
	CO_2e	68.91	174.36	50,837.61	41.63	3,757.57	16,745.73	71,625.81
Cruise	HC	0.21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.21
	CO	0.52	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.52
	NO_X	5.51	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.51
	PM_{10}	0.09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.09
	$PM_{2.5}$	0.08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.08
	SO_2	0.20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.20
	CO_2	321.30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	321.30
	CH_4	4.11E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.11E-03
	N_2O	1.40E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-02
	BC	2.43E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E-03
	CO_2e	325.56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	325.56
Breakbulk	HC	0.12	1.02	0.14	0.01	0.13	0.02	1.44
	CO	0.31	2.60	0.35	0.03	0.34	0.05	3.68
	NO_X	3.09	27.68	3.98	0.33	3.71	0.51	39.30
	PM_{10}	0.06	0.46	0.06	0.01	0.06	0.01	0.65
	$PM_{2.5}$	0.05	0.42	0.06	0.00	0.06	0.01	0.60
	SO_2	0.14	1.04	0.14	0.01	0.14	0.02	1.48
	CO_2	224.79	1,682.23	228.08	19.06	225.92	24.11	2,404.19
	CH_4	2.32E-03	2.04E-02	2.71E-03	2.41E-04	2.65E-03	4.08E-04	2.87E-02
	N_2O	1.07E-02	7.87E-02	1.06E-02	9.51E-04	1.05E-02	1.14E-03	1.13E-01
	BC	1.63E-03	1.26E-02	1.70E-03	1.43E-04	1.68E-03	1.94E-04	1.79E-02
	CO_2e	228.02	1,706.20	231.31	19.35	229.12	24.46	2,438.46
Ro-Ro	HC	0.00E+00	0.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.04
	CO	0.00E+00	0.10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.10
	NO_X	0.00E+00	0.91	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.91
	PM_{10}	0.00E+00	0.02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.02
	$PM_{2.5}$	0.00E+00	0.02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.02
	SO_2	0.00E+00	0.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.04
	CO_2	0.00E+00	58.85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	58.85
	CH_4	0.00E+00	8.47E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.47E-04
	N_2O	0.00E+00	2.90E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E-03
	BC	0.00E+00	4.50E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.50E-04
	CO_2e	0.00E+00	59.74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	59.74
Auto Carrier	HC	0.00E+00	3.81	0.00E+00	0.00E+00	0.00E+00	0.02	3.82
	CO	0.00E+00	8.75	0.00E+00	0.00E+00	0.00E+00	0.04	8.80
	NO_X	0.00E+00	86.71	0.00E+00	0.00E+00	0.00E+00	0.40	87.11
	PM_{10}	0.00E+00	1.41	0.00E+00	0.00E+00	0.00E+00	0.01	1.42
	$PM_{2.5}$	0.00E+00	1.30	0.00E+00	0.00E+00	0.00E+00	0.01	1.30
	SO_2	0.00E+00	3.32	0.00E+00	0.00E+00	0.00E+00	0.01	3.34
	CO_2	0.00E+00	5,070.04	0.00E+00	0.00E+00	0.00E+00	21.69	5,091.73
	CH_4	0.00E+00	7.61E-02	0.00E+00	0.00E+00	0.00E+00	3.76E-04	7.65E-02
	N_2O	0.00E+00	2.59E-01	0.00E+00	0.00E+00	0.00E+00	1.09E-03	2.60E-01
	BC	0.00E+00	3.89E-02	0.00E+00	0.00E+00	0.00E+00	1.71E-04	3.91E-02
	CO_2e	0.00E+00	5,149.23	0.00E+00	0.00E+00	0.00E+00	22.02	5,171.25

Emissions by Ship Type

Barge	HC	0.00E+00	0.10	1.94E-02	0.00E+00	0.00E+00	1.23E-02	0.13
	CO	0.00E+00	1.03	2.48E-01	0.00E+00	0.00E+00	0.14	1.42
	NO_X	0.00E+00	5.01	1.39E+00	0.00E+00	0.00E+00	0.65	7.05
	PM_{10}	0.00E+00	0.11	2.58E-02	0.00E+00	0.00E+00	1.38E-02	0.15
	$PM_{2.5}$	0.00E+00	0.11	2.50E-02	0.00E+00	0.00E+00	1.33E-02	0.15
	SO_2	0.00E+00	0.00	6.94E-04	0.00E+00	0.00E+00	4.09E-04	0.00
	CO_2	0.00E+00	352.24	7.59E+01	0.00E+00	0.00E+00	44.76	472.88
	CH_4	0.00E+00	2.00E-03	3.89E-04	0.00E+00	0.00E+00	2.46E-04	2.63E-03
	N_2O	0.00E+00	1.71E-02	3.69E-03	0.00E+00	0.00E+00	2.18E-03	2.30E-02
	BC	0.00E+00	8.24E-02	1.92E-02	0.00E+00	0.00E+00	1.03E-02	1.12E-01
	CO_2e	0.00E+00	357.40	7.70E+01	0.00E+00	0.00E+00	45.42	479.80
Chemical Tanker	HC	0.00E+00	0.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.04
	CO	0.00E+00	0.09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.09
	NO_X	0.00E+00	1.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00
	PM_{10}	0.00E+00	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.01
	$PM_{2.5}$	0.00E+00	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.01
	SO_2	0.00E+00	0.03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.03
	CO_2	0.00E+00	47.88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	47.88
	CH_4	0.00E+00	8.25E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.25E-04
	N_2O	0.00E+00	2.36E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-03
	BC	0.00E+00	3.86E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.86E-04
	CO_2e	0.00E+00	48.61	0.00E+00	0.00E+00	0.00E+00	0.00E+00	48.61
Offshore Support/Drilling	HC	0.02	0.07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.09
	CO	0.04	0.19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.23
	NO_X	0.52	1.99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.51
	PM_{10}	0.01	0.03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.04
	$PM_{2.5}$	0.01	0.03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.04
	SO_2	0.02	0.07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.09
	CO_2	26.13	113.07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	139.20
	CH_4	3.18E-04	1.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-03
	N_2O	1.10E-03	4.81E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.91E-03
	BC	1.97E-04	8.65E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-03
	CO_2e	26.47	114.54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	141.01
Miscellaneous	HC	0.03	4.40E-03	0.00E+00	0.03	0.00E+00	0.00E+00	0.06
	CO	0.09	0.01	0.00E+00	0.06	0.00E+00	0.00E+00	0.16
	NO_X	0.89	0.13	0.00E+00	0.78	0.00E+00	0.00E+00	1.80
	PM_{10}	0.01	1.81E-03	0.00E+00	0.01	0.00E+00	0.00E+00	0.03
	$PM_{2.5}$	0.01	1.66E-03	0.00E+00	0.01	0.00E+00	0.00E+00	0.02
	SO_2	0.03	4.11E-03	0.00E+00	0.02	0.00E+00	0.00E+00	0.06
	CO_2	61.37	6.48	0.00E+00	39.22	0.00E+00	0.00E+00	107.07
	CH_4	5.86E-04	8.80E-05	0.00E+00	5.12E-04	0.00E+00	0.00E+00	1.19E-03
	N_2O	3.14E-03	2.74E-04	0.00E+00	1.65E-03	0.00E+00	0.00E+00	5.07E-03
	BC	1.69E-03	4.99E-05	0.00E+00	2.99E-04	0.00E+00	0.00E+00	2.04E-03
	CO_2e	62.33	6.56	0.00E+00	39.72	0.00E+00	0.00E+00	108.61
Bulk Carrier	HC	0.00E+00	0.17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.17
	CO	0.00E+00	0.40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.40
	NO_X	0.00E+00	3.58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.58
	PM_{10}	0.00E+00	0.07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.07
	$PM_{2.5}$	0.00E+00	0.06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.06
	SO_2	0.00E+00	0.16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.16
	CO_2	0.00E+00	252.93	0.00E+00	0.00E+00	0.00E+00	0.00E+00	252.93
	CH_4	0.00E+00	3.36E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.36E-03
	N_2O	0.00E+00	1.28E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-02
	BC	0.00E+00	1.91E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.91E-03
	CO_2e	0.00E+00	256.83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	256.83

Emissions by Operating Mode

		Off Terminal			On Terminal	Total (ton)
		Transit (ton)	**Maneuver (ton)**	**Subtotal Off Terminal (ton)**	**Hotel (ton)**	
Union Pier	HC	0.16	0.03	0.19	0.25	0.45
	CO	0.34	0.06	0.40	0.71	1.11
	NO_X	3.21	0.59	3.80	7.46	11.26
	PM_{10}	0.05	0.01	0.06	0.13	0.19
	$PM_{2.5}$	0.04	0.01	0.05	0.12	0.17
	SO_2	0.12	0.02	0.14	0.30	0.44
	CO_2	168.12	34.08	202.20	499.21	701.41
	CH_4	3.20E-03	6.48E-04	3.85E-03	0.01	0.01
	N_2O	0.01	1.59E-03	0.01	0.02	0.03
	BC	0.00	3.06E-04	1.75E-03	4.77E-03	0.01
	CO_2e	170.52	34.57	205.09	506.19	711.29
Columbus Street	HC	2.59	0.57	3.16	2.23	5.39
	CO	6.34	0.95	7.30	6.17	13.47
	NO_X	57.98	7.07	65.05	64.57	129.61
	PM_{10}	0.76	0.13	0.89	1.26	2.16
	$PM_{2.5}$	0.70	0.12	0.82	1.17	1.99
	SO_2	1.55	0.30	1.85	2.93	4.78
	CO_2	2,425.71	401.07	2,826.78	4,928.47	7,755.25
	CH_4	0.05	0.01	0.06	0.04	0.11
	N_2O	0.12	0.02	0.14	0.25	0.39
	BC	0.06	0.01	0.08	0.06	0.14
	CO_2e	2,461.35	407.71	2,869.05	5,004.41	7,873.46
Wando Welch	HC	36.67	3.79	40.45	10.78	51.23
	CO	66.28	5.87	72.15	28.75	100.90
	NO_X	470.82	46.05	516.87	291.94	808.81
	PM_{10}	6.87	0.88	7.75	6.95	14.70
	$PM_{2.5}$	6.32	0.81	7.13	6.40	13.53
	SO_2	17.86	2.12	19.98	17.23	37.22
	CO_2	19,345.82	2,705.99	22,051.81	28,271.10	50,322.91
	CH_4	0.73	0.08	0.81	0.22	1.02
	N_2O	0.93	0.14	1.08	1.60	2.68
	BC	0.20	0.03	0.23	0.20	0.42
	CO_2e	19,642.59	2,749.89	22,392.49	28,753.42	51,145.90
Veterans	HC	0.03	4.46E-03	0.03	0.03	0.06
	CO	0.06	0.01	0.06	0.09	0.16
	NO_X	0.56	0.05	0.61	1.11	1.72
	PM_{10}	0.01	9.25E-04	0.01	0.02	0.03
	$PM_{2.5}$	0.01	8.51E-04	0.01	0.02	0.02
	SO_2	0.02	2.30E-03	0.02	0.04	0.06
	CO_2	24.47	2.64	27.11	72.13	99.24
	CH_4	5.13E-04	8.91E-05	6.02E-04	6.91E-04	1.29E-03
	N_2O	1.12E-03	1.39E-04	1.25E-03	3.54E-03	4.79E-03
	BC	2.05E-04	2.55E-05	2.30E-04	5.15E-04	7.45E-04
	CO_2e	24.82	2.68	27.50	73.20	100.70
Hugh Leatherman	HC	1.66	0.20	1.85	1.15	3.00
	CO	3.04	0.30	3.34	3.07	6.41
	NO_X	22.61	2.46	25.07	33.61	58.68
	PM_{10}	0.32	0.04	0.36	0.72	1.08
	$PM_{2.5}$	0.29	0.04	0.33	0.66	0.99
	SO_2	0.82	0.11	0.93	1.76	2.69
	CO_2	897.66	135.75	1,033.41	2,889.14	3,922.55
	CH_4	0.03	3.90E-03	0.04	0.02	0.06
	N_2O	0.04	0.01	0.05	0.16	0.21
	BC	0.01	1.22E-03	0.01	0.02	0.03
	CO_2e	911.36	137.95	1,049.31	2,937.38	3,986.69
North Charleston	HC	16.75	1.37	18.12	2.81	20.93
	CO	29.44	2.13	31.57	7.53	39.10
	NO_X	211.02	17.69	228.72	82.55	311.27
	PM_{10}	3.02	0.32	3.34	1.79	5.13
	$PM_{2.5}$	2.78	0.29	3.07	1.65	4.72
	SO_2	7.94	0.77	8.71	4.42	13.13
	CO_2	8,332.90	983.89	9,316.80	7,253.46	16,570.26
	CH_4	0.34	0.03	0.36	0.06	0.42
	N_2O	0.40	0.05	0.46	0.41	0.86
	BC	0.09	0.01	0.10	0.05	0.15
	CO_2e	8,461.73	999.81	9,461.55	7,376.09	16,837.63
Total	HC	57.85	5.96	63.81	17.26	81.07
	CO	105.50	9.32	114.82	46.32	161.14
	NO_X	766.20	73.92	840.12	481.24	1,321.36
	PM_{10}	11.02	1.38	12.40	10.87	23.28
	$PM_{2.5}$	10.14	1.27	11.42	10.01	21.42
	SO_2	28.31	3.33	31.64	26.68	58.32
	CO_2	31,194.69	4,263.42	35,458.10	43,913.51	79,371.61
	CH_4	1.16	0.12	1.28	0.35	1.62
	N_2O	1.51	0.22	1.73	2.44	4.17
	BC	0.37	0.05	0.42	0.34	0.75
	CO_2e	31,672.37	4,332.62	36,004.99	44,650.69	80,655.68

HARBOR CRAFT

2021 EMISSIONS CALCULATIONS

Emission Factors by Engine[1]

Engine Data										Emission Factors (g/kW-hr)[3]										
Vessel ID	**Engine Manufacturer**	**Engine Model**	**Type**	**Model Year**	**Engine Tier**	**Displacement per Cylinder (L)**	**Engine Power (hP)**	**Engine Power (kW)**	**Engine Category[2]**	**BSFC[4]**	**HC**	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$[5]**	**SO_2[6]**	**CO_2[7]**	**CH_4[8]**	**N_2O[9]**	**BC[10]**
James A. Moran 1236510	John Deere	6068	Auxiliary	2011	2	1.1	133	99	1	213	0.320	0.80	5.40	0.199	0.1928	6.25E-03	679.47	0.0064	3.32E-02	0.1485
James A. Moran 1236510	MTU	16V 4000, M63L	Main	2011	2	4.8	3004	2240	1	213	0.190	1.10	6.00	0.119	0.1152	6.25E-03	679.47	0.0038	3.32E-02	0.0887
Elizabeth Turecamo 9205055	EMD	16-645E7B	Main	1998	Uncontrolled	10.6	3070	2289	2	213	0.134	2.48	13.36	0.210	0.2036	6.25E-03	679.47	0.0027	3.32E-02	0.1568
Elizabeth Turecamo 9205055	John Deere	4045AFM85	Auxiliary	1998	Uncontrolled	1.1	133	99	1	213	0.320	1.70	10.00	0.420	0.4073	6.25E-03	679.47	0.0064	3.32E-02	0.3137
Wyatt Moran 9920265	John Deere	4045AFM85	Auxiliary	2021	3	1.1	133	99	1	213	0.130	0.80	4.02	0.080	0.0776	6.25E-03	679.47	0.0026	3.32E-02	0.0598
Wyatt Moran 9920265	Caterpillar	3512E-HD	Main	2021	4	4.9	2550	1902	1	213	0.040	1.10	1.30	0.030	0.0291	6.25E-03	679.47	0.0008	3.32E-02	0.0224
Jeffrey McAllister	John Deere	4045AFM85	Auxiliary	2016	3	1.1	133	99	1	213	0.130	0.80	4.02	0.080	0.0776	6.25E-03	679.47	0.0026	3.32E-02	0.0598
Jeffrey McAllister	EMD	8-710 G7B	Main	2016	3	11.6	2500	1864	2	213	0.070	2.00	5.97	0.110	0.1067	6.25E-03	679.47	0.0014	3.32E-02	0.0822
Moira McAllister	Caterpillar	3516 B-HD	Main	2003	1	4.9	2500	1864	1	213	0.270	1.80	9.20	0.190	0.1842	6.25E-03	679.47	0.0054	3.32E-02	0.1419
Moira McAllister	Caterpillar	3304	Auxiliary	2003	Uncontrolled	1.8	146.2	109	1	213	0.270	1.50	10.00	0.230	0.2230	6.25E-03	679.47	0.0054	3.32E-02	0.1717
Donal G. McAllister	EMD	16-645-E5	Main	2002	1	10.6	3000	2237	2	213	0.134	2.48	10.55	0.210	0.2036	6.25E-03	679.47	0.0027	3.32E-02	0.1568
Donal G. McAllister[11]	--	--	Auxiliary	2002	--	--	382	285	--	213	0.2871	1.5691	10.0806	0.2917	0.2829	6.25E-03	679.47	0.0057	3.32E-02	0.2178
Capt. Jim McAllister	Caterpillar	3516E	Main	2019	4	4.9	3385	2524	1	213	0.040	1.10	1.30	0.030	0.0291	6.25E-03	679.47	0.0008	3.32E-02	0.0224
Capt. Jim McAllister	Caterpillar	C7.1	Auxiliary	2019	3	1.2	160.9	120	1	213	0.110	0.90	4.77	0.070	0.0679	6.25E-03	679.47	0.0022	3.32E-02	0.0523
Fort Sumter, Fort Moultrie	MTU	12V2000	Main	2013	2	2	1450	1081	1	213	0.190	1.10	6.00	0.119	0.1152	6.25E-03	679.47	0.0038	3.32E-02	0.0887
Fort Ripley	Volvo Penta	IPS1050	Main	2014	3	2.1	800	597	1	213	0.100	1.10	4.69	0.070	0.0679	6.25E-03	679.47	0.0020	3.32E-02	0.0523
Fort Johnson	Cummins	QSL9	Main	2015	3	1.5	400	298	1	213	0.100	1.10	4.69	0.070	0.0679	6.25E-03	679.47	0.0020	3.32E-02	0.0523
Fort Sumter, Fort Moultrie, Fort Ripley	Northern Lights	M944W	Auxiliary	2014	3	0.8	43.5	32	1	248	0.410	1.53	2.32	0.180	0.1746	7.27E-03	791.12	0.0082	3.87E-02	0.1344

(1) Engine information was provided by Moran and the Pilots Association. If information was not provided, representative information was determined. McAllister engine information was gathered from the company website, the 2017 emissions inventory, or other sources as available.

(2) Engine category was determined according to Table 4.2 from the U.S. EPA Ports Emissions Inventory Guidance, Section 4.3.2 (April 2022).

(3) Emission factors are from Appendix H of the U.S. EPA Ports Emissions Inventory Guidance (April 2022), unless otherwise noted.

(4) BSFC is 248 g/kW-hr for engines <37 kW and 213 g/kW-hr for engines ≥ 213 kW for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.2 (April 2022).

(5) $PM_{2.5}$ emission factors are assumed to be 97% of PM10 emission factors for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.3 (April 2022).

(6) SO_2 emission factors are equal to BSFC x 15x10-6 (ULSD sulfur weight ratio) x 0.97753 (sulfur % converted to SO_2) x 2 (molecular weight ratio of sulfur to SO_2) for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.7 (April 2022).

(7) CO_2 emission factors are equal to BSFC x 3.19 g CO_2/g fuel for C1 and C2 diesel engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.6 (April 2022).

(8) CH_4 emission factors are assumed to be 2% of HC emission factors for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.4 (April 2022).

(9) N_2O emission factors are equal to BSFC x 0.000156 g N2O/g fuel for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.5 (April 2022).

(10) BC emission factors are assumed to be 77% of $PM_{2.5}$ emission factors for C1 and C2 engines as specified by the U.S. EPA Ports Emissions Inventory Guidance, Section 4.5.3 (April 2022).

(11) Auxiliary engine information was not available for Donal G. McAllister. Default engine power information was taken from Table G.1 of the U.S. EPA Ports Emissions Inventory Guidance, Appendix G (April 2022). The engine model year was assumed based off the Main Engine model year. Emission factors were taken from Table H.6, Appendix H of the inventory guidance or were calculated as specified above.

Engine Information[12]

			Main Engine(s)					Auxiliary Engine(s)				
Company	**Vessel ID**	**Vessel Year**	**Engine Count**	**HP**	**kW**	**Load Factor[13]**	**Annual Operating Hours (Total)[14]**	**Engine Count**	**HP**	**kW**	**Load Factor[13]**	**Annual Operating Hours (Total)[14]**
Moran	James A. Moran 1236510	2011	2	3004	2240	0.50	3977	2	132.8	99	0.43	1660
Moran	Wyatt Moran 9920265	2021	2	2550	1902	0.50	3710	2	132.8	99	0.43	1771
Moran	Elizabeth Turecamo 9205055	1998	2	3070	2289	0.50	4060	2	132.8	99	0.43	1750
Pilots Association	Fort Sumter	2000	2	1450	1081	0.51	3200	2	43.5	32	0.43	1600
Pilots Association	Fort Moultrie	2000	2	1450	1081	0.51	3200	2	43.5	32	0.43	1600
Pilots Association	Fort Ripley	2014	3	800	597	0.51	4800	2	43.5	32	0.43	1600
Pilots Association	Fort Johnson	2004	2	400	298	0.51	1600	0	--	--	--	--
McAllister	Moira McAllister	2003	2	2500	1864	0.50	1683	2	146.2	109	0.43	1404
McAllister	Jeffrey McAllister	2016	2	2500	1864	0.50	1683	2	132.8	99	0.43	1404
McAllister	Donal G. McAllister	1967	1	3000	2237	0.50	841.5	--	382.2	285	0.43	702
McAllister	Capt. Jim McAllister	2019	2	3385	2524	0.50	1683	3	160.9	120	0.43	2106

(12) Engine information was provided by Moran and the Pilots Association. If information was not provided, representative information was determined. McAllister engine information was gathered from the company website, the 2017 emissions inventory, or other sources as available.

(13) Load factors are from Table 4.4 of the U.S. EPA Ports Emissions Inventory Guidance, Section 4.6 (April 2022).

(14) Operating hours were not available for the McAllister tugboats. Default operating hours from Table G.1. of the U.S. EPA Ports Emissions Inventory Guidance, Appendix G (April 2022) were applied as well as an assumption that the tugboats serve SCPA terminals 50% of the time. This assumption is from the 2017 Emissions Inventory.

Emission Rates[15]		**Emissions (lbs/yr)**										
Company	**Vessel ID**	**HC**	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**	**CH_4**	**N_2O**	**BC**	**CO_2e**[16]
Moran	James A. Moran 1236510	1,915.89	10,928.01	59,768.78	1,199.73	1,161.44	62.32	6,779,099.07	38.32	331.52	894.31	6,878,849.10
Moran	Wyatt Moran 9920265	332.67	8,687.09	10,777.58	246.59	239.19	49.61	5,396,816.05	6.65	263.92	184.18	5,475,630.40
Moran	Elizabeth Turecamo 9205055	1,425.45	25,688.04	138,522.25	2,220.54	2,152.88	65.02	7,073,104.37	28.51	345.89	1,657.73	7,176,893.73
Pilots Association	Fort Sumter	759.34	4,354.64	23,456.15	471.81	456.76	24.66	2,682,289.05	15.19	131.17	351.70	2,721,757.83
Pilots Association	Fort Moultrie	759.34	4,354.64	23,456.15	471.81	456.76	24.66	2,682,289.05	15.19	131.17	351.70	2,721,757.83
Pilots Association	Fort Ripley	342.13	3,616.82	15,214.01	234.23	227.20	20.47	2,226,536.48	6.84	108.88	174.94	2,259,154.95
Pilots Association	Fort Johnson	53.66	590.26	2,516.64	37.56	36.43	3.35	364,602.06	1.07	17.83	28.05	369,942.25
McAllister	Moira McAllister	972.98	6,442.99	33,269.33	690.49	669.42	22.51	2,448,549.26	19.46	119.74	515.68	2,484,718.55
McAllister	Jeffrey McAllister	259.23	7,022.49	21,177.19	390.98	379.25	22.43	2,439,505.68	5.18	119.30	292.02	2,475,186.31
McAllister	Donal G. McAllister	332.52	5,443.91	23,804.49	491.10	476.15	14.15	1,538,855.57	6.64	75.25	366.63	1,561,447.43
McAllister	Capt. Jim McAllister	213.67	5,366.77	7,230.50	157.26	152.54	30.75	3,344,649.56	4.27	163.56	117.45	3,393,498.11
	Total	**7,366.86**	**82,495.67**	**359,193.06**	**6,612.08**	**6,408.02**	**339.93**	**36,976,296.18**	**147.33**	**1,808.25**	**4,934.41**	**37,518,836.49**

		Emissions (tons/yr)										
Company	**Vessel ID**	**HC**	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**	**CH_4**	**N_2O**	**BC**	**CO_2e**[16]
Moran	James A. Moran 1236510	0.96	5.46	29.88	0.60	0.58	3.12E-02	3,389.55	1.92E-02	0.17	0.45	3,439.42
Moran	Wyatt Moran 9920265	0.17	4.34	5.39	0.12	0.12	2.48E-02	2,698.41	3.33E-03	0.13	0.09	2,737.82
Moran	Elizabeth Turecamo 9205055	0.71	12.84	69.26	1.11	1.08	3.25E-02	3,536.55	1.43E-02	0.17	0.83	3,588.45
Pilots Association	Fort Sumter	0.38	2.18	11.73	0.24	0.23	1.23E-02	1,341.14	7.59E-03	0.07	0.18	1,360.88
Pilots Association	Fort Moultrie	0.38	2.18	11.73	0.24	0.23	1.23E-02	1,341.14	7.59E-03	0.07	0.18	1,360.88
Pilots Association	Fort Ripley	0.17	1.81	7.61	0.12	0.11	1.02E-02	1,113.27	3.42E-03	0.05	0.09	1,129.58
Pilots Association	Fort Johnson	0.03	0.30	1.26	0.02	0.02	1.68E-03	182.30	5.37E-04	0.01	0.01	184.97
McAllister	Moira McAllister	0.49	3.22	16.63	0.35	0.33	1.13E-02	1,224.27	9.73E-03	0.06	0.26	1,242.36
McAllister	Jeffrey McAllister	0.13	3.51	10.59	0.20	0.19	1.12E-02	1,219.75	2.59E-03	0.06	0.15	1,237.59
McAllister	Donal G. McAllister	0.17	2.72	11.90	0.25	0.24	7.07E-03	769.43	3.32E-03	0.04	0.18	780.72
McAllister	Capt. Jim McAllister	0.11	2.68	3.62	0.08	0.08	1.54E-02	1,672.32	2.14E-03	0.08	0.06	1,696.75
	Total	**3.68**	**41.25**	**179.60**	**3.31**	**3.20**	**0.17**	**18,488.15**	**0.07**	**0.90**	**2.47**	**18,759.42**

(15) The emissions in lbs/yr for each pollutant are calcualted as follows:
(Main Engine Power (kW) * Main Engine Load Factor (unitless) * Main Engine Total Annual Operating Hours (hrs) * Main Engine Emission Factor (g/kW-hr) + Auxiliary Engine Power (kW) * Auxiliary Engine Load Factor (unitless) * Auxiliary Engine Total Annual Operating Hours (hrs) * Auxiliary Engine Emission Factor (g/kW-hr)) / 453.592 (g/lb)

(16) CO_2e emissions are comprised of Carbon Dioxide (GWP of 1), Methane (GWP of 25), and Nitrous Oxide (GWP of 298).

RAIL

2021 EMISSIONS CALCULATIONS

2021 Container Activity Details

	Description	Source
1,531,669	SCPA Container movements in 2021	South Carolina Ports Authority Data
2,751,442	SCPA TEUs moved in 2021	South Carolina Ports Authority Data
22%	Percentage of TEUs to Intermodal	South Carolina Ports Authority Data
1.80	Factor for mix between 20', 40', and 45' containers for unit number	South Carolina Ports Authority Data
338,314	Total containers sent to trains	South Carolina Ports Authority Data
607,737	Total TEUs sent to trains	South Carolina Ports Authority Data
40	Long-haul Average Speed (mph)	2017 Inventory
35	Long-haul Average Dist to Tri-County Border (mi)	2017 Inventory
119	Long-haul Average Dist from Tri-County Border to Inland Port Dillon (mi)	South Carolina Ports Authority Personnel
183	Long-haul Average Dist from Tri-County Border to Inland Port Greer (mi)	South Carolina Ports Authority Personnel

Locomotive Inventory

Rail Inventory Item	Rail Company	Yard	Activity Type	Average Engine hp(1)	Engine Load(2)	Engine Build Date(3)	Engine Class(4)	EPA Tier Certification(5)	Number of TEUs per Train(6)	Total Number of TEUs(7)	Engines per Train(8)	Train Count Estimate(9)	Hours(10)
1	Palmetto Railways	Charleston Yard	Switching	1000	10%	1975	Switcher	Tier 0+	N/A	N/A	1	17	102
2	Palmetto Railways	Charleston Yard	Switching	1000	10%	1977	Switcher	Tier 0	N/A	N/A	1	203	4,300
3	Palmetto Railways	Charleston Yard	Switching	1000	10%	1977	Switcher	Tier 0	N/A	N/A	1	93	558
4	Palmetto Railways	Charleston Yard	Switching (road engine used in switching activity)	3500	10%	1994 est.	Class I	Tier 1+	N/A	N/A	2	301	350
5	Palmetto Railways	Charleston Yard	Switching (road engine used in switching activity)	4000	10%	2004 est.	Class I	Tier 2	N/A	N/A	2	26	32
6	Palmetto Railways	North Charleston Yard	Switching	2000	10%	1965	Switcher	Uncontrolled	N/A	N/A	1.5	365	1,095
7	Palmetto Railways	North Charleston Yard	Switching	2000	10%	1967	Switcher	Uncontrolled	N/A	N/A	1.5	365	1,095
8	CSX	Bennett Yard	Switching	2269	10%	1970s	Switcher	Tier 0	N/A	N/A	1	N/A	3,766
9	CSX	Bennett Yard	Long-haul	3752	28%	1990s/2000s	Class I	Tier 0/0+	360	201,418	4	559	490
10	CSX	Inland Port Dillon	Switching	2269	10%	1970s	Switcher	Tier 0	N/A	N/A	1	N/A	3,766
11	CSX	Inland Port Dillon	Long-haul	3752	28%	1990s/2000s	Class I	Tier 0/0+	126	52,125	4	415	1,233
12	Norfolk Southern	Seven Mile Yard	Switching	2668	10%	Multiple	Switcher	Tier 0/0+	N/A	N/A	1	N/A	3,766
13	Norfolk Southern	Seven Mile Yard	Long-haul	4344	28%	Multiple	Class I	Tier 0/0+	360	406,319	4	1129	988
14	Norfolk Southern	Inland Port Greer	Switching	2668	10%	Multiple	Switcher	Tier 0/0+	N/A	N/A	1	N/A	3,766
15	Norfolk Southern	Inland Port Greer	Long-haul	4344	28%	Multiple	Class I	Tier 0/0+	539	287,832	4	534	2,444

(1) For Palmetto Railways units, average engine hp was provided by the company. For CSX and Norfolk Southern units, average engine hp was estimated from the 2021 STB R-1 Report, Schedule 710. For Norfolk Southern, both multiple purpose units and switching units were considered to be switching units.
(2) Average load factors from Section 8.4.3 of the U.S. EPA Port Emissions Inventory Guidance (April 2022), since detailed information to determine load factors is not available.
(3) Engine build dates for Palmetto Railways were provided by the company. For CSX and Norfolk Southern, this information was taken from the previous 2017 Emissions Inventory.
(4) Engine class information for Palmetto Railways was provided by the company. CSX and Norfolk Southern are both Class I railroad companies.
(5) U.S. EPA Tier Certification information for Palmetto Railways was provided by the company. For CSX and Norfolk Southern, this information was taken from the previous 2017 Emissions Inventory.
(6) Number of TEUs per train for Bennett Yard and Seven Mile Yard is from previous 2017 Emissions Inventory. For inland ports, this is based on information from SCPA personnel.
(7) Number of TEUs for Bennett Yard and Seven Mile are based on the total number of TEUs sent to rail. A breakdown between the two yards was not available, so the ratio of container movements from the 2017 Emissions Inventory between the yards was used. For Inland Ports, this is based on information from SCPA personnel.
(8) For Palmetto Railways units, number of engines per train were provided by the company. For CSX and Norfolk Southern four (4) engines are assumed for long-haul operations and one (1) engine is assumed for switching operations.
(9) For Palmetto Railways units, number of trains were provided by the company. For CSX and Norfolk Southern long-haul operations, number of trains is estimated based on the total number of containers moved and the number of containers per train.
(10) For Palmetto Railways units, hours were provided by the company. For CSX and Norfolk Southern long-haul operations, hours were based on the total number of trains, an average speed of 40 mph, and the distance per trip. For CSX and Norfolk Southern switching operations, an average of the total switching hours for Charleston Yard and North Charleston Yard was used.

Emission Rates

Rail Inventory Item	Rail Company	Yard	Emissions (tons/year)(11)											
			NO_x	PM_{10}	HC	CO	$PM_{2.5}$	BSFC	SO_2	CO_2	CH_4	N_2O	BC	CO_2e(12)
1	Palmetto Railways	Charleston Yard	0.12	2.59E-03	0.01	0.02	2.51E-03	2.37	6.96E-05	7.57	5.93E-04	1.90E-04	1.83E-03	7.64
2	Palmetto Railways	Charleston Yard	5.97	2.09E-01	0.48	0.87	2.02E-01	100.01	2.93E-03	319.04	2.50E-02	8.00E-03	1.48E-01	322.05
3	Palmetto Railways	Charleston Yard	0.78	2.71E-02	0.06	0.11	2.63E-02	12.98	3.81E-04	41.40	3.24E-03	1.04E-03	1.92E-02	41.79
4	Palmetto Railways	Charleston Yard	1.81	5.40E-02	0.08	0.35	5.24E-02	41.59	1.22E-03	132.67	1.04E-02	3.33E-03	3.82E-02	133.92
5	Palmetto Railways	Charleston Yard	0.14	5.08E-03	0.01	0.04	4.93E-03	4.35	1.27E-04	13.86	1.09E-03	3.48E-04	3.60E-03	13.99
6	Palmetto Railways	North Charleston Yard	6.30	1.59E-01	0.37	0.66	1.55E-01	76.41	2.24E-03	243.73	1.91E-02	6.11E-03	1.13E-01	246.03
7	Palmetto Railways	North Charleston Yard	6.30	1.59E-01	0.37	0.66	1.55E-01	76.41	2.24E-03	243.73	1.91E-02	6.11E-03	1.13E-01	246.03
8	CSX	Bennett Yard	11.87	4.14E-01	0.95	1.72	4.02E-01	198.71	5.83E-03	633.89	4.97E-02	1.59E-02	2.93E-01	639.87
9	CSX	Bennett Yard	19.50	7.26E-01	1.09	2.90	7.04E-01	349.26	1.02E-02	1,114.15	8.73E-02	2.79E-02	5.14E-01	1,124.66
10	CSX	Inland Port Dillon	11.87	4.14E-01	0.95	1.72	4.02E-01	198.71	5.83E-03	633.89	4.97E-02	1.59E-02	2.93E-01	639.87
11	CSX	Inland Port Dillon	49.13	1.83E+00	2.74	7.31	1.77E+00	879.81	2.58E-02	2,806.60	2.20E-01	7.04E-02	1.29E+00	2,833.07
12	Norfolk Southern	Seven Mile Yard	13.96	4.87E-01	1.12	2.03	4.73E-01	233.70	6.85E-03	745.50	5.84E-02	1.87E-02	3.45E-01	752.53
13	Norfolk Southern	Seven Mile Yard	45.55	1.69E+00	2.54	6.78	1.64E+00	815.59	2.39E-02	2,601.72	2.04E-01	6.52E-02	1.20E+00	2,626.26
14	Norfolk Southern	Inland Port Greer	13.96	4.87E-01	1.12	2.03	4.73E-01	233.70	6.85E-03	745.50	5.84E-02	1.87E-02	3.45E-01	752.53
15	Norfolk Southern	Inland Port Greer	112.69	4.19E+00	6.29	16.77	4.07E+00	2017.95	5.92E-02	6437.28	5.04E-01	1.61E-01	2.97E+00	6,498.00
		Total	**299.93**	**10.86**	**18.17**	**43.98**	**10.54**	**5,241.55**	**0.15**	**16,720.54**	**1.31**	**0.42**	**7.69**	**16,878.26**

(11) For units where the EPA Tier Certification was specified as Tier 0/0+, the Tier 0 emission factors were used.
(12) CO_2e emissions are comprised of Carbon Dioxide (GWP of 1), Methane (GWP of 25), and Nitrous Oxide (GWP of 298).

Emission Factors[(1)]

		Emission Factors (g/hp-h)										
Engine Type	**Tier Level**	**NO_x**	**PM_{10}**	**HC**	**CO**	**$PM_{2.5}$[(2)]**	**BSFC[(3)]**	**SO_2[(4)]**	**CO_2[(5)]**	**CH_4[(6)]**	**N_2O[(7)]**	**BC[(8)]**
Line-Haul	Uncontrolled	13.00	0.32	0.48	1.28	0.31	154	4.52E-03	491.26	0.04	0.01	0.23
Line-Haul	Tier 0	8.60	0.32	0.48	1.28	0.31	154	4.52E-03	491.26	0.04	0.01	0.23
Line-Haul (Class II/III)[(9)]	Tier 0	8.60	0.32	0.48	1.28	0.31	176	5.16E-03	561.44	0.04	0.01	0.23
Line-Haul	Tier 0+	7.20	0.20	0.30	1.28	0.19	154	4.52E-03	491.26	0.04	0.01	0.14
Line-Haul	Tier 1	6.70	0.32	0.47	1.28	0.31	154	4.52E-03	491.26	0.04	0.01	0.23
Line-Haul	Tier 1+	6.70	0.20	0.29	1.28	0.19	154	4.52E-03	491.26	0.04	0.01	0.14
Line-Haul	Tier 2	4.95	0.18	0.26	1.28	0.17	154	4.52E-03	491.26	0.04	0.01	0.13
Line-Haul	Tier 2+	4.95	0.08	0.13	1.28	0.08	154	4.52E-03	491.26	0.04	0.01	0.06
Line-Haul	Tier 3	4.95	0.08	0.13	1.28	0.08	154	4.52E-03	491.26	0.04	0.01	0.06
Line-Haul	Tier 4	1.00	0.015	0.04	1.28	0.01	154	4.52E-03	491.26	0.04	0.01	0.01
Switcher	Uncontrolled	17.40	0.44	1.01	1.83	0.43	211	6.19E-03	673.09	0.05	0.02	0.31
Switcher	Tier 0	12.60	0.44	1.01	1.83	0.43	211	6.19E-03	673.09	0.05	0.02	0.31
Switcher	Tier 0+	10.60	0.23	0.57	1.83	0.22	211	6.19E-03	673.09	0.05	0.02	0.16
Switcher	Tier 1	9.90	0.43	1.01	1.83	0.42	211	6.19E-03	673.09	0.05	0.02	0.30
Switcher	Tier 1+	9.90	0.23	0.57	1.83	0.22	211	6.19E-03	673.09	0.05	0.02	0.16
Switcher	Tier 2	7.30	0.19	0.51	1.83	0.18	211	6.19E-03	673.09	0.05	0.02	0.13
Switcher	Tier 2+	7.30	0.11	0.26	1.83	0.11	211	6.19E-03	673.09	0.05	0.02	0.08
Switcher	Tier 3	4.50	0.08	0.26	1.83	0.08	211	6.19E-03	673.09	0.05	0.02	0.06
Switcher	Tier 4	1.00	0.015	0.08	1.83	0.01	211	6.19E-03	673.09	0.05	0.02	0.01

(1) Emission factors from the U.S. EPA Ports Emissions Inventory Guidance, Tables 8.2 and 8.3 (April 2022), unless otherwise noted.

(2) $PM_{2.5}$ emission factors are calculated as 97% of PM_{10} emission factors in accordance with the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.1 (April 2022).

(3) BSFC values are taken from the U.S. EPA Ports Emissions Inventory Guidance, Table 8.4 (April 2022).

(4) SO_2 emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.6 (April 2022).

(5) CO_2 emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.3 (April 2022).

(6) CH_4 emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.4 (April 2022).

(7) N_2O emission factors are calculated according to the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.5 (April 2022).

(8) BC emission factors are calculated as 73% of $PM_{2.5}$ emission factors in accordance with the U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.4 (April 2022).

(9) Line-haul emission factors above are for Class I locomotives. Class II and III line-haul locomotives should use Tier 0 line-haul emission factors (U.S. EPA Ports Emissions Inventory Guidance, Section 8.5.1.1 (April 2022)).

ON-ROAD – HEAVY DUTY VEHICLES

2021 EMISSIONS CALCULATIONS

Heavy Duty Vehicles Emissions Summary

Terminal	Truck Type	Emissions (tpy)										
		CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	HC	CO_2	CH_4	N_2O	BC	CO_2e
Columbus Street (CST)	Container	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Breakbulk	1.47	3.10	3.70E-03	0.18	0.09	0.12	1,096.40	0.02	0.12	0.05	1,133.07
	Total	1.47	3.10	3.70E-03	0.18	0.09	0.12	1,096.40	0.02	0.12	0.05	1,133.07
North Charleston (NCT)	Container	27.57	58.04	0.07	3.55	1.72	2.32	19,341.97	0.31	2.15	0.87	19,989.65
	Breakbulk	0.01	0.02	2.41E-05	1.26E-03	6.19E-04	8.29E-04	7.14	1.09E-04	7.92E-04	3.19E-04	7.37
	Total	27.58	58.06	0.07	3.55	1.72	2.32	19,349.10	0.31	2.15	0.87	19,997.02
Union Pier (UPT)	Container	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Breakbulk	0.07	0.14	1.69E-04	0.01	4.16E-03	0.01	50.13	7.18E-04	0.01	2.20E-03	51.81
	Total	0.07	0.14	1.69E-04	0.01	4.16E-03	0.01	50.13	7.18E-04	0.01	2.20E-03	51.81
Veterans (VT)	Container	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Breakbulk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Wando Welch (WWT)	Container	185.11	386.86	0.46	23.57	11.53	15.03	137,165.43	1.96	15.22	6.06	141,751.19
	Breakbulk	0.03	0.05	6.38E-05	3.25E-03	1.59E-03	2.08E-03	18.93	2.71E-04	2.10E-03	8.36E-04	19.56
	Total	185.14	386.91	0.46	23.58	11.53	15.03	137,184.36	1.96	15.23	6.06	141,770.75
Hugh Leatherman Terminal (HLT)	Container	15.59	32.71	0.04	1.98	0.97	1.28	11,521.81	0.17	1.28	0.51	11,907.12
	Breakbulk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	15.59	32.71	0.04	1.98	0.97	1.28	11,521.81	0.17	1.28	0.51	11,907.12
Inland Port Dillon	Container	0.19	0.37	2.81E-04	0.04	0.01	0.02	83.45	2.30E-03	0.01	4.42E-03	86.26
	Breakbulk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	0.19	0.37	2.81E-04	0.04	0.01	0.02	83.45	2.30E-03	0.01	4.42E-03	86.26
Inland Port Greer	Container	1.18	2.27	0.00	0.27	0.07	0.10	507.67	0.01	0.06	0.03	524.75
	Breakbulk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total	1.18	2.27	0.00	0.27	0.07	0.10	507.67	0.01	0.06	0.03	524.75
	SCPA Total	231.23	483.57	0.57	29.62	14.40	18.87	169792.93	2.47	18.85	7.53	175470.78

MOVES Input for Charleston, SC[1]

Parameter	Jan, 2017	July, 2017	Jan, 2021	July, 2021
Relative Humidity	71%	32%	93.54%	54.95%
Temperature	-15 °F	115 °F	35.91 °F	87.27 °F

[1] 2021 humidity and temperature data was taken from the 2020 National Emission Inventory data for Greenville County, SC.

Heavy Duty Annual Activity

Activity Variable		Baseline 2017	Baseline 2021
Truck moves/yr		895,113	1,488,931
Working days/week[2]		6	6
Trucks/hour[3]		150-250	23-232
Facility	Idling (%)	6	3-98
	Facility Transit Total (min)	38-45	9-53

[2]For 2021, the facility began operating on some Sundays starting in September through the end of the year. For calculations purposes, an average of 5 weekdays and 1 weekend day was assumed. There is not a significant difference between the emission factors for a weekday and for a weekend day.
[3] Trucks per hour are representative of average values for Hugh Leatherman, Wando Welch, and North Charleston terminals.

Heavy Duty Annual Acitivty by Terminal and Truck Type

	No. Container Truck Arrivals/yr 2017	No. Breakbulk Arrivals/yr 2017	No. Container Truck Arrivals/yr 2021	No. Breakbulk Arrivals/yr 2021[4]
Columbus St	--	14,341	--	8,569
North Charleston	178,387	116	212,668	69
Union Pier	--	641	--	383
Veterans	--	--	--	--
Wando Welch	701,398	230	980,208	137
Hugh Leatherman	--	--	95,430	--
Inland Port Dillon	--	--	20,162	--
Inland Port Greer	--	--	171,304	--

[4] Specific breakbulk trip information was not avaialble for 2021. Breakbulk values from the previous 2017 inventory were scaled with the tonnage of dry bulk handled between 2017 and 2021.

Container Truck Type by Terminal[5]

Truck Type	Columbus St		North Charleston		Union Pier		Veterans		Wando Welch		Hugh Leatherman	
	2017	2021	2017	2021	2017	2021	2017	2021	2017	2021	2017	2021
Bobtails	1%	1%	12%	12%	--	--	--	--	5%	5%	--	5%
Chassis	1%	1%	15%	15%	--	--	--	--	5%	5%	--	5%
Loads & Empties	98%	98%	73%	73%	--	--	--	--	90%	90%	--	90%

[5]Updated truck type breakdown information was not available for 2021. The same breadowns from 2017 were used. For the Hugh Leatherman terminal, SCPA Personnel advised for the Wando Welch breakdowns to be used.

Truck Turn and Operations[6]

Operation	Container 2017	Breakbulk 2017	Container 2021	Breakbulk 2021
Engine Off	0%	70%	0%	0%
Creep Idle	20%	25%	3-94%	3-94%
Stop Idle	6%	0%		
Moving (10 mph)	74%	5%	6-97%	6-97%

[6]For 2021, only total idling operations were considered.

Cruise Ship Shuttle Operations

Activity	Min Bus (Embark) 2017	Motor Coach Bus (Debark) 2017	Min Bus (Embark) 2021	Motor Coach Bus (Debark) 2021
Cruise Ship Calls	79		2	
Average Shuttle Ride per Call	106	90	0	0
Shuttle Ride per Year	8,339	7,110	0	0
Total Embark/Debark	15,449		0	

Heavy Duty Destination by Truck Type

	Truck Type	% split 2017	% split 2021	Origin/Destination
Containerized	Loads & Empties	23.0%	22.0%	Offsite Railyards
		16.1%	16.6%	Local Charleston
		60.9%	61.4%	Out of Tri-County
	Bobtail	100.0%	100.0%	Ashley P west of 26
	Chassis	100.0%	100.0%	Offsite Railyards
Breakbulk	Breakbulk	0.0%	0.0%	Offsite Railyards
		50.0%	50.0%	Local Charleston
		50.0%	50.0%	Out of Tri-County

Heavy Duty Travel Distance to Off-Site Destination

			Distance (miles) to/from Terminal					
Destination	**Cargo Type**	**Truck Type**	**Columbus Street**	**North Charleston**	**Union Pier**	**Veterans**	**Wando Welch**	**Hugh Leatherman**
Offsite Railyards	Containerized	Loads & Empties	6.00	5.50	7.00	--	12.75	6.85
Local Charleston			14.30	9.75	15.30	--	16.50	9.30
Out of Tri-County			50.00	40.00	51.00	--	52.00	48.00
Ashley P west of 26		Bobtail	11.30	6.75	12.30	--	13.50	6.30
Offsite Railyards		Chassis	6.00	5.50	7.00	--	12.75	6.85
Offsite Railyards	Breakbulk	Breakbulk	6.00	5.50	7.00	4.00	12.75	6.85
Local Charleston			14.30	9.75	15.30	25.00	16.50	9.30
Out of Tri-County			50.00	40.00	51.00	45.00	52.00	48.00
Typical Routes, Terminal to Tri-County Boundary			Via I-26 West	Virginia Ave to I-526, merges with Highway 17A and I-26	Morrison Drive to I-26 W	Rivers Ave to I-26	I-526 to I-26, with approximately 3-5% taking Hwy 17	Via I-26 West

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
CO	Urban Unrestricted Access	5	1	15.222	15.222	15.222	15.222	15.222
CO	Urban Unrestricted Access	5	2	9.464	9.464	9.464	9.464	9.464
CO	Urban Unrestricted Access	5	3	6.212	6.212	6.212	6.212	6.212
CO	Urban Unrestricted Access	5	4	4.999	4.999	4.999	4.999	4.999
CO	Urban Unrestricted Access	5	5	3.961	3.961	3.961	3.961	3.961
CO	Urban Unrestricted Access	5	6	3.444	3.444	3.444	3.444	3.444
CO	Urban Unrestricted Access	5	7	3.049	3.049	3.049	3.049	3.049
CO	Urban Unrestricted Access	5	8	2.513	2.513	2.513	2.513	2.513
CO	Urban Unrestricted Access	5	9	2.254	2.254	2.254	2.254	2.254
CO	Urban Unrestricted Access	5	10	2.052	2.052	2.052	2.052	2.052
CO	Urban Unrestricted Access	5	11	1.848	1.848	1.848	1.848	1.848
CO	Urban Unrestricted Access	5	12	1.670	1.670	1.670	1.670	1.670
CO	Urban Unrestricted Access	5	13	1.610	1.610	1.610	1.610	1.610
CO	Urban Unrestricted Access	5	14	1.623	1.623	1.623	1.623	1.623
CO	Urban Unrestricted Access	5	15	1.635	1.635	1.635	1.635	1.635
CO	Urban Unrestricted Access	5	16	1.657	1.657	1.657	1.657	1.657
CO	Urban Restricted Access	4	1	15.222	15.222	15.222	15.222	15.222
CO	Urban Restricted Access	4	2	9.464	9.464	9.464	9.464	9.464
CO	Urban Restricted Access	4	3	6.212	6.212	6.212	6.212	6.212
CO	Urban Restricted Access	4	4	4.999	4.999	4.999	4.999	4.999
CO	Urban Restricted Access	4	5	3.961	3.961	3.961	3.961	3.961
CO	Urban Restricted Access	4	6	3.444	3.444	3.444	3.444	3.444
CO	Urban Restricted Access	4	7	3.049	3.049	3.049	3.049	3.049
CO	Urban Restricted Access	4	8	2.513	2.513	2.513	2.513	2.513
CO	Urban Restricted Access	4	9	2.254	2.254	2.254	2.254	2.254
CO	Urban Restricted Access	4	10	2.052	2.052	2.052	2.052	2.052
CO	Urban Restricted Access	4	11	1.848	1.848	1.848	1.848	1.848
CO	Urban Restricted Access	4	12	1.670	1.670	1.670	1.670	1.670
CO	Urban Restricted Access	4	13	1.610	1.610	1.610	1.610	1.610
CO	Urban Restricted Access	4	14	1.623	1.623	1.623	1.623	1.623
CO	Urban Restricted Access	4	15	1.635	1.635	1.635	1.635	1.635
CO	Urban Restricted Access	4	16	1.657	1.657	1.657	1.657	1.657

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
NO_X	Urban Unrestricted Access	5	1	39.272	39.272	32.726	32.726	35.999
NO_X	Urban Unrestricted Access	5	2	21.566	21.566	17.971	17.971	19.769
NO_X	Urban Unrestricted Access	5	3	12.932	12.932	10.776	10.776	11.854
NO_X	Urban Unrestricted Access	5	4	10.200	10.200	8.500	8.500	9.350
NO_X	Urban Unrestricted Access	5	5	8.394	8.394	6.995	6.995	7.694
NO_X	Urban Unrestricted Access	5	6	7.328	7.328	6.106	6.106	6.717
NO_X	Urban Unrestricted Access	5	7	6.726	6.726	5.605	5.605	6.165
NO_X	Urban Unrestricted Access	5	8	5.529	5.529	4.607	4.607	5.068
NO_X	Urban Unrestricted Access	5	9	5.039	5.039	4.199	4.199	4.619
NO_X	Urban Unrestricted Access	5	10	4.658	4.658	3.882	3.882	4.270
NO_X	Urban Unrestricted Access	5	11	4.199	4.199	3.499	3.499	3.849
NO_X	Urban Unrestricted Access	5	12	3.767	3.767	3.139	3.139	3.453
NO_X	Urban Unrestricted Access	5	13	3.681	3.681	3.068	3.068	3.375
NO_X	Urban Unrestricted Access	5	14	3.979	3.979	3.316	3.316	3.647
NO_X	Urban Unrestricted Access	5	15	4.234	4.234	3.528	3.528	3.881
NO_X	Urban Unrestricted Access	5	16	4.515	4.515	3.762	3.762	4.139
NO_X	Urban Restricted Access	4	1	39.272	39.272	32.726	32.726	35.999
NO_X	Urban Restricted Access	4	2	21.566	21.566	17.971	17.971	19.769
NO_X	Urban Restricted Access	4	3	12.932	12.932	10.776	10.776	11.854
NO_X	Urban Restricted Access	4	4	10.200	10.200	8.500	8.500	9.350
NO_X	Urban Restricted Access	4	5	8.394	8.394	6.995	6.995	7.694
NO_X	Urban Restricted Access	4	6	7.328	7.328	6.106	6.106	6.717
NO_X	Urban Restricted Access	4	7	6.726	6.726	5.605	5.605	6.165
NO_X	Urban Restricted Access	4	8	5.529	5.529	4.607	4.607	5.068
NO_X	Urban Restricted Access	4	9	5.039	5.039	4.199	4.199	4.619
NO_X	Urban Restricted Access	4	10	4.658	4.658	3.882	3.882	4.270
NO_X	Urban Restricted Access	4	11	4.199	4.199	3.499	3.499	3.849
NO_X	Urban Restricted Access	4	12	3.767	3.767	3.139	3.139	3.453
NO_X	Urban Restricted Access	4	13	3.681	3.681	3.068	3.068	3.375
NO_X	Urban Restricted Access	4	14	3.979	3.979	3.316	3.316	3.647
NO_X	Urban Restricted Access	4	15	4.234	4.234	3.528	3.528	3.881
NO_X	Urban Restricted Access	4	16	4.515	4.515	3.762	3.762	4.139

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
SO_2	Urban Unrestricted Access	5	1	0.023	0.023	0.023	0.023	0.023
SO_2	Urban Unrestricted Access	5	2	0.014	0.014	0.014	0.014	0.014
SO_2	Urban Unrestricted Access	5	3	0.009	0.009	0.009	0.009	0.009
SO_2	Urban Unrestricted Access	5	4	0.008	0.008	0.008	0.008	0.008
SO_2	Urban Unrestricted Access	5	5	0.007	0.007	0.007	0.007	0.007
SO_2	Urban Unrestricted Access	5	6	0.007	0.007	0.007	0.007	0.007
SO_2	Urban Unrestricted Access	5	7	0.007	0.007	0.007	0.007	0.007
SO_2	Urban Unrestricted Access	5	8	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Unrestricted Access	5	9	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Unrestricted Access	5	10	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Unrestricted Access	5	11	0.005	0.005	0.005	0.005	0.005
SO_2	Urban Unrestricted Access	5	12	0.005	0.005	0.005	0.005	0.005
SO_2	Urban Unrestricted Access	5	13	0.005	0.005	0.005	0.005	0.005
SO_2	Urban Unrestricted Access	5	14	0.005	0.005	0.005	0.005	0.005
SO_2	Urban Unrestricted Access	5	15	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Unrestricted Access	5	16	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Restricted Access	4	1	0.023	0.023	0.023	0.023	0.023
SO_2	Urban Restricted Access	4	2	0.014	0.014	0.014	0.014	0.014
SO_2	Urban Restricted Access	4	3	0.009	0.009	0.009	0.009	0.009
SO_2	Urban Restricted Access	4	4	0.008	0.008	0.008	0.008	0.008
SO_2	Urban Restricted Access	4	5	0.007	0.007	0.007	0.007	0.007
SO_2	Urban Restricted Access	4	6	0.007	0.007	0.007	0.007	0.007
SO_2	Urban Restricted Access	4	7	0.007	0.007	0.007	0.007	0.007
SO_2	Urban Restricted Access	4	8	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Restricted Access	4	9	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Restricted Access	4	10	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Restricted Access	4	11	0.005	0.005	0.005	0.005	0.005
SO_2	Urban Restricted Access	4	12	0.005	0.005	0.005	0.005	0.005
SO_2	Urban Restricted Access	4	13	0.005	0.005	0.005	0.005	0.005
SO_2	Urban Restricted Access	4	14	0.005	0.005	0.005	0.005	0.005
SO_2	Urban Restricted Access	4	15	0.006	0.006	0.006	0.006	0.006
SO_2	Urban Restricted Access	4	16	0.006	0.006	0.006	0.006	0.006

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
PM_{10} - Exhaust	Urban Unrestricted Access	5	1	0.714	0.714	0.714	0.714	0.714
PM_{10} - Exhaust	Urban Unrestricted Access	5	2	0.383	0.383	0.383	0.383	0.383
PM_{10} - Exhaust	Urban Unrestricted Access	5	3	0.247	0.247	0.247	0.247	0.247
PM_{10} - Exhaust	Urban Unrestricted Access	5	4	0.231	0.231	0.231	0.231	0.231
PM_{10} - Exhaust	Urban Unrestricted Access	5	5	0.211	0.211	0.211	0.211	0.211
PM_{10} - Exhaust	Urban Unrestricted Access	5	6	0.197	0.197	0.197	0.197	0.197
PM_{10} - Exhaust	Urban Unrestricted Access	5	7	0.188	0.188	0.188	0.188	0.188
PM_{10} - Exhaust	Urban Unrestricted Access	5	8	0.144	0.144	0.144	0.144	0.144
PM_{10} - Exhaust	Urban Unrestricted Access	5	9	0.134	0.134	0.134	0.134	0.134
PM_{10} - Exhaust	Urban Unrestricted Access	5	10	0.126	0.126	0.126	0.126	0.126
PM_{10} - Exhaust	Urban Unrestricted Access	5	11	0.110	0.110	0.110	0.110	0.110
PM_{10} - Exhaust	Urban Unrestricted Access	5	12	0.093	0.093	0.093	0.093	0.093
PM_{10} - Exhaust	Urban Unrestricted Access	5	13	0.085	0.085	0.085	0.085	0.085
PM_{10} - Exhaust	Urban Unrestricted Access	5	14	0.090	0.090	0.090	0.090	0.090
PM_{10} - Exhaust	Urban Unrestricted Access	5	15	0.095	0.095	0.095	0.095	0.095
PM_{10} - Exhaust	Urban Unrestricted Access	5	16	0.101	0.101	0.101	0.101	0.101
PM_{10} - Exhaust	Urban Restricted Access	4	1	0.714	0.714	0.714	0.714	0.714
PM_{10} - Exhaust	Urban Restricted Access	4	2	0.383	0.383	0.383	0.383	0.383
PM_{10} - Exhaust	Urban Restricted Access	4	3	0.247	0.247	0.247	0.247	0.247
PM_{10} - Exhaust	Urban Restricted Access	4	4	0.231	0.231	0.231	0.231	0.231
PM_{10} - Exhaust	Urban Restricted Access	4	5	0.211	0.211	0.211	0.211	0.211
PM_{10} - Exhaust	Urban Restricted Access	4	6	0.197	0.197	0.197	0.197	0.197
PM_{10} - Exhaust	Urban Restricted Access	4	7	0.188	0.188	0.188	0.188	0.188
PM_{10} - Exhaust	Urban Restricted Access	4	8	0.144	0.144	0.144	0.144	0.144
PM_{10} - Exhaust	Urban Restricted Access	4	9	0.134	0.134	0.134	0.134	0.134
PM_{10} - Exhaust	Urban Restricted Access	4	10	0.126	0.126	0.126	0.126	0.126
PM_{10} - Exhaust	Urban Restricted Access	4	11	0.110	0.110	0.110	0.110	0.110
PM_{10} - Exhaust	Urban Restricted Access	4	12	0.093	0.093	0.093	0.093	0.093
PM_{10} - Exhaust	Urban Restricted Access	4	13	0.085	0.085	0.085	0.085	0.085
PM_{10} - Exhaust	Urban Restricted Access	4	14	0.090	0.090	0.090	0.090	0.090
PM_{10} - Exhaust	Urban Restricted Access	4	15	0.095	0.095	0.095	0.095	0.095
PM_{10} - Exhaust	Urban Restricted Access	4	16	0.101	0.101	0.101	0.101	0.101

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
PM_{10} - Brakewear	Urban Unrestricted Access	5	1	1.700	1.700	1.700	1.700	1.700
PM_{10} - Brakewear	Urban Unrestricted Access	5	2	2.058	2.058	2.058	2.058	2.058
PM_{10} - Brakewear	Urban Unrestricted Access	5	3	1.140	1.140	1.140	1.140	1.140
PM_{10} - Brakewear	Urban Unrestricted Access	5	4	0.651	0.651	0.651	0.651	0.651
PM_{10} - Brakewear	Urban Unrestricted Access	5	5	0.396	0.396	0.396	0.396	0.396
PM_{10} - Brakewear	Urban Unrestricted Access	5	6	0.347	0.347	0.347	0.347	0.347
PM_{10} - Brakewear	Urban Unrestricted Access	5	7	0.257	0.257	0.257	0.257	0.257
PM_{10} - Brakewear	Urban Unrestricted Access	5	8	0.196	0.196	0.196	0.196	0.196
PM_{10} - Brakewear	Urban Unrestricted Access	5	9	0.141	0.141	0.141	0.141	0.141
PM_{10} - Brakewear	Urban Unrestricted Access	5	10	0.099	0.099	0.099	0.099	0.099
PM_{10} - Brakewear	Urban Unrestricted Access	5	11	0.061	0.061	0.061	0.061	0.061
PM_{10} - Brakewear	Urban Unrestricted Access	5	12	0.029	0.029	0.029	0.029	0.029
PM_{10} - Brakewear	Urban Unrestricted Access	5	13	0.012	0.012	0.012	0.012	0.012
PM_{10} - Brakewear	Urban Unrestricted Access	5	14	0.009	0.009	0.009	0.009	0.009
PM_{10} - Brakewear	Urban Unrestricted Access	5	15	0.007	0.007	0.007	0.007	0.007
PM_{10} - Brakewear	Urban Unrestricted Access	5	16	0.005	0.005	0.005	0.005	0.005
PM_{10} - Brakewear	Urban Restricted Access	4	1	1.700	1.700	1.700	1.700	1.700
PM_{10} - Brakewear	Urban Restricted Access	4	2	2.058	2.058	2.058	2.058	2.058
PM_{10} - Brakewear	Urban Restricted Access	4	3	1.140	1.140	1.140	1.140	1.140
PM_{10} - Brakewear	Urban Restricted Access	4	4	0.651	0.651	0.651	0.651	0.651
PM_{10} - Brakewear	Urban Restricted Access	4	5	0.396	0.396	0.396	0.396	0.396
PM_{10} - Brakewear	Urban Restricted Access	4	6	0.347	0.347	0.347	0.347	0.347
PM_{10} - Brakewear	Urban Restricted Access	4	7	0.257	0.257	0.257	0.257	0.257
PM_{10} - Brakewear	Urban Restricted Access	4	8	0.196	0.196	0.196	0.196	0.196
PM_{10} - Brakewear	Urban Restricted Access	4	9	0.141	0.141	0.141	0.141	0.141
PM_{10} - Brakewear	Urban Restricted Access	4	10	0.099	0.099	0.099	0.099	0.099
PM_{10} - Brakewear	Urban Restricted Access	4	11	0.061	0.061	0.061	0.061	0.061
PM_{10} - Brakewear	Urban Restricted Access	4	12	0.029	0.029	0.029	0.029	0.029
PM_{10} - Brakewear	Urban Restricted Access	4	13	0.012	0.012	0.012	0.012	0.012
PM_{10} - Brakewear	Urban Restricted Access	4	14	0.009	0.009	0.009	0.009	0.009
PM_{10} - Brakewear	Urban Restricted Access	4	15	0.007	0.007	0.007	0.007	0.007
PM_{10} - Brakewear	Urban Restricted Access	4	16	0.005	0.005	0.005	0.005	0.005

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
PM10 - Tirewear	Urban Unrestricted Access	5	1	0.062	0.062	0.062	0.062	0.062
PM10 - Tirewear	Urban Unrestricted Access	5	2	0.059	0.059	0.059	0.059	0.059
PM10 - Tirewear	Urban Unrestricted Access	5	3	0.055	0.055	0.055	0.055	0.055
PM10 - Tirewear	Urban Unrestricted Access	5	4	0.051	0.051	0.051	0.051	0.051
PM10 - Tirewear	Urban Unrestricted Access	5	5	0.047	0.047	0.047	0.047	0.047
PM10 - Tirewear	Urban Unrestricted Access	5	6	0.044	0.044	0.044	0.044	0.044
PM10 - Tirewear	Urban Unrestricted Access	5	7	0.041	0.041	0.041	0.041	0.041
PM10 - Tirewear	Urban Unrestricted Access	5	8	0.038	0.038	0.038	0.038	0.038
PM10 - Tirewear	Urban Unrestricted Access	5	9	0.035	0.035	0.035	0.035	0.035
PM10 - Tirewear	Urban Unrestricted Access	5	10	0.032	0.032	0.032	0.032	0.032
PM10 - Tirewear	Urban Unrestricted Access	5	11	0.030	0.030	0.030	0.030	0.030
PM10 - Tirewear	Urban Unrestricted Access	5	12	0.028	0.028	0.028	0.028	0.028
PM10 - Tirewear	Urban Unrestricted Access	5	13	0.026	0.026	0.026	0.026	0.026
PM10 - Tirewear	Urban Unrestricted Access	5	14	0.024	0.024	0.024	0.024	0.024
PM10 - Tirewear	Urban Unrestricted Access	5	15	0.022	0.022	0.022	0.022	0.022
PM10 - Tirewear	Urban Unrestricted Access	5	16	0.021	0.021	0.021	0.021	0.021
PM10 - Tirewear	Urban Restricted Access	4	1	0.062	0.062	0.062	0.062	0.062
PM10 - Tirewear	Urban Restricted Access	4	2	0.059	0.059	0.059	0.059	0.059
PM10 - Tirewear	Urban Restricted Access	4	3	0.055	0.055	0.055	0.055	0.055
PM10 - Tirewear	Urban Restricted Access	4	4	0.051	0.051	0.051	0.051	0.051
PM10 - Tirewear	Urban Restricted Access	4	5	0.047	0.047	0.047	0.047	0.047
PM10 - Tirewear	Urban Restricted Access	4	6	0.044	0.044	0.044	0.044	0.044
PM10 - Tirewear	Urban Restricted Access	4	7	0.041	0.041	0.041	0.041	0.041
PM10 - Tirewear	Urban Restricted Access	4	8	0.038	0.038	0.038	0.038	0.038
PM10 - Tirewear	Urban Restricted Access	4	9	0.035	0.035	0.035	0.035	0.035
PM10 - Tirewear	Urban Restricted Access	4	10	0.032	0.032	0.032	0.032	0.032
PM10 - Tirewear	Urban Restricted Access	4	11	0.030	0.030	0.030	0.030	0.030
PM10 - Tirewear	Urban Restricted Access	4	12	0.028	0.028	0.028	0.028	0.028
PM10 - Tirewear	Urban Restricted Access	4	13	0.026	0.026	0.026	0.026	0.026
PM10 - Tirewear	Urban Restricted Access	4	14	0.024	0.024	0.024	0.024	0.024
PM10 - Tirewear	Urban Restricted Access	4	15	0.022	0.022	0.022	0.022	0.022
PM10 - Tirewear	Urban Restricted Access	4	16	0.021	0.021	0.021	0.021	0.021

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	1	0.657	0.657	0.657	0.657	0.657
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	2	0.352	0.352	0.352	0.352	0.352
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	3	0.228	0.228	0.228	0.228	0.228
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	4	0.213	0.213	0.213	0.213	0.213
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	5	0.194	0.194	0.194	0.194	0.194
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	6	0.181	0.181	0.181	0.181	0.181
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	7	0.173	0.173	0.173	0.173	0.173
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	8	0.132	0.132	0.132	0.132	0.132
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	9	0.123	0.123	0.123	0.123	0.123
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	10	0.116	0.116	0.116	0.116	0.116
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	11	0.102	0.102	0.102	0.102	0.102
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	12	0.085	0.085	0.085	0.085	0.085
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	13	0.079	0.079	0.079	0.079	0.079
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	14	0.083	0.083	0.083	0.083	0.083
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	15	0.087	0.087	0.087	0.087	0.087
$PM_{2.5}$ - Exhaust	Urban Unrestricted Access	5	16	0.093	0.093	0.093	0.093	0.093
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	1	0.657	0.657	0.657	0.657	0.657
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	2	0.352	0.352	0.352	0.352	0.352
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	3	0.228	0.228	0.228	0.228	0.228
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	4	0.213	0.213	0.213	0.213	0.213
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	5	0.194	0.194	0.194	0.194	0.194
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	6	0.181	0.181	0.181	0.181	0.181
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	7	0.173	0.173	0.173	0.173	0.173
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	8	0.132	0.132	0.132	0.132	0.132
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	9	0.123	0.123	0.123	0.123	0.123
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	10	0.116	0.116	0.116	0.116	0.116
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	11	0.102	0.102	0.102	0.102	0.102
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	12	0.085	0.085	0.085	0.085	0.085
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	13	0.079	0.079	0.079	0.079	0.079
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	14	0.083	0.083	0.083	0.083	0.083
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	15	0.087	0.087	0.087	0.087	0.087
$PM_{2.5}$ - Exhaust	Urban Restricted Access	4	16	0.093	0.093	0.093	0.093	0.093

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	1	0.213	0.213	0.213	0.213	0.213
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	2	0.257	0.257	0.257	0.257	0.257
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	3	0.143	0.143	0.143	0.143	0.143
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	4	0.081	0.081	0.081	0.081	0.081
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	5	0.050	0.050	0.050	0.050	0.050
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	6	0.043	0.043	0.043	0.043	0.043
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	7	0.032	0.032	0.032	0.032	0.032
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	8	0.024	0.024	0.024	0.024	0.024
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	9	0.018	0.018	0.018	0.018	0.018
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	10	0.012	0.012	0.012	0.012	0.012
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	11	0.008	0.008	0.008	0.008	0.008
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	12	0.004	0.004	0.004	0.004	0.004
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	13	0.001	0.001	0.001	0.001	0.001
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	14	0.001	0.001	0.001	0.001	0.001
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	15	0.001	0.001	0.001	0.001	0.001
$PM_{2.5}$ - Brakewear	Urban Unrestricted Access	5	16	0.001	0.001	0.001	0.001	0.001
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	1	0.213	0.213	0.213	0.213	0.213
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	2	0.257	0.257	0.257	0.257	0.257
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	3	0.143	0.143	0.143	0.143	0.143
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	4	0.081	0.081	0.081	0.081	0.081
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	5	0.050	0.050	0.050	0.050	0.050
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	6	0.043	0.043	0.043	0.043	0.043
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	7	0.032	0.032	0.032	0.032	0.032
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	8	0.024	0.024	0.024	0.024	0.024
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	9	0.018	0.018	0.018	0.018	0.018
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	10	0.012	0.012	0.012	0.012	0.012
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	11	0.008	0.008	0.008	0.008	0.008
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	12	0.004	0.004	0.004	0.004	0.004
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	13	0.001	0.001	0.001	0.001	0.001
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	14	0.001	0.001	0.001	0.001	0.001
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	15	0.001	0.001	0.001	0.001	0.001
$PM_{2.5}$ - Brakewear	Urban Restricted Access	4	16	0.001	0.001	0.001	0.001	0.001

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
PM2.5 - Tirewear	Urban Unrestricted Access	5	1	0.009	0.009	0.009	0.009	0.009
PM2.5 - Tirewear	Urban Unrestricted Access	5	2	0.009	0.009	0.009	0.009	0.009
PM2.5 - Tirewear	Urban Unrestricted Access	5	3	0.008	0.008	0.008	0.008	0.008
PM2.5 - Tirewear	Urban Unrestricted Access	5	4	0.008	0.008	0.008	0.008	0.008
PM2.5 - Tirewear	Urban Unrestricted Access	5	5	0.007	0.007	0.007	0.007	0.007
PM2.5 - Tirewear	Urban Unrestricted Access	5	6	0.007	0.007	0.007	0.007	0.007
PM2.5 - Tirewear	Urban Unrestricted Access	5	7	0.006	0.006	0.006	0.006	0.006
PM2.5 - Tirewear	Urban Unrestricted Access	5	8	0.006	0.006	0.006	0.006	0.006
PM2.5 - Tirewear	Urban Unrestricted Access	5	9	0.005	0.005	0.005	0.005	0.005
PM2.5 - Tirewear	Urban Unrestricted Access	5	10	0.005	0.005	0.005	0.005	0.005
PM2.5 - Tirewear	Urban Unrestricted Access	5	11	0.005	0.005	0.005	0.005	0.005
PM2.5 - Tirewear	Urban Unrestricted Access	5	12	0.004	0.004	0.004	0.004	0.004
PM2.5 - Tirewear	Urban Unrestricted Access	5	13	0.004	0.004	0.004	0.004	0.004
PM2.5 - Tirewear	Urban Unrestricted Access	5	14	0.004	0.004	0.004	0.004	0.004
PM2.5 - Tirewear	Urban Unrestricted Access	5	15	0.003	0.003	0.003	0.003	0.003
PM2.5 - Tirewear	Urban Unrestricted Access	5	16	0.003	0.003	0.003	0.003	0.003
PM2.5 - Tirewear	Urban Restricted Access	4	1	0.009	0.009	0.009	0.009	0.009
PM2.5 - Tirewear	Urban Restricted Access	4	2	0.009	0.009	0.009	0.009	0.009
PM2.5 - Tirewear	Urban Restricted Access	4	3	0.008	0.008	0.008	0.008	0.008
PM2.5 - Tirewear	Urban Restricted Access	4	4	0.008	0.008	0.008	0.008	0.008
PM2.5 - Tirewear	Urban Restricted Access	4	5	0.007	0.007	0.007	0.007	0.007
PM2.5 - Tirewear	Urban Restricted Access	4	6	0.007	0.007	0.007	0.007	0.007
PM2.5 - Tirewear	Urban Restricted Access	4	7	0.006	0.006	0.006	0.006	0.006
PM2.5 - Tirewear	Urban Restricted Access	4	8	0.006	0.006	0.006	0.006	0.006
PM2.5 - Tirewear	Urban Restricted Access	4	9	0.005	0.005	0.005	0.005	0.005
PM2.5 - Tirewear	Urban Restricted Access	4	10	0.005	0.005	0.005	0.005	0.005
PM2.5 - Tirewear	Urban Restricted Access	4	11	0.005	0.005	0.005	0.005	0.005
PM2.5 - Tirewear	Urban Restricted Access	4	12	0.004	0.004	0.004	0.004	0.004
PM2.5 - Tirewear	Urban Restricted Access	4	13	0.004	0.004	0.004	0.004	0.004
PM2.5 - Tirewear	Urban Restricted Access	4	14	0.004	0.004	0.004	0.004	0.004
PM2.5 - Tirewear	Urban Restricted Access	4	15	0.003	0.003	0.003	0.003	0.003
PM2.5 - Tirewear	Urban Restricted Access	4	16	0.003	0.003	0.003	0.003	0.003

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
HC	Urban Unrestricted Access	5	1	1.737	1.737	1.737	1.737	1.737
HC	Urban Unrestricted Access	5	2	0.947	0.947	0.947	0.947	0.947
HC	Urban Unrestricted Access	5	3	0.510	0.510	0.510	0.510	0.510
HC	Urban Unrestricted Access	5	4	0.360	0.360	0.360	0.360	0.360
HC	Urban Unrestricted Access	5	5	0.276	0.276	0.276	0.276	0.276
HC	Urban Unrestricted Access	5	6	0.236	0.236	0.236	0.236	0.236
HC	Urban Unrestricted Access	5	7	0.210	0.210	0.210	0.210	0.210
HC	Urban Unrestricted Access	5	8	0.180	0.180	0.180	0.180	0.180
HC	Urban Unrestricted Access	5	9	0.165	0.165	0.165	0.165	0.165
HC	Urban Unrestricted Access	5	10	0.154	0.154	0.154	0.154	0.154
HC	Urban Unrestricted Access	5	11	0.141	0.141	0.141	0.141	0.141
HC	Urban Unrestricted Access	5	12	0.127	0.127	0.127	0.127	0.127
HC	Urban Unrestricted Access	5	13	0.120	0.120	0.120	0.120	0.120
HC	Urban Unrestricted Access	5	14	0.122	0.122	0.122	0.122	0.122
HC	Urban Unrestricted Access	5	15	0.123	0.123	0.123	0.123	0.123
HC	Urban Unrestricted Access	5	16	0.128	0.128	0.128	0.128	0.128
HC	Urban Restricted Access	4	1	1.737	1.737	1.737	1.737	1.737
HC	Urban Restricted Access	4	2	0.947	0.947	0.947	0.947	0.947
HC	Urban Restricted Access	4	3	0.510	0.510	0.510	0.510	0.510
HC	Urban Restricted Access	4	4	0.360	0.360	0.360	0.360	0.360
HC	Urban Restricted Access	4	5	0.276	0.276	0.276	0.276	0.276
HC	Urban Restricted Access	4	6	0.236	0.236	0.236	0.236	0.236
HC	Urban Restricted Access	4	7	0.210	0.210	0.210	0.210	0.210
HC	Urban Restricted Access	4	8	0.180	0.180	0.180	0.180	0.180
HC	Urban Restricted Access	4	9	0.165	0.165	0.165	0.165	0.165
HC	Urban Restricted Access	4	10	0.154	0.154	0.154	0.154	0.154
HC	Urban Restricted Access	4	11	0.141	0.141	0.141	0.141	0.141
HC	Urban Restricted Access	4	12	0.127	0.127	0.127	0.127	0.127
HC	Urban Restricted Access	4	13	0.120	0.120	0.120	0.120	0.120
HC	Urban Restricted Access	4	14	0.122	0.122	0.122	0.122	0.122
HC	Urban Restricted Access	4	15	0.123	0.123	0.123	0.123	0.123
HC	Urban Restricted Access	4	16	0.128	0.128	0.128	0.128	0.128

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
CH_4	Urban Unrestricted Access	5	1	0.246	0.246	0.246	0.246	0.246
CH_4	Urban Unrestricted Access	5	2	0.134	0.134	0.134	0.134	0.134
CH_4	Urban Unrestricted Access	5	3	0.073	0.073	0.073	0.073	0.073
CH_4	Urban Unrestricted Access	5	4	0.053	0.053	0.053	0.053	0.053
CH_4	Urban Unrestricted Access	5	5	0.041	0.041	0.041	0.041	0.041
CH_4	Urban Unrestricted Access	5	6	0.035	0.035	0.035	0.035	0.035
CH_4	Urban Unrestricted Access	5	7	0.032	0.032	0.032	0.032	0.032
CH_4	Urban Unrestricted Access	5	8	0.025	0.025	0.025	0.025	0.025
CH_4	Urban Unrestricted Access	5	9	0.022	0.022	0.022	0.022	0.022
CH_4	Urban Unrestricted Access	5	10	0.020	0.020	0.020	0.020	0.020
CH_4	Urban Unrestricted Access	5	11	0.017	0.017	0.017	0.017	0.017
CH_4	Urban Unrestricted Access	5	12	0.014	0.014	0.014	0.014	0.014
CH_4	Urban Unrestricted Access	5	13	0.013	0.013	0.013	0.013	0.013
CH_4	Urban Unrestricted Access	5	14	0.014	0.014	0.014	0.014	0.014
CH_4	Urban Unrestricted Access	5	15	0.016	0.016	0.016	0.016	0.016
CH_4	Urban Unrestricted Access	5	16	0.018	0.018	0.018	0.018	0.018
CH_4	Urban Restricted Access	4	1	0.246	0.246	0.246	0.246	0.246
CH_4	Urban Restricted Access	4	2	0.134	0.134	0.134	0.134	0.134
CH_4	Urban Restricted Access	4	3	0.073	0.073	0.073	0.073	0.073
CH_4	Urban Restricted Access	4	4	0.053	0.053	0.053	0.053	0.053
CH_4	Urban Restricted Access	4	5	0.041	0.041	0.041	0.041	0.041
CH_4	Urban Restricted Access	4	6	0.035	0.035	0.035	0.035	0.035
CH_4	Urban Restricted Access	4	7	0.032	0.032	0.032	0.032	0.032
CH_4	Urban Restricted Access	4	8	0.025	0.025	0.025	0.025	0.025
CH_4	Urban Restricted Access	4	9	0.022	0.022	0.022	0.022	0.022
CH_4	Urban Restricted Access	4	10	0.020	0.020	0.020	0.020	0.020
CH_4	Urban Restricted Access	4	11	0.017	0.017	0.017	0.017	0.017
CH_4	Urban Restricted Access	4	12	0.014	0.014	0.014	0.014	0.014
CH_4	Urban Restricted Access	4	13	0.013	0.013	0.013	0.013	0.013
CH_4	Urban Restricted Access	4	14	0.014	0.014	0.014	0.014	0.014
CH_4	Urban Restricted Access	4	15	0.016	0.016	0.016	0.016	0.016
CH_4	Urban Restricted Access	4	16	0.018	0.018	0.018	0.018	0.018

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
N_2O	Urban Unrestricted Access	5	1	0.734	0.734	0.734	0.734	0.734
N_2O	Urban Unrestricted Access	5	2	0.440	0.440	0.440	0.440	0.440
N_2O	Urban Unrestricted Access	5	3	0.295	0.295	0.295	0.295	0.295
N_2O	Urban Unrestricted Access	5	4	0.265	0.265	0.265	0.265	0.265
N_2O	Urban Unrestricted Access	5	5	0.242	0.242	0.242	0.242	0.242
N_2O	Urban Unrestricted Access	5	6	0.223	0.223	0.223	0.223	0.223
N_2O	Urban Unrestricted Access	5	7	0.218	0.218	0.218	0.218	0.218
N_2O	Urban Unrestricted Access	5	8	0.191	0.191	0.191	0.191	0.191
N_2O	Urban Unrestricted Access	5	9	0.188	0.188	0.188	0.188	0.188
N_2O	Urban Unrestricted Access	5	10	0.185	0.185	0.185	0.185	0.185
N_2O	Urban Unrestricted Access	5	11	0.177	0.177	0.177	0.177	0.177
N_2O	Urban Unrestricted Access	5	12	0.169	0.169	0.169	0.169	0.169
N_2O	Urban Unrestricted Access	5	13	0.171	0.171	0.171	0.171	0.171
N_2O	Urban Unrestricted Access	5	14	0.180	0.180	0.180	0.180	0.180
N_2O	Urban Unrestricted Access	5	15	0.187	0.187	0.187	0.187	0.187
N_2O	Urban Unrestricted Access	5	16	0.194	0.194	0.194	0.194	0.194
N_2O	Urban Restricted Access	4	1	0.734	0.734	0.734	0.734	0.734
N_2O	Urban Restricted Access	4	2	0.440	0.440	0.440	0.440	0.440
N_2O	Urban Restricted Access	4	3	0.295	0.295	0.295	0.295	0.295
N_2O	Urban Restricted Access	4	4	0.265	0.265	0.265	0.265	0.265
N_2O	Urban Restricted Access	4	5	0.242	0.242	0.242	0.242	0.242
N_2O	Urban Restricted Access	4	6	0.223	0.223	0.223	0.223	0.223
N_2O	Urban Restricted Access	4	7	0.218	0.218	0.218	0.218	0.218
N_2O	Urban Restricted Access	4	8	0.191	0.191	0.191	0.191	0.191
N_2O	Urban Restricted Access	4	9	0.188	0.188	0.188	0.188	0.188
N_2O	Urban Restricted Access	4	10	0.185	0.185	0.185	0.185	0.185
N_2O	Urban Restricted Access	4	11	0.177	0.177	0.177	0.177	0.177
N_2O	Urban Restricted Access	4	12	0.169	0.169	0.169	0.169	0.169
N_2O	Urban Restricted Access	4	13	0.171	0.171	0.171	0.171	0.171
N_2O	Urban Restricted Access	4	14	0.180	0.180	0.180	0.180	0.180
N_2O	Urban Restricted Access	4	15	0.187	0.187	0.187	0.187	0.187
N_2O	Urban Restricted Access	4	16	0.194	0.194	0.194	0.194	0.194

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
CO_2	Urban Unrestricted Access	5	1	6,797.220	6,797.220	6,797.220	6,797.220	6,797.220
CO_2	Urban Unrestricted Access	5	2	4,007.350	4,007.350	4,007.350	4,007.350	4,007.350
CO_2	Urban Unrestricted Access	5	3	2,666.030	2,666.030	2,666.030	2,666.030	2,666.030
CO_2	Urban Unrestricted Access	5	4	2,401.190	2,401.190	2,401.190	2,401.190	2,401.190
CO_2	Urban Unrestricted Access	5	5	2,185.400	2,185.400	2,185.400	2,185.400	2,185.400
CO_2	Urban Unrestricted Access	5	6	2,017.130	2,017.130	2,017.130	2,017.130	2,017.130
CO_2	Urban Unrestricted Access	5	7	1,969.870	1,969.870	1,969.870	1,969.870	1,969.870
CO_2	Urban Unrestricted Access	5	8	1,722.220	1,722.220	1,722.220	1,722.220	1,722.220
CO_2	Urban Unrestricted Access	5	9	1,690.680	1,690.680	1,690.680	1,690.680	1,690.680
CO_2	Urban Unrestricted Access	5	10	1,666.160	1,666.160	1,666.160	1,666.160	1,666.160
CO_2	Urban Unrestricted Access	5	11	1,599.560	1,599.560	1,599.560	1,599.560	1,599.560
CO_2	Urban Unrestricted Access	5	12	1,527.270	1,527.270	1,527.270	1,527.270	1,527.270
CO_2	Urban Unrestricted Access	5	13	1,541.110	1,541.110	1,541.110	1,541.110	1,541.110
CO_2	Urban Unrestricted Access	5	14	1,626.780	1,626.780	1,626.780	1,626.780	1,626.780
CO_2	Urban Unrestricted Access	5	15	1,700.210	1,700.210	1,700.210	1,700.210	1,700.210
CO_2	Urban Unrestricted Access	5	16	1,776.560	1,776.560	1,776.560	1,776.560	1,776.560
CO_2	Urban Restricted Access	4	1	6,797.220	6,797.220	6,797.220	6,797.220	6,797.220
CO_2	Urban Restricted Access	4	2	4,007.350	4,007.350	4,007.350	4,007.350	4,007.350
CO_2	Urban Restricted Access	4	3	2,666.020	2,666.030	2,666.030	2,666.020	2,666.025
CO_2	Urban Restricted Access	4	4	2,401.190	2,401.190	2,401.190	2,401.190	2,401.190
CO_2	Urban Restricted Access	4	5	2,185.400	2,185.400	2,185.400	2,185.400	2,185.400
CO_2	Urban Restricted Access	4	6	2,017.130	2,017.130	2,017.130	2,017.130	2,017.130
CO_2	Urban Restricted Access	4	7	1,969.860	1,969.870	1,969.870	1,969.860	1,969.865
CO_2	Urban Restricted Access	4	8	1,722.220	1,722.220	1,722.220	1,722.220	1,722.220
CO_2	Urban Restricted Access	4	9	1,690.680	1,690.680	1,690.680	1,690.680	1,690.680
CO_2	Urban Restricted Access	4	10	1,666.160	1,666.160	1,666.160	1,666.160	1,666.160
CO_2	Urban Restricted Access	4	11	1,599.560	1,599.560	1,599.560	1,599.560	1,599.560
CO_2	Urban Restricted Access	4	12	1,527.270	1,527.270	1,527.270	1,527.270	1,527.270
CO_2	Urban Restricted Access	4	13	1,541.110	1,541.110	1,541.110	1,541.110	1,541.110
CO_2	Urban Restricted Access	4	14	1,626.780	1,626.780	1,626.780	1,626.780	1,626.780
CO_2	Urban Restricted Access	4	15	1,700.210	1,700.210	1,700.210	1,700.210	1,700.210
CO_2	Urban Restricted Access	4	16	1,776.560	1,776.560	1,776.560	1,776.560	1,776.560

Combination Long-Haul Trucks Moving Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)				
				January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
BC	Urban Unrestricted Access	5	1	0.366	0.366	0.366	0.366	0.366
BC	Urban Unrestricted Access	5	2	0.211	0.211	0.211	0.211	0.211
BC	Urban Unrestricted Access	5	3	0.141	0.141	0.141	0.141	0.141
BC	Urban Unrestricted Access	5	4	0.133	0.133	0.133	0.133	0.133
BC	Urban Unrestricted Access	5	5	0.123	0.123	0.123	0.123	0.123
BC	Urban Unrestricted Access	5	6	0.116	0.116	0.116	0.116	0.116
BC	Urban Unrestricted Access	5	7	0.111	0.111	0.111	0.111	0.111
BC	Urban Unrestricted Access	5	8	0.086	0.086	0.086	0.086	0.086
BC	Urban Unrestricted Access	5	9	0.080	0.080	0.080	0.080	0.080
BC	Urban Unrestricted Access	5	10	0.075	0.075	0.075	0.075	0.075
BC	Urban Unrestricted Access	5	11	0.066	0.066	0.066	0.066	0.066
BC	Urban Unrestricted Access	5	12	0.055	0.055	0.055	0.055	0.055
BC	Urban Unrestricted Access	5	13	0.051	0.051	0.051	0.051	0.051
BC	Urban Unrestricted Access	5	14	0.053	0.053	0.053	0.053	0.053
BC	Urban Unrestricted Access	5	15	0.056	0.056	0.056	0.056	0.056
BC	Urban Unrestricted Access	5	16	0.060	0.060	0.060	0.060	0.060
BC	Urban Restricted Access	4	1	0.366	0.366	0.366	0.366	0.366
BC	Urban Restricted Access	4	2	0.211	0.211	0.211	0.211	0.211
BC	Urban Restricted Access	4	3	0.141	0.141	0.141	0.141	0.141
BC	Urban Restricted Access	4	4	0.133	0.133	0.133	0.133	0.133
BC	Urban Restricted Access	4	5	0.123	0.123	0.123	0.123	0.123
BC	Urban Restricted Access	4	6	0.116	0.116	0.116	0.116	0.116
BC	Urban Restricted Access	4	7	0.111	0.111	0.111	0.111	0.111
BC	Urban Restricted Access	4	8	0.086	0.086	0.086	0.086	0.086
BC	Urban Restricted Access	4	9	0.080	0.080	0.080	0.080	0.080
BC	Urban Restricted Access	4	10	0.075	0.075	0.075	0.075	0.075
BC	Urban Restricted Access	4	11	0.066	0.066	0.066	0.066	0.066
BC	Urban Restricted Access	4	12	0.055	0.055	0.055	0.055	0.055
BC	Urban Restricted Access	4	13	0.051	0.051	0.051	0.051	0.051
BC	Urban Restricted Access	4	14	0.053	0.053	0.053	0.053	0.053
BC	Urban Restricted Access	4	15	0.056	0.056	0.056	0.056	0.056
BC	Urban Restricted Access	4	16	0.060	0.060	0.060	0.060	0.060

Combination Long-Haul Trucks Moving Particulate Emission Factors

Pollutant	Road Type	Road Type	Speed Bin	Emission Factors (g/VMT)
				Average
PM_{10}	Urban Unrestricted Access	5	1	2.476
PM_{10}	Urban Unrestricted Access	5	2	2.500
PM_{10}	Urban Unrestricted Access	5	3	1.442
PM_{10}	Urban Unrestricted Access	5	4	0.933
PM_{10}	Urban Unrestricted Access	5	5	0.655
PM_{10}	Urban Unrestricted Access	5	6	0.587
PM_{10}	Urban Unrestricted Access	5	7	0.486
PM_{10}	Urban Unrestricted Access	5	8	0.377
PM_{10}	Urban Unrestricted Access	5	9	0.310
PM_{10}	Urban Unrestricted Access	5	10	0.257
PM_{10}	Urban Unrestricted Access	5	11	0.202
PM_{10}	Urban Unrestricted Access	5	12	0.150
PM_{10}	Urban Unrestricted Access	5	13	0.123
PM_{10}	Urban Unrestricted Access	5	14	0.123
PM_{10}	Urban Unrestricted Access	5	15	0.124
PM_{10}	Urban Unrestricted Access	5	16	0.127
PM_{10}	Urban Restricted Access	4	1	2.476
PM_{10}	Urban Restricted Access	4	2	2.500
PM_{10}	Urban Restricted Access	4	3	1.442
PM_{10}	Urban Restricted Access	4	4	0.933
PM_{10}	Urban Restricted Access	4	5	0.655
PM_{10}	Urban Restricted Access	4	6	0.587
PM_{10}	Urban Restricted Access	4	7	0.486
PM_{10}	Urban Restricted Access	4	8	0.377
PM_{10}	Urban Restricted Access	4	9	0.310
PM_{10}	Urban Restricted Access	4	10	0.257
PM_{10}	Urban Restricted Access	4	11	0.202
PM_{10}	Urban Restricted Access	4	12	0.150
PM_{10}	Urban Restricted Access	4	13	0.123
PM_{10}	Urban Restricted Access	4	14	0.123
PM_{10}	Urban Restricted Access	4	15	0.124
PM_{10}	Urban Restricted Access	4	16	0.127
$PM_{2.5}$	Urban Unrestricted Access	5	1	0.879
$PM_{2.5}$	Urban Unrestricted Access	5	2	0.618
$PM_{2.5}$	Urban Unrestricted Access	5	3	0.378
$PM_{2.5}$	Urban Unrestricted Access	5	4	0.302
$PM_{2.5}$	Urban Unrestricted Access	5	5	0.251
$PM_{2.5}$	Urban Unrestricted Access	5	6	0.231
$PM_{2.5}$	Urban Unrestricted Access	5	7	0.211
$PM_{2.5}$	Urban Unrestricted Access	5	8	0.162
$PM_{2.5}$	Urban Unrestricted Access	5	9	0.146
$PM_{2.5}$	Urban Unrestricted Access	5	10	0.133
$PM_{2.5}$	Urban Unrestricted Access	5	11	0.114
$PM_{2.5}$	Urban Unrestricted Access	5	12	0.093
$PM_{2.5}$	Urban Unrestricted Access	5	13	0.084
$PM_{2.5}$	Urban Unrestricted Access	5	14	0.088
$PM_{2.5}$	Urban Unrestricted Access	5	15	0.091
$PM_{2.5}$	Urban Unrestricted Access	5	16	0.097
$PM_{2.5}$	Urban Restricted Access	4	1	0.879
$PM_{2.5}$	Urban Restricted Access	4	2	0.618
$PM_{2.5}$	Urban Restricted Access	4	3	0.378
$PM_{2.5}$	Urban Restricted Access	4	4	0.302
$PM_{2.5}$	Urban Restricted Access	4	5	0.251
$PM_{2.5}$	Urban Restricted Access	4	6	0.231
$PM_{2.5}$	Urban Restricted Access	4	7	0.211
$PM_{2.5}$	Urban Restricted Access	4	8	0.162
$PM_{2.5}$	Urban Restricted Access	4	9	0.146
$PM_{2.5}$	Urban Restricted Access	4	10	0.133
$PM_{2.5}$	Urban Restricted Access	4	11	0.114
$PM_{2.5}$	Urban Restricted Access	4	12	0.093
$PM_{2.5}$	Urban Restricted Access	4	13	0.084
$PM_{2.5}$	Urban Restricted Access	4	14	0.088
$PM_{2.5}$	Urban Restricted Access	4	15	0.091
$PM_{2.5}$	Urban Restricted Access	4	16	0.097

Combination Long-Haul Trucks Idling Emission Factors

Pollutant	Road Type	Emission Factors (g/hr)				
		January Weekend Day	January Weekday	July Weekend Day	July Weekday	Average
CO	Off-Network	18.227	18.227	18.227	18.227	18.227
NO_X	Off-Network	53.341	53.341	44.449	44.449	48.895
SO_2	Off-Network	0.026	0.026	0.026	0.026	0.026
PM_{10} - Exhaust	Off-Network	1.211	1.211	1.211	1.211	1.211
$PM_{2.5}$ - Exhaust	Off-Network	1.114	1.114	1.114	1.114	1.114
HC	Off-Network	2.795	2.795	2.795	2.795	2.795
CH_4	Off-Network	0.369	0.369	0.369	0.369	0.369
N_2O	Off-Network	0.878	0.878	0.878	0.878	0.878
CO_2	Off-Network	7,756.040	7,756.040	7,756.040	7,756.040	7,756.040
Black Carbon	Off-Network	0.352	0.352	0.352	0.352	0.352

North Charleston Heavy Duty Vehicles

Container Truck Visits per Year	212,668
Container Truck Trips	425,336
On-Terminal Miles	1.25

Breakbulk Visits	69
Breakbulk Truck Trips	139
On-Terminal Miles	1.25

Road Truck Trips (on-terminal)

Container Truck Turn Time		0.88	hrs
Idle	86%	0.76	hrs/truck arrival
Moving (10 mph)	14%	0.13	hrs/truck arrival
Total per truck arrival (truck visit)		0.88	Truck Turn Time

Arriving Trucks	Annual Hours
212,668	161,273.2
	Annual VMT
212,668	265,835.0
212,668	

Breakbulk Truck Turn Time		0.88	hrs
Idle	86%	0.76	hrs/truck arrival
Moving (10 mph)	14%	0.13	hrs/truck arrival
Total per truck arrival (truck visit)		0.88	Truck Turn Time

Arriving Trucks	Annual Hours
69.31067829	52.6
	Annual VMT
69.31067829	86.6
69.31067829	

Container Truck Emissions

Emission Factors										Emissions (short tons)										
NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
48.895	1.211	1.114	2.795	0.026	18.227	7756.040	0.369	0.878	0.352	8.69	0.22	0.20	0.50	4.65E-03	3.24	1378.82	0.07	0.16	0.06	1426.97
(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
11.854	1.442	0.378	0.510	0.009	6.212	2666.030	0.073	0.295	0.141	3.47	0.42	0.11	0.15	2.63E-03	1.82	781.23	0.02	0.09	0.04	807.51
									Container Truck Total Emissions	12.17	0.64	0.31	0.65	0.01	5.06	2160.05	0.09	0.24	0.10	2234.47

Breakbulk Truck Emissions

Emission Factors										Emissions (short tons)										
NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
48.895	1.211	1.114	2.795	0.026	18.227	7756.040	0.369	0.878	0.352	2.83E-03	7.02E-05	6.45E-05	1.62E-04	1.51E-06	1.06E-03	0.45	2.14E-05	5.09E-05	2.04E-05	0.47
(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
11.854	1.442	0.378	0.510	0.009	6.212	2666.030	0.073	0.295	0.141	1.13E-03	1.38E-04	3.61E-05	4.87E-05	8.58E-07	5.93E-04	0.25	7.00E-06	2.81E-05	1.35E-05	0.26
									Breakbulk Truck Total Emissions	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.73
									Total on Terminal	12.17	0.64	0.31	0.65	0.01	5.06	2160.76	0.09	0.24	0.10	2235.20

Road Truck Trips (off-terminal) 425,475

Truck Trips	Truck Trips	Truck Type	Time Period		# Trips per Year		% of Trips		Dist (mi)	Avg Speed	Speed Bin	Road Type	VMT	NO_X (g/VMT)	PM_{10} (g/VMT)	$PM_{2.5}$ (g/VMT)	HC (g/VMT)	SO_2 (g/VMT)	CO (g/VMT)	CO_2 (g/VMT)	CH_4 (g/VMT)	N_2O (g/VMT)	BC (g/VMT)	NO_X (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	HC (tpy)	SO_2 (tpy)	CO (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)	BC (tpy)	CO_2e (tpy)
425336	51040	12% Bobtails	1 Weekday AM Rush Hour - 13%	Arriving / Departing	6635	Path BA1	100%	Seg 1	3.00	15	4	5	19,905.72	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.21	0.02	0.01	0.01	0.00	0.11	52.69	0.00	0.01	0.00	54.45
								Seg 2	3.75	45	10	4	24,882.16	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.12	0.01	0.00	0.00	0.00	0.06	45.70	0.00	0.01	0.00	47.23
						Path BA2	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path BA3	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	6635	Path BA1	100%	Seg 1	3.00	15	4	5	19,905.72	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.21	0.02	0.01	0.01	0.00	0.11	52.69	0.00	0.01	0.00	54.45
								Seg 2	3.75	45	10	4	24,882.16	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.12	0.01	0.00	0.00	0.00	0.06	45.70	0.00	0.01	0.00	47.23
						Path BA2	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path BA3	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			3 Non-Rush Hour - 74%	Arriving / Departing	37770	Path BA1	100%	Seg 1	3.00	20	5	5	113,309.51	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.96	0.08	0.03	0.03	0.00	0.49	272.96	0.01	0.03	0.02	282.10
								Seg 2	3.75	50	11	4	141,636.89	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.60	0.03	0.02	0.02	0.00	0.29	249.74	0.00	0.03	0.01	258.06
						Path BA2	0%	Seg 1	0.00	30	7	5	0.00	6.165	0.486	0.211	0.210	0.007	3.049	1,969.870	0.032	0.218	0.111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path BA3	0%	Seg 1	0.00	30	7	5	0.00	6.165	0.486	0.211	0.210	0.007	3.049	1,969.870	0.032	0.218	0.111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	63800	15% Chassis	1 Weekday AM Rush Hour - 13%	Arriving / Departing	8294	OFSRL	100%	Seg 1	3.00	15	4	5	24,882.16	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.26	0.03	0.01	0.01	0.00	0.14	65.86	0.00	0.01	0.00	68.06
								Seg 2	2.50	35	8	4	20,735.13	5.068	0.377	0.162	0.180	0.006	2.513	1,722.220	0.025	0.191	0.086	0.12	0.01	0.00	0.00	0.00	0.06	39.36	0.00	0.00	0.00	40.68
						Path CA2	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path CA3	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	8294	OFSRL	100%	Seg 1	3.00	15	4	5	24,882.16	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.26	0.03	0.01	0.01	0.00	0.14	65.86	0.00	0.01	0.00	68.06
								Seg 2	2.50	35	8	4	20,735.13	5.068	0.377	0.162	0.180	0.006	2.513	1,722.220	0.025	0.191	0.086	0.12	0.01	0.00	0.00	0.00	0.06	39.36	0.00	0.00	0.00	40.68
						Path CA2	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path CA3	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			3 Non-Rush Hour - 74%	Arriving / Departing	47212	OFSRL	100%	Seg 1	3.00	20	5	5	141,636.89	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	1.20	0.10	0.04	0.04	0.00	0.62	341.20	0.01	0.04	0.02	352.62
								Seg 2	2.50	40	9	4	118,030.74	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.60	0.04	0.02	0.02	0.00	0.29	219.97	0.00	0.02	0.01	227.32
						Path CA2	0%	Seg 1	0.00	30	7	5	0.00	6.165	0.486	0.211	0.210	0.007	3.049	1,969.870	0.032	0.218	0.111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path CA3	0%	Seg 1	0.00	30	7	5	0.00	6.165	0.486	0.211	0.210	0.007	3.049	1,969.870	0.032	0.218	0.111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	310495	73% Loads & Empties	1 Weekday AM Rush Hour - 13%	Arriving / Departing	40364	OFSRL	23.0%	Seg 1	3.00	15	4	5	27,851.43	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.29	0.03	0.01	0.01	0.00	0.15	73.72	0.00	0.01	0.00	76.18
								Seg 2	2.50	45	10	4	23,209.52	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.11	0.01	0.00	0.00	0.00	0.05	42.63	0.00	0.00	0.00	44.05
						LOCAL	16.1%	Seg 1	3.00	15	4	5	19,496.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.20	0.02	0.01	0.01	0.00	0.11	51.60	0.00	0.01	0.00	53.33
								Seg 2	6.75	45	10	4	43,866.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.21	0.01	0.01	0.01	0.00	0.10	80.57	0.00	0.01	0.00	83.26
						Path LA3	60.9%	Seg 1	3.00	15	4	5	73,745.73	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.76	0.08	0.02	0.03	0.00	0.41	195.19	0.00	0.02	0.01	201.72
								Seg 2	37.00	45	10	4	909,530.72	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	4.28	0.26	0.13	0.15	0.01	2.06	1,670.47	0.02	0.19	0.08	1,726.27
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	40364	OFSRL	23.0%	Seg 1	3.00	15	4	5	27,851.43	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.29	0.03	0.01	0.01	0.00	0.15	73.72	0.00	0.01	0.00	76.18
								Seg 2	2.50	45	10	4	23,209.52	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.11	0.01	0.00	0.00	0.00	0.05	42.63	0.00	0.00	0.00	44.05
						LOCAL	16.1%	Seg 1	3.00	15	4	5	19,496.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.20	0.02	0.01	0.01	0.00	0.11	51.60	0.00	0.01	0.00	53.33
								Seg 2	6.75	45	10	4	43,866.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.21	0.01	0.01	0.01	0.00	0.10	80.57	0.00	0.01	0.00	83.26
						Path LA3	60.9%	Seg 1	3.00	15	4	5	73,745.73	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.76	0.08	0.02	0.03	0.00	0.41	195.19	0.00	0.02	0.01	201.72
								Seg 2	37.00	45	10	4	909,530.72	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	4.28	0.26	0.13	0.15	0.01	2.06	1,670.47	0.02	0.19	0.08	1,726.27
			3 Non-Rush Hour - 74%	Arriving / Departing	229767	OFSRL	23.0%	Seg 1	3.00	20	5	5	158,538.89	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	1.34	0.11	0.04	0.05	0.00	0.69	381.92	0.01	0.04	0.02	394.70
								Seg 2	2.50	50	11	4	132,115.74	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.56	0.03	0.02	0.02	0.00	0.27	232.95	0.00	0.03	0.01	240.71
						LOCAL	16.1%	Seg 1	3.00	20	5	5	110,977.22	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.94	0.08	0.03	0.03	0.00	0.48	267.34	0.01	0.03	0.01	276.29
								Seg 2	6.75	50	11	4	249,698.75	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	1.06	0.06	0.03	0.04	0.00	0.51	440.27	0.00	0.05	0.02	454.94
						Path LA3	60.9%	Seg 1	3.00	20	5	5	419,783.41	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	3.56	0.30	0.12	0.13	0.00	1.83	1,011.25	0.02	0.11	0.06	1,045.11
								Seg 2	37.00	50	11	4	5,177,328.71	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	21.97	1.15	0.65	0.80	0.03	10.55	9,128.73	0.10	1.01	0.37	9,432.86
139	139	Breakbulk Trips	1 Weekday AM Rush Hour - 13%	Arriving / Departing	18	OFSRL	0.0%	Seg 1	3.00	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	2.50	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	15	4	5	27.03	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.07
								Seg 2	6.75	45	10	4	60.82	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.12
						Path LA3	50.0%	Seg 1	3.00	15	4	5	27.03	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.07
								Seg 2	37.00	45	10	4	333.38	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.63
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	18	OFSRL	0.0%	Seg 1	3.00	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	2.50	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	15	4	5	27.03	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.07
								Seg 2	6.75	45	10	4	60.82	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.12
						Path LA3	50.0%	Seg 1	3.00	15	4	5	27.03	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.07
								Seg 2	37.00	45	10	4	333.38	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.63
			3 Non-Rush Hour - 74%	Arriving / Departing	103	OFSRL	0.0%	Seg 1	3.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	2.50	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	20	5	5	153.87	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.38
								Seg 2	6.75	50	11	4	346.21	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.63
						Path LA3	50.0%	Seg 1	3.00	20	5	5	153.87	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.38
								Seg 2	37.00	50	11	4	1,897.73	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.01	0.00	0.00	0.00	0.00	0.00	3.35	0.00	0.00	0.00	3.46
				Totals	425,475								9,142,714.08											45.89	2.92	1.41	1.67	0.06	22.51	17,188.35	0.22	1.91	0.77	17,761.82

Speed Specific Emission Factors in g/VMT; Emissions (short tons) in tpy.

North Charleston Heavy Duty Vehicles Emissions

OFF TERMINAL (tpy)

	# Trips	Avg Dist	VMT	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Loads & Empties	310,495	27.2	8,443,841.52	41.12	2.54	1.25	1.50	0.05	20.09	15,690.83	0.20	1.74	0.69	16,214.24
Bobtails	51,040	6.8	344,522.16	2.21	0.17	0.07	0.08	0.00	1.12	719.47	0.01	0.08	0.04	743.51
Chassis	63,800	5.5	350,902.20	2.55	0.21	0.08	0.09	0.00	1.30	771.62	0.01	0.09	0.04	797.43
Subtotal Containers	425,336	--	9,139,265.88	45.88	2.92	1.41	1.67	0.06	22.50	17,181.92	0.22	1.91	0.77	17,755.17
Subtotal Breakbulk	138.6213566	24.9	3,448.21	0.02	0.00	0.00	0.00	0.00	0.01	6.43	0.00	0.00	0.00	6.65
Total	425,475	--	9,142,714.08	45.89	2.92	1.41	1.67	0.06	22.51	17,188.35	0.22	1.91	0.77	17,761.82

ON TERMINAL (tpy)

	# Visits (1/2 trips)	Hrs/Visit	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Subtotal Containers	212,668	0.88	12.17	0.64	0.31	0.65	0.01	5.06	2,160.05	0.09	0.24	0.10	2,234.47
Subtotal Breakbulk	69	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.73
Total	212,737		12.17	0.64	0.31	0.65	0.01	5.06	2,160.76	0.09	0.24	0.10	2,235.20

TOTAL (tpy)

	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Subtotal Containers	58.04	3.55	1.72	2.32	0.07	27.57	19,341.97	0.31	2.15	0.87	19,989.65
Subtotal Breakbulk	0.02	0.00	0.00	0.00	0.00	0.01	7.14	0.00	0.00	0.00	7.37
Total	58.06	3.55	1.72	2.32	0.07	27.58	19,349.10	0.31	2.15	0.87	19,997.02

Columbus Street Heavy Duty Vehicles

Container Truck Visits per Year	--
Container Truck Trips	0
On-Terminal Miles	0.8

Breakbulk Visits	8,569
Breakbulk Truck Trips	17,138
On-Terminal Miles	0.8

Road Truck Trips (on-terminal)

Breakbulk Truck Turn Time		0.88	hrs
Idle	91%	0.80	hrs/truck arrival
Moving (10 mph)	9%	0.08	hrs/truck arrival
Total per truck arrival (truck visit)		0.88	Truck Turn Time

Arriving Trucks	Annual Hours
8,569	6,883.6
	Annual VMT
8,569	6,855.1
8,569	

Breakbulk Truck Emissions

Emission Factors										Emissions (short tons)										
NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
48.895	1.211	1.114	2.795	0.026	18.227	7756.040	0.369	0.878	0.352	0.37	0.01	0.01	0.02	0.00	0.14	58.85	0.00	0.01	0.00	60.91
(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
11.854	1.442	0.378	0.510	0.009	6.212	2666.030	0.073	0.295	0.141	0.09	0.01	0.00	0.00	0.00	0.05	20.15	0.00	0.00	0.00	20.82
Breakbulk Truck Total Emissions										0.46	0.02	0.01	0.03	0.00	0.19	79.00	0.00	0.01	0.00	81.73
Total on Terminal										0.46	0.02	0.01	0.03	0.00	0.19	79.00	0.00	0.01	0.00	81.73

Road Truck Trips (off-terminal) 17,138

Truck Trips	Truck Trips	Truck Type	Time Period		# Trips per Year		% of Trips		Dist (mi)	Avg Speed	Speed Bin	Road Type	VMT
17138	17138	Breakbulk Trips	1 Weekday AM Rush Hour - 13%	Arriving / Departing	2,228	OFSRL	0.0%	Seg 1	3.00	15	4	5	0.00
								Seg 2	3.00	45	10	4	0.00
						LOCAL	50.0%	Seg 1	3.00	15	4	5	3,341.84
								Seg 2	11.30	45	10	4	12,587.61
						Path LA3	50.0%	Seg 1	3.00	15	4	5	3,341.84
								Seg 2	47.00	45	10	4	52,355.56
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	2,228	OFSRL	0.0%	Seg 1	3.00	15	4	5	0.00
								Seg 2	3.00	45	10	4	0.00
						LOCAL	50.0%	Seg 1	3.00	15	4	5	3,341.84
								Seg 2	11.30	45	10	4	12,587.61
						Path LA3	50.0%	Seg 1	3.00	15	4	5	3,341.84
								Seg 2	47.00	45	10	4	52,355.56
			3 Non-Rush Hour - 74%	Arriving / Departing	12,682	OFSRL	0.0%	Seg 1	3.00	20	5	5	0.00
								Seg 2	3.00	50	11	4	0.00
						LOCAL	50.0%	Seg 1	3.00	20	5	5	19,022.81
								Seg 2	11.30	50	11	4	71,652.57
						Path LA3	50.0%	Seg 1	3.00	20	5	5	19,022.81
								Seg 2	47.00	50	11	4	298,023.95
				Totals	**17,138**								**550,975.86**

Speed Specific Emission Factors (g/VMT) and Emissions (short tons) (tpy):

Period / Route / Seg	NO_X (g/VMT)	PM_{10} (g/VMT)	$PM_{2.5}$ (g/VMT)	HC (g/VMT)	SO_2 (g/VMT)	CO (g/VMT)	CO_2 (g/VMT)	CH_4 (g/VMT)	N_2O (g/VMT)	BC (g/VMT)	NO_X (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	HC (tpy)	SO_2 (tpy)	CO (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)	BC (tpy)	CO_2e (tpy)
1 / OFSRL / Seg 1	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 / OFSRL / Seg 2	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 / LOCAL / Seg 1	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.03	0.00	0.00	0.00	0.00	0.02	8.85	0.00	0.00	0.00	9.14
1 / LOCAL / Seg 2	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.06	0.00	0.00	0.00	0.00	0.03	23.12	0.00	0.00	0.00	23.89
1 / Path LA3 / Seg 1	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.03	0.00	0.00	0.00	0.00	0.02	8.85	0.00	0.00	0.00	9.14
1 / Path LA3 / Seg 2	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.25	0.01	0.01	0.01	0.00	0.12	96.16	0.00	0.01	0.00	99.37
2 / OFSRL / Seg 1	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 / OFSRL / Seg 2	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 / LOCAL / Seg 1	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.03	0.00	0.00	0.00	0.00	0.02	8.85	0.00	0.00	0.00	9.14
2 / LOCAL / Seg 2	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.06	0.00	0.00	0.00	0.00	0.03	23.12	0.00	0.00	0.00	23.89
2 / Path LA3 / Seg 1	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.03	0.00	0.00	0.00	0.00	0.02	8.85	0.00	0.00	0.00	9.14
2 / Path LA3 / Seg 2	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.25	0.01	0.01	0.01	0.00	0.12	96.16	0.00	0.01	0.00	99.37
3 / OFSRL / Seg 1	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 / OFSRL / Seg 2	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 / LOCAL / Seg 1	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.16	0.01	0.01	0.01	0.00	0.08	45.83	0.00	0.01	0.00	47.36
3 / LOCAL / Seg 2	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.30	0.02	0.01	0.01	0.00	0.15	126.34	0.00	0.01	0.01	130.55
3 / Path LA3 / Seg 1	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.16	0.01	0.01	0.01	0.00	0.08	45.83	0.00	0.01	0.00	47.36
3 / Path LA3 / Seg 2	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	1.26	0.07	0.04	0.05	0.00	0.61	525.48	0.01	0.06	0.02	542.99
Totals											**2.64**	**0.16**	**0.08**	**0.10**	**0.00**	**1.29**	**1,017.40**	**0.01**	**0.11**	**0.04**	**1,051.34**

Columbus Street Heavy Duty Vehicles Emissions

OFF TERMINAL (tpy)

	# Trips	Avg Dist	VMT	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Loads & Empties	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobtails	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chassis	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Containers	0	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Breakbulk	17,138	32.2	550,975.86	2.64	0.16	0.08	0.10	0.00	1.29	1,017.40	0.01	0.11	0.04	1,051.34
Total	17,138	--	550,975.86	2.64	0.16	0.08	0.10	0.00	1.29	1,017.40	0.01	0.11	0.04	1,051.34

ON TERMINAL (tpy)

	# Visits (1/2 trips)	Hrs/Visit	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Subtotal Containers	--	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Breakbulk	8,568.83	0.88	0.46	0.02	0.01	0.03	0.00	0.19	79.00	0.00	0.01	0.00	81.73
Total	8,568.83		0.46	0.02	0.01	0.03	0.00	0.19	79.00	0.00	0.01	0.00	81.73

TOTAL (tpy)

	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Subtotal Containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Breakbulk	3.10	0.18	0.09	0.12	0.00	1.47	1,096.40	0.02	0.12	0.05	1,133.07
Total	3.10	0.18	0.09	0.12	0.00	1.47	1,096.40	0.02	0.12	0.05	1,133.07

Union Pier Heavy Duty Vehicles

Container Truck Visits per Year	--
Container Truck Trips	0
On-Terminal Miles	0.5

Breakbulk Visits	383
Breakbulk Truck Trips	766
On-Terminal Miles	0.5

Road Trucks on-terminal

Breakbulk Truck Turn Time		0.88	hrs
Idle	94%	0.83	hrs/truck arrival
Moving (10 mph)	6%	0.05	hrs/truck arrival
Total per truck arrival (truck visit)		0.88	Truck Turn Time

Arriving Trucks	Annual Hours
383.0012481	319.2
	Annual VMT
383.0012481	191.5
383.0012481	

Breakbulk Truck Emissions

	Emission Factors										Emissions (short tons)										
	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
	48.895	1.211	1.114	2.795	0.026	18.227	7756.040	0.369	0.878	0.352	0.02	0%	0.00	0.00	0.00	0.01	2.73	0.00	0.00	0.00	2.82
	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
	11.854	1.442	0.378	0.510	0.009	6.212	2666.030	0.073	0.295	0.141	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.58
Breakbulk Truck Total Emissions											0.02	0.00	0.00	0.00	0.00	0.01	3.29	0.00	0.00	0.00	3.41
Total on Terminal											0.02	0.00	0.00	0.00	0.00	0.01	3.29	0.00	0.00	0.00	3.41

Road Truck Trips (off-terminal) 766

Truck Trips	Truck Trips	Truck Type	Time Period		# Trips per Year		% of Trips		Dist (mi)	Avg Speed	Speed Bin	Road Type	VMT	NO_X (g/VMT)	PM_{10} (g/VMT)	$PM_{2.5}$ (g/VMT)	HC (g/VMT)	SO_2 (g/VMT)	CO (g/VMT)	CO_2 (g/VMT)	CH_4 (g/VMT)	N_2O (g/VMT)	BC (g/VMT)	NO_X (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	HC (tpy)	SO_2 (tpy)	CO (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)	BC (tpy)	CO_2e (tpy)
766	766	Breakbulk Trips	1 Weekday AM Rush Hour - 13%	Arriving / Departing	100	OFSRL	0.0%	Seg 1	3.00	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	4.00	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	15	4	5	149.37	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.41
								Seg 2	12.30	45	10	4	612.42	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	1.12	0.00	0.00	0.00	1.16
						Path LA3	50.0%	Seg 1	3.00	15	4	5	149.37	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.41
								Seg 2	48.00	45	10	4	2389.93	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.01	0.00	0.00	0.00	0.00	0.01	4.39	0.00	0.00	0.00	4.54
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	100	OFSRL	0.0%	Seg 1	3.00	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	4.00	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	15	4	5	149.37	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.41
								Seg 2	12.30	45	10	4	612.42	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	1.12	0.00	0.00	0.00	1.16
						Path LA3	50.0%	Seg 1	3.00	15	4	5	149.37	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.41
								Seg 2	48.00	45	10	4	2389.93	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.01	0.00	0.00	0.00	0.00	0.01	4.39	0.00	0.00	0.00	4.54
			3 Non-Rush Hour - 74%	Arriving / Departing	567	OFSRL	0.0%	Seg 1	3.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	4.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	20	5	5	850.26	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.01	0.00	0.00	0.00	0.00	0.00	2.05	0.00	0.00	0.00	2.12
								Seg 2	12.30	50	11	4	3486.08	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.01	0.00	0.00	0.00	0.00	0.01	6.15	0.00	0.00	0.00	6.35
						Path LA3	50.0%	Seg 1	3.00	20	5	5	850.26	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.01	0.00	0.00	0.00	0.00	0.00	2.05	0.00	0.00	0.00	2.12
								Seg 2	48.00	50	11	4	13604.20	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.06	0.00	0.00	0.00	0.00	0.03	23.99	0.00	0.00	0.00	24.79
				Totals	**766**								**25392.983**											**0.12**	**0.01**	**0.00**	**0.00**	**0.00**	**0.06**	**46.84**	**0.00**	**0.01**	**0.00**	**48.40**

Union Pier Heavy Duty Vehicles Emissions

OFF TERMINAL (tpy)

	# Trips	Avg Dist	VMT	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Loads & Empties	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobtails	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chassis	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Containers	0	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Breakbulk	766	33.2	25,392.98	0.12	0.01	0.00	0.00	0.00	0.06	46.84	0.00	0.01	0.00	48.40
Total	766	--	25,392.98	0.12	0.01	0.00	0.00	0.00	0.06	46.84	0.00	0.01	0.00	48.40

ON TERMINAL (tpy)

	# Visits (1/2 trips)	Hrs/Visit	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Loads & Empties													
Bobtails													
Chassis													
Subtotal Containers	--	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Breakbulk	383	0.88	0.02	0.00	0.00	0.00	0.00	0.01	3.29	0.00	0.00	0.00	3.41
Total	383.00125		0.02	0.00	0.00	0.00	0.00	0.01	3.29	0.00	0.00	0.00	3.41

TOTAL (tpy)

	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Loads & Empties											
Bobtails											
Chassis											
Subtotal Containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Breakbulk	0.14	0.01	0.00	0.01	0.00	0.07	50.13	0.00	0.01	0.00	51.81
Total	0.14	0.01	0.00	0.01	0.00	0.07	50.13	0.00	0.01	0.00	51.81

Wando Welch Heavy Duty Vehicles

Container Truck Visits per Year	980,208	Breakbulk Visits	137
Container Truck Trips	1,960,416	Breakbulk Truck Trips	275
On-Terminal Miles	1.9	On-Terminal Miles	1.9

Road Trucks on-terminal

Container Truck Turn Time		0.88	hrs
Idle	78%	0.69	hrs/truck arrival
Moving (10 mph)	22%	0.19	hrs/truck arrival
Total per truck arrival (truck visit)		0.88	Truck Turn Time

Arriving Trucks	Annual Hours
980,208	679,610.9
	Annual VMT
980,208	1,862,395.2
980,208	

Breakbulk Truck Turn Time		0.88	hrs
Idle	78%	0.69	hrs/truck arrival
Moving (10 mph)	22%	0.19	hrs/truck arrival
Total per truck arrival (truck visit)		0.88	Truck Turn Time

Arriving Trucks	Annual Hours
137	95.3
	Annual VMT
137	261.1
137	

Container Truck Emissions

	Emission Factors										**Emissions (short tons)**										
	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
	48.895	1.211	1.114	2.795	0.026	18.227	7,756.040	0.369	0.878	0.352	36.63	0.91	0.83	2.09	0.02	13.65	5,810.38	0.28	0.66	0.26	6,013.29
	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
	11.854	1.442	0.378	0.510	0.009	6.212	2,666.030	0.073	0.295	0.141	24.34	2.96	0.78	1.05	0.02	12.75	5,473.20	0.15	0.61	0.29	5,657.25
Container Truck Total Emissions											60.97	3.87	1.61	3.14	0.04	26.41	11,283.58	0.43	1.26	0.55	11,670.54

Breakbulk Truck Emissions

	Emission Factors										**Emissions (short tons)**										
	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
	48.895	1.211	1.114	2.795	0.026	18.227	7,756.040	0.369	0.878	0.352	0.01	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.84
	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
	11.854	1.442	0.378	0.510	0.009	6.212	2,666.030	0.073	0.295	0.141	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.79
Breakbulk Truck Total Emissions											0.01	0.00	0.00	0.00	0.00	0.00	1.58	0.00	0.00	0.00	1.64
Total on Terminal											60.97	3.87	1.61	3.14	0.04	26.41	11,285.16	0.43	1.26	0.55	11,672.17

Road Truck Trips (off-terminal) 1960691

Truck Trips	Truck Trips	Truck Type	Time Period		# Trips per Year		% of Trips		Dist (mi)	Avg Speed	Speed Bin	Road Type	VMT	NOx (g/VMT)	PM10 (g/VMT)	PM2.5 (g/VMT)	HC (g/VMT)	SO2 (g/VMT)	CO (g/VMT)	CO2 (g/VMT)	CH4 (g/VMT)	N2O (g/VMT)	BC (g/VMT)	NOx (tpy)	PM10 (tpy)	PM2.5 (tpy)	HC (tpy)	SO2 (tpy)	CO (tpy)	CO2 (tpy)	CH4 (tpy)	N2O (tpy)	BC (tpy)	CO2e (tpy)
														Speed Specific Emission Factors										Emissions (short tons)										
1960416	98021	5% Bobtails	1 Weekday AM Rush Hour - 13%	Arriving / Departing	12,743	Path BA1	100%	Seg 1	3.00	15	4	5	38,228.11	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.39	0.04	0.01	0.02	0.00	0.21	101.18	0.00	0.01	0.01	104.57
								Seg 2	10.50	45	10	4	133,798.39	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.63	0.04	0.02	0.02	0.00	0.30	245.74	0.00	0.03	0.01	253.95
						Path BA2	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path BA3	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	12,743	Path BA1	100%	Seg 1	3.00	15	4	5	38,228.11	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.39	0.04	0.01	0.02	0.00	0.21	101.18	0.00	0.01	0.01	104.57
								Seg 2	10.50	45	10	4	133,798.39	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.63	0.04	0.02	0.02	0.00	0.30	245.74	0.00	0.03	0.01	253.95
						Path BA2	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path BA3	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			3 Non-Rush Hour - 74%	Arriving / Departing	72,535	Path BA1	100%	Seg 1	3.00	20	5	5	217,606.18	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	1.85	0.16	0.06	0.07	0.00	0.95	524.21	0.01	0.06	0.03	541.76
								Seg 2	10.50	50	11	4	761,621.62	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	3.23	0.17	0.10	0.12	0.00	1.55	1,342.90	0.01	0.15	0.06	1,387.64
						Path BA2	0%	Seg 1	0.00	30	7	5	0.00	6.165	0.486	0.211	0.210	0.007	3.049	1,969.870	0.032	0.218	0.111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path BA3	0%	Seg 1	0.00	30	7	5	0.00	6.165	0.486	0.211	0.210	0.007	3.049	1,969.870	0.032	0.218	0.111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	98021	5% Chassis	1 Weekday AM Rush Hour - 13%	Arriving / Departing	12,743	OFSRL	100%	Seg 1	3.00	15	4	5	38,228.11	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.39	0.04	0.01	0.02	0.00	0.21	101.18	0.00	0.01	0.01	104.57
								Seg 2	9.75	35	8	4	124,241.36	5.068	0.377	0.162	0.180	0.006	2.513	1,722.220	0.025	0.191	0.086	0.69	0.05	0.02	0.02	0.00	0.34	235.86	0.00	0.03	0.01	243.75
						Path CA2	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path CA3	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	12,743	OFSRL	100%	Seg 1	3.00	15	4	5	38,228.11	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.39	0.04	0.01	0.02	0.00	0.21	101.18	0.00	0.01	0.01	104.57
								Seg 2	9.75	35	8	4	124,241.36	5.068	0.377	0.162	0.180	0.006	2.513	1,722.220	0.025	0.191	0.086	0.69	0.05	0.02	0.02	0.00	0.34	235.86	0.00	0.03	0.01	243.75
						Path CA2	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path CA3	0%	Seg 1	0.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	40	9	4	0.00	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			3 Non-Rush Hour - 74%	Arriving / Departing	72,535	OFSRL	100%	Seg 1	3.00	20	5	5	217,606.18	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	1.85	0.16	0.06	0.07	0.00	0.95	524.21	0.01	0.06	0.03	541.76
								Seg 2	9.75	40	9	4	707,220.07	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	3.60	0.24	0.11	0.13	0.00	1.76	1,318.01	0.02	0.15	0.06	1,362.07
						Path CA2	0%	Seg 1	0.00	30	7	5	0.00	6.165	0.486	0.211	0.210	0.007	3.049	1,969.870	0.032	0.218	0.111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Path CA3	0%	Seg 1	0.00	30	7	5	0.00	6.165	0.486	0.211	0.210	0.007	3.049	1,969.870	0.032	0.218	0.111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	0.00	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1764374	90% Loads & Empties	1 Weekday AM Rush Hour - 13%	Arriving / Departing	229,369	OFSRL	23.0%	Seg 1	3.00	15	4	5	158,264.38	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	1.63	0.16	0.05	0.06	0.00	0.87	418.90	0.01	0.05	0.02	432.91
								Seg 2	9.75	45	10	4	514,359.25	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	2.42	0.15	0.08	0.09	0.00	1.16	944.69	0.01	0.10	0.04	976.24
						LOCAL	16.1%	Seg 1	3.00	15	4	5	110,785.07	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	1.14	0.11	0.04	0.04	0.00	0.61	293.23	0.01	0.03	0.02	303.04
								Seg 2	13.50	45	10	4	498,532.81	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	2.35	0.14	0.07	0.08	0.00	1.13	915.62	0.01	0.10	0.04	946.21
						Path LA3	60.9%	Seg 1	3.00	15	4	5	419,056.56	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	4.32	0.43	0.14	0.17	0.00	2.31	1,109.18	0.02	0.12	0.06	1,146.27
								Seg 2	49.00	45	10	4	6,844,590.54	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	32.22	1.94	1.00	1.16	0.04	15.48	12,570.96	0.15	1.40	0.57	12,990.91
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	229,369	OFSRL	23.0%	Seg 1	3.00	15	4	5	158,264.38	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	1.63	0.16	0.05	0.06	0.00	0.87	418.90	0.01	0.05	0.02	432.91
								Seg 2	9.75	45	10	4	514,359.25	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	2.42	0.15	0.08	0.09	0.00	1.16	944.69	0.01	0.10	0.04	976.24
						LOCAL	16.1%	Seg 1	3.00	15	4	5	110,785.07	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	1.14	0.11	0.04	0.04	0.00	0.61	293.23	0.01	0.03	0.02	303.04
								Seg 2	13.50	45	10	4	498,532.81	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	2.35	0.14	0.07	0.08	0.00	1.13	915.62	0.01	0.10	0.04	946.21
						Path LA3	60.9%	Seg 1	3.00	15	4	5	419,056.56	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	4.32	0.43	0.14	0.17	0.00	2.31	1,109.18	0.02	0.12	0.06	1,146.27
								Seg 2	49.00	45	10	4	6,844,590.54	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	32.22	1.94	1.00	1.16	0.04	15.48	12,570.96	0.15	1.40	0.57	12,990.91
			3 Non-Rush Hour - 74%	Arriving / Departing	1,305,637	OFSRL	23.0%	Seg 1	3.00	20	5	5	900,889.57	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	7.64	0.65	0.25	0.27	0.01	3.93	2,170.23	0.04	0.24	0.12	2,242.88
								Seg 2	9.75	50	11	4	2,927,891.10	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	12.42	0.65	0.37	0.45	0.02	5.97	5,162.50	0.06	0.57	0.21	5,334.48
						LOCAL	16.1%	Seg 1	3.00	20	5	5	630,622.70	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	5.35	0.46	0.17	0.19	0.01	2.75	1,519.16	0.03	0.17	0.09	1,570.02
								Seg 2	13.50	50	11	4	2,837,802.14	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	12.04	0.63	0.36	0.44	0.02	5.78	5,003.65	0.05	0.55	0.21	5,170.35
						Path LA3	60.9%	Seg 1	3.00	20	5	5	2,385,398.90	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	20.23	1.72	0.66	0.73	0.02	10.41	5,746.40	0.11	0.64	0.32	5,938.77
								Seg 2	49.00	50	11	4	38,961,515.39	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	165.31	8.66	4.89	6.04	0.23	79.38	68,697.45	0.74	7.62	2.82	70,986.10
275	275	Breakbulk Trips	1 Weekday AM Rush Hour - 13%	Arriving / Departing	36	OFSRL	0.0%	Seg 1	3.00	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	9.75	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	15	4	5	53.60	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.15
								Seg 2	13.50	45	10	4	241.18	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.46
						Path LA3	50.0%	Seg 1	3.00	15	4	5	53.60	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.15
								Seg 2	49.00	45	10	4	875.41	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	1.61	0.00	0.00	0.00	1.66
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	36	OFSRL	0.0%	Seg 1	3.00	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	9.75	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	15	4	5	53.60	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.15
								Seg 2	13.50	45	10	4	241.18	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.46
						Path LA3	50.0%	Seg 1	3.00	15	4	5	53.60	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.15
								Seg 2	49.00	45	10	4	875.41	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	1.61	0.00	0.00	0.00	1.66
			3 Non-Rush Hour - 74%	Arriving / Departing	203	OFSRL	0.0%	Seg 1	3.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	9.75	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						LOCAL	50.0%	Seg 1	3.00	20	5	5	305.09	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.76
								Seg 2	13.50	50	11	4	1,372.89	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.01	0.00	0.00	0.00	0.00	0.00	2.42	0.00	0.00	0.00	2.50
						Path LA3	50.0%	Seg 1	3.00	20	5	5	305.09	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.76
								Seg 2	49.00	50	11	4	4,983.08	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.02	0.00	0.00	0.00	0.00	0.01	8.79	0.00	0.00	0.00	9.08
				Totals	1,960,691								68,317,756.73											325.94	19.71	9.92	11.89	0.42	158.73	125,899.20	1.54	13.96	5.51	130,098.58

Wando Welch Heavy Duty Vehicles Emissions

	# Trips	Avg Dist	VMT	OFF TERMINAL (tpy) NOx	PM10	PM2.5	HC	SO2	CO	CO2	CH4	N2O	BC	CO2e	# Visits (1/2 trips)	Hrs/Visit	ON TERMINAL (tpy) NOx	PM10	PM2.5	HC	SO2	CO	CO2	CH4	N2O	BC	CO2e	TOTAL (tpy) NOx	PM10	PM2.5	HC	SO2	CO	CO2	CH4	N2O	BC	CO2e
Loads & Empties	1,764,374	37.3	65,735,297.02	311.15	18.64	9.45	11.35	0.41	151.36	120,804.57	1.46	13.40	5.26	124,833.76																								
Bobtails	98,021	13.5	1,323,280.80	7.12	0.48	0.22	0.26	0.01	3.53	2,560.96	0.03	0.28	0.12	2,646.43																								
Chassis	98,021	12.8	1,249,765.20	7.62	0.58	0.24	0.27	0.01	3.82	2,516.32	0.04	0.28	0.13	2,600.47																								
Subtotal Containers	1,960,416	--	68,308,343.02	325.89	19.70	9.92	11.89	0.42	158.71	125,881.85	1.54	13.96	5.51	130,080.66	980,208	0.88	60.97	3.87	1.61	3.14	0.04	26.41	11,283.58	0.43	1.26	0.55	11,670.54	386.86	23.57	11.53	15.03	0.46	185.11	137,165.43	1.96	15.22	6.06	141,751.19
Subtotal Breakbulk	275	34.3	9,413.70	0.04	0.00	0.00	0.00	0.00	0.02	17.35	0.00	0.00	0.00	17.92	137	0.88	0.01	0.00	0.00	0.00	0.00	0.00	1.58	0.00	0.00	0.00	1.64	0.05	0.00	0.00	0.00	0.00	0.03	18.93	0.00	0.00	0.00	19.56
Total	1,960,691	--	68,317,756.73	325.94	19.71	9.92	11.89	0.42	158.73	125,899.20	1.54	13.96	5.51	130,098.58	980,345		60.97	3.87	1.61	3.14	0.04	26.41	11,285.16	0.43	1.26	0.55	11,672.17	386.91	23.58	11.53	15.03	0.46	185.14	137,184.36	1.96	15.23	6.06	141,770.75

Hugh Leatherman Heavy Duty Vehicles

Container Truck Visits per Year	95,430
Container Truck Trips	190,860
On-Terminal Miles	2.0

Breakbulk Visits	--
Breakbulk Truck Trips	0
On-Terminal Miles	2.0

Road Trucks on-terminal

Container Truck Turn Time		0.88	hrs
Idle	77%	0.68	hrs/truck arrival
Moving (10 mph)	23%	0.2	hrs/truck arrival
Total per truck arrival (truck visit)		0.88	Truck Turn Time

Arriving Trucks	Annual Hours
95,430	65,210.5
	Annual VMT
95,430	190,860.0
95,430	

Breakbulk Truck Turn Time		0.88	hrs
Idle	77%	0.68	hrs/truck arrival
Moving (10 mph)	23%	0.2	hrs/truck arrival
Total per truck arrival (truck visit)		0.88	Truck Turn Time

Arriving Trucks	Annual Hours
0	0.0
	Annual VMT
0	0.0
0	

Container Truck Emissions

Emission Factors										Emissions (short tons)										
NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
48.895	1.211	1.114	2.795	0.026	18.227	7,756.040	0.369	0.878	0.352	3.51	0.09	0.08	0.20	0.00	1.31	557.52	0.03	0.06	0.03	576.99
(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
11.854	1.442	0.378	0.510	0.009	6.212	2,666.030	0.073	0.295	0.141	2.49	0.30	0.08	0.11	0.00	1.31	560.90	0.02	0.06	0.03	579.76
									Container Truck Total Emissions	6.01	0.39	0.16	0.31	0.00	2.62	1,118.42	0.04	0.13	0.06	1,156.75

Breakbulk Truck Emissions

Emission Factors										Emissions (short tons)										
NOx	PM10	PM2.5	HC	SO2	CO	CO2	CH4	N2O	BC	NOx	PM10	PM2.5	HC	SO2	CO	CO2	CH4	N2O	BC	CO2e
(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
48.895	1.211	1.114	2.795	0.026	18.227	7,756.040	0.369	0.878	0.352	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
11.854	1.442	0.378	0.510	0.009	6.212	2,666.030	0.073	0.295	0.141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									Breakbulk Truck Total Emissions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									Total on Terminal	6.01	0.39	0.16	0.31	0.00	2.62	1,118.42	0.04	0.13	0.06	1,156.75

Road Truck Trips (off-terminal) 190860

Truck Trips	Truck Trips	Truck Type	Time Period		# Trips per Year		% of Trips		Dist (mi)	Avg Speed	Speed Bin	Road Type	VMT	Speed Specific Emission Factors NO_x (g/VMT)	PM_{10} (g/VMT)	$PM_{2.5}$ (g/VMT)	HC (g/VMT)	SO_2 (g/VMT)	CO (g/VMT)	CO_2 (g/VMT)	CH_4 (g/VMT)	N_2O (g/VMT)	BC (g/VMT)	Emissions (short tons) NO_x (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	HC (tpy)	SO_2 (tpy)	CO (tpy)	CO_2 (tpy)	CH_4 (tpy)	N_2O (tpy)	BC (tpy)	CO_2e (tpy)
190860	9543	5% Bobtails	1 Weekday AM Rush Hour - 13%	Arriving / Departing	1,241	Ashley P west of 26	100%	Seg 1	3.00	15	4	5	3,721.77	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.04	0.00	0.00	0.00	0.00	0.02	9.85	0.00	0.00	0.00	10.18
								Seg 2	3.30	45	10	4	4,093.95	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.02	0.00	0.00	0.00	0.00	0.01	7.52	0.00	0.00	0.00	7.77
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	1,241	Ashley P west of 26	100%	Seg 1	3.00	15	4	5	3,721.77	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.04	0.00	0.00	0.00	0.00	0.02	9.85	0.00	0.00	0.00	10.18
								Seg 2	3.30	45	10	4	4,093.95	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.02	0.00	0.00	0.00	0.00	0.01	7.52	0.00	0.00	0.00	7.77
			3 Non-Rush Hour - 74%	Arriving / Departing	7,062	Ashley P west of 26	100%	Seg 1	3.00	20	5	5	21,185.46	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.18	0.02	0.01	0.01	0.00	0.09	51.04	0.00	0.01	0.00	52.74
								Seg 2	3.30	50	11	4	23,304.01	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.10	0.01	0.00	0.00	0.00	0.05	41.09	0.00	0.00	0.00	42.46
	9543	5% Chassis	1 Weekday AM Rush Hour - 13%	Arriving / Departing	1,241	OFSRL	100%	Seg 1	3.00	15	4	5	3,721.77	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.04	0.00	0.00	0.00	0.00	0.02	9.85	0.00	0.00	0.00	10.18
								Seg 2	3.85	35	8	4	4,776.27	5.068	0.377	0.162	0.180	0.006	2.513	1,722.220	0.025	0.191	0.086	0.03	0.00	0.00	0.00	0.00	0.01	9.07	0.00	0.00	0.00	9.37
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	1,241	OFSRL	100%	Seg 1	3.00	15	4	5	3,721.77	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.04	0.00	0.00	0.00	0.00	0.02	9.85	0.00	0.00	0.00	10.18
								Seg 2	3.85	35	8	4	4,776.27	5.068	0.377	0.162	0.180	0.006	2.513	1,722.220	0.025	0.191	0.086	0.03	0.00	0.00	0.00	0.00	0.01	9.07	0.00	0.00	0.00	9.37
			3 Non-Rush Hour - 74%	Arriving / Departing	7,062	OFSRL	100%	Seg 1	3.00	20	5	5	21,185.46	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.18	0.02	0.01	0.01	0.00	0.09	51.04	0.00	0.01	0.00	52.74
								Seg 2	3.85	40	9	4	27,188.01	4.619	0.310	0.146	0.165	0.006	2.254	1,690.680	0.022	0.188	0.080	0.14	0.01	0.00	0.00	0.00	0.07	50.67	0.00	0.01	0.00	52.36
	171774	90% Loads & Empties	1 Weekday AM Rush Hour - 13%	Arriving / Departing	22,331	OFSRL	23.0%	Seg 1	3.00	15	4	5	15,408.13	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.16	0.02	0.01	0.01	0.00	0.08	40.78	0.00	0.00	0.00	42.15
								Seg 2	3.85	45	10	4	19,773.76	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.09	0.01	0.00	0.00	0.00	0.04	36.32	0.00	0.00	0.00	37.53
						LOCAL	16.1%	Seg 1	3.00	15	4	5	10,785.69	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.11	0.01	0.00	0.00	0.00	0.06	28.55	0.00	0.00	0.00	29.50
								Seg 2	6.30	45	10	4	22,649.95	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.11	0.01	0.00	0.00	0.00	0.05	41.60	0.00	0.00	0.00	42.99
						Out of Tri-County	60.9%	Seg 1	1.50	15	4	5	20,399.02	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.21	0.02	0.01	0.01	0.00	0.11	53.99	0.00	0.01	0.00	55.80
								Seg 2	46.50	45	10	4	632,369.66	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	2.98	0.18	0.09	0.11	0.00	1.43	1,161.43	0.01	0.13	0.05	1,200.23
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	22,331	OFSRL	23.0%	Seg 1	3.00	15	4	5	15,408.13	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.16	0.02	0.01	0.01	0.00	0.08	40.78	0.00	0.00	0.00	42.15
								Seg 2	3.85	45	10	4	19,773.76	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.09	0.01	0.00	0.00	0.00	0.04	36.32	0.00	0.00	0.00	37.53
						LOCAL	16.1%	Seg 1	3.00	15	4	5	10,785.69	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.11	0.01	0.00	0.00	0.00	0.06	28.55	0.00	0.00	0.00	29.50
								Seg 2	6.30	45	10	4	22,649.95	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.11	0.01	0.00	0.00	0.00	0.05	41.60	0.00	0.00	0.00	42.99
						Out of Tri-County	60.9%	Seg 1	1.50	15	4	5	20,399.02	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.21	0.02	0.01	0.01	0.00	0.11	53.99	0.00	0.01	0.00	55.80
								Seg 2	46.50	45	10	4	632,369.66	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	2.98	0.18	0.09	0.11	0.00	1.43	1,161.43	0.01	0.13	0.05	1,200.23
			3 Non-Rush Hour - 74%	Arriving / Departing	127,113	OFSRL	23.0%	Seg 1	3.00	20	5	5	87,707.80	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.74	0.06	0.02	0.03	0.00	0.38	211.29	0.00	0.02	0.01	218.36
								Seg 2	3.85	50	11	4	112,558.35	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.48	0.03	0.01	0.02	0.00	0.23	198.46	0.00	0.02	0.01	205.08
						LOCAL	16.1%	Seg 1	3.00	20	5	5	61,395.46	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.52	0.04	0.02	0.02	0.00	0.27	147.90	0.00	0.02	0.01	152.85
								Seg 2	6.30	50	11	4	128,930.47	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.55	0.03	0.02	0.02	0.00	0.26	227.33	0.00	0.03	0.01	234.91
						Out of Tri-County	60.9%	Seg 1	1.50	20	5	5	116,117.51	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.98	0.08	0.03	0.04	0.00	0.51	279.73	0.01	0.03	0.02	289.09
								Seg 2	46.50	50	11	4	3,599,642.69	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	15.27	0.80	0.45	0.56	0.02	7.33	6,346.94	0.07	0.70	0.26	6,558.38
0	0	Breakbulk Trips	1 Weekday AM Rush Hour - 13%	Arriving / Departing	0	LOCAL	50.0%	Seg 1	3.00	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	6.30	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Out of Tri-County	50.0%	Seg 1	1.50	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	46.50	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			2 Weekday PM Rush Hour - 13%	Arriving / Departing	0	LOCAL	50.0%	Seg 1	3.00	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	6.30	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Out of Tri-County	50.0%	Seg 1	1.50	15	4	5	0.00	9.350	0.933	0.302	0.360	0.008	4.999	2,401.190	0.053	0.265	0.133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	46.50	45	10	4	0.00	4.270	0.257	0.133	0.154	0.006	2.052	1,666.160	0.020	0.185	0.075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			3 Non-Rush Hour - 74%	Arriving / Departing	0	LOCAL	50.0%	Seg 1	3.00	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	6.30	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						Out of Tri-County	50.0%	Seg 1	1.50	20	5	5	0.00	7.694	0.655	0.251	0.276	0.007	3.961	2,185.400	0.041	0.242	0.123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								Seg 2	46.50	50	11	4	0.00	3.849	0.202	0.114	0.141	0.005	1.848	1,599.560	0.017	0.177	0.066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				Totals	**190,860**								**5,674,615.17**											**26.70**	**1.59**	**0.81**	**0.97**	**0.04**	**12.98**	**10,403.39**	**0.13**	**1.15**	**0.45**	**10,750.37**

Hugh Leatherman Heavy Duty Vehicles Emissions

	OFF TERMINAL # Trips	Avg Dist	VMT	(tpy) NO_x	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e	ON TERMINAL # Visits (1/2 trips)	Hrs/Visit	(tpy) NO_x	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e	TOTAL (tpy) NO_x	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
Loads & Empties	171,774	32.3	5,549,124.72	25.86	1.52	0.78	0.94	0.03	12.55	10,136.98	0.12	1.12	0.44	10,475.06																								
Bobtails	9,543	6.3	60,120.90	0.39	0.03	0.01	0.01	0.00	0.20	126.87	0.00	0.01	0.01	131.10																								
Chassis	9,543	6.9	65,369.55	0.45	0.04	0.01	0.02	0.00	0.23	139.54	0.00	0.02	0.01	144.21																								
Subtotal Containers	190,860	--	5,674,615.17	26.70	1.59	0.81	0.97	0.04	12.98	10,403.39	0.13	1.15	0.45	10,750.37	95,430.00	0.88	6.01	0.39	0.16	0.31	0.00	2.62	1,118.42	0.04	0.13	0.06	1,156.75	32.71	1.98	0.97	1.28	0.04	15.59	11,521.81	0.17	1.28	0.51	11,907.12
Subtotal Breakbulk	0	28.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	190,860	--	5,674,615.17	26.70	1.59	0.81	0.97	0.04	12.98	10,403.39	0.13	1.15	0.45	10,750.37	95,430.00		6.01	0.39	0.16	0.31	0.00	2.62	1,118.42	0.04	0.13	0.06	1,156.75	32.71	1.98	0.97	1.28	0.04	15.59	11,521.81	0.17	1.28	0.51	11,907.12

Inland Port Dillon Heavy Duty Vehicles

Container Truck Visits per Year	20,162
On-Terminal Miles	1.4

Road Trucks on-terminal

Container Truck Turn Time		0.15	hrs
Idle	2%	0.00	hrs/truck arrival
Moving (10 mph)	98%	0.1421	hrs/truck arrival
Total per truck arrival (truck visit)		0.15	Truck Turn Time

Arriving Trucks	Annual Hours
20,162	58.5
	Annual VMT
20,162	28,226.8
20,162	

Container Truck Emissions

Emission Factors										Emissions (short tons)										
NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
48.895	1.211	1.114	2.795	0.026	18.227	7,756.040	0.369	0.878	0.352	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.52
(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
11.854	1.442	0.378	0.510	0.009	6.212	2,666.030	0.073	0.295	0.141	0.37	0.04	0.01	0.02	0.00	0.19	82.95	0.00	0.01	0.00	85.74
									Container Truck Total Emissions	0.37	0.04	0.01	0.02	0.00	0.19	83.45	0.00	0.01	0.00	86.26

Inland Port Greer Heavy Duty Vehicles

Container Truck Visits per Year	171,304
On-Terminal Miles	1.0

Road Trucks on-terminal

Container Truck Turn Time		0.15	hrs
Idle	2%	0.00	hrs/truck arrival
Moving (10 mph)	98%	0.1421	hrs/truck arrival
Total per truck arrival (truck visit)		0.15	Truck Turn Time

Arriving Trucks	Annual Hours
171,304	496.8
	Annual VMT
171,304	171,304.0
171,304	

Container Truck Emissions

Emission Factors										Emissions (short tons)										
NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	NO_X	PM_{10}	$PM_{2.5}$	HC	SO_2	CO	CO_2	CH_4	N_2O	BC	CO_2e
(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(g/hr)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
48.895	1.211	1.114	2.795	0.026	18.227	7,756.040	0.369	0.878	0.352	0.03	0.00	0.00	0.00	0.00	0.01	4.25	0.00	0.00	0.00	4.40
(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)	(g/VMT)											
11.854	1.442	0.378	0.510	0.009	6.212	2,666.030	0.073	0.295	0.141	2.24	0.27	0.07	0.10	0.00	1.17	503.43	0.01	0.06	0.03	520.36
									Container Truck Total Emissions	2.27	0.27	0.07	0.10	0.00	1.18	507.67	0.01	0.06	0.03	524.75
									Inland Port Total	2.64	0.32	0.08	0.11	0.00	1.38	591.13	0.02	0.07	0.03	611.01

NON-ROAD ENGINES – CONTAINER HANDLING EQUIPMENT

2021 EMISSIONS CALCULATIONS

Emission Rates

Yard Trucks Emissions Summary (tons/yr)												
Terminal	HC	CO	NOX	PM	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e	BC
NCT	0.11	0.54	1.68	0.12	0.12	0.12	0.01	3,114.90	0.01	0.14	3,157.91	0.09
IPG	0.03	0.16	0.51	0.04	0.04	0.03	0.00	944.17	0.00	0.04	957.21	0.03
WWT	0.73	3.49	10.75	0.76	0.76	0.74	0.05	19,956.78	0.06	0.92	20,232.35	0.57
IPD	0.00	0.02	0.07	0.01	0.01	0.00	0.00	131.72	0.00	0.01	133.54	0.00
HLT	0.00	0.01	0.04	0.00	0.00	0.00	0.00	80.58	0.00	0.00	81.69	0.00
Total	0.88	4.23	13.05	0.92	0.92	0.90	0.07	24,228.14	0.07	1.12	24,562.70	0.69

Forklifts Emissions Summary (tons/yr)												
Terminal	HC	CO	NOX	PM	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e	BC
CST	0.00	0.01	0.03	0.00	0.00	0.00	0.00	60.33	0.00	0.00	61.16	0.00
UPT	0.00	0.02	0.05	0.00	0.00	0.00	0.00	92.83	0.00	0.00	94.11	0.00
NCT	0.00	0.03	0.09	0.01	0.01	0.01	0.00	177.90	0.00	0.01	180.35	0.01
IPG	0.00	0.01	0.03	0.00	0.00	0.00	0.00	54.08	0.00	0.00	54.82	0.00
WWT	0.00	0.03	0.09	0.01	0.01	0.01	0.00	188.60	0.00	0.01	191.20	0.01
HLT	0.00	0.02	0.05	0.00	0.00	0.00	0.00	100.49	0.00	0.00	101.88	0.00
Total	0.02	0.11	0.33	0.03	0.03	0.03	0.00	674.23	0.00	0.03	683.53	0.02

Rubber-Tired Gantry (RTG) Cranes Emissions Summary (tons/yr)												
Terminal	HC	CO	NOX	PM	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e	BC
CST	0.16	1.01	3.35	0.14	0.14	0.13	0.00	701.64	0.01	0.03	711.54	0.10
NCT	0.75	5.33	14.57	0.65	0.65	0.63	0.01	4,542.31	0.05	0.21	4,605.99	0.48
IPG	0.86	5.46	16.42	0.72	0.72	0.70	0.02	5,118.42	0.06	0.24	5,190.21	0.54
WWT	5.40	30.93	102.44	4.44	4.44	4.31	0.10	32,048.84	0.37	1.48	32,498.46	3.32
IPD	0.14	0.70	2.58	0.11	0.11	0.11	0.00	805.08	0.01	0.04	816.38	0.08
HLT	0.12	0.54	2.34	0.13	0.13	0.13	0.00	1,033.10	0.01	0.05	1,047.55	0.10
Total	7.42	43.97	141.70	6.19	6.19	6.01	0.13	44,249.39	0.51	2.04	44,870.13	4.63

Container Handlers Emissions Summary (tons/yr)												
Terminal	HC	CO	NOX	PM	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e	BC
NCT	0.33	1.61	5.97	0.26	0.26	0.25	0.01	2,056.38	0.02	0.09	2,085.21	0.19
IPG	0.09	0.35	1.42	0.07	0.07	0.07	0.00	836.28	0.01	0.04	847.97	0.05
WWT	0.91	4.04	15.70	0.71	0.71	0.69	0.02	7,151.46	0.07	0.33	7,251.55	0.53
HLT	0.02	0.08	0.34	0.02	0.02	0.02	0.00	200.13	0.00	0.01	202.93	0.01
Total	1.35	6.08	23.43	1.05	1.05	1.02	0.03	10,244.25	0.11	0.47	10,387.65	0.78

Total Emissions Summary by Terminal (tons/yr)												
Terminal	HC	CO	NOX	PM	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e	BC
CST	0.16	1.02	3.38	0.14	0.14	0.14	0.00	761.97	0.01	0.04	772.70	0.10
UPT	0.00	0.02	0.05	0.00	0.00	0.00	0.00	92.83	0.00	0.00	94.11	0.00
NCT	1.19	7.51	22.31	1.03	1.03	1.00	0.03	9,891.49	0.08	0.46	10,029.47	0.77
IPG	0.98	5.98	18.37	0.83	0.83	0.80	0.02	6,952.95	0.07	0.32	7,050.20	0.62
WWT	7.05	38.49	128.98	5.92	5.92	5.74	0.17	59,345.68	0.51	2.74	60,173.56	4.42
IPD	0.14	0.73	2.65	0.12	0.12	0.11	0.00	936.79	0.01	0.04	949.91	0.09
HLT	0.15	0.65	2.77	0.16	0.16	0.15	0.00	1,414.30	0.01	0.07	1,434.05	0.12
Total	9.67	54.39	178.51	8.20	8.20	7.95	0.23	79,396.01	0.69	3.66	80,504.00	6.12

Emissions Summary for Rail Cargo Handling Equipment (tons/yr)												
Railway Companies	HC	CO	NOX	PM	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e	BC
Total	0.71	3.43	12.89	0.58	0.58	0.56	0.02	5,286.89	0.05	0.24	5,360.84	0.43

Emissions Summary Overall (tons/yr)												
	HC	CO	NOX	PM	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e	BC
Total	10.38	57.83	191.40	8.78	8.78	8.51	0.25	84,682.90	0.75	3.90	85,864.85	6.55

Emission Factors for Nonroad Engines

Equipment Type	MOVES Equipment Name[1]	SCC[2]	Fuel Type	Load Factor[3]	Horsepower Range (hp)	MOVES Emission Factors[4] Brake-Specific Fuel Consumption (g/hp-hr)	HC (g/hp-hr)	CO (g/hp-hr)	NO_X (g/hp-hr)	PM[5] (g/hp-hr)	PM_{10} (g/hp-hr)	$PM_{2.5}$ (g/hp-hr)	SO_2 (g/hp-hr)	CO_2 (g/hp-hr)	CH_4 (g/hp-hr)	N_2O[6] (g/hp-hr)	BC[7] (g/hp-hr)
Yard Truck	Terminal Tractors	2270003070	Nonroad Diesel	0.39	175 < hp <= 300	168.283	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015
Crane, RTG	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	300 < hp <= 600	166.468	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
Crane, RTG	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	600 < hp <= 750	166.468	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
Crane, RTG / Hybrid	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	100 < hp <= 175	166.468	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
Crane, Truck	Cranes	2270002045	Nonroad Diesel	0.43	175 < hp <= 300	166.468	0.057	0.164	0.778	0.036	0.036	0.035	0.001	530.865	0.004	0.024	0.027
Crane, Truck	Cranes	2270002045	Nonroad Diesel	0.43	300 < hp <= 600	166.468	0.133	0.701	2.820	0.108	0.108	0.105	0.002	530.627	0.009	0.024	0.081
Crane, Truck	Cranes	2270002045	Nonroad Diesel	0.43	600 < hp <= 750	166.468	0.126	0.947	2.775	0.115	0.115	0.111	0.002	530.649	0.008	0.024	0.086
Container Handler, Empty	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	175 < hp <= 300	166.468	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
Container Handler, Full	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	175 < hp <= 300	166.468	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
Container Handler, Full	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	300 < hp <= 600	166.468	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
Forklifts	Forklifts	2270003020	Nonroad Diesel	0.59	100 < hp <= 175	168.283	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
Forklifts	Forklifts	2270003020	Nonroad Diesel	0.59	175 < hp <= 300	168.283	0.013	0.049	0.178	0.012	0.012	0.012	0.001	536.788	0.001	0.025	0.009
Machine Lift	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	300 < hp <= 600	166.468	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
Reach Stacker	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	175 < hp <= 300	166.468	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
Side Loader	Other General Industrial Equipment	2270003040	Nonroad Diesel	0.43	100 < hp <= 175	166.468	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051

Notes

[1] Names assigned according to Table 6.1 of the U.S. EPA Ports Emissions Inventory Guidance, Section 6.3.1 (April 2022).
[2] SCC codes assigned according to Table 6.2 of the U.S. EPA Ports Emissions Inventory Guidance, Section 6.3.1 (April 2022).
[3] Load factor assigned according to Table 6.4 of the U.S. EPA Ports Emissions Inventory Guidance, Section 6.4 (April 2022).
[4] Emission factors are from U.S. EPA's MOVES Program, Version 4.0.1. Emission factors are for Charleston County, SC for 2021.
[5] Total PM emission factors are not available. Assumes PM = PM_{10}.
[6] Emission factors for N_2O are calculated according to Equation 6.2 in the U.S. EPA Ports Emissions Inventory Guidance, Section 6.5.2 (April 2022).
[7] Emission factors for Black Carbon (BC) are calculated according to Equation 6.3 in the U.S. EPA Ports Emissions Inventory Guidance, Section 6.5.3 (April 2022).

Emission Factors for Yard Trucks

Equipment Inventory		Operation					Emission Factors (g/bhp-hr)											
Equipment Type[1]	Terminal	HP (for calc.)[2]	Fuel	Load Factor	2021 Operating Hours[3]	2021 Fuel Use (gal)	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
Yard Trucks - Leased	WWT	200	ULSD	0.39	59,365	54,789	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015
Yard Trucks - Leased	NCT	200	ULSD	0.39	6,799	4,274	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015
Yard Trucks - Leased	IPD	200	ULSD	0.39	2,854	3,142	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015
Yard Trucks - Leased	IPG	200	ULSD	0.39	20,458	32,628	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015
Yard Trucks - Leased	HLT	200	ULSD	0.39	1,746	2,124	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015
Yard Trucks	WWT	200	ULSD	0.39	373,053	618,142	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015
Yard Trucks	NCT	200	ULSD	0.39	60,694	100,569	0.020	0.094	0.289	0.020	0.020	0.020	0.001	536.769	0.002	0.025	0.015

[1] Yard trucks are representative of entire fleet at each terminal.

[2] Specific engine information including horsepower was not available. A representative horsepower was chosen based on similar equipment.

[3] For non-leased Yard Trucks, operating hours were provided as a total for both WWT and NCT. The operating hours have been allocated based on the fuel usage data provided.

Emission Rates for Yard Trucks

Equipment Inventory		Operation					Emission Rates (lbs/yr)											
Equipment Type[(1)]	Terminal	HP (for calc.)[(2)]	Fuel	Load Factor	2021 Operating Hours[(3)]	2021 Fuel Use (gal)	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	BC
Yard Trucks - Leased	WWT	200	ULSD	0.39	59,365	54,789	199.86	957.53	2,950.48	209.14	209.14	202.86	14.74	5,479,576.19	16.38	252.53	5,555,240.20	156.20
Yard Trucks - Leased	NCT	200	ULSD	0.39	6,799	4,274	22.89	109.66	337.91	23.95	23.95	23.23	1.69	627,569.08	1.88	28.92	636,234.79	17.89
Yard Trucks - Leased	IPD	200	ULSD	0.39	2,854	3,142	9.61	46.03	141.85	10.05	10.05	9.75	0.71	263,433.18	0.79	12.14	267,070.76	7.51
Yard Trucks - Leased	IPG	200	ULSD	0.39	20,458	32,628	68.88	329.98	1,016.77	72.07	72.07	69.91	5.08	1,888,337.74	5.65	87.03	1,914,412.60	53.83
Yard Trucks - Leased	HLT	200	ULSD	0.39	1,746	2,124	5.88	28.16	86.78	6.15	6.15	5.97	0.43	161,161.29	0.48	7.43	163,386.67	4.59
Yard Trucks	WWT	200	ULSD	0.39	373,053	618,142	1,255.94	6,017.17	18,540.96	1,314.22	1,314.22	1,274.79	92.61	34,433,976.95	102.95	1,586.92	34,909,454.01	981.59
Yard Trucks	NCT	200	ULSD	0.39	60,694	100,569	204.34	978.96	3,016.52	213.82	213.82	207.40	15.07	5,602,235.17	16.75	258.18	5,679,592.90	159.70
Total Hours, Fuel (gal) and Emissions (lbs/yr)					524,969	815,667	1,767	8,467	26,091	1,849	1,849	1,794	130	48,456,290	145	2,233	49,125,392	1,381

(1) Yard trucks are representative of entire fleet at each terminal.

(2) Specific engine information including horsepower was not available. A representative horsepower was chosen based on similar equipment.

(3) For non-leased Yard Trucks, operating hours were provided as a total for both WWT and NCT. The operating hours have been allocated based on the fuel usage data provided.

Emission Factors for Forklifts

Equipment Inventory					Operation				Emission Factors (g/bhp-hr)											
Equipment ID	Equipment Type	Equipment Model No.	Capacity (lbs)	Terminal	HP	Fuel	Load Factor	2021 Operating Hours(1)	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
M-75-148	Forklift	H360XL	36,000	UPT	144.2	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-159	Forklift	H360XL	36,000	HLT	144.2	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-160	Forklift	H360XL	36,000	UPT	144.2	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-167	Forklift	H550F	55,000	NCT	185	ULSD	0.59	303	0.013	0.049	0.178	0.012	0.012	0.012	0.001	536.788	0.001	0.025	0.009
M-75-171	Forklift	H360XL2	33,500	NCT	144.2	ULSD	0.59	75	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-180	Forklift	DCD-250-12LB	55,000	WWT	234	ULSD	0.59	303	0.013	0.049	0.178	0.012	0.012	0.012	0.001	536.788	0.001	0.025	0.009
M-75-181	Forklift	H360XL2	36,000	NCT	144.2	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-190	Forklift	DCD-250-12LB	55,000	CST	234	ULSD	0.59	303	0.013	0.049	0.178	0.012	0.012	0.012	0.001	536.788	0.001	0.025	0.009
M-75-205	Forklift	DCE 160-12	36,000	WWT	173	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-209	Forklift	DCE160-12	36,000	WWT	168	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-210	Forklift	DCE 160-12	36,000	NCT	168	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-218	Forklift	DCE 160-12	36,000	NCT	168	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-220	Forklift	H360-48HD2	36,000	IPG	168	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-232	Forklift	DCG-250-12	55,000	CST	168	ULSD	0.59	303	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-234	Forklift	H360-48HD	35,000	WWT	168	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-239	Forklift	H360-XD48	36,000	HLT	168	ULSD	0.59	922	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016
M-75-245	Forklift	H550XD48	55,000	CST	168	ULSD	0.59	303	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016

(1) Operating hours were not available for forklifts. Operating hours have been estimated based on the 2017 Emissions Inventory. Operating hours have been scaled with the overall SCPA container volumes handled in 2017 and 2021.

Emission Rates for Forklifts

Equipment Inventory					Operation				Emission Rates (lbs/yr)											
Equipment ID	Equipment Type	Equipment Model No.	Capacity (lbs)	Terminal	HP	Fuel	Load Factor	2021 Operating Hours[(1)]	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	BC
M-75-148	Forklift	H360XL	36,000	UPT	144.2	ULSD	0.59	922	2.21	15.38	46.84	3.77	3.77	3.65	0.25	92,829.85	0.19	4.28	94,109.48	2.81
M-75-159	Forklift	H360XL	36,000	HLT	144.2	ULSD	0.59	922	2.21	15.38	46.84	3.77	3.77	3.65	0.25	92,829.85	0.19	4.28	94,109.48	2.81
M-75-160	Forklift	H360XL	36,000	UPT	144.2	ULSD	0.59	922	2.21	15.38	46.84	3.77	3.77	3.65	0.25	92,829.85	0.19	4.28	94,109.48	2.81
M-75-167	Forklift	H550F	55,000	NCT	185	ULSD	0.59	303	0.98	3.58	12.96	0.89	0.89	0.87	0.10	39,163.22	0.06	1.80	39,702.59	0.67
M-75-171	Forklift	H360XL2	33,500	NCT	144.2	ULSD	0.59	75	0.18	1.24	3.79	0.30	0.30	0.30	0.02	7,506.46	0.02	0.35	7,609.93	0.23
M-75-180	Forklift	DCD-250-12LB	55,000	WWT	234	ULSD	0.59	303	1.24	4.53	16.39	1.13	1.13	1.09	0.13	49,536.18	0.08	2.28	50,218.41	0.84
M-75-181	Forklift	H360XL2	36,000	NCT	144.2	ULSD	0.59	922	2.21	15.38	46.84	3.77	3.77	3.65	0.25	92,829.85	0.19	4.28	94,109.48	2.81
M-75-190	Forklift	DCD-250-12LB	55,000	CST	234	ULSD	0.59	303	1.24	4.53	16.39	1.13	1.13	1.09	0.13	49,536.18	0.08	2.28	50,218.41	0.84
M-75-205	Forklift	DCE 160-12	36,000	WWT	173	ULSD	0.59	922	2.66	18.46	56.20	4.52	4.52	4.38	0.30	111,370.07	0.23	5.13	112,905.27	3.38
M-75-209	Forklift	DCE160-12	36,000	WWT	168	ULSD	0.59	922	2.58	17.92	54.58	4.39	4.39	4.26	0.29	108,151.28	0.22	4.98	109,642.11	3.28
M-75-210	Forklift	DCE 160-12	36,000	NCT	168	ULSD	0.59	922	2.58	17.92	54.58	4.39	4.39	4.26	0.29	108,151.28	0.22	4.98	109,642.11	3.28
M-75-218	Forklift	DCE 160-12	36,000	NCT	168	ULSD	0.59	922	2.58	17.92	54.58	4.39	4.39	4.26	0.29	108,151.28	0.22	4.98	109,642.11	3.28
M-75-220	Forklift	H360-48HD2	36,000	IPG	168	ULSD	0.59	922	2.58	17.92	54.58	4.39	4.39	4.26	0.29	108,151.28	0.22	4.98	109,642.11	3.28
M-75-232	Forklift	DCG-250-12	55,000	CST	168	ULSD	0.59	303	0.85	5.89	17.95	1.44	1.44	1.40	0.09	35,564.57	0.07	1.64	36,054.82	1.08
M-75-234	Forklift	H360-48HD	35,000	WWT	168	ULSD	0.59	922	2.58	17.92	54.58	4.39	4.39	4.26	0.29	108,151.28	0.22	4.98	109,642.11	3.28
M-75-239	Forklift	H360-XD48	36,000	HLT	168	ULSD	0.59	922	2.58	17.92	54.58	4.39	4.39	4.26	0.29	108,151.28	0.22	4.98	109,642.11	3.28
M-75-245	Forklift	H550XD48	55,000	CST	168	ULSD	0.59	303	0.85	5.89	17.95	1.44	1.44	1.40	0.09	35,564.57	0.07	1.64	36,054.82	1.08
							Total Hours and Emissions (lbs/yr)	11,733	32	213	656	52	52	51	4	1,348,468	3	62	1,367,055	39

[(1)] Operating hours were not available for forklifts. Operating hours have been estimated based on the 2017 Emissions Inventory. Operating hours have been scaled with the overall SCPA container volumes handled in 2017 and 2021.

Emission Factors for Railway Cargo Handling Equipment

Equipment Inventory[(1)]	Operation[(1)]				Emission Factors (g/bhp-hr)										
Equipment Type	HP	Fuel	Load Factor	2021 Operating Hours	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
Machine Lift, Taylor 950	425	ULSD	0.43	15,508	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
Machine Lift, Taylor 974	335	ULSD	0.43	15,508	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
Reach Stacker	300	ULSD	0.43	20,677	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
Side Loader	155	ULSD	0.43	5,169	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
Forklift	155	ULSD	0.59	10,338	0.013	0.089	0.271	0.022	0.022	0.021	0.001	536.790	0.001	0.025	0.016

(1) Equipment information was not available for 2021. Operating hours have been estimated based on the 2017 Emissions Inventory. Operating hours have been scaled with the overall SCPA container volumes handled in 2017 and 2021.

Emission Rates for Railway Cargo Handling Equipment

Equipment Inventory[1]	Operation[1]				Emission Rates (lbs/yr)												
Equipment Type	HP	Fuel	Load Factor	2021 Operating Hours	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	BC
Machine Lift, Taylor 950	425	ULSD	0.43	15,508	567.48	2,897.41	10,629.52	453.56	453.56	439.95	10.03	3,316,126.40	39.12	152.89	3,362,666.11	338.76
Machine Lift, Taylor 974	335	ULSD	0.43	15,508	447.31	2,283.84	8,378.57	357.51	357.51	346.78	7.91	2,613,887.86	30.84	120.51	2,650,572.11	267.02
Reach Stacker	300	ULSD	0.43	20,677	330.04	1,289.70	5,297.78	251.61	251.61	244.07	8.95	3,121,695.42	29.86	143.90	3,165,323.30	187.93
Side Loader	155	ULSD	0.43	5,169	46.76	208.88	911.65	52.33	52.33	50.76	1.16	403,206.37	4.13	18.59	408,848.50	39.08
Forklift	155	ULSD	0.59	10,338	26.68	185.41	564.61	45.41	45.41	44.05	2.98	1,118,854.22	2.31	51.56	1,134,277.23	33.91

Total Hours and Emissions (lbs/yr)	67,199	1,418	6,865	25,782	1,160	1,160	1,126	31	10,573,770	106	487	10,721,687	867

[1] Equipment information was not available for 2021. Operating hours have been estimated based on the 2017 Emissions Inventory. Operating hours have been scaled with the overall SCPA container volumes handled in 2017 and 2021.

Emission Factors for Container Handlers

Equipment Inventory					Operation						Emission Factors (g/bhp-hr)										
Equipment ID	Equipment Type	Equipment Model No.	Terminal	Engine Tier	Engine BHP	HP (for calc.)	Fuel	Load Factor	2021 Operating Hours	2021 Fuel Use (gal)	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
H-01-055	Container Handler, Full	C9	IPG	3	300hp @ 2200 rpm	300	ULSD	0.43	105	325	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-062	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	17	64	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-066	Container Handler, Full	C9	WWT	3	300hp @ 2200 rpm	300	ULSD	0.43	0	0	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-068	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	59	217	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-083	Container Handler, Full	C9	WWT	3	300hp @ 2200 rpm	300	ULSD	0.43	493	2,530	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-086	Container Handler, Empty	TWD731VE	WWT	1	210hp @ 1800 rpm	210	ULSD	0.43	47	141	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-087	Container Handler, Empty	TWD731VE	WWT	1	210hp @ 1800 rpm	210	ULSD	0.43	1,609	3,361	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-088	Container Handler, Empty	TWD731VE	WWT	1	210hp @ 1800 rpm	210	ULSD	0.43	66	113	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-089	Container Handler, Full	M11	NCT	1	300hp @ 2200 rpm	300	ULSD	0.43	0	0	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-090	Container Handler, Empty	TWD731VE	NCT	1	210hp @ 1800 rpm	210	ULSD	0.43	323	0	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-091	Container Handler, Empty	TWD731VE	WWT	1	210hp @ 1800 rpm	210	ULSD	0.43	0	0	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-096	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	283	832	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-097	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	280	63	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-099	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	90	936	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-101	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	65	0	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-102	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	114	464	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-103	Container Handler, Full	QSM11	NCT	2	350hp @ 1800 rpm	350	ULSD	0.43	0	0	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-104	Container Handler, Full	QSM11	NCT	2	350hp @ 1800 rpm	350	ULSD	0.43	4	14	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-109	Container Handler, Empty	TAD720VE	WWT	2	222hp @ 1800 rpm	222	ULSD	0.43	102	173	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-116	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	2,083	4,437	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-117	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	1,827	4,903	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-118	Container Handler, Empty	QSB 6.7	IPG	3	275hp @ 1800 rpm	275	ULSD	0.43	1,524	4,180	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-119	Container Handler, Empty	QSB 6.7	IPG	3	275hp @ 1800 rpm	275	ULSD	0.43	2,782	6,692	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-120	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	2,590	7,155	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-121	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	2,613	6,549	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-122	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	0	0	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-123	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,871	11,002	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-124	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,056	7,872	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-125	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	942	10,245	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-126	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,750	6,013	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-127	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,523	8,822	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-128	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	3,297	11,620	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-129	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,802	9,873	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054

Emission Factors for Container Handlers

Equipment Inventory					Operation						Emission Factors (g/bhp-hr)										
Equipment ID	Equipment Type	Equipment Model No.	Terminal	Engine Tier	Engine BHP	HP (for calc.)	Fuel	Load Factor	2021 Operating Hours	2021 Fuel Use (gal)	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
H-01-130	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,509	9,962	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-131	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,633	10,059	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-132	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,605	9,986	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-133	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,813	9,952	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-135	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	4,779	22,919	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-136	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	4,621	23,016	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-137	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	3,682	16,439	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-138	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,074	7,795	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-139	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,570	9,426	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-01-140	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,580	8,984	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-141	Container Handler, Empty	QSB 6.7	IPG	3	275hp @ 1800 rpm	275	ULSD	0.43	2,235	4,379	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-142	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,483	7,552	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-143	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	2,725	7,478	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-144	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,825	8,653	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-145	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,477	7,747	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-146	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,397	7,025	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-147	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,474	7,670	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-148	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,864	8,514	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-149	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,718	7,389	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-150	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	4,121	9,120	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-151	Container Handler, Empty	QSB 6.7	NCT	3	275hp @ 1800 rpm	275	ULSD	0.43	4,026	8,882	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-152	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,760	7,867	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-153	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	1,903	3,745	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-154	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	836	1,689	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-156	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,535	6,277	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-157	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,642	5,861	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-158	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	3,169	7,268	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-159	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,713	6,605	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-160	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,665	6,344	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-161	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,662	6,240	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-162	Container Handler, Empty	TAD871VE	IPG	4F	248 hp @ 2200 rpm	248	ULSD	0.43	1,852	6,047	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-163	Container Handler, Empty	TAD871VE	IPG	4F	248 hp @ 2200 rpm	248	ULSD	0.43	4,169	7,830	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-164	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	944	905	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-165	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	819	834	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-166	Container Handler, Empty	TAD871VE	NCT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	610	840	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-167	Container Handler, Empty	TAD871VE	NCT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	142	190	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-168	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	275	960	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-169	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	342	365	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-170	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	504	800	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-171	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	323	338	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-174	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	620	1,858	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032
H-01-175	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	710	1,340	0.056	0.219	0.901	0.043	0.043	0.042	0.002	530.867	0.005	0.024	0.032

Emission Rates for Container Handlers

Equipment Inventory					Operation						Emission Rate (lbs/yr)											
Equipment ID	Equipment Type	Equipment Model No.	Terminal	Engine Tier	Engine BHP	HP (for calc.)	Fuel	Load Factor	2021 Operating Hours	2021 Fuel Use (gal)	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	BC
H-01-055	Container Handler, Full	C9	IPG	3	300hp @ 2200 rpm	300	ULSD	0.43	105	325	1.68	6.55	26.90	1.28	1.28	1.24	0.05	15,852.54	0.15	0.73	16,074.09	0.95
H-01-062	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	17	64	0.27	1.06	4.36	0.21	0.21	0.20	0.01	2,566.60	0.02	0.12	2,602.47	0.15
H-01-066	Container Handler, Full	C9	WWT	3	300hp @ 2200 rpm	300	ULSD	0.43	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H-01-068	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	59	217	0.94	3.68	15.12	0.72	0.72	0.70	0.03	8,907.62	0.09	0.41	9,032.11	0.54
H-01-083	Container Handler, Full	C9	WWT	3	300hp @ 2200 rpm	300	ULSD	0.43	493	2,530	7.87	30.75	126.32	6.00	6.00	5.82	0.21	74,431.46	0.71	3.43	75,471.69	4.48
H-01-086	Container Handler, Empty	TWD731VE	WWT	1	210hp @ 1800 rpm	210	ULSD	0.43	47	141	0.53	2.05	8.43	0.40	0.40	0.39	0.01	4,967.13	0.05	0.23	5,036.55	0.30
H-01-087	Container Handler, Empty	TWD731VE	WWT	1	210hp @ 1800 rpm	210	ULSD	0.43	1,609	3,361	17.98	70.25	288.58	13.71	13.71	13.29	0.49	170,044.93	1.63	7.84	172,421.42	10.24
H-01-088	Container Handler, Empty	TWD731VE	WWT	1	210hp @ 1800 rpm	210	ULSD	0.43	66	113	0.74	2.88	11.84	0.56	0.56	0.55	0.02	6,975.12	0.07	0.32	7,072.60	0.42
H-01-089	Container Handler, Full	M11	NCT	1	300hp @ 2200 rpm	300	ULSD	0.43	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H-01-090	Container Handler, Empty	TWD731VE	NCT	1	210hp @ 1800 rpm	210	ULSD	0.43	323	0	3.61	14.10	57.93	2.75	2.75	2.67	0.10	34,135.81	0.33	1.57	34,612.88	2.06
H-01-091	Container Handler, Empty	TWD731VE	WWT	1	210hp @ 1800 rpm	210	ULSD	0.43	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H-01-096	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	283	832	4.52	17.65	72.51	3.44	3.44	3.34	0.12	42,726.37	0.41	1.97	43,323.50	2.57
H-01-097	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	280	63	4.47	17.46	71.74	3.41	3.41	3.31	0.12	42,273.44	0.40	1.95	42,864.24	2.54
H-01-099	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	90	936	1.44	5.61	23.06	1.10	1.10	1.06	0.04	13,587.89	0.13	0.63	13,777.79	0.82
H-01-101	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	65	0	1.04	4.05	16.65	0.79	0.79	0.77	0.03	9,813.48	0.09	0.45	9,950.63	0.59
H-01-102	Container Handler, Full	C9	NCT	3	300hp @ 2200 rpm	300	ULSD	0.43	114	464	1.82	7.11	29.21	1.39	1.39	1.35	0.05	17,211.33	0.16	0.79	17,451.87	1.04
H-01-103	Container Handler, Full	QSM11	NCT	2	350hp @ 1800 rpm	350	ULSD	0.43	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H-01-104	Container Handler, Full	QSM11	NCT	2	350hp @ 1800 rpm	350	ULSD	0.43	4	14	0.12	0.62	2.26	0.10	0.10	0.09	0.00	704.41	0.01	0.03	714.30	0.07
H-01-109	Container Handler, Empty	TAD720VE	WWT	2	222hp @ 1800 rpm	222	ULSD	0.43	102	173	1.20	4.71	19.34	0.92	0.92	0.89	0.03	11,395.71	0.11	0.53	11,554.98	0.69
H-01-116	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	2,083	4,437	30.48	119.10	489.23	23.24	23.24	22.54	0.83	288,277.21	2.76	13.29	292,306.08	17.35
H-01-117	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	1,827	4,903	26.73	104.46	429.10	20.38	20.38	19.77	0.72	252,848.04	2.42	11.66	256,381.76	15.22
H-01-118	Container Handler, Empty	QSB 6.7	IPG	3	275hp @ 1800 rpm	275	ULSD	0.43	1,524	4,180	22.30	87.14	357.94	17.00	17.00	16.49	0.60	210,914.29	2.02	9.72	213,861.96	12.70
H-01-119	Container Handler, Empty	QSB 6.7	IPG	3	275hp @ 1800 rpm	275	ULSD	0.43	2,782	6,692	40.71	159.07	653.40	31.03	31.03	30.10	1.10	385,015.45	3.68	17.75	390,396.31	23.18
H-01-120	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	2,590	7,155	37.90	148.09	608.31	28.89	28.89	28.02	1.03	358,443.57	3.43	16.52	363,453.07	21.58
H-01-121	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	2,613	6,549	38.23	149.40	613.71	29.15	29.15	28.27	1.04	361,626.66	3.46	16.67	366,680.65	21.77
H-01-122	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H-01-123	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,871	11,002	86.52	441.75	1,620.63	69.15	69.15	67.08	1.53	505,593.16	5.97	23.31	512,688.83	51.65
H-01-124	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,056	7,872	61.96	316.35	1,160.58	49.52	49.52	48.04	1.10	362,068.80	4.27	16.69	367,150.21	36.99
H-01-125	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	942	10,245	28.39	144.94	531.74	22.69	22.69	22.01	0.50	165,889.50	1.96	7.65	168,217.65	16.95
H-01-126	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,750	6,013	82.87	423.14	1,552.33	66.24	66.24	64.25	1.47	484,284.63	5.71	22.33	491,081.26	49.47
H-01-127	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,523	8,822	76.03	388.21	1,424.19	60.77	60.77	58.95	1.34	444,309.14	5.24	20.49	450,544.73	45.39
H-01-128	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	3,297	11,620	99.36	507.30	1,861.10	79.41	79.41	77.03	1.76	580,613.25	6.85	26.77	588,761.79	59.31
H-01-129	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,802	9,873	84.44	431.14	1,581.68	67.49	67.49	65.46	1.49	493,442.02	5.82	22.75	500,367.16	50.41

Emission Rates for Container Handlers

Equipment Inventory					Operation						Emission Rate (lbs/yr)											
Equipment ID	Equipment Type	Equipment Model No.	Terminal	Engine Tier	Engine BHP	HP (for calc.)	Fuel	Load Factor	2021 Operating Hours	2021 Fuel Use (gal)	HC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	BC
H-01-130	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,509	9,962	75.61	386.05	1,416.29	60.43	60.43	58.62	1.34	441,843.69	5.21	20.37	448,044.68	45.14
H-01-131	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,633	10,059	79.35	405.13	1,486.28	63.42	63.42	61.52	1.40	463,680.52	5.47	21.38	470,187.98	47.37
H-01-132	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,605	9,986	78.51	400.82	1,470.48	62.74	62.74	60.86	1.39	458,749.63	5.41	21.15	465,187.88	46.86
H-01-133	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,813	9,952	84.77	432.83	1,587.89	67.75	67.75	65.72	1.50	495,379.15	5.84	22.84	502,331.48	50.61
H-01-135	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	4,779	22,919	144.02	735.33	2,697.66	115.11	115.11	111.65	2.55	841,598.64	9.93	38.80	853,409.94	85.97
H-01-136	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	4,621	23,016	139.26	711.02	2,608.47	111.30	111.30	107.96	2.46	813,774.29	9.60	37.52	825,195.09	83.13
H-01-137	Container Handler, Full	QSM11	WWT	3	350hp @ 1800 rpm	350	ULSD	0.43	3,682	16,439	110.96	566.54	2,078.43	88.69	88.69	86.03	1.96	648,413.10	7.65	29.90	657,513.16	66.24
H-01-138	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,074	7,795	62.50	319.12	1,170.74	49.95	49.95	48.46	1.11	365,238.67	4.31	16.84	370,364.56	37.31
H-01-139	Container Handler, Full	QSM11	NCT	3	350hp @ 1800 rpm	350	ULSD	0.43	2,570	9,426	77.45	395.44	1,450.72	61.90	61.90	60.04	1.37	452,586.00	5.34	20.87	458,937.76	46.23
H-01-140	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,580	8,984	52.38	204.69	840.83	39.93	39.93	38.74	1.42	495,454.83	4.74	22.84	502,379.15	29.83
H-01-141	Container Handler, Empty	QSB 6.7	IPG	3	275hp @ 1800 rpm	275	ULSD	0.43	2,235	4,379	32.70	127.79	524.93	24.93	24.93	24.18	0.89	309,313.28	2.96	14.26	313,636.15	18.62
H-01-142	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,483	7,552	50.96	199.15	818.05	38.85	38.85	37.69	1.38	482,030.49	4.61	22.22	488,767.20	29.02
H-01-143	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	2,725	7,478	39.87	155.81	640.02	30.40	30.40	29.49	1.08	377,126.93	3.61	17.38	382,397.54	22.70
H-01-144	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,825	8,653	55.97	218.70	898.37	42.67	42.67	41.39	1.52	529,361.65	5.06	24.40	536,759.85	31.87
H-01-145	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,477	7,747	50.87	198.80	816.64	38.79	38.79	37.62	1.38	481,200.12	4.60	22.18	487,925.23	28.97
H-01-146	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,397	7,025	49.70	194.23	797.85	37.89	37.89	36.76	1.35	470,128.50	4.50	21.67	476,698.88	28.30
H-01-147	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,474	7,670	50.83	198.63	815.93	38.75	38.75	37.59	1.38	480,784.93	4.60	22.16	487,504.24	28.94
H-01-148	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,864	8,514	56.54	220.93	907.53	43.10	43.10	41.81	1.53	534,759.06	5.11	24.65	542,232.70	32.19
H-01-149	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,718	7,389	54.40	212.58	873.24	41.47	41.47	40.23	1.47	514,553.36	4.92	23.72	521,744.61	30.98
H-01-150	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	4,121	9,120	60.30	235.63	967.89	45.97	45.97	44.59	1.63	570,326.63	5.45	26.29	578,297.34	34.33
H-01-151	Container Handler, Empty	QSB 6.7	NCT	3	275hp @ 1800 rpm	275	ULSD	0.43	4,026	8,882	58.91	230.19	945.58	44.91	44.91	43.56	1.60	557,179.09	5.33	25.68	564,966.05	33.54
H-01-152	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	3,760	7,867	55.01	214.98	883.10	41.94	41.94	40.68	1.49	520,365.96	4.98	23.99	527,638.44	31.33
H-01-153	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	1,903	3,745	27.84	108.81	446.95	21.23	21.23	20.59	0.75	263,366.07	2.52	12.14	267,046.80	15.86
H-01-154	Container Handler, Empty	QSB 6.7	WWT	3	275hp @ 1800 rpm	275	ULSD	0.43	836	1,689	12.23	47.80	196.35	9.33	9.33	9.05	0.33	115,698.39	1.11	5.33	117,315.36	6.97
H-01-156	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,535	6,277	33.45	130.71	536.93	25.50	25.50	24.74	0.91	316,386.53	3.03	14.58	320,808.25	19.05
H-01-157	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,642	5,861	34.86	136.23	559.60	26.58	26.58	25.78	0.94	329,740.91	3.15	15.20	334,349.27	19.85
H-01-158	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	3,169	7,268	41.82	163.40	671.22	31.88	31.88	30.92	1.13	395,514.37	3.78	18.23	401,041.96	23.81
H-01-159	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,713	6,605	35.80	139.89	574.64	27.29	27.29	26.47	0.97	338,602.23	3.24	15.61	343,334.44	20.38
H-01-160	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,665	6,344	35.16	137.42	564.47	26.81	26.81	26.00	0.95	332,611.48	3.18	15.33	337,259.96	20.02
H-01-161	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	2,662	6,240	35.13	137.26	563.83	26.78	26.78	25.98	0.95	332,237.06	3.18	15.31	336,880.30	20.00
H-01-162	Container Handler, Empty	TAD871VE	IPG	4F	248 hp @ 2200 rpm	248	ULSD	0.43	1,852	6,047	24.44	95.49	392.27	18.63	18.63	18.07	0.66	231,143.14	2.21	10.65	234,373.53	13.92
H-01-163	Container Handler, Empty	TAD871VE	IPG	4F	248 hp @ 2200 rpm	248	ULSD	0.43	4,169	7,830	55.01	214.97	883.03	41.94	41.94	40.68	1.49	520,321.68	4.98	23.98	527,593.54	31.32
H-01-164	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	944	905	12.46	48.68	199.95	9.50	9.50	9.21	0.34	117,818.10	1.13	5.43	119,464.69	7.09
H-01-165	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	819	834	10.81	42.23	173.47	8.24	8.24	7.99	0.29	102,217.19	0.98	4.71	103,645.74	6.15
H-01-166	Container Handler, Empty	TAD871VE	NCT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	610	840	8.05	31.45	129.20	6.14	6.14	5.95	0.22	76,132.46	0.73	3.51	77,196.46	4.58
H-01-167	Container Handler, Empty	TAD871VE	NCT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	142	190	1.87	7.32	30.08	1.43	1.43	1.39	0.05	17,722.64	0.17	0.82	17,970.32	1.07
H-01-168	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	275	960	3.63	14.18	58.25	2.77	2.77	2.68	0.10	34,322.01	0.33	1.58	34,801.68	2.07
H-01-169	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	342	365	4.51	17.63	72.44	3.44	3.44	3.34	0.12	42,684.10	0.41	1.97	43,280.64	2.57
H-01-170	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	504	800	6.65	25.99	106.75	5.07	5.07	4.92	0.18	62,902.88	0.60	2.90	63,782.00	3.79
H-01-171	Container Handler, Empty	TAD871VE	HLT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	323	338	4.26	16.65	68.41	3.25	3.25	3.15	0.12	40,312.76	0.39	1.86	40,876.16	2.43
H-01-174	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	620	1,858	8.18	31.97	131.32	6.24	6.24	6.05	0.22	77,380.53	0.74	3.57	78,461.98	4.66
H-01-175	Container Handler, Empty	TAD871VE	WWT	4F	248 hp @ 2200 rpm	248	ULSD	0.43	710	1,340	9.37	36.61	150.38	7.14	7.14	6.93	0.25	88,613.19	0.85	4.08	89,851.62	5.33
								Total Hours, Fuel (gal) and Emissions (lbs/yr)	138,723	395,743	2,691	12,158	46,865	2,102	2,102	2,039	60	20,488,496	214	945	20,775,307	1,570

Emission Factors for RTG Cranes and Crane Trucks

Equipment Inventory					Operation						Emissions Factor (g/hp-hr)										
Equipment ID[1]	Equipment Type	Engine Manuf.	Terminal	Engine Tier	Engine Horsepower	Fuel	HP (for calc.)	Load Factor	2021 Operating Hours[1]	2021 Fuel Use (gal)	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
H-41-009	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,885	14,892.40	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-010	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,324	12,154.10	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-011	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,042	16,167.10	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-012	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,976	15,932.30	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-013	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,988	15,920.00	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-014	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,453	17,958.20	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-015	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	3,653	16,461.50	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-016	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	5,282	17,028.30	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-017	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	4,002	14,963.00	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-018	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	650	27,571.00	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-019	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	1,473	22,652.00	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-020	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,008	25,667.00	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-021	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,988	29,167.20	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-022	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,198	24,610.50	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-023	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,162	31,574.00	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-024	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,257	3,442.10	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-025	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,265	7,314.50	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-026	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	433	9,944.20	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-027	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	2,934	15,261.00	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-028	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	5,466	18,743.43	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-029	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,030	18,559.40	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-030	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,137	2,250.60	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-031	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,381	15,439.70	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-032	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,217	12,644.20	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-033	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	1,994	14,199.40	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-034	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,800	14,822.80	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-035	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,863	10,668.20	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-036	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,465	14,890.60	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-037	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,490	16,111.90	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-038	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,443	13,716.50	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-039	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	3,273	11,724.10	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-040	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,718	11,651.90	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-041	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,807	19,774.30	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-042	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,483	15,131.10	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-043	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	3,375	15,443.80	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057

Emission Factors for RTG Cranes and Crane Trucks

Equipment Inventory					Operation						Emissions Factor (g/hp-hr)										
Equipment ID[(1)]	Equipment Type	Engine Manuf.	Terminal	Engine Tier	Engine Horsepower	Fuel	HP (for calc.)	Load Factor	2021 Operating Hours[(1)]	2021 Fuel Use (gal)	HC	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
H-41-044	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	3,144	18,982.80	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-045	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,157	19,470.70	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-046	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,942	18,046.50	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-047	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	3,326	17,151.10	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-048	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,671	17,686.60	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-049	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	1,446	20,588.30	0.088	0.623	1.703	0.076	0.076	0.074	0.002	530.769	0.006	0.024	0.057
H-41-050	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,831	20,908.50	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-051	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,419	15,941.40	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-052	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,017	14,147.80	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-053	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,597	17,212.20	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-054	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,807	15,310.60	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-055	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,488	18,051.70	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-056	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,428	19,421.00	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-057	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,246	17,196.30	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-058	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,018	16,083.40	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-059	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,287	15,871.10	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-060	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,172	15,154.00	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-061	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,816	14,567.70	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-062	Crane, RTG	Cummins	IPD	4F	555hp @ 1800 rpm	ULSD	555	0.43	2,830	13,707.91	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-063	Crane, RTG	Cummins	IPD	4F	555hp @ 1800 rpm	ULSD	555	0.43	2,936	16,282.80	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-064	Crane, RTG	Cummins	IPG	4F	555hp @ 1800 rpm	ULSD	555	0.43	7,630	8,985.00	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-065	Crane, RTG	Cummins	IPG	4F	555hp @ 1800 rpm	ULSD	555	0.43	5,538	17,514.80	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-066	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	2,358	14,554.10	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-067	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,602	14,886.60	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-068	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,122	16,346.50	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-069	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,114	15,941.60	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-070	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,712	13,580.10	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-071	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,382	17,819.10	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-072	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,871	14,882.40	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-073	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,909	17,448.00	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-074	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,076	18,392.30	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-075	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,697	12,546.90	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-076	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,894	15,873.90	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-077	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,796	16,204.30	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-078	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,442	17,007.30	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-079	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,103	14,044.14	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054

Emission Factors for RTG Cranes and Crane Trucks

Equipment Inventory					Operation						Emissions Factor (g/hp-hr)										
Equipment ID[1]	Equipment Type	Engine Manuf.	Terminal	Engine Tier	Engine Horsepower	Fuel	HP (for calc.)	Load Factor	2021 Operating Hours[1]	2021 Fuel Use (gal)	HC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	BC
H-41-080	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,859	18,261.60	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-081	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,341	16,422.20	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-082	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,887	18,023.40	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-083	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,863	16,848.20	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-084	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,321	17,731.20	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-085	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,806	13,001.70	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-086	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,916	13,318.30	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-087	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,000	10,898.40	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-088	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,887	9,362.80	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-089	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,140	10,091.30	0.091	0.464	1.701	0.073	0.073	0.070	0.002	530.759	0.006	0.024	0.054
H-41-090	Crane, RTG / Hybrid	John Deere	WWT	4F	122hp @ 1800 rpm	ULSD	122	0.43	4,110	9,524.80	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-091	Crane, RTG / Hybrid	John Deere	WWT	4F	122hp @ 1800 rpm	ULSD	122	0.43	3,542	10,733.10	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-092	Crane, RTG / Hybrid	John Deere	WWT	4F	122hp @ 1800 rpm	ULSD	122	0.43	3,328	12,301.30	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-093	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,390	4,091.90	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-094	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	705	3,007.00	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-095	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	902	3,575.50	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-096	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	991	3,552.10	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-097	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,407	4,292.40	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-098	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,651	4,205.70	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-099	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,342	3,997.40	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-100	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,317	3,806.90	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-101	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,346	3,890.10	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-102	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,558	4,586.70	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-103	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,104	4,069.30	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-104	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,057	3,784.70	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-105	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,307	3,528.60	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-106	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,109	3,775.90	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-107	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	755	3,256.70	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-108	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,149	4,014.90	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-109	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,555	3,670.00	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-110	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,141	4,118.10	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-111	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,367	4,178.00	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-112	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,284	4,140.20	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-113	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	463	2,957.30	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-114	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	338	2,484.90	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-115	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	906	3,492.40	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-116	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,238	4,005.00	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
H-41-117	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,532	4,271.60	0.062	0.275	1.200	0.069	0.069	0.067	0.002	530.850	0.005	0.024	0.051
GROVE RT880E	Crane, Truck	--	CST	4F	--	ULSD	275	0.43	659	--	0.057	0.164	0.778	0.036	0.036	0.035	0.001	530.865	0.004	0.024	0.027
LinkBelt HTC86100	Crane, Truck	--	CST	4F	--	ULSD	675	0.43	2,262	--	0.126	0.947	2.775	0.115	0.115	0.111	0.002	530.649	0.008	0.024	0.086
LinkBelt HTC8690	Crane, Truck	--	CST	1	--	ULSD	445	0.43	1,942	--	0.133	0.701	2.820	0.108	0.108	0.105	0.002	530.627	0.009	0.024	0.081
LinkBeltHTC8670	Crane, Truck	--	CST	1	--	ULSD	365	0.43	953	--	0.133	0.701	2.820	0.108	0.108	0.105	0.002	530.627	0.009	0.024	0.081

[1] Information for crane trucks was not available for 2021. The information for this equipment was taken from the 2017 emission inventory. The operational hours have been scaled for overall SCPA production changes between 2017 and 2021.

Emission Rates for RTG Cranes and Crane Trucks

Equipment Inventory					Operation						Emission Rate (lbs/yr)											
Equipment ID	Equipment Type	Engine Manuf.	Terminal	Engine Tier	Engine Horsepower	Fuel	HP (for calc.)	Load Factor	2021 Operating Hours[1]	2021 Fuel Use (gal)	HC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	BC
H-41-009	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,885	14,892.40	146.25	1,040.92	2,845.75	126.69	126.69	122.89	2.68	886,942.17	9.94	40.89	899,376.56	94.63
H-41-010	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,324	12,154.10	117.81	838.51	2,292.38	102.06	102.06	99.00	2.16	714,472.65	8.01	32.94	724,489.13	76.23
H-41-011	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,042	16,167.10	154.21	1,097.57	3,000.61	133.59	133.59	129.58	2.83	935,209.04	10.48	43.12	948,320.10	99.78
H-41-012	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,976	15,932.30	150.86	1,073.76	2,935.51	130.69	130.69	126.77	2.77	914,918.50	10.26	42.18	927,745.11	97.61
H-41-013	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,988	15,920.00	151.47	1,078.08	2,947.35	131.22	131.22	127.28	2.78	918,607.69	10.30	42.35	931,486.02	98.01
H-41-014	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,453	17,958.20	175.04	1,245.86	3,406.02	151.64	151.64	147.09	3.21	1,061,563.71	11.90	48.94	1,076,446.19	113.26
H-41-015	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	3,653	16,461.50	185.18	1,318.02	3,603.30	160.42	160.42	155.61	3.40	1,123,050.17	12.59	51.78	1,138,794.66	119.82
H-41-016	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	5,282	17,028.30	267.76	1,905.77	5,210.14	231.96	231.96	225.00	4.91	1,623,857.37	18.20	74.87	1,646,622.88	173.25
H-41-017	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	4,002	14,963.00	202.87	1,443.94	3,947.55	175.75	175.75	170.47	3.72	1,230,344.04	13.79	56.72	1,247,592.72	131.26
H-41-018	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	650	27,571.00	32.95	234.52	641.16	28.54	28.54	27.69	0.60	199,830.99	2.24	9.21	202,632.50	21.32
H-41-019	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	1,473	22,652.00	74.67	531.47	1,452.96	64.69	64.69	62.75	1.37	452,847.77	5.08	20.88	459,196.42	48.31
H-41-020	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,008	25,667.00	101.79	724.50	1,980.68	88.18	88.18	85.54	1.87	617,324.04	6.92	28.46	625,978.56	65.86
H-41-021	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,988	29,167.20	151.47	1,078.08	2,947.35	131.22	131.22	127.28	2.78	918,607.69	10.30	42.35	931,486.02	98.01
H-41-022	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,198	24,610.50	162.11	1,153.85	3,154.49	140.44	140.44	136.23	2.98	983,168.47	11.02	45.33	996,951.90	104.89
H-41-023	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,162	31,574.00	160.29	1,140.86	3,118.98	138.86	138.86	134.69	2.94	972,100.91	10.90	44.82	985,729.18	103.71
H-41-024	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,257	3,442.10	165.11	1,175.14	3,212.69	143.03	143.03	138.74	3.03	1,001,306.98	11.23	46.16	1,015,344.70	106.83
H-41-025	Crane, RTG	Volvo	NCT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,265	7,314.50	114.82	817.22	2,234.18	99.47	99.47	96.48	2.11	696,334.14	7.81	32.10	706,096.33	74.29
H-41-026	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	433	9,944.20	21.95	156.23	427.11	19.02	19.02	18.44	0.40	133,118.18	1.49	6.14	134,984.42	14.20
H-41-027	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	2,934	15,261.00	148.73	1,058.60	2,894.08	128.85	128.85	124.98	2.73	902,006.35	10.11	41.59	914,651.93	96.23
H-41-028	Crane, RTG	Volvo	IPG	3	611hp @ 1800 rpm	ULSD	611	0.43	5,466	18,743.43	277.08	1,972.16	5,391.63	240.04	240.04	232.84	5.08	1,680,424.91	18.84	77.48	1,703,983.46	179.28
H-41-029	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,030	18,559.40	153.60	1,093.24	2,988.78	133.06	133.06	129.07	2.82	931,519.85	10.44	42.95	944,579.20	99.38
H-41-030	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,137	2,250.60	106.73	759.68	2,076.88	92.46	92.46	89.69	1.96	647,305.49	7.26	29.84	656,380.32	69.06
H-41-031	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,381	15,439.70	118.92	846.42	2,314.01	103.02	103.02	99.93	2.18	721,214.02	8.09	33.25	731,325.01	76.95
H-41-032	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,217	12,644.20	163.08	1,160.71	3,173.23	141.27	141.27	137.04	2.99	989,009.69	11.09	45.60	1,002,875.01	105.52
H-41-033	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	1,994	14,199.40	101.08	719.44	1,966.87	87.57	87.57	84.94	1.85	613,019.99	6.87	28.26	621,614.16	65.40
H-41-034	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,800	14,822.80	141.94	1,010.25	2,761.91	122.96	122.96	119.27	2.60	860,810.42	9.65	39.69	872,878.47	91.84
H-41-035	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,863	10,668.20	142.99	1,017.77	2,782.45	123.88	123.88	120.16	2.62	867,213.67	9.72	39.98	879,371.48	92.52
H-41-036	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	2,465	14,890.60	124.96	889.38	2,431.46	108.25	108.25	105.00	2.29	757,820.60	8.50	34.94	768,444.79	80.85
H-41-037	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,490	16,111.90	124.36	885.17	2,419.94	107.74	107.74	104.50	2.28	754,230.54	8.46	34.77	764,804.40	80.47
H-41-038	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,443	13,716.50	122.02	868.46	2,374.27	105.70	105.70	102.53	2.24	739,994.06	8.30	34.12	750,368.33	78.95
H-41-039	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	3,273	11,724.10	163.47	1,163.52	3,180.92	141.62	141.62	137.37	3.00	991,404.24	11.11	45.71	1,005,303.13	105.77
H-41-040	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,718	11,651.90	135.75	966.22	2,641.53	117.60	117.60	114.07	2.49	823,292.61	9.23	37.96	834,834.68	87.84
H-41-041	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,807	19,774.30	140.20	997.86	2,728.03	121.45	121.45	117.81	2.57	850,251.05	9.53	39.20	862,171.06	90.71
H-41-042	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,483	15,131.10	176.56	1,256.68	3,435.61	152.95	152.95	148.37	3.24	1,070,786.68	12.00	49.37	1,085,798.46	114.24
H-41-043	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	3,375	15,443.80	168.57	1,199.78	3,280.05	146.03	146.03	141.65	3.09	1,022,300.43	11.46	47.13	1,036,632.47	109.07

Emission Rates for RTG Cranes and Crane Trucks

Equipment Inventory					Operation						Emission Rate (lbs/yr)											
Equipment ID	Equipment Type	Engine Manuf.	Terminal	Engine Tier	Engine Horsepower	Fuel	HP (for calc.)	Load Factor	2021 Operating Hours[(1)]	2021 Fuel Use (gal)	HC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	BC
H-41-044	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	3,144	18,982.80	157.03	1,117.66	3,055.54	136.03	136.03	131.95	2.88	952,329.64	10.68	43.91	965,680.73	101.60
H-41-045	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,157	19,470.70	160.04	1,139.06	3,114.05	138.64	138.64	134.48	2.94	970,563.75	10.88	44.75	984,170.47	103.55
H-41-046	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	2,942	18,046.50	146.94	1,045.85	2,859.23	127.29	127.29	123.47	2.70	891,143.07	9.99	41.09	903,636.36	95.08
H-41-047	Crane, RTG	Volvo	WWT	4	602hp @ 1800 rpm	ULSD	602	0.43	3,326	17,151.10	166.12	1,182.36	3,232.42	143.91	143.91	139.59	3.05	1,007,458.14	11.29	46.45	1,021,582.10	107.49
H-41-048	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	3,671	17,686.60	186.09	1,324.51	3,621.06	161.21	161.21	156.37	3.42	1,128,583.95	12.65	52.03	1,144,406.02	120.41
H-41-049	Crane, RTG	Volvo	WWT	3	611hp @ 1800 rpm	ULSD	611	0.43	1,446	20,588.30	73.30	521.72	1,426.33	63.50	63.50	61.60	1.35	444,547.10	4.98	20.50	450,779.38	47.43
H-41-050	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,831	20,908.50	183.07	934.73	3,429.16	146.32	146.32	141.93	3.24	1,069,806.14	12.62	49.32	1,084,820.19	109.29
H-41-051	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,419	15,941.40	211.17	1,078.19	3,955.48	168.78	168.78	163.72	3.73	1,234,005.05	14.56	56.89	1,251,323.52	126.06
H-41-052	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,017	14,147.80	191.96	980.11	3,595.65	153.42	153.42	148.82	3.39	1,121,746.61	13.23	51.72	1,137,489.61	114.59
H-41-053	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,597	17,212.20	219.68	1,121.62	4,114.81	175.58	175.58	170.31	3.88	1,283,711.52	15.15	59.19	1,301,727.59	131.14
H-41-054	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,807	15,310.60	229.71	1,172.86	4,302.79	183.60	183.60	178.09	4.06	1,342,353.99	15.84	61.89	1,361,193.07	137.13
H-41-055	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,488	18,051.70	214.47	1,095.03	4,017.25	171.41	171.41	166.27	3.79	1,253,273.29	14.79	57.78	1,270,862.18	128.03
H-41-056	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,428	19,421.00	211.60	1,080.39	3,963.54	169.12	169.12	164.05	3.74	1,236,518.30	14.59	57.01	1,253,872.04	126.32
H-41-057	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,246	17,196.30	202.91	1,035.98	3,800.63	162.17	162.17	157.31	3.59	1,185,694.82	13.99	54.67	1,202,335.29	121.13
H-41-058	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,018	16,083.40	192.01	980.35	3,596.55	153.46	153.46	148.86	3.40	1,122,025.86	13.24	51.73	1,137,772.78	114.62
H-41-059	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,287	15,871.10	204.87	1,045.98	3,837.33	163.74	163.74	158.83	3.62	1,197,144.07	14.12	55.19	1,213,945.22	122.30
H-41-060	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,172	15,154.00	199.37	1,017.93	3,734.39	159.34	159.34	154.56	3.53	1,165,030.34	13.75	53.71	1,181,380.79	119.01
H-41-061	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,816	14,567.70	182.36	931.07	3,415.73	145.75	145.75	141.38	3.22	1,065,617.39	12.57	49.13	1,080,572.65	108.86
H-41-062	Crane, RTG	Cummins	IPD	4F	555hp @ 1800 rpm	ULSD	555	0.43	2,830	13,707.91	135.24	690.49	2,533.16	108.09	108.09	104.85	2.39	790,277.05	9.32	36.44	801,368.08	80.73
H-41-063	Crane, RTG	Cummins	IPD	4F	555hp @ 1800 rpm	ULSD	555	0.43	2,936	16,282.80	140.30	716.35	2,628.04	112.14	112.14	108.77	2.48	819,877.53	9.67	37.80	831,383.99	83.76
H-41-064	Crane, RTG	Cummins	IPG	4F	555hp @ 1800 rpm	ULSD	555	0.43	7,630	8,985.00	364.62	1,861.64	6,829.68	291.42	291.42	282.68	6.45	2,130,676.29	25.14	98.24	2,160,578.97	217.66
H-41-065	Crane, RTG	Cummins	IPG	4F	555hp @ 1800 rpm	ULSD	555	0.43	5,538	17,514.80	264.65	1,351.22	4,957.11	211.52	211.52	205.17	4.68	1,546,485.62	18.25	71.30	1,568,189.56	157.98
H-41-066	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	2,358	14,554.10	112.68	575.33	2,110.67	90.06	90.06	87.36	1.99	658,471.12	7.77	30.36	667,712.35	67.27
H-41-067	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,602	14,886.60	219.92	1,122.84	4,119.29	175.77	175.77	170.50	3.89	1,285,107.77	15.16	59.25	1,303,143.43	131.28
H-41-068	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,122	16,346.50	196.98	1,005.73	3,689.64	157.44	157.44	152.71	3.48	1,151,067.84	13.58	53.07	1,167,222.35	117.59
H-41-069	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,114	15,941.60	196.60	1,003.77	3,682.48	157.13	157.13	152.42	3.48	1,148,833.85	13.55	52.97	1,164,956.99	117.36
H-41-070	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,712	13,580.10	225.17	1,149.68	4,217.75	179.97	179.97	174.57	3.98	1,315,825.25	15.52	60.67	1,334,292.02	134.42
H-41-071	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,382	17,819.10	209.40	1,069.16	3,922.36	167.37	167.37	162.34	3.70	1,223,672.80	14.44	56.42	1,240,846.27	125.01
H-41-072	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,871	14,882.40	184.99	944.48	3,464.96	147.85	147.85	143.41	3.27	1,080,976.13	12.75	49.84	1,096,146.94	110.43
H-41-073	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,909	17,448.00	234.59	1,197.75	4,394.09	187.49	187.49	181.87	4.15	1,370,837.47	16.17	63.20	1,390,076.30	140.04
H-41-074	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,076	18,392.30	194.78	994.50	3,648.46	155.68	155.68	151.01	3.44	1,138,222.35	13.43	52.48	1,154,196.57	116.28
H-41-075	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,697	12,546.90	224.46	1,146.02	4,204.32	179.40	179.40	174.01	3.97	1,311,636.50	15.48	60.47	1,330,044.48	133.99
H-41-076	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,894	15,873.90	233.87	1,194.09	4,380.66	186.92	186.92	181.31	4.14	1,366,648.72	16.12	63.01	1,385,828.76	139.61
H-41-077	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,796	16,204.30	181.40	926.19	3,397.83	144.98	144.98	140.63	3.21	1,060,032.40	12.51	48.87	1,074,909.27	108.29
H-41-078	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,442	17,007.30	212.27	1,083.80	3,976.07	169.66	169.66	164.57	3.75	1,240,427.79	14.63	57.19	1,257,836.40	126.72
H-41-079	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,103	14,044.14	196.07	1,001.09	3,672.63	156.71	156.71	152.01	3.47	1,145,762.10	13.52	52.83	1,161,842.14	117.05

Emission Rates for RTG Cranes and Crane Trucks

Equipment Inventory					Operation						Emission Rate (lbs/yr)											
Equipment ID	Equipment Type	Engine Manuf.	Terminal	Engine Tier	Engine Horsepower	Fuel	HP (for calc.)	Load Factor	2021 Operating Hours[1]	2021 Fuel Use (gal)	HC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	CO_2e	BC
H-41-080	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,859	18,261.60	232.20	1,185.55	4,349.33	185.58	185.58	180.02	4.11	1,356,874.98	16.01	62.56	1,375,917.85	138.61
H-41-081	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,341	16,422.20	207.45	1,059.16	3,885.67	165.80	165.80	160.83	3.67	1,212,223.56	14.30	55.89	1,229,236.34	123.84
H-41-082	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,887	18,023.40	233.54	1,192.38	4,374.39	186.65	186.65	181.05	4.13	1,364,693.97	16.10	62.92	1,383,846.58	139.41
H-41-083	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,863	16,848.20	232.39	1,186.52	4,352.91	185.74	185.74	180.16	4.11	1,357,991.98	16.02	62.61	1,377,050.53	138.73
H-41-084	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,321	17,731.20	206.49	1,054.28	3,867.76	165.04	165.04	160.08	3.65	1,206,638.56	14.24	55.63	1,223,572.96	123.27
H-41-085	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,806	13,001.70	229.67	1,172.62	4,301.89	183.56	183.56	178.05	4.06	1,342,074.74	15.83	61.88	1,360,909.90	137.10
H-41-086	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,916	13,318.30	234.92	1,199.45	4,400.35	187.76	187.76	182.13	4.15	1,372,792.22	16.20	63.29	1,392,058.48	140.24
H-41-087	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	4,000	10,898.40	191.15	975.96	3,580.43	152.78	152.78	148.19	3.38	1,116,999.36	13.18	51.50	1,132,675.74	114.11
H-41-088	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,887	9,362.80	185.75	948.39	3,479.29	148.46	148.46	144.01	3.28	1,085,444.13	12.81	50.04	1,100,677.65	110.88
H-41-089	Crane, RTG	Cummins	WWT	4F	555hp @ 1800 rpm	ULSD	555	0.43	3,140	10,091.30	150.05	766.13	2,810.64	119.93	119.93	116.33	2.65	876,844.50	10.35	40.43	889,150.45	89.57
H-41-090	Crane, RTG / Hybrid	John Deere	WWT	4F	122hp @ 1800 rpm	ULSD	122	0.43	4,110	9,524.80	29.27	130.72	570.53	32.75	32.75	31.77	0.73	252,334.36	2.59	11.63	255,865.32	24.46
H-41-091	Crane, RTG / Hybrid	John Deere	WWT	4F	122hp @ 1800 rpm	ULSD	122	0.43	3,542	10,733.10	25.22	112.66	491.68	28.22	28.22	27.38	0.63	217,461.88	2.23	10.02	220,504.86	21.08
H-41-092	Crane, RTG / Hybrid	John Deere	WWT	4F	122hp @ 1800 rpm	ULSD	122	0.43	3,328	12,301.30	23.70	105.85	461.97	26.52	26.52	25.72	0.59	204,323.30	2.09	9.42	207,182.43	19.81
H-41-093	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,390	4,091.90	11.52	51.46	224.58	12.89	12.89	12.50	0.29	99,329.42	1.02	4.58	100,719.35	9.63
H-41-094	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	705	3,007.00	5.84	26.10	113.91	6.54	6.54	6.34	0.15	50,379.31	0.52	2.32	51,084.28	4.88
H-41-095	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	902	3,575.50	7.48	33.39	145.74	8.37	8.37	8.11	0.19	64,456.93	0.66	2.97	65,358.89	6.25
H-41-096	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	991	3,552.10	8.21	36.69	160.12	9.19	9.19	8.91	0.20	70,816.87	0.73	3.26	71,807.83	6.86
H-41-097	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,407	4,292.40	11.66	52.09	227.33	13.05	13.05	12.66	0.29	100,544.24	1.03	4.63	101,951.17	9.75
H-41-098	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,651	4,205.70	13.68	61.12	266.75	15.31	15.31	14.85	0.34	117,980.48	1.21	5.44	119,631.40	11.44
H-41-099	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,342	3,997.40	11.12	49.68	216.83	12.45	12.45	12.07	0.28	95,899.34	0.98	4.42	97,241.27	9.30
H-41-100	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,317	3,806.90	10.92	48.76	212.79	12.21	12.21	11.85	0.27	94,112.84	0.96	4.34	95,429.77	9.12
H-41-101	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,346	3,890.10	11.16	49.83	217.47	12.48	12.48	12.11	0.28	96,185.18	0.99	4.43	97,531.11	9.32
H-41-102	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,558	4,586.70	12.91	57.68	251.73	14.45	14.45	14.02	0.32	111,334.70	1.14	5.13	112,892.63	10.79
H-41-103	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,104	4,069.30	9.15	40.87	178.37	10.24	10.24	9.93	0.23	78,891.85	0.81	3.64	79,995.80	7.65
H-41-104	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,057	3,784.70	8.76	39.13	170.78	9.80	9.80	9.51	0.22	75,533.23	0.77	3.48	76,590.18	7.32
H-41-105	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,307	3,528.60	10.83	48.39	211.17	12.12	12.12	11.76	0.27	93,398.24	0.96	4.31	94,705.17	9.05
H-41-106	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,109	3,775.90	9.19	41.06	179.18	10.28	10.28	9.98	0.23	79,249.15	0.81	3.65	80,358.10	7.68
H-41-107	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	755	3,256.70	6.26	27.95	121.99	7.00	7.00	6.79	0.16	53,952.31	0.55	2.49	54,707.27	5.23
H-41-108	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,149	4,014.90	9.52	42.54	185.64	10.66	10.66	10.34	0.24	82,107.55	0.84	3.78	83,256.50	7.96
H-41-109	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,555	3,670.00	12.89	57.57	251.24	14.42	14.42	13.99	0.32	111,120.32	1.14	5.12	112,675.25	10.77
H-41-110	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,141	4,118.10	9.46	42.24	184.35	10.58	10.58	10.26	0.24	81,535.87	0.84	3.76	82,676.82	7.90
H-41-111	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,367	4,178.00	11.33	50.61	220.87	12.68	12.68	12.30	0.28	97,685.84	1.00	4.50	99,052.77	9.47
H-41-112	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,284	4,140.20	10.64	47.53	207.46	11.91	11.91	11.55	0.26	91,754.66	0.94	4.23	93,038.59	8.89
H-41-113	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	463	2,957.30	3.84	17.14	74.81	4.29	4.29	4.17	0.10	33,085.99	0.34	1.53	33,548.96	3.21
H-41-114	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	338	2,484.90	2.80	12.51	54.61	3.13	3.13	3.04	0.07	24,153.48	0.25	1.11	24,491.47	2.34
H-41-115	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	906	3,492.40	7.51	33.54	146.38	8.40	8.40	8.15	0.19	64,742.77	0.66	2.98	65,648.73	6.28
H-41-116	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,238	4,005.00	10.26	45.83	200.02	11.48	11.48	11.14	0.26	88,467.50	0.91	4.08	89,705.44	8.58
H-41-117	Crane, RTG / Hybrid	Cummins	HLT	4	142hp @ 1800 rpm	ULSD	142	0.43	1,532	4,271.60	12.70	56.71	247.53	14.21	14.21	13.78	0.32	109,476.74	1.12	5.05	111,008.67	10.61
GROVE RT880E	Crane, Truck	--	CST	4F	--	ULSD	275	0.43	659	--	9.72	28.11	133.50	6.22	6.22	6.03	0.26	91,142.99	0.71	4.20	92,412.71	4.64
LinkBelt HTC86100	Crane, Truck	--	CST	4F	--	ULSD	675	0.43	2,262	--	182.32	1,370.42	4,015.53	166.32	166.32	161.33	2.50	767,914.06	11.67	35.41	778,758.69	124.23
LinkBelt HTC8690	Crane, Truck	--	CST	1	--	ULSD	445	0.43	1,942	--	108.84	574.19	2,310.70	88.76	88.76	86.10	1.42	434,749.39	7.09	20.05	440,901.41	66.30
LinkBeltHTC8670	Crane, Truck	--	CST	1	--	ULSD	365	0.43	953	--	43.81	231.11	930.06	35.73	35.73	34.66	0.57	174,987.98	2.86	8.07	177,464.19	26.68
Total Hours, Fuel (gal) and Emissions (lbs/yr)									336,468	1,423,533	14,873	88,123	284,089	12,409	12,409	12,036	268	88,564,287	1,024	4,083	89,806,708	9,268

[1] Information for crane trucks was not available for 2021. The information for this equipment was taken from the 2017 emission inventory. The operational hours have been scaled for overall SCPA production changes between 2017 and 2021.

APPENDIX 2

PORT EMISSIONS IN REGIONAL CONTEXT

TABLE OF CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION

This Appendix compares emissions, in tons, from the South Carolina Ports Authority (SCPA) for 2021 to regional emissions, as described in each of the sections below. Data availability from each regional source determined the pollutants for each comparison. Overall, the following pollutants are included in the regional comparisons:

- Oxides of nitrogen (NO_X)
- Sulfur dioxide (SO_2)
- Particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10})
- Particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$)
- Carbon monoxide (CO)
- Carbon dioxide (CO_2)

2.0 COMPARISON TO NATIONAL EMISSIONS INVENTORY

The National Emissions Inventory (NEI) is a detailed, comprehensive estimate of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants from air emissions sources. EPA releases the NEI every three years. The NEI is based primarily on data provided by state, local, and tribal air agencies for sources in their jurisdictions, and supplemented by data developed by EPA. In this section, the 2020 NEI is compared to pollutant emissions calculated for the 2021 SCPA Emissions Inventory.

2.1 LIMITATIONS

The 2020 NEI captures emissions over a one-year period that was impacted by the COVID 19 pandemic. However, according to the U.S. International Trade Commission, a sharp decline in the volume of goods handled by ports in the first half of 2020 was followed by a sharp increase in the second half of 2020, with overall goods handled similar to 2019 over the entire year. Pollutant trends in the Charleston – North Core Based Statistical Area (CBSA) for the years 2020 and 2021 were compared. As illustrated in Figure 1, 2020 and 2021 annual emissions are generally comparable. This section compares the 2020 NEI to SCPA 2021 emissions in tons per year. For the purposes of comparing SCPA emissions to NEI emissions, the 2020 PM_{10} NEI data was adjusted down 11.8%, and the 2020 SO_2 NEI data was adjusted down 22%. The adjustment was made to account for data collected reflecting 2021 emissions as opposed to 2020 emissions (see Figure 1). Otherwise, NEI pollutant emissions remained unchanged from 2020 to 2021. There was no 2021 CBSA data available for CO, 1-hr NO_2, or CO_2.

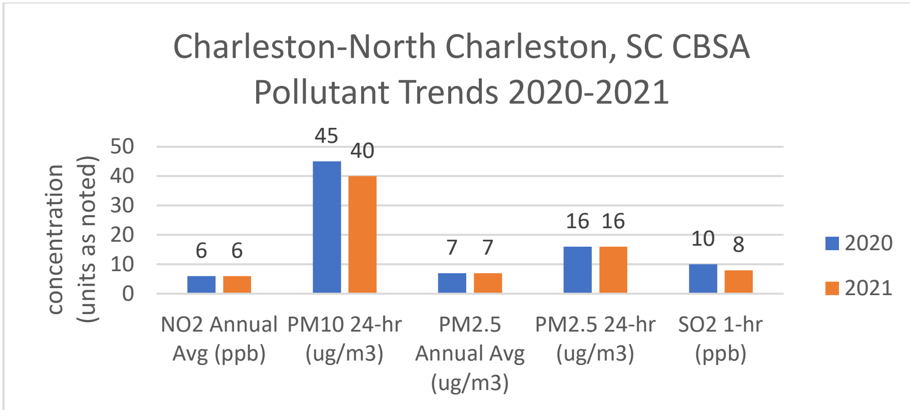


Figure 1: **2020 and 2021 Air Quality Trends for Charleston – North Charleston, SC CBSA**[1]

2.2 SECTOR COMPARISON

The NEI provides data summaries by sector. The SCPA 2021 Emissions Inventory calculates pollutant summaries for the following NEI sectors:

- Mobile - Commercial Marine Vessels
- Mobile - Locomotives
- Mobile - Non-Road Equipment - Diesel
- Mobile - On-Road Diesel Heavy Duty Vehicles

The SCPA contribution of pollutant emissions, in tons, for the four sectors listed above to the local tri-county area (Berkely, Charleston, Dorchester) is shown in the figures below. These figures illustrate the percentage of SCPA emissions contributing to total emissions in the tri-county area within these four sectors.

[1]U.S. EPA Air Quality Trends by CBSA 2000 – 2022. https://www.epa.gov/air-trends/air-quality-cities-and-counties

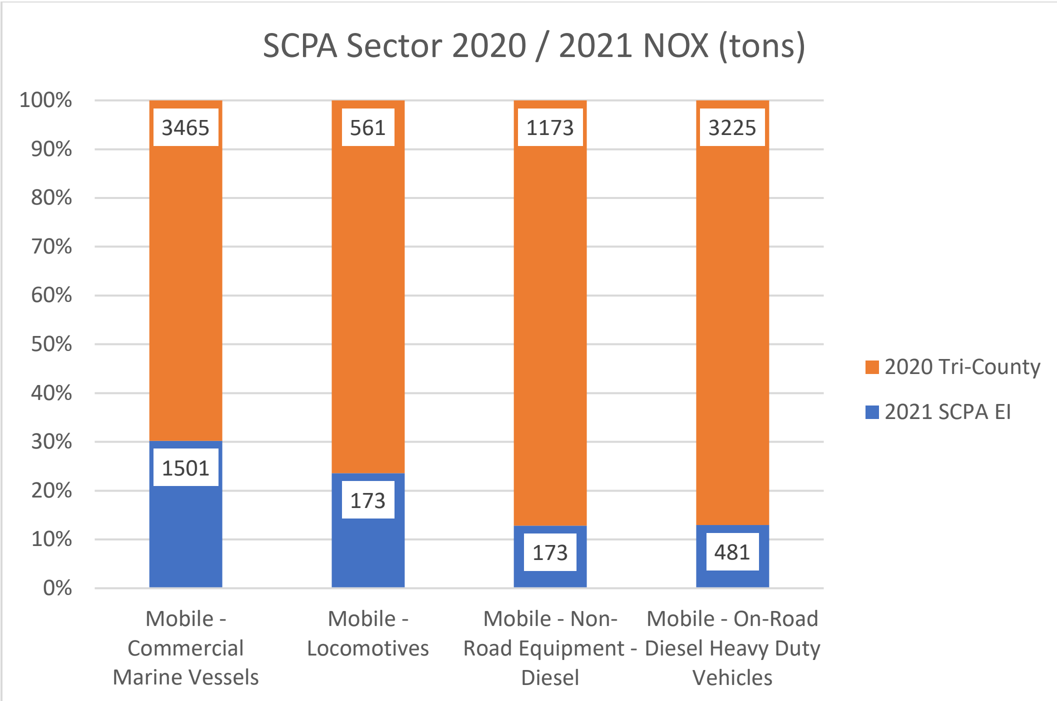


Figure 2: **SCPA / Tri-County Area Emissions by Sector (NO_X)**

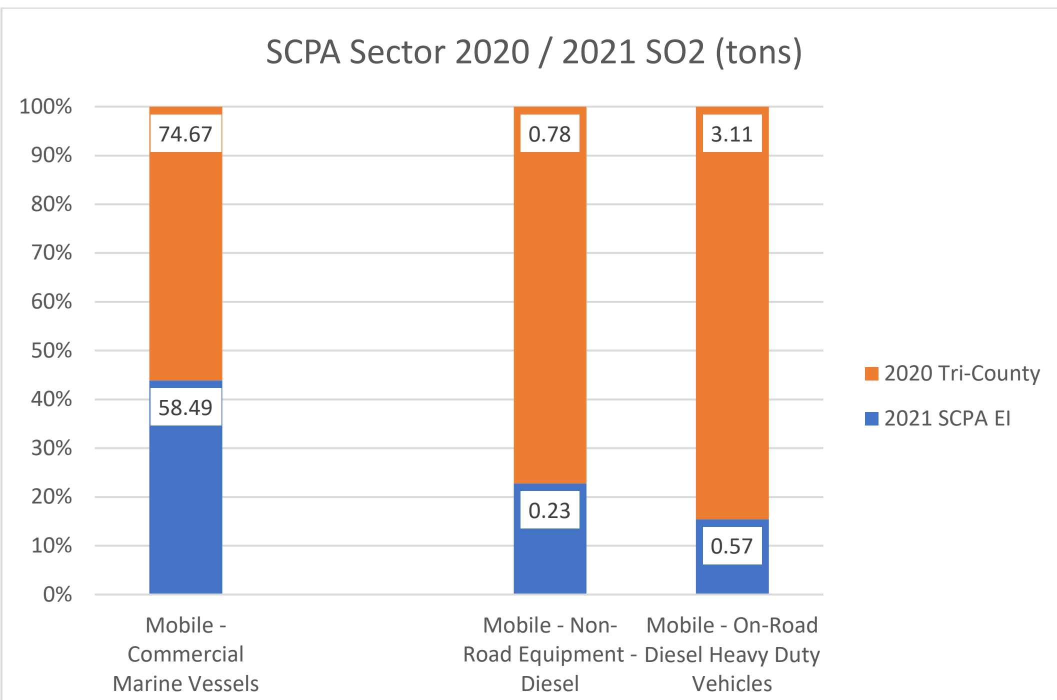


Figure 3: **SCPA / Tri-County Area Emissions by Sector (SO_2)**

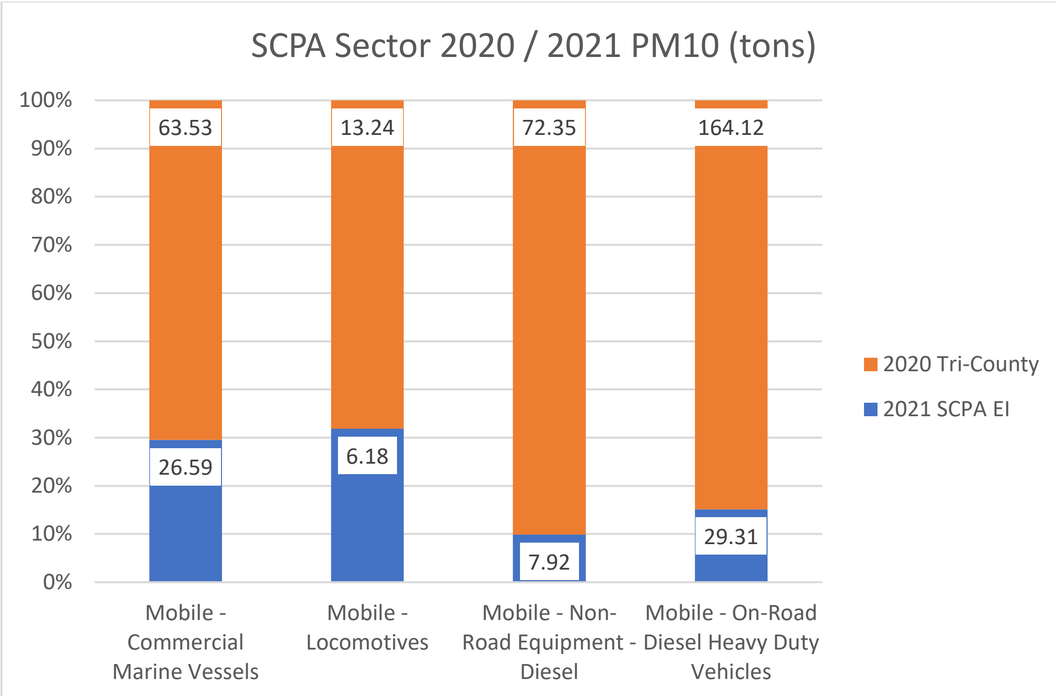


Figure 4: **SCPA / Tri-County Area Emissions by Sector (PM_{10})**

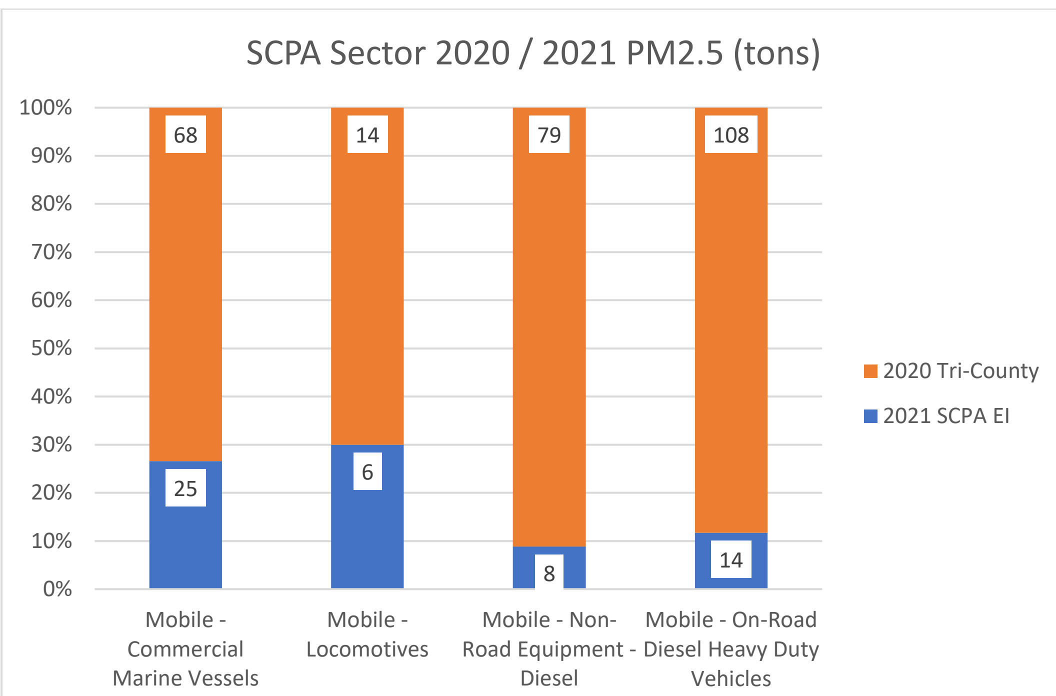


Figure 5: **SCPA / Tri-County Area Emissions by Sector ($PM_{2.5}$)**

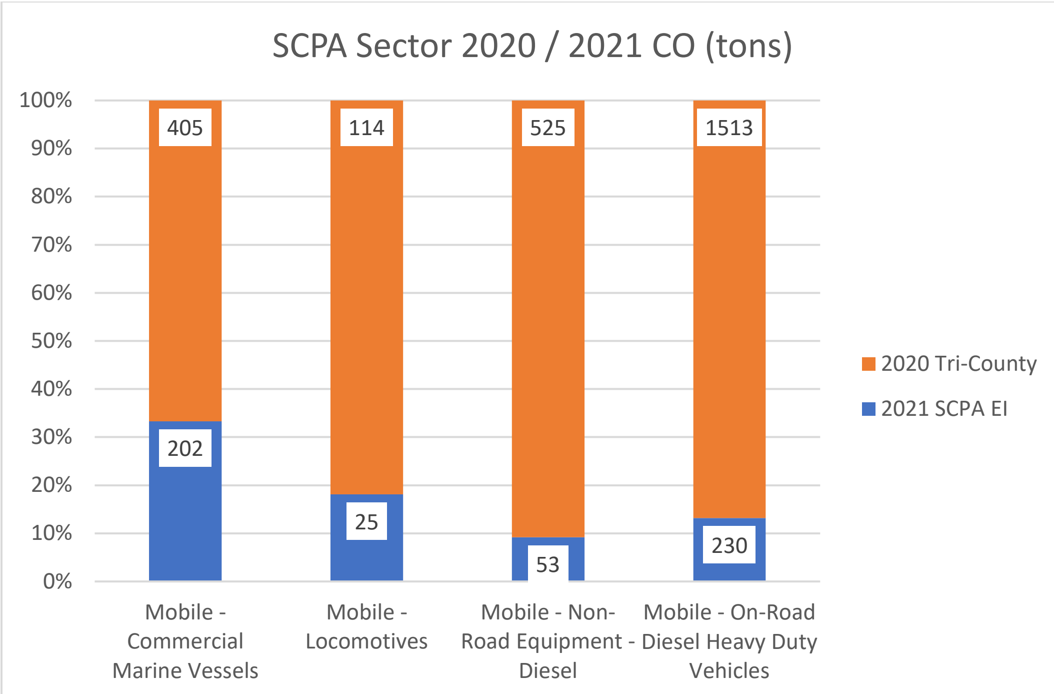


Figure 6: **SCPA / Tri-County Area Emissions by Sector (CO)**

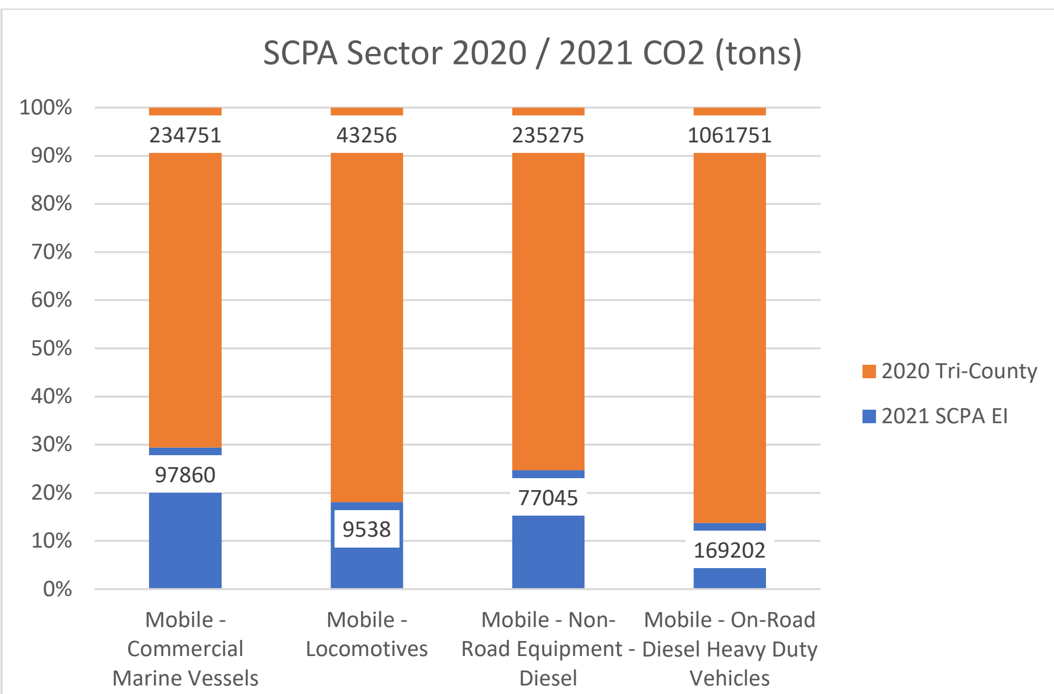
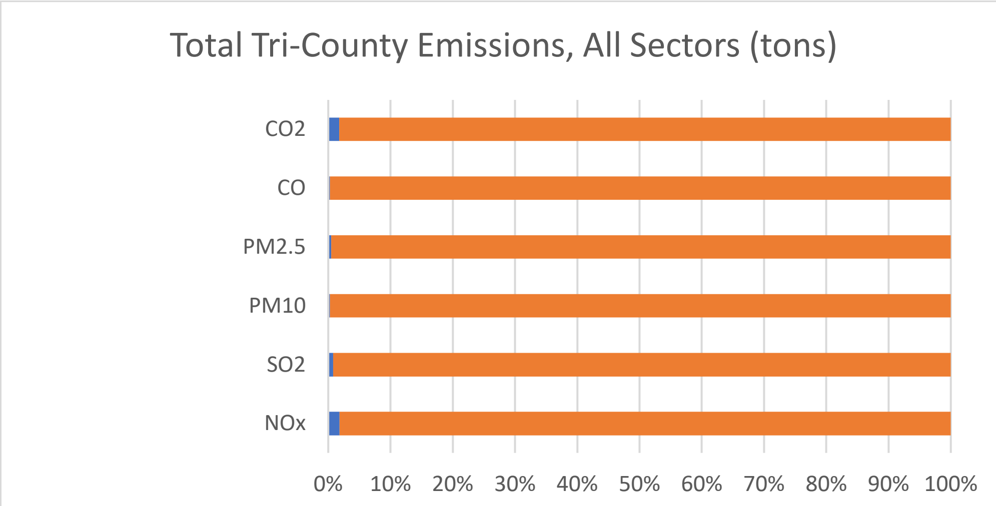


Figure 7: **SCPA / Tri-County Area Emissions by Sector (CO_2)**

2.3 SCPA TRI-COUNTY POLLUTANT CONTRIBUTION

Figure 8 illustrates the percentage of mass (tons) of pollutant emissions in the tri-county area attributed to SCPA.



	NOx	SO2	PM10	PM2.5	CO	CO2
2021 SCPA EI	1.8%	0.8%	0.3%	0.5%	0.3%	1.75%
2020 All Tri-County Sectors	98.2%	99.2%	99.7%	99.5%	99.7%	98.25%

Figure 8: **SCPA / Tri-County Area Total Emissions (All Sectors)**

3.0 COMPARISON TO AREA MONITORS

The South Carolina Department of Health and Environmental Control (SC DHEC) operates air monitoring stations throughout South Carolina to measure the concentrations of pollutants in outdoor (ambient) air. This section provides a comparison of area monitors maintained by SC DHEC to the SCPA monitors located at the Hugh Leatherman Terminal and the Union Pier Terminal.

3.1 AMBIENT AIR MONITORING STATIONS

SCPA operates a monitoring site located at the Hugh Leatherman Terminal (HLT) and the other at Union Pier Terminal (UPT). SC DHEC operated a monitoring site located at Irving Street (Monitor ID 45-019-0021) from 2020 through 2022 to monitor emissions from construction activities and post-construction operations associated with the addition of the Hugh Leatherman Terminal. SC DHEC currently operates a monitoring site at the North Charleston Fire Station (Monitor ID 45-019-0020), located approximately one mile west of the Hugh Leatherman Terminal. Data is available from the North Charleston Fire Station starting in 2022 and therefore is not included in the area monitor comparisons. There were no monitors in the SC DHEC monitoring network located in the proximity of the Union Pier Terminal that were identified as active in 2021 or that currently collect data.

3.1.1 Hugh Leatherman Terminal SCPA Monitoring Site (Charleston County)

The Hugh Leatherman monitoring site is located at latitude 32° 50’ 45.39” N, longitude 79° 56’ 39.98” W. Data collection started in March 2021. This site measures $PM_{2.5}$, NO, NO_2, NO_X, and SO_2. Publicly available quarterly reports provide 24-hour averages of $PM_{2.5}$, NO, NO_2, NO_X, and SO_2, as well as daily maximum 1-hour NO_2, 1-hour SO_2, and 3-hour SO_2.

3.1.2 Irving Street Monitoring Site (Charleston County)

The Irving Street (Monitor ID 45-019-0021) Monitoring Site is located at latitude 32.8366° N and longitude 79.957 W. The site began monitoring SO_2 and $PM_{2.5}$ on June 10, 2020. NO_2 monitoring began June 11, 2020. This site operated through December 31, 2022. The Irving Street Monitoring Site is located in the “neck” of Charleston in close proximity to the Hugh Leatherman Terminal.

The monitor was installed to monitor ambient air pollutant concentrations during pre and post construction of the Hugh Leatherman Terminal. The terminal opened in March 2021.

3.1.3 Union Pier Terminal Monitoring Site (Charleston County)

SCPA operates a monitoring site located at the Union Pier Terminal. The monitoring site is located at latitude 32° 47' 06.36" N, longitude 79° 55' 38.87 W. Data collection started in late February 2015. This site measures $PM_{2.5}$, NO, NO_2, NO_X, and SO_2. Publicly available quarterly reports provide 24-hour averages of $PM_{2.5}$, NO, NO_2, NO_X, and SO_2, as well as daily maximum 1-hour NO_2, 1-hour SO_2, and 3-hour SO_2.

3.2 LIMITATIONS

This section presumes that the SCPA onsite monitoring stations were sited and were operated in general accordance with regulatory guidelines, similarly to requirements for the SC DHEC maintained monitors. The data representing pollutants with hourly averaging periods (NO_2 and SO_2) use the maximum 1-hr daily concentration; therefore, time of day was not considered in this analysis. 2020 data collected from the Irving St. monitor is compared to 2021 data collected at the same monitor. In 2020, the Irving St. monitor collected data form June through December; therefore, this same time period is used to compare 2021 data. The HLT monitor began collecting data in March 2021. For consistency, comparisons between the HLT monitor and Irving St. monitor for 2021 are also limited to June through December.

3.3 HLT AND IRVING ST MONITORS

Concentrations detected at the HLT monitor site and the Irving St. monitor site are compared in this section. Figure 9 shows the locations of the two monitoring sites as well as the immediate surrounding area. The common pollutants monitored by the Irving St. monitor and the HLT monitor are 1-hr NO_2, 24-hr $PM_{2.5}$, and 1-hr SO_2; therefore, only these three pollutants and averaging periods are compared. The Irving St. monitor operated from mid 2020 through December 31, 2022. The Hugh Leatherman Terminal began operations in March 2021, and the on-site monitoring station also began collecting data in March 2021.

3.3.1 Comparison Methodology

Cumulative frequency was used to compare monitored concentrations. The cumulative frequency patterns illustrate how frequently concentrations occur in a period. For example, the 50th percent concentration frequency for NO_2 in Figure 12 (below) indicates that the ambient concentration of NO_2 at the Irving St. monitor site was ≤10 ppb for 50% of the time between June and December of 2020 and ≤ 12 ppb between June and December of 2020. Pollutant concentration cumulative frequencies around 50% are expected to occur almost daily. Concentrations occur less frequently as the cumulative frequency percent increases and rarely occur at cumulative frequencies closer to 98-100%. In general, ambient or background concentration can subjectively be inferred at the point in a cumulative frequency where the slope of the plotted data begins to increase.

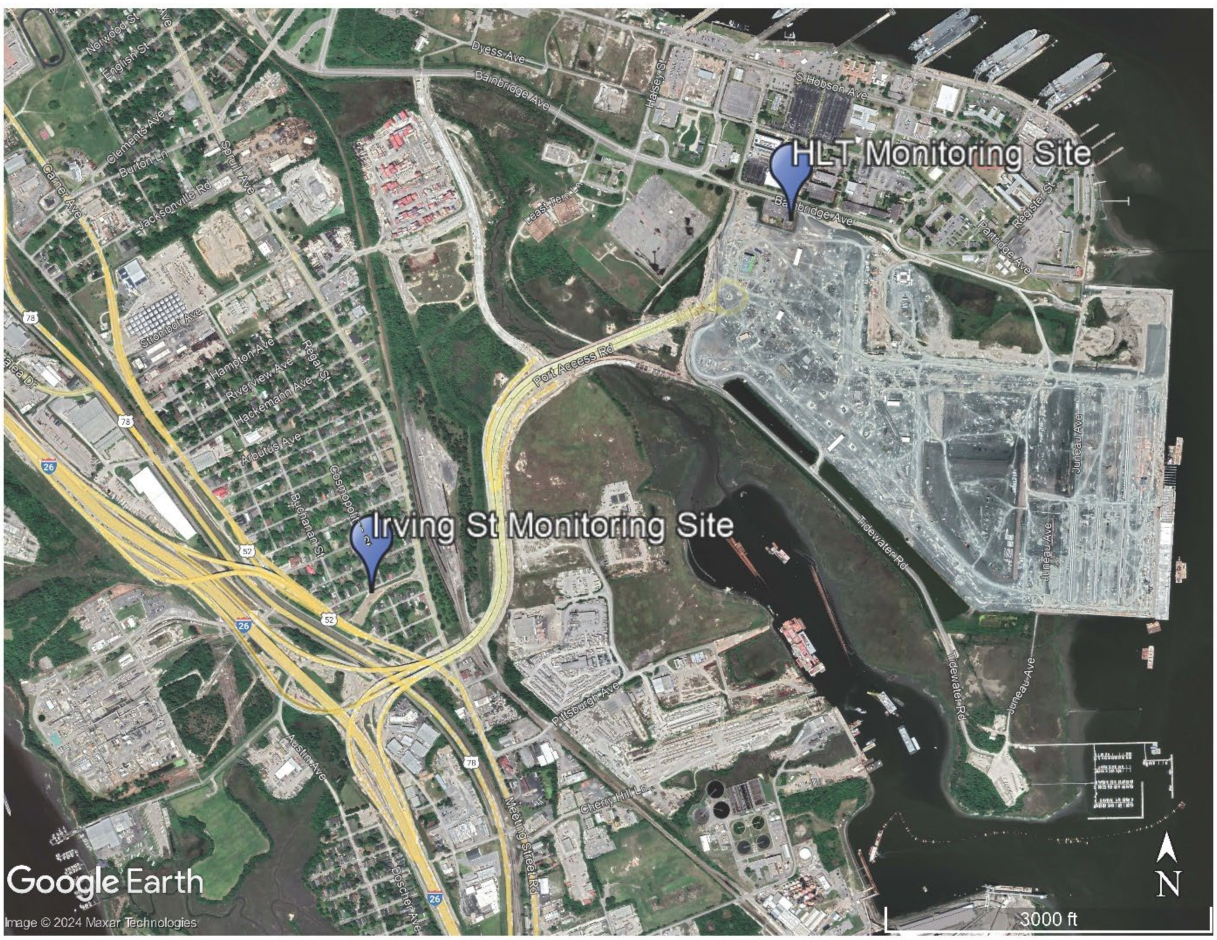


Figure 9: **HLT and Irving St. Monitoring Site Locations**

3.3.2 Irving St. Monitor

Concentrations of pollutants monitored at Irving St. during 2020 were compared with concentrations monitored in 2021 to estimate baseline data prior to HLT commencing operations. The Irving St. station began monitoring in June 2020; therefore, 2020 and 2021 data were compared for the months of June through December. Monitor concentrations were compared only for calendar days in which both monitors had available data. Potential impacts to air quality from construction and operation of the HLT are discussed below.

Potential Impacts to Irving St. Monitor: 2020 Construction (June through December)[2]

Initial site preparation, likely the activity with the most significant potential during construction to contribute to nearby ambient pollutant concentrations, occurred in late 2019 / early 2020. This work included the use of heavy machinery burning diesel, concrete demolition, and earth work. By June of 2020, much of the initial site preparation was completed. Steel framed buildings were being erected, which continued to include earthwork, and final work had been completed on the wharf. Construction was substantially complete by September 2020.

Potential Impacts to Irving St. Monitor: 2021 HLT Operations

Between June and December of 2021, there were a total of 78,122 truck visits and 33 ship calls at HLT. Monthly truck visits and ship calls during this time are shown in Figures 10 and 11.

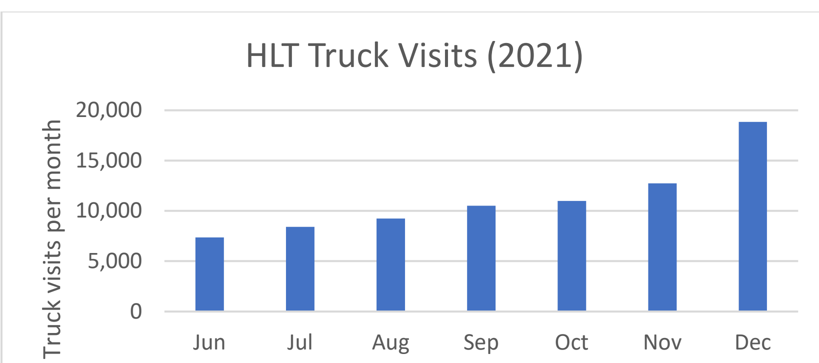


Figure 10: **HLT Truck Visits in 2021 (Jun – Dec)**

[2] https://scspa.com/about-the-port/photo-gallery/hugh-leatherman-terminal-photo-gallery/

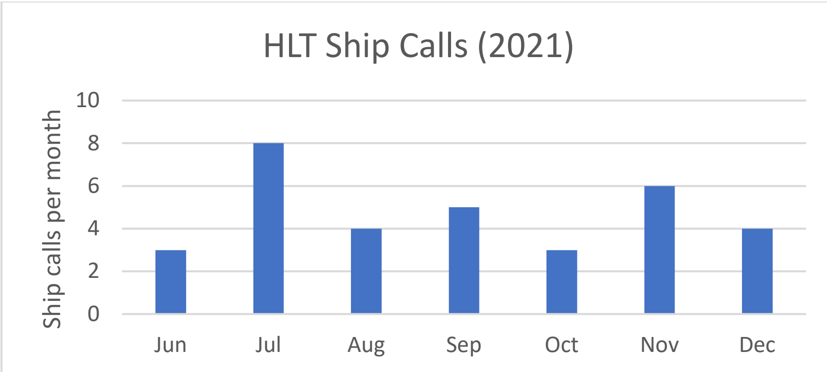


Figure 11: **HLT Ship Calls in 2021 (Jun – Dec)**

Comparison of Irving St. Monitor 2020 and 2021 Pollutant Concentrations

2020 and 2021 pollutant concentrations at the Irving St. monitor were compared for the months of June through December. These comparisons are shown in Figure 12, Figure 13, and Figure 14. Figures 12-14 illustrate a slight increase in the background concentrations of NOx, $PM_{2.5}$, and SO_2, from 2020 to 2021. At this monitor, the background concentration of NOx is inferred to be about 20 ppb in 2020 and closer to 25 ppb in 2021. The background concentration of 24-hr $PM_{2.5}$ was about 12 μg/m^3 in 2020 and 15 μg/m^3 in 2021. The background concentration of 1-hr SO_2 was about 1 ppb in both 2020 and 2021.

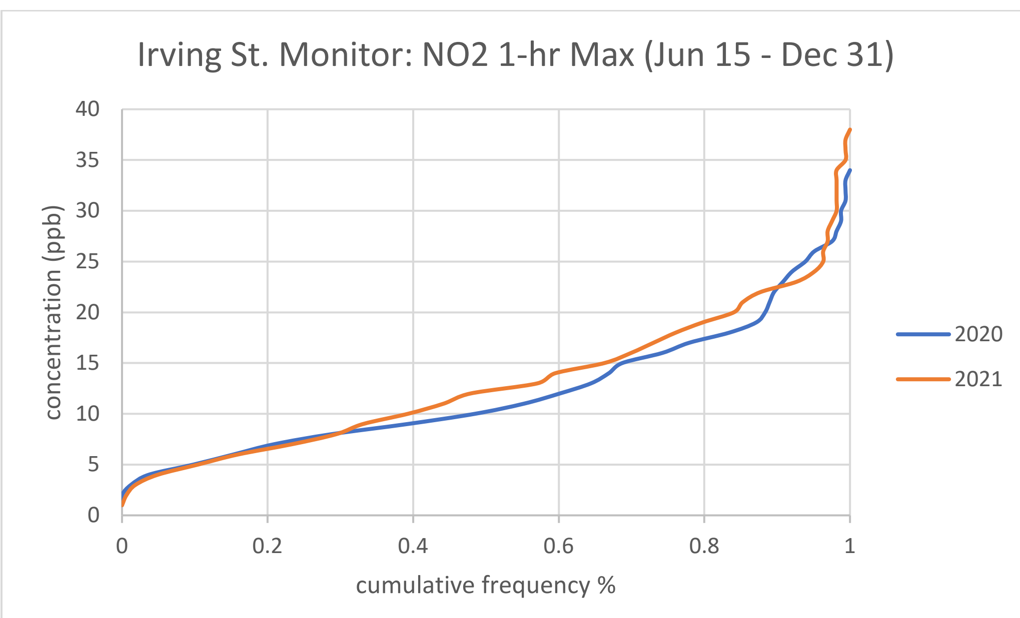


Figure 12: **Irving St. Monitor 2020 to 2021 Comparison, 1-hr NO_2**

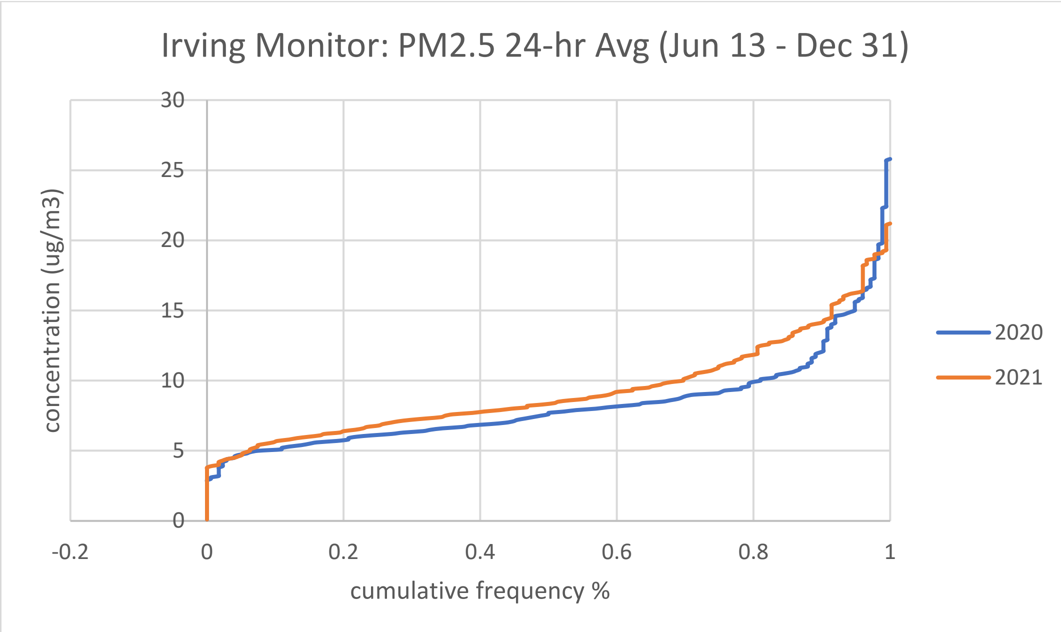


Figure 13: **Irving St. Monitor 2020 to 2021 Comparison, 24-hr $PM_{2.5}$**

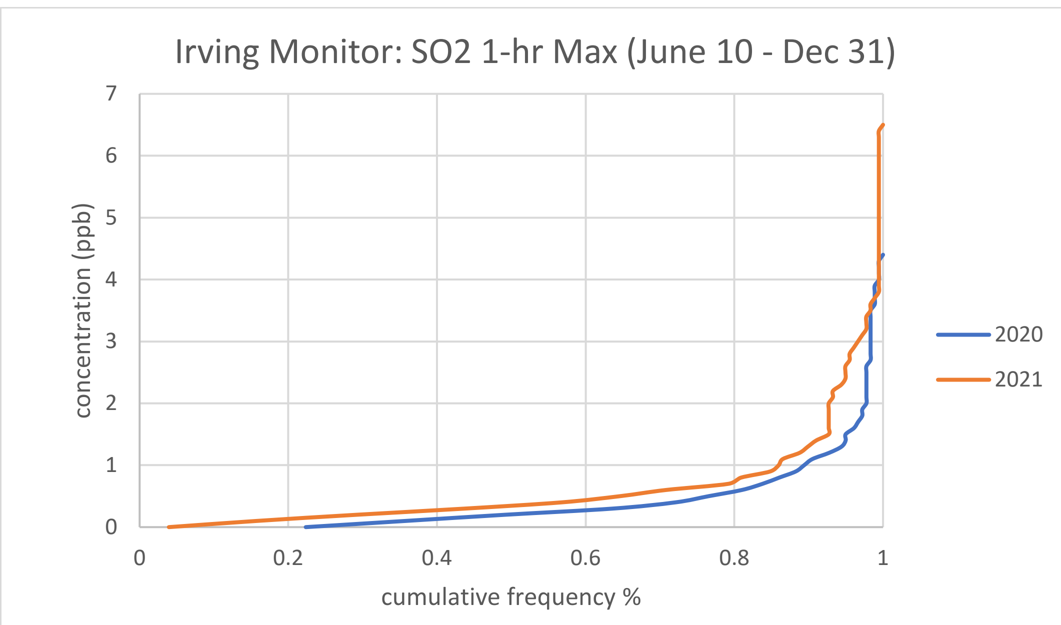


Figure 14: **Irving St. Monitor 2020 to 2021 Comparison, 1-hr SO_2**

Potential HLT Impacts to the Irving St. Monitor

Monitors located in urban communities often show weak source-to-receptor relationships for pollutants emitted from industrial sources or activities. This is due to other types of sources of emissions often occurring closer to the monitor than an industrial source (e.g., emissions from transportation and other urban activities). Emissions from these activities often tend to dominate what is measured by community monitors[3]. As seen in Figure 9, above, the Irving St. monitor is surrounded on three sides by major thoroughfares, which have the potential to contribute significantly to ambient concentrations of particulates ($PM_{2.5}$) and NO_X.

3.3.3 HLT Monitor

Cumulative frequency data from the HLT monitor was overlayed onto the 2020 and 2021 Irving St. monitor cumulative frequency data. The Irving St. monitor and HLT monitor data follow similar trends, as can be seen in Figures 18, 19, and 20. Data is shown only for those days common to all three data sets (Irving St. 2020 and 2021, and HLT 2021), which resulted in the removal of November data from the Irving St. data sets. At this monitor, the background concentration of NO_X is inferred to be about 15 ppb, the background concentration of 24-hr $PM_{2.5}$ is about 11 μg/m^3, and the background concentration of 1-hr SO_2 at this monitor is about 2 ppb.

[3] W.B. Kindzierski, PhD, P.Eng., P. Chelme-Ayala, PhD, M. Gamal El-Din, PhD, P.Eng. "Wood Buffalo Environmental Association Ambient Air Quality Data Summary and Trend Analysis", Department of Public Health Sciences, School of Public Health, Department of Civil and Environmental Engineering University of Alberta, Edmonton, Alberta.
https://ceaa-acee.gc.ca/050/documents_staticpost/59540/82534/Ambient_Air_Quality_Studies.pdf

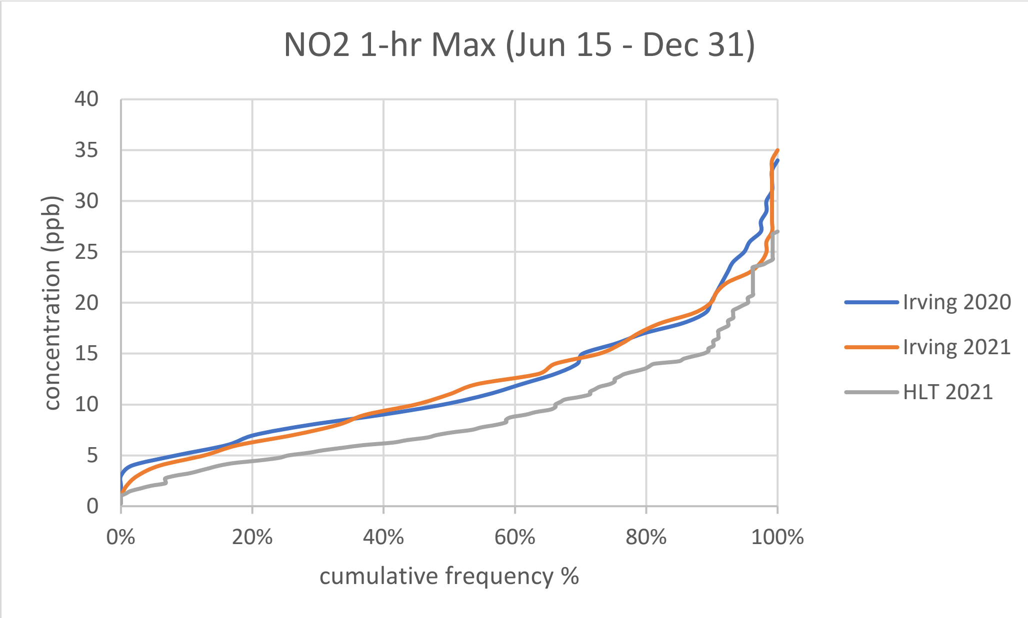


Figure 15: **Irving St. and HLT Monitor Comparison, 1-hr NO_2**

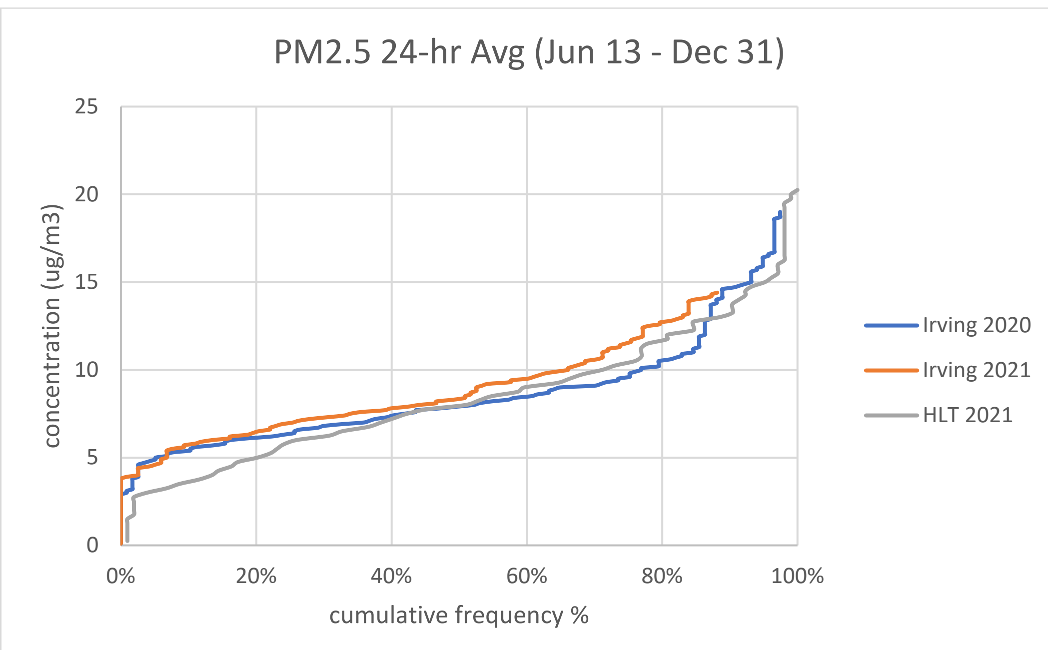


Figure 16: **Irving St. and HLT Monitor Comparison, 24-hr $PM_{2.5}$**

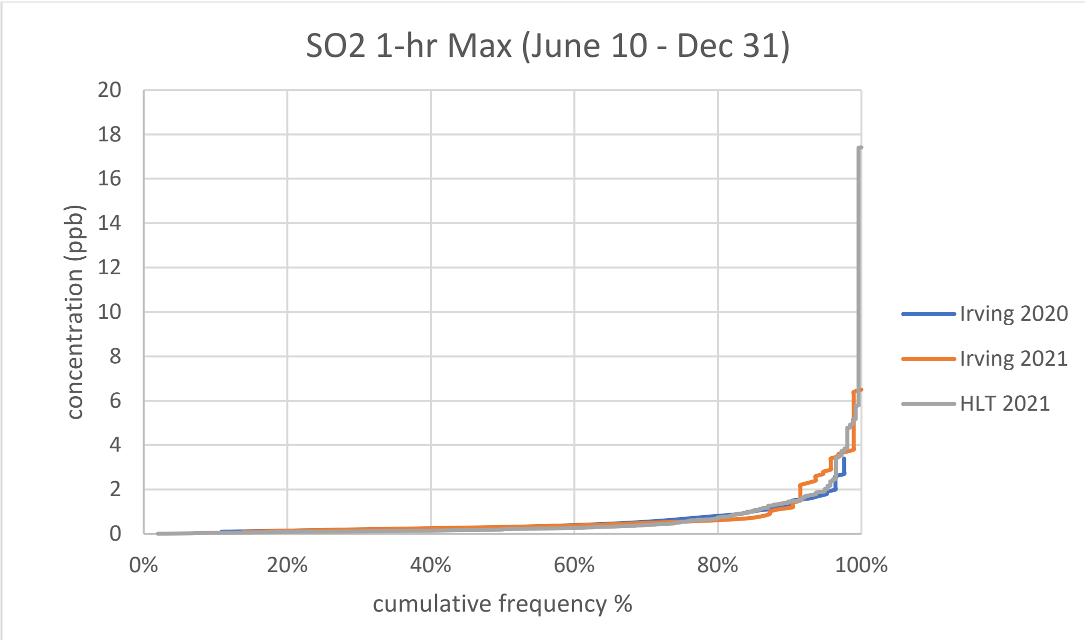


Figure 17: **Irving St. and HLT Monitor Comparison, 1-hr SO_2**

3.3.4 Single Factor ANOVA Test

Single factor (one way) analysis of variance (ANOVA) tests were used to analyze the Irving St. 2020, Irving St. 2021, and HLT 2021 annual monitoring data sets. One-way ANOVA is used to test for variance among two or more independent groups of data. ANOVA test results are an indication of whether there are statistically significant differences in data sets, or alternatively, if there is not enough evidence to reject the hypothesis that the data sets are similar. Results of the ANOVA tests are provided in Table 1. Based on this test, there is not enough evidence to suggest that there is a statistically significant difference in the means of the Irving St. data sets (2020 and 2021), as well as the Irving St. 2021 and HLT SO_2 data sets. The Irving St. 2021 and HLT 2021 NO_X and $PM_{2.5}$ means have statistically significant differences.

Table 1: ANOVA Tests

Data Set	Irv St. 2020			HLT 2021		
	Statistically Significant[1] Difference?					
	NO_X	$PM_{2.5}$	SO_2	NO_X	$PM_{2.5}$	SO_2
Irv St. 2021	No Dif	No Dif	No Dif	Yes	Yes	No Dif

[1]Signfiicance level = 0.05, No Dif = not enough evidence to suggest data sets do not have a statistically significant difference, Yes = ANOVA tests indicate data sets have statistically significant difference in means.

3.3.5 Summary and Conclusions

While the Irving St. monitor and HLT monitor appear to have similar trends when comparing cumulative frequencies by pollutant, ANOVA tests indicate the HLT and Irving St. NO_X and $PM_{2.5}$ data have statistically significant differences. With regard to NO_X and $PM_{2.5}$, it is likely that other types of sources of emissions, such as emissions from transportation and other urban activities, are the primary source of ambient pollutant concentrations in this area. This is not to say that activities at the HLT do not impact local air quality, but rather the magnitude of other sources of pollutant emissions in the area outweigh or mask impacts specifically attributed to NO_X and $PM_{2.5}$ generating activities at HLT. Based on the Irving St. 2021 and HLT 2021 data set ANOVA test, it cannot be ruled out that the data sets have similar means. Considering that ocean-going vessels may burn fuel with up to 0.1% sulfur content and all other diesel engines in the area, including passenger vehicles, require fuel with a sulfur content no greater than 0.0015% (ULSD), it is reasonable to postulate that operation of ocean-going vessels at HLT impact local SO_2 air quality in a greater proportion than NO_X and $PM_{2.5}$. Using the single factor ANOVA test on this data is a simplification used to explore the possibility that the HLT monitor impacted the Irving St. monitor, or sources near the Irving St. monitor impacted the HLT monitor. Additional analyses would need to be conducted to investigate specific potential differences in the two data sets.

3.4 TRI-COUNTY NAAQS DESIGN VALUES

A design value is a statistic that describes the air quality status of a given location relative to the level of the National Ambient Air Quality Standards (NAAQS). Design values are computed and published annually by EPA's Office of Air Quality Planning and Standards and reviewed in conjunction with the EPA Regional Offices. Design values are three-year averages of the pollutant specific statistical forms specified in 40 CFR 50. Table 2 compares 2017 and 2021 design values for the tri-county area. For reference, monitor locations are shown in Figure 18.

Table 2: **Site (Monitor) Level Design Values**

Pollutant	AQS Site ID	County	Units	NAAQS	2017 DV	2021 DV	Change
NO_2 (1-hr) 98th percentile of 1-hour daily maximum concentrations	450190046	Charleston	ppb	100	9	11 (invalid)	-2
	450190003*	Charleston			37	30 (invalid)	-7
NO_2 (Annual) Annual mean	450190046	Charleston	ppb	53	1	2	+1
Ozone (8-hr) Annual fourth-highest daily maximum 8-hour concentration	450190046	Charleston	ppm	0.070	0.059	0.058	-0.01
PM10 (24-hr)[1] Not to be exceeded more than once per year	450190003*	Charleston	ug/m3	150	0 exceed (invalid)	0 exceed (invalid)	No change
PM2.5 (24-hr) 98th percentile, averaged over 3 years	450190048	Charleston	ug/m3	35	7.3 (invalid)	7.1	-0.2
	450190049	Charleston			7.1	6.8 (invalid)	-0.3

*Irving Street Monitoring Site

[1] Reported as number of exceedances.

Figure 18: **Air Monitors (NAAQS Design Values)**

For comparison, monitoring data from the HLT monitor site and the UPT monitor site are summarized in the table below. These values are maximum values rather than the less conservative statistical forms of the NAAQS.

Table 3: **SCPA Onsite Monitor Data Compared to the NAAQS**

	Units	2017	2021	NAAQS	NAAQS Design Value
Union Pier Terminal Monitor					
NO2 (1-hr) Max average	ppb	14.19	12.82	100	98th percentile of 1-hour daily maximum concentrations
PM2.5 (24-hr) Average	ug/m3	9.68	9.60	35	98th percentile, averaged over 3 years
SO2 (1-hr) Max average	ppb	1.48	0.75	75	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

Hugh Leatherman Terminal Monitor					
	Units	2017	2021(1)	NAAQS	NAAQS Design Value
NO2 (1-hr) Max average	ppb	--	15.73	100	98th percentile of 1-hour daily maximum concentrations
PM2.5 (24-hr) Average	ug/m3	--	9.31	35	98th percentile, averaged over 3 years
SO2 (1-hr) Max average	ppb	--	1.02	75	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

[1]Data beginning March 15, 2021.

3.5 SUMMARY AND DISCUSSION

The SCPA terminals account for only a fraction of emissions in the tri-county area, according to NEI data. When considering NEI sectors specific to SCPA operations and activities, mobile emissions from commercial marine vessels contribute about 30-40% of overall emissions from that sector in the tri-county area, and mobile emissions from SCPA rail activities contribute about 20-30% of overall emissions from that sector in the tri-county area. A pollutant-by-pollutant comparison shows SCPA terminals contribute less than 2% of the total overall pollutant emissions in the tri-county area.

A comparison of the monitor site located on the Hugh Leatherman Terminal to a monitor site operated by SC DHEC in the same area indicated that the SO_2 datasets from these two monitors did not have statistically significant differences.

Tri-county NAAQS design values indicate that pollutant concentrations do not exceed the NAAQS and showed an overall decrease from 2017 to 2021, with the exception of annual NO_2. Pollutant concentrations detected at the UPT and HLT monitor sites indicate all pollutants monitored (NO_2, $PM_{2.5}$ and SO_2) are a small fraction of the NAAQS.

APPENDIX 3
AIR EMISSIONS MODELING

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1.0 DISPERSION MODELING

A dispersion modeling analysis was conducted to compare modeled ambient air pollutant concentrations to monitored concentrations. In this analysis, pollutant concentrations recorded at the Hugh Leatherman Terminal (HLT) monitor were compared to the results of an air dispersion modeling analysis.

Air dispersion modeling analyses are commonly used in lieu of air monitoring data to demonstrate ambient air concentrations from sources of emissions do not cause or contribute to exceedances of the NAAQS. Air dispersion modeling can be used to estimate the impact of discrete sources, such as from an industrial facility, on ambient air. Dispersion modeling can also be conducted on a regional scale, often by regulatory agencies. This modeling analysis estimates ambient air concentrations from four discrete sources of emissions operating at the HLT: hotelling emissions from OGV and emissions from the use of harbor craft, operation of cargo handling equipment, and emissions from heavy-duty on-terminal truck traffic. Presumed background concentrations were not incorporated into model results.

To correspond with data collected at the HLT monitor site, the pollutants and averaging periods included in this modeling analysis are 1-hr NO_X, 24-hr $PM_{2.5}$, 1-hr SO_2, and 3-hr SO_2.

1.1 LIMITATIONS

There are fundamental differences between ambient air data collected from a monitor and ambient air data predicted by a model. The primary difference is that dispersion modeling estimates ambient air concentrations of pollutant emissions sources specified in the model. Air monitor data represents all sources of pollutant emissions, including discrete impacts from nearby sources as well as general background concentrations of pollutants. Figure 1 shows sources outside of the terminal that were included in the 2020 National Emissions Inventory (NEI), indicated by numbered circles.

P:\330-000\334-120\-GIS\Maps\Maps\Maps.aprx 3/22/2024 1:53 PM (htowne)

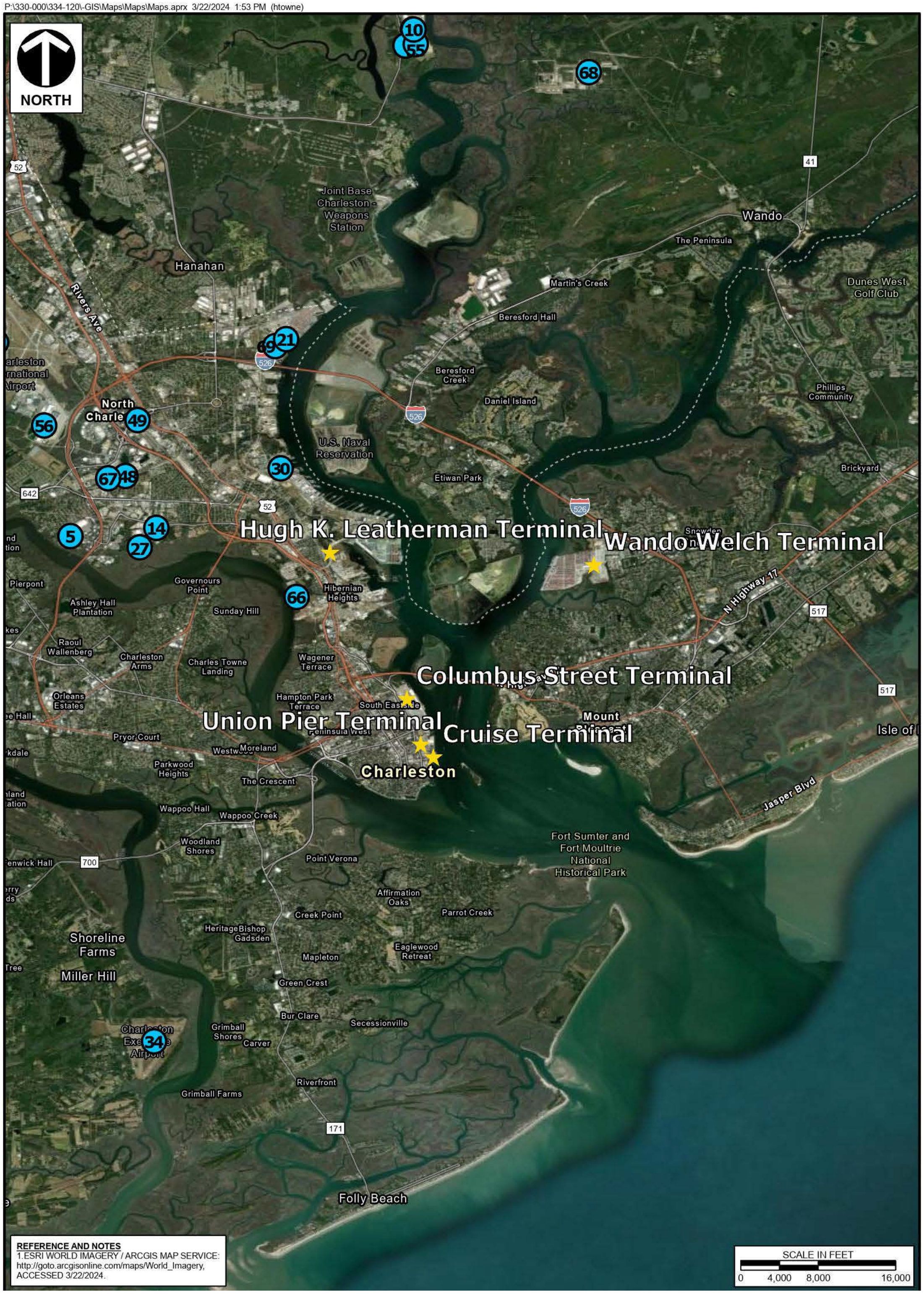

Figure 1: **Nearby Sources of Pollutant Emissions**

The other major difference between monitored and modeled data is that model data results inherently assume that the specified emission rates occur simultaneously (unless otherwise indicated) on the worst-case meteorological hour of the entire meteorological data set. To put this in context, the model results assume the following occurred simultaneously in a one-hour period, at one specific wind direction:

- The ship with the highest hourly emissions calling on HLT during 2021 was at berth and both the boiler and auxiliary engines were operating.
- The maximum number of cargo handling equipment was operating.
- The maximum average number of heavy-duty trucks during any one month visiting HLT in 2021 were driving at 10 mph and idling at the terminal during the hour.
- One harbor craft was operating continuously near the wharf.

Another source of inconsistency between modeled and monitored data stems from the use of emission factors to calculate emission rates for each of the sources in the bulleted items above. None of these sources were independently tested. The best generally applicable sources of data were used to estimate emission rates for these sources.

With the HLT monitor located on the north side of where most emissions producing activities occur (as opposed to within the area) wind direction also impacts monitor data. Modeled results are based on worst-case meteorological data occurring in one wind direction. A wind rose based on data from the Charleston International Airport in 2021 is provided as Figure 2.

Additional differences between monitored and modeled data are called out, as applicable, in specific sections of this Appendix.

1.2 MODELING METHODOLOGY

The latest version of AERMOD (v. 23132) was used for this analysis. AERMOD is a steady-state Gaussian plume model applicable to directly emitted air pollutants that employs best state-of-practice parameterizations for characterizing meteorological influences and dispersion.

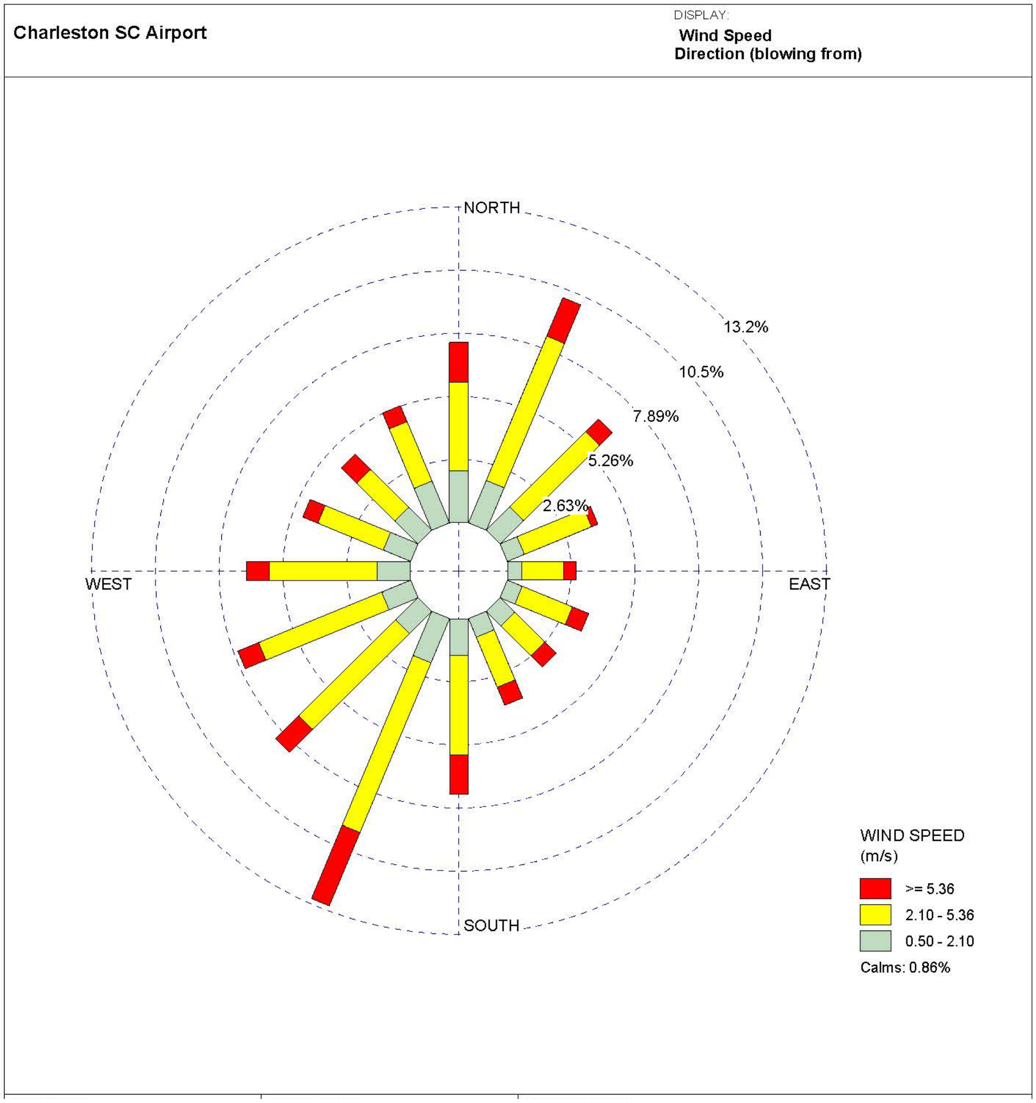

Figure 2: **2021 Wind Rose (CHS)**

1.2.1 Meteorological Data

SC DHEC provides meteorological data for use in dispersion modeling demonstrations. For Charleston County, SC DHEC provides meteorological data from the Charleston International Airport (CHS) for both surface and upper air. The current meteorological set available online from SC DHEC is through the year 2019. For this analysis AERMOD-ready meteorological data for 2021 based on measurements from CHS was purchased from a vendor. The airport is located about six miles northwest of the HLT monitoring site. Model predictions are influenced, among many other factors, by the land use surrounding the area under review. The CHS meteorological data was processed assuming all sectors (divisions of 360° surrounding the area under review) are airport use. While airport use is a conservative estimate compared to other types of land use such as urban development, when considering surface roughness in particular, it is a less conservative estimate for open water. Refinement of meteorological data is beyond the scope of this Appendix; however, if additional studies of modeling / monitoring data comparisons are undertaken, one area of refinement may be the incorporation of land use sectors specific to the area of the HLT monitor into the meteorological data set.

1.2.2 Urban Option

Based on the land use tool available through SC DHEC's website, the urban option was not used in this analysis.

1.2.3 Receptors

One receptor was placed at the location of the HLT monitor. The receptor was placed at a height of seven meters, which is the presumed height of the monitor.

1.2.4 Modeled Emission Rates

Emission rates used in this modeling analysis were assumed to be the short term (lb/hr) emission rates used in the emission calculations detailed in Appendix 1 of the 2021 Emissions Inventory.

1.2.5 NO_X / NO_2 Conversion

This analysis is based on NO_X with no conversion. Source emission rates are mixed. Some quantify NO_X while others specific NO_2. The HLT monitor collects both NO_2 and NO_X measurements, and a sample of the data indicates the NO_X / NO_2 ratio is close to one in most instances.

1.2.6 Modeled Daily Hours

Except for hotelling, the terminal activities simulated in the modeling analysis are anticipated to occur between gate open and close hours. Assuming worst-case modeling scenarios would occur when all sources of emissions are in operation, the meteorological data hours modeled were from

7:00 to 18:00 hours daily, since there were times when gates were open on Sunday. In addition, the modeling only compares short term concentration data, which would not be significantly skewed by the inclusion of an extra day of the week.

1.3 SOURCE CHARACTERIZATION

In AERMOD, sources are characterized as point sources, which have a defined stationary stack (in this case stationary refers to a ship at berth that would be expected to stay in the same location for the duration of the call), area sources, volume sources, or roads. There was no rail service at HLT in 2021. As shown in Table 1, the engines were modeled assuming two different modeling scenarios. In the first scenario, engine emissions are characterized as volume sources and in the second as area sources. The modeling study referenced in Table 1 characterized these emissions as area sources. In a broad perspective, area sources can be visualized as two-dimensional sources and volume sources as three dimensional, with the third dimension being an initial vertical component. For this comparison study, both scenarios are included.

Table 1: **Emission Source Characterization**

Emission Source	Source Type	Release Ht	Exit Temp	Exit Velocity	Stack Diameter	
		m	K	m/s	m	
Hotelling	Point[1]	43	618	16	0.5	
		Release Ht (m)	Length of side (m)	Init Vert. (m)	Init Lat (m)	Description
Harbor Craft	Area[1]	6	--	--	--	Area about ship berth, 160 m wide
Engines – Scenario 1						
Non-road engines	Volume Source	3.2 (1)	254.93	1.49	59.29	Cargo handling area of HLT footprint, as seen in 9/2021 aerial image.
	Volume Source	3.2 (1)	205.47	1.49	47.78	
On-Road Engines	Volume Sources	3.5 (1)	Adjacent volume sources, idling and moving 10 mph			Haul road along perimeter truck route, excluding cargo handling area, as seen in 9/2021 aerial image.
Engines Scenario 2						
Non-road engines	Area Source	3.2 (1)	--	--	--	Cargo handling area of HLT footprint, as seen in 9/2021 aerial image.
On-Road Engines	Area Source Idling	3.2 (1)	--	--	--	Area within the haul road perimeter, excluding the cargo handling area.

[1] Rosenbaum, A., et al., Analysis of Diesel Particulate Matter Health Risk Disparities in Selected US Harbor Areas. Am. J. Public Health 2011, 101, (Suppl 1), S217-S223.
[2] Container truck movement and idling, and non-road engines.

1.4 MODEL RUNS

An initial model run using the entire meteorological data set for 2021 beginning March 15 (when HLT began operations) through December 31 produced extremely conservative results. To refine the modeling process, only the specific dates at which four of the larger ships called on the HLT were used in four different modeling runs. The ships and dates are shown in Table 2. Each row represents a separate model run for each of the three modeled pollutants.

Table 2: **Modeled Days**

From Ship Data		Met Start	Met End
4/26/21 9:03	OOCL BRUSSELS	4/26/2021	4/27/2021
4/30/21 21:18	ANTWERPEN EXPRESS	4/29/2021	5/1/2021
8/4/21 18:50	NAVIOS CONSTELLATION	8/4/2021	8/5/2021
11/5/21 15:01	MAERSK TUKANG	11/5/2021	11/6/2021

1.5 MODEL RESULTS

Modeled results are presented in the tables below and compared with both the HLT monitor data and the Irving St. monitor data.

1.5.1 1-hr NO_X

NO_X model results are compared to site monitor data in Table 3. In two of the runs, the model significantly overestimates NO_X emissions. In one run, the model is similar to monitor data; however, it only accounts for some fraction of the sources potentially impacting the monitor and is therefore likely overestimating NO_X emissions. In the two remaining runs, modeled concentrations are less than the monitor data.

Table 3: **Model Results and Comparison to Site Monitor, 1-hr NO_X (ppb)**

		1-hr NOx (ppb)			
Met Start	Met End	Model Scene 1	Model Scene 2	HLT Monitor	Irving St. Monitor
3/15/2021	12/31/2021	376.31	420.65	33.33	--
4/26/2021	4/27/2021	74.66	150.11	16.36	--
4/29/2021	5/1/2021	26.18	20.72	17.99	--
8/4/2021	8/5/2021	2.06	0.06	10.39	7.00
11/5/2021	11/6/2021	0.50	0.01	2.27	8.00

1.5.2 24-hr $PM_{2.5}$

$PM_{2.5}$ model results are compared to site monitor data in Table 4. The modeled data are consistently less than the monitor data, to varying degrees for each run. The four activities modeled should result in concentrations less than concentration recorded at the monitor.

Table 4: **Model Results and Comparison to Site Monitor, 24-hr $PM_{2.5}$ (μg/m³)**

		24-hr PM2.5 (ug/m3)			
Met Start	Met End	Model Scene 1	Model Scene 2	HLT Monitor	Irving St. Monitor
3/15/2021	12/31/2021	0.84	2.87	23.36	--
4/26/2021	4/27/2021	0.37	0.60	16.30	11.70
4/29/2021	5/1/2021	0.36	0.37	7.97	11.20
8/4/2021	8/5/2021	1.31E-02	2.80E-04	8.32	7.60
11/5/2021	11/6/2021	8.44E-03	2.10E-04	7.00	5.90

1.5.3 1-hr and 3-hr SO_2

SO_2 model results are compared to site monitor data in Table 5. All model runs result in significantly less SO_2 concentrations than were recorded at the monitor.

Table 5: **Model Results and Comparison to Site Monitor, 1-hr SO2 (ppb)**

		1-hr SO2 (ppb)				3-hr SO2 (ppb)			
Met Start	Met End	Model Scene 1	Model Scene 2	HLT Monitor	Irving St. Monitor	Model Scene 1	Model Scene 2	HLT Monitor	Irving St. Monitor
3/15/2021	12/31/2021	0.29	0.29	17.41	--	0.11	0.21	8.55	--
4/26/2021	4/27/2021	0.06	0.11	0.27	0.60	0.02	0.05	0.13	0.50
4/29/2021	5/1/2021	0.02	0.01	1.37	1.00	0.02	0.01	0.53	0.40
8/4/2021	8/5/2021	1.52E-03	0.00E+00	0.14	0.40	8.20E-04	0.00E+00	0.09	0.30
11/5/2021	11/6/2021	3.70E-04	0.00E+00	0.73	0.00E+00	3.00E-04	0.00E+00	0.36	0.00E+00

1.6 DISCUSSION OF MODEL RESULTS

AERMOD is intended to serve as a conservative estimate of ambient air concentrations in the absence of air monitoring data. As shown in this modeling analysis and comparison, modeled concentrations and monitored concentrations can vary considerably. Major limitations to comparing modeling data with monitoring data were discussed in Section 1.1 of this Appendix. The following sections discuss specific factors as indicated or inferred by the comparisons in the Section 1.5, Model Results.

1.6.1 Emission Rates

Emission rates were estimated for each emissions source included in the modeling analysis. While they are defensible from a regulatory perspective, these emission rates could vary significantly in actuality from what was used in the model.

1.6.2 Meteorological Data

The intent of only modeling certain days corresponding to hotelling ships was to better approximate meteorological conditions at the time / day ships were at the terminal. Meteorological conditions include wind direction, temperature, precipitation, and cloud cover. Raw meteorological data is processed in AERMET (the meteorological pre-processor for AERMOD) before being incorporated into AERMOD. A more refined study between modeled and monitored data could be used to incorporate site specific data into the processed meteorological data.

1.6.3 Operating Scenarios

The limitations section summarized the operations that were assumed to occur simultaneously. As a single factor, this approach would likely overestimate pollutant concentrations.

1.7 DISCUSSION AND SUMMARY

Overall, the modeled concentrations in this study are not comparable to the monitored concentrations likely due to a combination of factors. Modeling is typically used to estimate ambient pollutant concentrations in the absence of monitor data. It is possible that a future study or analysis could be designed to better approximate actual conditions by closely coordinating onsite activities with model inputs, by coordinating nearby industrial activities that may directly impact the monitor, and by using a comprehensive plan to approximate true background concentrations.

APPENDIX 4

EMISSION REDUCTION OPPORTUNITIES

APPENDIX 4
EMISSION REDUCTIONS OPPORTUNITIES

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1.0 INTRODUCTION

Reducing emissions at shipping ports is crucial for mitigating environmental impact, particularly in terms of air quality and greenhouse gas emissions. There are many strategies and technologies commonly employed for emission reduction at shipping ports including:

1. **Shore Power (Cold Ironing):** Also known as shore-to-ship power, this technology allows ships to shut down their diesel generators while at port and connect to the local electrical grid for power, reducing emissions significantly.
2. **Alternative Fuels:** Adoption of cleaner fuels such as liquefied natural gas (LNG), hydrogen, biofuels, and even battery power for ships can help reduce emissions at ports.
3. **Efficiency Improvements:** Implementing measures to improve the energy efficiency of port operations, including optimizing cargo handling equipment, using energy-efficient systems, and employing advanced energy management systems.
4. **Hybrid and Electric Equipment:** Introduction of hybrid or fully electric equipment for cargo handling, such as cranes, forklifts, and trucks, reduces emissions at ports.
5. **Emission Control Technologies:** Installation of emission control technologies on ships and port equipment will reduce air pollutants.
6. **Port Logistics Optimization:** Optimizing port operations to reduce idle times for vessels and trucks, thereby minimizing emissions associated with waiting and queuing.
7. **Regulatory Compliance:** Compliance with local and international regulations, such as the International Maritime Organization's (IMO) sulfur emission regulations (IMO 2020) and other emission control areas (ECAs), which mandate the use of low-sulfur fuels and impose limits on emissions.
8. **Green Port Initiatives:** Participating in green port initiatives and certification programs that encourage and recognize sustainable practices, emission reduction efforts, and environmental stewardship.
9. **Collaboration and Stakeholder Engagement**: Collaboration among port authorities, shipping companies, terminal operators, government agencies, and local communities to develop and implement emission reduction strategies collaboratively.

These measures can contribute to significant reductions in emissions and environmental impact associated with port activities, fostering a more sustainable maritime industry. The emission sources associated with each of the emission reduction strategies are detailed in this report.

2.0 SHORE POWER (COLD IRONING)

Ocean going vessels and harbor craft can achieve reduced emissions by utilizing shore power. Hotelling at port is when the vessels operate auxiliary engines to maintain core functioning of the vessels during the time at port. These auxiliary engines utilize diesel fuel and are the main contributor to emissions during hotelling. Hotelling emissions can be reduced if the auxiliary engines operating time is reduced by utilizing Shore Power. Shore Power could be used during hotelling, and the vessels would plug into the local electricity grid while at port. The Shore Power Technology Assessment at U.S. Ports, 2022 Update, demonstrates that Shore Power installations typically produce zero onsite emissions. Most power generation facilities that supply electricity to Shore Power installations generate lower emissions than the emissions generated from diesel-fired auxiliary engines operating while at port. Although Shore Power can reduce emissions at the port from the auxiliary engines, there are other emission sources such as boilers that may remain operational while the vessel is at port.

EPA's Shore Power Emissions Calculator can be used to evaluate the emissions benefits of Shore Power. As renewable electricity generation continues to become more available, emissions reductions will continue to increase as well. There has been an expansion in the application of Shore Power since the last emission inventory report in 2017.

Shore Power requires appropriate infrastructure to connect the vessels as well as upgraded connections to the electrical grid. Additionally, vessels must be retrofitted with vessel-side infrastructure to be able to connect to Shore Power. The cost of Shore Power implementation and the required upgrades to the infrastructure can be significant. According to Case Studies in the Shore Power Technology Assessment, the cost of implementing Shore Power could be approximately $5 million per berth up to tens of millions of dollars. Due to the high cost of implementing Shore Power, public funding sources are cited as a critical need.

3.0 ALTERNATIVE FUELS

All emissions sources in this inventory are the result of fuel combustion. The majority of the fuel used for combustion sources is diesel fuel. By utilizing cleaner fuels such as biofuels, renewable diesel, LNG, hydrogen, biofuels, and battery power can help reduce emissions at ports.

Ocean going vessels, harbor crafts, heavy duty vehicles, and railcars can all utilize alternative fuels to provide emissions reductions. Establishing the infrastructure for producing, storing, disturbing, and refueling alternative fuels can be a significant challenge to implementing alternative fuels. Some alternative fuels are not readily available, and reliability of the fuel is imperative to the ports operations. Technical feasibility of alternative fuels will need to be considered for each combustion emission source. Modifications to existing engines may be extensive, and ensuring alternative fuel compatibility with existing engines is essential. Market demand for alternative fuels and cost-effectiveness play a crucial role in determining the ability to utilizes alternative fuels as well.

4.0 EFFICIENCY IMPROVEMENTS

Emissions reductions will be seen as older equipment becomes replaced with newer more efficient equipment. Newer manufactured engines must meet with the USEPA Tier 4 standards, which have lower emission rates than previous standards. SCPA has already replaced older RTG cranes with more efficient engines meeting the current EPA standards for the engine's manufacturing year. Continuing to replace older RTG cranes with the latest engines available will continue to reduce emissions. Similarly, replacement of older non-road engines at the end of their useful life should be considered and will result in emissions reductions.

The rail companies have also been replacing older locomotive engines with newer tier compliant engines. Although SCPA does not own the rail companies, the locomotive engines are included in the inventory.

Newer tier engines are readily available and can be replaced as older engines are at the end of their life.

5.0 HYBRID AND ELECTRIC EQUIPMENT

In addition to utilizing alternative fuels, the fossil fuel-fired engines can evaluate the use of hybrid or electric equipment as a replacement. Hybrid power systems are typically fueled by diesel with electric, hydraulic, or fuel cell-electric as options. Electrification is available for many of the emissions sources.

Electrification of the RTG cranes could be done by utilizing a motor drive cable reel system or a conductor rail system. Energy savings of around 85% can be achieved, leading to reduced emissions for RTG operations. Evaluation of replacing RTGs at the end of its life with hybrid or electric RTGs would need further study and may be cost-effective based on the fuel savings throughout the life of the RTG cranes.

On-terminal trucks could reduce emissions by replacing older trucks with electric trucks that utilize exchangeable battery systems. While electric trucks are readily available, additional infrastructure would be required to support the vehicle battery charging and battery changes. The amount of vehicle miles per charge can vary based on the truck model and battery technology. Tractors are also available with electric batteries and would also require infrastructure upgrades to be able to charge and change out the batteries. Charging and operating times may vary depending on the model and battery technology.

6.0 EMISSION CONTROL TECHNOLOGIES

Emission control technologies exist for stationary fossil fuel combustion equipment and can be utilized at the port. Hotel load reduction strategies (bonnets) to control emissions from ocean going vessels while they are docked aim to minimize auxiliary engine use during vessel berthing. Bonnets capture emissions from the auxiliary engines and treat the emissions while the ships are at port.

The USEPA granted the California Air Resources Board (CARB) authorization request for their 2020 At Berth Regulation and was published in the Federal Register on October 20, 2023. The regulation was effective January 1, 2023 and requires all ocean going vessels to have control requirements.

During hotelling, a bonnet is placed over the vessel's exhaust stack and captures the exhaust emissions. The treatment methods used to destroy or reduce the emissions can vary. Some treatment technologies include particulate matter filters, selective catalytic reduction to reduce NOx emissions, and advanced exhaust gas cleaning systems. The bonnet can be applied to multiple stack types and do not require any modifications to the ships. There are a number of available bonnet systems on the market.

7.0 PORT LOGISTICS OPTIMIZATION

Emission reductions can be achieved by optimizing port operations for many sources. Decreasing the number of times a container is moved will also reduce the idling times for vessels and trucks; and thereby reduce emissions. Digital technologies are available to optimize logistics, improve configuration of the terminal, reduce waiting times, and enhance overall efficiency. Using analytics to predict vessel arrivals, cargo handling times, and optimal berthing schedules can reduce emissions by minimizing idling times and fuel consumption. Real-time monitoring can aid in evaluating schedules and planning.

Smart ports are intelligent digital ports that operate autonomously. The port systems can adapt based on real-time conditions to adjust based on changing demands as well as optimize operations. Smart ports can utilize many different technologies. Internet of Things (IoT) collect data from various port components to enable real-time data monitoring. Block chain, augmented reality, edge computing, high-speed connectivity, and artificial intelligence (AI) are all technologies that can help to optimize logistics to reduce emissions.

Challenges to some of the logistics include system incompatibilities, infrastructure constraints resource and funding, and security threats. Integrating the smart port technologies into the existing systems could be difficult because existing systems may not be able to communicate with newer technologies without significant updates. Infrastructure updates may be needed to create the space and technology needed to implement smart port technologies. Resource constraints could be citied as a challenge for many emission reductions opportunities. With smart port technologies, developing the personnel to handle the technology upgrades as well was the investment required to implement the technologies can be a constraint. Security is an important risk to consider with smart port technologies. As the port becomes more connected and has more data electronically available, there will be an increase in cybersecurity threats and potential data breaches.

8.0 REGULATORY COMPLIANCE

As regulations continue to be promulgated for marine ports, emissions will continue to be reduced. The International Maritime Organization's (IMO) implements regulations, and the most recent regulations were implemented in 2020. The IMO sulfur cap limits the sulfur content in marine fuels of 0.5%, which further reduces sulfur dioxide emissions. The IMO will continue to set standards for new and existing ships to improve energy efficiency and reduce emissions.

Currently there is proposed legislation in the U.S. that aims to tax marine carbon fuels and regulate port emissions. The Clean Shipping Act of 2023 is a bill that directs the EPA to set lower carbon intensity standards for fuels used in ships. The bill has a goal to eliminate in-port ship emissions by 2030, and reduce greenhouse gas emissions by 2040.

Although the CARB regulations won't apply to SCPA, there is the potential that other regulatory agencies will also implement similar regulations that seek to control pollution from auxiliary engines while at berth.

9.0 GREEN PORT INITIATIVES

A set of policy measures and management approaches to reduce the environmental impact of maritime operations. Green port initiatives are focused on sustainability of ports and maritime operations both from an economic and environmental perspective.

Many of the above emission reduction strategies can be combined with these green port initiatives. Increasing investment in shore power, utilizing lower emitting fuels, and reducing energy consumption are all key aspects of green port initiatives.

Some U.S. and international ports are offering incentives for ships that are more environmentally friendly. Some incentives include: offering priority port slots to more environmentally friendly ships, reducing dockage fees for ships that reduce speed while approaching the port, ports dues reductions for zero-carbon or low-carbon fuel use, offering registration fee and tax reductions for new ships, and developing an emissions-trading scheme. Currently only a small amount of port-based incentives are available. Implementing green port initiatives will help to incentivize the ships to further reduce emissions. There are additional programs such as the Environmental Ship Index, Clean Shipping Index, GHG Emissions Rating, and Green Award that seek to incentivize qualified ships.

10.0 COLLABORATION AND STAKEHOLDER ENGAGEMENT

Effective reduction strategies can be achieved through collaboration among various stakeholders such as port authorities, shipping companies, terminal operators, government agencies, and local communities. Investment and sharing of data is important for port authorities when working with other stakeholders. Port authorities can be active in setting emission reduction targets, enforcing regulations, developing green port incentives, and promoting sustainable operations. A key partner for the ports authorities are the shipping companies. The shipping companies could lead the effort in investigating alternative fuels and increasing the vessels efficiency. By sharing data with other stakeholders, shipping companies can help to support regulatory reporting and identify emission reduction opportunities. Additional collaboration with the rail yards, terminal operations, and pilot associations could help to identify and track emission reductions.

Government agencies and local communities also play a role as stakeholders in achieving emission reductions at ports. Many of the above reduction strategies can be achieved but can be economically infeasible. By providing financial incentives such as tax credits or grant opportunities, the federal, state and local governments can help the ports support emission reduction efforts. Additional research is required to make additional emission reduction strategies both technically and economically feasible. Investment in research and pilot projects is imperative to develop and test those emission reduction technologies. Engaging the local community in the decision-making process will help to align the ports priorities. It is important to both understand the local community’s concerns and educate the community about the ports operations and emission reduction efforts.