GREENHOUSE GAS AND CRITERIA AIR POLLUTANT EMISSIONS INVENTORY FOR THE PORT AUTHORITY OF NEW YORK & NEW JERSEY

Calendar Year 2019

Final Report

Prepared for:

The Port Authority of New York & New Jersey

Prepared by:

SC&A, Inc.

October 2021

(This page intentionally left blank)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

AC	air conditioning
ACRP	Airport Cooperative Research Program
AEDT	Aviation Environmental Design Tool
AMT	Auto Marine Terminal
APU	Auxiliary Power Unit
ATADS	Air Traffic Activity Data System
B20	20 percent biodiesel
Btu	British thermal units
CAD	Central Automotive Division
CAP	criteria air pollutant
ccf	100 cubic feet
CFCs	chlorofluorocarbons
CH_4	methane
CHP	combined heat and power
CNG	compressed natural gas
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
ConEdison	Consolidated Edison Co. of N.Y., Inc.
CY	calendar year
EDMS	Emission and Dispersion Modeling System
eGRID	Emissions & Generation Resource Integrated Database
E10	10 percent ethanol
E85	85 percent ethanol
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EUI	energy use intensities
EWR	Newark Liberty International Airport
EY	emission year
FAA	Federal Aviation Administration
FLIGHT	EPA's Facility Level Information on GreenHouse Gases Tool
ft	foot, feet
g	gram(s)
g/mi	grams per mile
gal	gallon
GHG	greenhouse gas
GRP	general reporting protocol
GSE	ground support equipment
GW Bridge	George Washington Bridge
GWBBS	George Washington Bridge Bus Station
GWP	global warming potential
HCFC	hydrochlorofluorocarbon
HFCs	hydrofluorocarbons
hp	horsepower
hr	hour
HRSG	heat recovery steam generator
Hz	hertz
ICAO	International Civil Aviation Organization
IPCC	Intergovernmental Panel on Climate Change
JFK	John F. Kennedy International Airport
kBtu	kilo-Btu
kg	kilogram
KIAC	Kennedy International Airport Cogeneration
kWh	kilowatt hour

lb	pound
LF	load factor
LGA	LaGuardia Airport
LPG	liquefied petroleum gas
LTO	landing and take-off
MARKAL	EPA's MARKet ALlocation database
MMBtu	million British thermal units
MOVES	EPA's MOtor Vehicle Emissions Simulator
MWh	megawatt hour(s)
Mlbs	thousand pounds
National Grid	National Grid USA Service Company, Inc.
N_2O	nitrous oxide
N/A	not applicable
NJ	New Jersey
NJMT	New Jersey Marine Terminals
No.	number
NO_x	nitrogen oxides
NPCC	Northeast Power Coordinating Council
NY	New York
NYC	New York City
NYCW	NPCC NYC/Westchester
NYMT	New York Marine Terminals
NYNJLINA	New York/Northern New Jersey/Long Island Non-Attainment Area
NYUP	NPCC Upstate NY
ODS	ozone-depleting substance
PABT	Port Authority Bus Terminal
PATH	Port Authority Trans-Hudson
PCA	preconditioned air
PDF	portable document format
Pechan	former E.H. Pechan & Associates (now SC&A)
PFCs	perfluorocarbons
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
Port Authority	Port Authority of New York and New Jersey
ppm	parts per million
PSEG	Public Service Electric and Gas
RFCE	Reliable First Corporation East
scf	standard cubic foot
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
SO_x	sulfur oxides
SWF	Stewart International Airport
TCR	The Climate Registry
TEB	Teterboro Airport
VMT	vehicle miles traveled
VOCs	volatile organic compounds
WPCI	World Ports Climate Initiative
WRI	World Resources Institute
WTC	World Trade Center

EXECUTIVE SUMMARY

In 2018, the Port Authority of New York and New Jersey (Port Authority) became the first public transportation agency in the nation to embrace the Paris Climate Agreement. In doing so, the Port Authority set a goal to reduce its greenhouse gas (GHG) emissions by 80 percent by 2050 and an interim goal of reducing operational control emissions by 35 percent by 2025, both from a 2006 baseline. Since 2006, the Port Authority has achieved a reduction of 53,995 metric tons carbon dioxide equivalent (CO_2e) emissions from activities under its operational control through changes in operations and implementation of numerous sustainability initiatives. This corresponds to a 19.7 percent reduction relative to the 2006 base year, thus making significant progress toward the agency's GHG reduction goal of a 35 percent reduction in operations control emissions by 2025. The reduction in 2019 is due to several energy efficiency initiatives being completed, as well as continued decarbonization of the electricity grid.

Port Authority's 2019 operational control (scopes 1 and 2) emissions are down 19.7 percent as compared to the 2006 baseline as documented in this GHG inventory report. There are several major drivers:

- From 2006 to 2019, the Port Authority implemented numerous energy efficiency programs across its facilities, such as the installation of LED lighting, upgrading HVAC equipment, and building efficiency improvements. As of 2019, over 15,000 light fixtures at several facilities were converted to LED technology, resulting in over 2,700 metric tons of avoided GHG emissions. Port Authority has also been transitioning fleet vehicles to electric models, in 2019 reaching 122 electric light-duty vehicles, which reduced GHG emissions from fuel consumption by 8 percent**.** Port Authority plans to have 50 percent of the fleet electrified by the year 2023, which will result in 600 to 700 light-duty vehicles no longer powered by fossil fuels. In addition, the Port Authority has invested in solar projects at Newark and Stewart airports and PATH, which produce power for facilities, reducing emissions by 324 metric tons of CO_2e annually.
- Weather has an impact on operational control emissions because providing heating and cooling is a primary driver of energy consumption. Both 2018 and 2019 were colder than average, with 2019 being the coldest year in New York City since 2014. An analysis was conducted of the impact of 2019 temperatures at LaGuardia Airport compared to the 2010–2019 historical average. This analysis found that emissions from natural gas (for heating) were 4.8 percent higher than would be expected in a typical year, whereas electricity emissions (for cooling) were largely in line with the historical average. These weather conditions affected energy consumption and emissions across Port Authority facilities in 2019.
- Emissions & Generation Resource Integrated Database (eGRID) emission factors are used in calculating the emissions from electricity consumption in a specific geographic area. They are updated and released biennially by the US Environmental Protection Agency (EPA). As the electricity grid transitions away from fossil fuels to cleaner sources, especially renewables, the eGRID emission factors decrease. Electricity decarbonization is continuing in both New York and New Jersey. The 2019 GHG emissions inventory

updated the eGRID emission factors (which previously were from 2017). Overall electricity consumption was flat between 2018 and 2019, but electricity GHG emissions declined by 3 percent, because of electricity decarbonization.

- Port Authority's emissions can be normalized to account for increasing services provided by the Port Authority to its customers. This normalization shows the GHG emissions per unit of activity in a consistent manner over time, illustrating the impact of the Port Authority's actions, independent from the change in activity. For example, the normalized emissions show GHG emissions at airport facilities per airport passenger, PATH emissions per PATH passenger, with similar appropriate metrics for each facility. Within its operational control, Port Authority's normalized emissions have declined faster (33%) than the decline in absolute emissions (20%) over the 2006-2019 period.
- In 2019, there was a one-time release of fire suppressant materials at the George Washington Bridge Bus Station, which resulted in emissions of 533 tCO2e. This represented 0.2 percent of agency-wide operational control emissions in 2019.

In 2019, scope 3 emissions (emissions outside Port Authority's operational control, but related to Port Authority facilities, such as actions of tenants, customers and employees) decreased 8.1% compared to 2006.

While many of the factors influencing the Port Authority's annual GHG emissions are difficult to predict, the Port Authority continues to make significant strides in the decarbonization of agency and stakeholder activities, including renewable energy projects, energy efficiency measures and sustainability initiatives aimed at decreasing emissions. In this report you will find the Port Authority's emissions profile for 2019 across scopes 1, 2, and 3. For more information on Port Authority sustainability initiatives, visit the agency's public website at www.panynj.gov/port-authority/en/about/Environmental-Initiatives.html

1.0 INTRODUCTION

1.1 Background

The Port Authority of New York and New Jersey (Port Authority) owns, manages, and maintains bridges, tunnels, bus terminals, airports, the Port Authority Trans-Hudson (PATH) commuter rail system, and marine terminals that are critical to the metropolitan New York and New Jersey region's trade and transportation capabilities. Major facilities owned, managed, operated, or maintained by the Port Authority include John F. Kennedy International Airport (JFK), Newark Liberty International Airport (EWR), LaGuardia Airport (LGA), Stewart International Airport (SWF), and Teterboro Airport (TEB); the George Washington Bridge and Bus Station; the Lincoln and Holland tunnels; Bayonne Bridge; Goethals Bridge; Outerbridge Crossing; Port Newark; Howland Hook Marine Terminal; the Port Authority Bus Terminal (PABT); and the 16-acre World Trade Center (WTC) site in lower Manhattan.

In June 1993, the Port Authority issued its environmental policy affirming its long-standing commitment to provide transportation, terminal, and other facilities of commerce within its jurisdiction, to the greatest extent practicable, in an environmentally sound manner and consistent with applicable environmental laws and regulations. On March 27, 2008, the Board of Commissioners expanded the Port Authority's environmental policy to include a sustainability component that explicitly addresses the problem of climate change and ensures that the agency maintains an aggressive posture in its efforts to reduce greenhouse gas (GHG) emissions. On October 25, 2018, the Port Authority became the first public transportation agency in the United States to embrace the Paris Climate Agreement, setting aggressive interim GHG reduction targets that call for a 35-percent reduction by 2025 and reaffirming the agency's commitment to an 80-percent reduction by 2050 relative to its 2006 base year.

The Port Authority retained the services of SC&A, Inc. to conduct annual emission inventories covering GHGs and co-pollutants that are collectively referred to as criteria air pollutants (CAP). The Port Authority's inventories follow international best practices for defining the inventory boundary in terms of an organizational and operational boundary, and further characterizing the operational boundary in terms of scope 1, scope 2, and scope 3 emissions (WRI 2004). A thorough discussion of the Port Authority's inventory structure is provided in Section 1.2.

The Port Authority is publishing this 2019 GHG and CAP inventory as a tool for evaluating the effects of ongoing mitigation actions and informing the design of future environmental and sustainability initiatives.

1.2 Inventory Structure

The structure of the Port Authority's GHG and CAP inventory conforms to the corporate accounting and reporting standard (GHG Protocol) published by the World Resources Institute (WRI) and World Business Council for

Sustainable Development (WRI 2004). Per the GHG Protocol, the Port Authority defined the inventory boundary in relation to its organizational and operational boundaries. The Port Authority sets the organizational boundary using the operational control approach. The GHG Protocol defines operational control as an organization having “the full authority to introduce and implement its operating policies at the operation” (WRI 2004). The Port Authority’s operational boundary encompasses direct and indirect emissions as follows:

- Direct scope 1 emissions result from the combustion of fuels by or fugitive losses from sources operated by the Port Authority (e.g., Port Authority-owned and -controlled vehicles, air conditioning (AC) equipment, and emergency generators).
- Indirect scope 2 emissions pertain to Port Authority energy acquisitions for the benefit of its operations but from sources not operated by the Port Authority (e.g., electricity purchases for the benefit of Port Authority operations).
- Indirect scope 3 emissions relate to emissions from tenant and customer activities within or physically interacting with Port Authority-owned facilities (e.g., aircraft movements during landing and take-off cycle below an altitude of 3,000 feet (ACRP 2009), vehicular movements across bridges and tunnels). This scope also includes emissions from Port Authority employee commuting.

To clarify the extent to which the Port Authority has influence over scopes 1, 2, and 3 emitting activities, a carbon management dimension was added to the inventory boundary. At one end of the carbon management spectrum are activities over which the Port Authority has the most influence, such as energy acquisitions for the benefit of its own operations (e.g., natural gas, transportation fuels, electricity purchases). At the other end are activities over which the Port Authority has little influence, such as an employee’s decision on mobility (e.g., use of personal vehicle versus mass transit for daily commuting). An illustration of the Port Authority’s inventory boundary and key structural features is shown in **Error! Reference source not found.**.

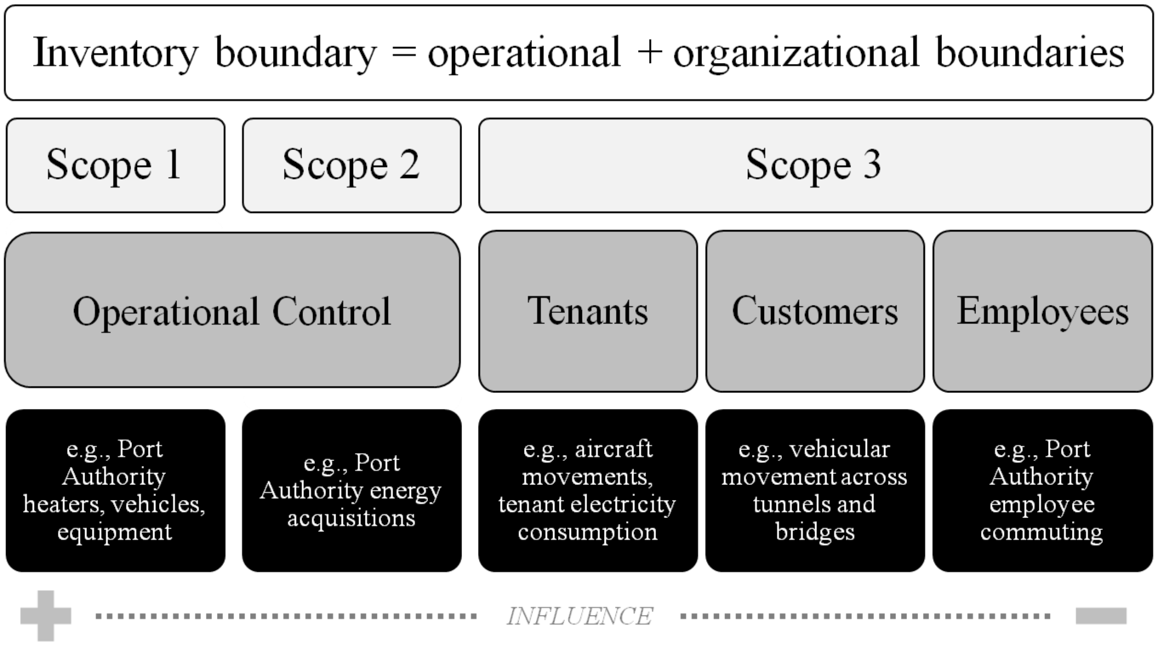

Figure 1-1. Schematic of the Port Authority's Inventory Boundary

1.2.1 Pollutant Coverage

The Port Authority inventory covers the six main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Where applicable, the report also shows emissions in carbon dioxide equivalent (CO_2e), where the emissions of each pollutant are multiplied by their respective global warming potential (discussed in Section 1.2.2) to express total radiative forcing effects in a single unit, with CO_2 as the reference gas. The inventory also quantifies key co-pollutants referred to collectively as criteria pollutants or CAPs; these include nitrogen oxides (NO_x), sulfur oxides (SO_x), particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}), and particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$).

1.2.2 Global Warming Potentials

The Intergovernmental Panel on Climate Change (IPCC) develops global warming potentials (GWPs) to quantify the globally averaged relative radiative forcing effects of a given GHG, using CO_2 as the reference gas. In 1996, the IPCC published a set of GWPs in its Second Assessment Report (IPCC 1996) that are still used by international convention to maintain consistency with international practices, including by the United States and Canada when submitting national communications to the United Nations Framework Convention on Climate Change. For this reason, this GHG inventory adopts the GWP values from the Second Assessment Report as reference GWP values, shown here in Table 1-1.

Table 1-1. Global Warming Potential Factors for Reportable GHGs

Common Name	Formula	Chemical Name	GWP
Carbon dioxide	CO_2	N/A	1
Methane	CH_4	N/A	21
Nitrous oxide	N_2O	N/A	310
Sulfur hexafluoride	SF_6	N/A	23,900
Hydrofluorocarbons (HFCs)			
HFC-23	CHF_3	trifluoromethane	11,700
HFC-32	CH_2F_2	difluoromethane	650
HFC-41	CH_3F	fluoromethane	150
HFC-43-10mee	$C_5H_2F_{10}$	1,1,1,2,3,4,4,5,5,5-decafluoropentane	1,300
HFC-125	C_2HF_5	pentafluoroethane	2,800
HFC-134	$C_2H_2F_4$	1,1,2,2-tetrafluoroethane	1,000
HFC134a	$C_2H_2F_4$	1,1,1,2-tetrafluoroethane	1,300
HFC-143	$C_2H_3F_3$	1,1,2-trifluoroethane	300
HFC-143a	$C_2H_3F_3$	1,1,1-trifluoroethane	3,800
HFC-152	$C_2H_4F_2$	1,2-difluoroethane	43
HFC-152a	$C_2H_4F_2$	1,1-difluoroethane	140
HFC-161	C_2H_5F	fluoroethane	12
HFC-227ea	C_3HF_7	1,1,1,2,3,3,3-heptafluoropropane	2,900
HFC-236cb	$C_3H_2F_6$	1,1,1,2,2,3-hexafluoropropane	1,300
HFC-236ea	$C_3H_2F_6$	1,1,1,2,3,3-hexafluoropropane	1,200
HFC-236fa	$C_3H_2F_6$	1,1,1,3,3,3-hexafluoropropane	6,300
HFC-245ca	$C_3H_3F_5$	1,1,2,2,3-pentafluoropropane	560
HFC-245fa	$C_3H_3F_5$	1,1,1,3,3-pentafluoropropane	950
HFC-365mfc	$C_4H_5F_5$	1,1,1,3,3-pentafluoropropane	890
Perfluorocarbons (PFCs)			
Perfluoromethane	CF_4	tetrafluoromethane	6,500
Perfluoroethane	C_2F_6	hexafluoroethane	9,200
Perfluoropropane	C_3F_8	octafluoropropane	7,000
Perfluorobutane	C_4F_{10}	decafluorobutane	7,000
Perfluorocyclobutane	$c\text{-}C_4F_8$	octafluorocyclobutane	8,700
Perfluoropentane	C_5F_{12}	dodecafluoropentane	7,500
Perfluorohexane	C_6F_{14}	tetradecafluorohexane	7,400

Source: IPCC 1996.

1.2.3 Operational Control Emissions

Emissions that fall under the operational control of the Port Authority include direct scope 1 emissions and indirect scope 2 emissions as defined by the GHG Protocol (WRI 2004). The Port Authority sponsors annual assessments of scope 1 and scope 2 emissions for the purpose of tracking progress towards the goal of carbon neutrality for Port Authority operations. To that end, the Port Authority selects emission estimation methods that meet a materiality standard of 5 percent (i.e., the sum of errors and misstatements do not exceed 5 percent of total emissions). The Port Authority successfully registered the 2010, 2011, and 2012 scope 1 and scope 2 inventories with The Climate Registry (TCR). These GHG inventories were independently verified to be complete, transparent, and materially accurate. Since 2015, the Port Authority also voluntarily discloses its verified carbon footprint to CDP (a nonprofit organization that provides a global system for companies and cities to measure, disclose, manage, and share vital environmental information) and has its GHG inventory independently verified by a third party on an annual basis.

The characterization of emission sources under the operational control of the Port Authority is presented in Table 1-2. Emission sources are grouped by general emission categories, including stationary and mobile combustion; purchased heating, cooling, and steam; and fugitive emissions. In addition, a range of activities associated with these emission categories is provided. "Buildings" represents emissions from energy consumption (e.g., natural gas or electricity) at Port Authority facilities. "Emergency Generators and Fire Pumps" corresponds to emissions from fuel combustion by emergency response equipment. "Rail Systems" refers to emissions from energy acquisitions for the operation of the PATH light rail lines and stations. Emissions from combustion of transportation fuels by the Port Authority's vehicle fleet are broken down by three fleet segments, the "CAD Main Fleet," the "Executive Fleet," and the "Scope 1 Tenant Fleet." Emissions from combustion of fuels for operation of non-road equipment along the PATH system are labeled "PATH Non-Road Equipment." "Refrigeration/Fire Suppression" refers to unintentional releases of refrigerant from air conditioning equipment and intentional releases from specialty fire suppression systems. "Landfill Gas" is associated with fugitive emissions from a closed landfill at Port Elizabeth. "Welding" refers to emissions that stem from routine maintenance operations.

Table 1-2 also identifies for each emitting activity the corresponding scope and indicates whether biogenic emissions are also generated. For the Port Authority, biogenic emissions are the result of bioethanol and biodiesel fuel consumption by the Central Automotive Division (CAD) fleet and CO_2 fugitive emissions from the closed Elizabeth Landfill.

Table 1-2. Characterization of Sources under the Operational Control of the Port Authority

Emission Category	Activity	Scope		
		1	2	Biogenic
Stationary Combustion	Buildings	✓		
	Emergency Generators and Fire Pumps	✓		
	Welding	✓		
Mobile Combustion	CAD Main Fleet	✓		✓
	Executive Fleet	✓		✓
	Scope 1 Tenant Fleet	✓		✓
	PATH Non-Road Equipment	✓		
Purchased Electricity	Buildings		✓	
	Rail Systems		✓	
Purchased Cooling	Buildings		✓	
Purchased Heating	Buildings		✓	
Purchased Steam	Buildings		✓	
Fugitive Emissions	Landfill Gas	✓		✓
	Refrigeration/Fire Suppression	✓		

1.2.4 Scope 3 Emissions – Tenants

The Port Authority promotes commerce and regional economic development with the help of partners, tenants, and contractors (hereinafter referred to as "tenants"). In general, tenants conduct business within Port Authority facilities (e.g., operation of cargo handling equipment in maritime terminals) or interact directly with Port Authority infrastructure (e.g., aircraft movements). Emissions from tenant activities fall outside the Port Authority's operational control and, therefore, are classified as scope 3. Emission estimates for tenant sources are based on best available methods and data sources. In some cases, these estimates have a margin of error of less than 5 percent, but in most cases, tenant emission estimates do not subscribe to a 5 percent materiality standard. Assessing tenant emissions helps the Port Authority identify environmental and sustainability initiatives that can best be achieved in collaboration with its tenants.

The characterization of tenant emission sources is presented in Table 1-3. Emission sources are grouped by general emission categories, including stationary and mobile combustion; purchased electricity, heating, cooling, and steam; as well as construction and aircrafts. In addition, a range of activities associated with these emission categories is provided. “Buildings” corresponds to emissions from tenant energy consumption (e.g., natural gas or electricity). “Cargo Handling Equipment” points to emissions from fuel combustion by cargo processing equipment at maritime ports. “Ferry Movements” are mobile emissions from ferry operations that arrive to and depart from the Port Authority’s Brookfield Place (formerly known as the World Financial Center) Ferry Terminal. “Rail Locomotives” refers to mobile emissions from such equipment with access to Port Authority property. “Rail Systems” refers to emissions from energy acquisitions for the AirTrain light rail lines and stations. “Shadow Fleet” corresponds to mobile emissions from vehicles owned by, but not operated by, the Port Authority. “AMT, Vehicle Movements” are mobile emissions from staging imported vehicles on the premises of the Auto Marine Terminal (AMT). “Non-Road Diesel Engines” reflects emissions from diesel construction equipment activity on Port Authority-sponsored sites. “Aircraft Movements” account for emissions from aircraft engines during a landing and take-off cycle. “Auxiliary Power Units” are emissions from aircraft auxiliary engines used to provide lighting and air conditioning at the terminal gate. Finally, “Ground Support Equipment” refers to emissions from equipment used to service aircrafts between flights.

Table 1-3. Characterization of Tenant Sources

<table>
<tr><th rowspan="2">Emission Category</th><th rowspan="2">Activity</th><th colspan="2">Scope</th></tr>
<tr><th>3</th><th>Biogenic</th></tr>
<tr><td>Stationary Combustion</td><td>Buildings</td><td>✓</td><td></td></tr>
<tr><td rowspan="5">Mobile Combustion</td><td>AMT, Vehicle Movements</td><td>✓</td><td rowspan="5">✓</td></tr>
<tr><td>Ferry Movements</td><td>✓</td></tr>
<tr><td>Rail Locomotives</td><td>✓</td></tr>
<tr><td>Shadow Fleet</td><td>✓</td></tr>
<tr><td>Cargo Handling Equipment</td><td>✓</td></tr>
<tr><td rowspan="2">Purchased Electricity</td><td>Buildings</td><td>✓</td><td></td></tr>
<tr><td>Rail Systems</td><td>✓</td><td></td></tr>
<tr><td rowspan="2">Purchased Cooling</td><td>Buildings</td><td>✓</td><td></td></tr>
<tr><td>Rail Systems</td><td>✓</td><td></td></tr>
<tr><td rowspan="2">Purchased Heating</td><td>Buildings</td><td>✓</td><td></td></tr>
<tr><td>Rail Systems</td><td>✓</td><td></td></tr>
<tr><td>Construction</td><td>Non-Road Diesel Engines</td><td>✓</td><td></td></tr>
<tr><td rowspan="3">Aircrafts</td><td>Aircraft Movements</td><td>✓</td><td rowspan="3"></td></tr>
<tr><td>Auxiliary Power Units</td><td>✓</td></tr>
<tr><td>Ground Support Equipment</td><td>✓</td></tr>
</table>

1.2.5 Scope 3 Emissions – Customers

The Port Authority promotes commerce and regional economic development for the benefit of the public (hereinafter referred to as "customers"). Emissions from customer activities fall outside the Port Authority's operational control and are therefore classified as scope 3. Emission estimates for customer sources are based on best available methods and data sources, but customer emission estimates do not subscribe to a 5 percent materiality standard. Assessing customer emissions helps the Port Authority consider carbon and air pollution impacts stemming from utilization of its infrastructure and may inform decision-makers on the selection and design of future capital projects.

The characterization of customer emission sources is presented in Table 1-4. Emission sources are grouped by general emission categories, including attracted travel and energy production. Attracted travel refers to customer motorized travel to access Port Authority infrastructure and includes a range of activities. The category "Drayage Trucks" covers emissions from drayage trucks moving cargo inland from the maritime ports. "Commercial Marine Vessels" refers to emissions from vessels that call on or provided service to vessels that call on Port Authority ports. "Airport Passenger" accounts for emissions from motorized travel to access Port Authority air terminals. "Air Cargo" pertains to emissions associated with the distribution of cargo shipping to and from Port Authority airports. "Through Traffic" describes emissions from vehicles that travel across Port Authority tunnels, bridges, and bus terminals. "Queued Traffic" accounts for emissions from vehicular congestion when the demand for a given tunnel or bridge exceeds its capacity. "Electricity Sold to Market" accounts for emissions from electricity that is generated in Port Authority-owned power plants but consumed downstream by a non-specified end user through the electricity market. This category excludes electricity produced in a Port Authority-owned power plant and consumed by the Port Authority or a Port Authority tenant. Note that electricity production at the Essex County Resource Recovery plant is generated primarily from the combustion of municipal solid waste, which qualifies by federal and New Jersey state law as biogenic emissions. Finally, the "Economic Recovery Program" refers to the distribution of low-cost electricity to local business impacted by the events of September 11, 2001.

Table 1-4. Characterization of Customer Sources

Emission Category	Activity	Scope	
		3	Biogenic
Attracted Travel	Air Cargo	✓	
	Airport Passenger	✓	
	Commercial Marine Vessels	✓	
	Drayage Trucks	✓	
	PATH Passenger	✓	
	Through Traffic	✓	
	Queued Traffic	✓	
Energy Production	Electricity Sold to Market	✓	✓
Purchased Electricity	Economic Recovery Program	✓	

1.2.6 Scope 3 Emissions – Employees

The Port Authority includes in its scope 3 boundary emissions associated with the commuting of its employees. The Port Authority regularly conducts anonymous employee surveys to collect information about commuting habits, including but not limited to distance, mode, origin, and destination. Through these surveys, the Port Authority gathers feedback about proposed initiatives affecting employee commuting. The characterization of employee emission sources is presented in Table 1-5.

Table 1-5. Characterization of Employee Sources

Emission Category	Activity	Scope	
		3	Biogenic
Mobile Combustion	Employee Business Travel	✓	
	Employee Commuting	✓	✓

1.3 Summary of GHG Emissions Results

This section presents the results of the 2019 GHG inventory for anthropogenic emissions, unless otherwise specified. CAP emissions were estimated as co-pollutants; those emissions results are presented thematically at the end of each chapter.

In 2019, the Port Authority had a total carbon footprint (scopes 1+2+3) of 5,362 thousand metric tons CO_2e. This represents a decrease of 8.1 percent relative to the revised 2006 base year.[1] Since 2006, the Port Authority has achieved notable emission reductions in scope 2 emissions through the implementation of energy efficiency and energy conservation initiatives. Additionally, the Port Authority has kept scope 3 emissions in check despite growing customer demand for Port Authority infrastructure over time. A comparison of the 2019 carbon footprint with the 2006 baseline is presented in **Error! Reference source not found.**.

[1] In March 2018, the 2006 base year inventory was revised to reflect the best practices adopted by Port Authority's GHG inventory program. The revisions to the 2006 inventory are detailed in Appendix D to the 2016 GHG and CAP report.

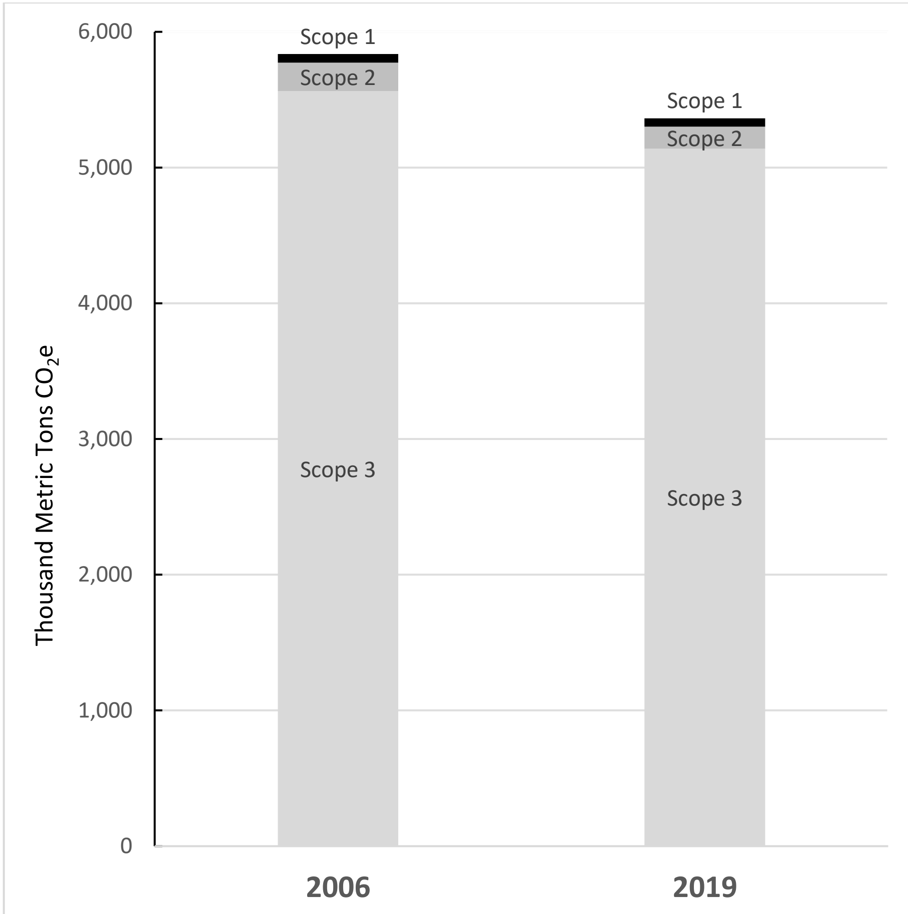

Figure 1-2. 2019 GHG Inventory Comparison with the 2006 Baseline

The carbon footprint of the Port Authority's operations (scopes 1+2) amounted to 220,262 metric tons of CO_2e in 2019. Since 2006, the Port Authority has achieved a reduction of 53,995 metric tons CO_2e through changes in operations and implementation of numerous sustainability initiatives. This level of carbon mitigation corresponds to a 19.7 percent reduction relative to the 2006 base year, thus making significant progress toward the agency's scope 1 and 2 mitigation goal of 35 percent by 2025. A comparison of the 2019 and 2006 operational control GHG emission inventories is shown in **Error! Reference source not found.**.

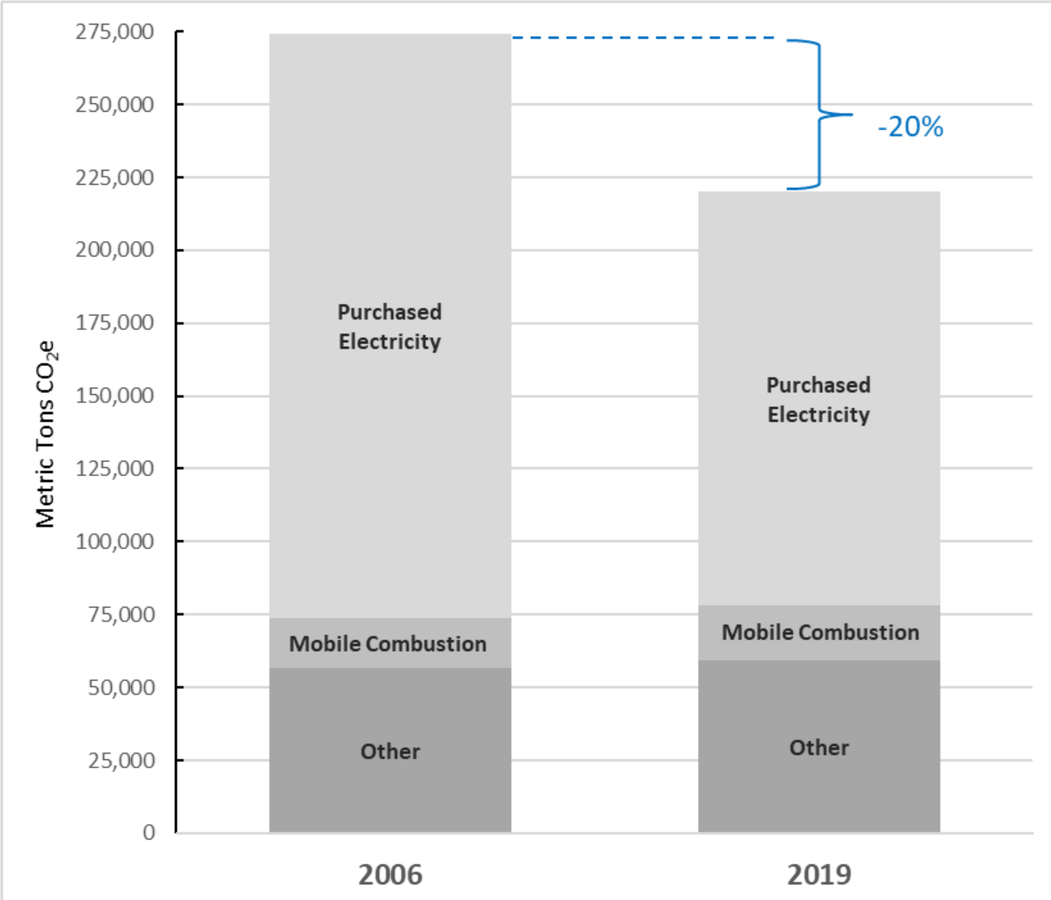

Figure 1-3. 2019 Operational Control GHG Emissions Comparison with the 2006 Baseline

The breakdown of emissions by carbon management level and scope is presented in Table 1-6. Total GHG emissions in the Port Authority's inventory are 5,362,113 metric tons CO_2e. Tenant emissions account for half of total emissions (53.1 percent), followed by customer emissions (42.5 percent). Operational control emissions are relatively small, amounting to 4.1 percent. Employee emissions are the smallest, making up less than 1 percent of the entire Port Authority inventory. The Port Authority assesses GHG and criteria pollutants from all emitting activities in its operational control boundary annually and assesses emissions from scope 3 sources on a regular basis. An account of scope 3 emission estimates by year of assessment is provided as supplemental information in Appendix A: Scope 3 GHG Emissions by Year of Assessment.

Table 1-6. Port Authority 2019 GHG Emissions Summary (metric tons CO_2e)

Carbon Management Level	Scope 1	Scope 2	Scope 3[a]	Total	Total %
Operational Control	60,026	160,236		220,262	4.1%
Tenants	0		2,845,089	2,845,089	53.1%
Customers			2,277,123	2,277,123	42.5%
Employees			19,638	19,638	0.4%
TOTAL	**60,026**	**160,236**	**5,141,851**	**5,362,113**	**100.0%**

[a] The sum of scope 3 emissions reflects emission values for the most recent assessment of a given source.
Note: Totals may not match the column sums due to rounding.

In conformance with the GHG Protocol, the Port Authority reports biogenic emissions separately. Within the Port Authority inventory boundary, there are multiple sources of biogenic emissions, including the CO_2 byproduct of municipal solid waste decomposition released from the closed Elizabeth Landfill and combustion of biofuels by the CAD main fleet, executive fleet, Scope 1 tenant fleet, shadow fleet, and vehicles used by commuting employees. Most biogenic emissions come from energy recovery activities at the Essex County Resource Recovery facility, where municipal solid waste is combusted. A summary of biogenic emissions is presented in Table 1-7.

Table 1-7. Port Authority 2019 Biogenic GHG Emissions Summary (metric tons CO_2e)

Carbon Management Level	Facility	Activity	Biogenic CO_2
Operational Control	Elizabeth Landfill	Landfill Gas	470
	Fleet Vehicles	CAD Main Fleet	1,148
		Executive Fleet	0
		Tenant Fleet (Formerly Shadow Fleet)	848
Tenant & Partners	Multi-Facility: Aviation	Shadow Fleet: Aviation	616
	Multi-Facility: Non-Aviation	Shadow Fleet: Non-Aviation	29
Customers	Essex County Resource Recovery	Electricity Sold to Market	517,611
Employees	Multi-Facility	Employee Commuting	845
TOTAL			**521,566**

Note: Totals may not match the column sums due to rounding.

Table 1-8 presents anthropogenic emissions by line department and emissions categories across the carbon management spectrum. Sources grouped as “Multi-Department” include mobile combustion emissions from employees commuting to various Port Authority facilities and stationary combustion emissions from the maintenance and use of emergency generators and fire pumps located across the entire organization. Emissions from sources not expressly affiliated with one department, such as electricity purchases and heating in support of central administrative functions, are denoted as “Central Administration.”

Table 1-9 summarizes the Port Authority’s anthropogenic GHG emissions by emission category and emitting activity across the carbon management spectrum. For the “Drayage Trucks” activity under “Attracted Travel,” this report accounts for emissions to the first point of rest to a maximum distance of 400 miles, which is about the distance travelled on a full tank of diesel by a drayage truck in a day. The first point of rest boundary reflects an industry good practice for the management of GHG emissions (WPCI 2010). Drayage truck emissions in this report complement the results of the Port Department’s 2019 Multi-Facility Emission Inventory (Starcrest 2020) by estimating incremental emissions from the 16-county New York/Northern New Jersey/Long Island Non-Attainment Area (NYNJLINA) boundary to the first point of rest.

Table 1-8. Port Authority 2019 GHG Emissions by Line Department (metric tons CO_2e)

Department/Emissions Category	Scope 1	Scope 2	Scope 3			Total
	Ops. Control		*Tenants & Partners*	*Customers*	*Employees*	
Aviation	**26,100**	**75,781**	**2,519,348**	**795,429**		**3,416,659**
Aircraft			2,261,671			2,261,671
Attracted Travel				738,693		738,693
Energy Production				56,736		56,736
Fugitive Emissions	1,758					1,758
Mobile Combustion			8,663			8,663
Purchased Cooling		5,751	13,355			19,107
Purchased Electricity		66,802	202,511			269,313
Purchased Heating		3,228	8,777			12,005
Stationary Combustion	24,342		24,370			48,712
Central Administration	**19,722**	**3,469**	**82**			**23,274**
Fugitive Emissions	196					196
Mobile Combustion	18,451		82			18,533
Purchased Electricity		3,469				3,469
Stationary Combustion	1,075					1,075
Engineering	**0**		**21,762**			**21,762**
Construction			21,762			21,762
Fugitive Emissions	0					0
Multi-Department	**852**				**19,638**	**20,491**
Mobile Combustion					19,638	19,638
Stationary Combustion	852					852
PATH	**4,645**	**38,612**	**389**	**44,850**		**88,495**
Attracted Travel				44,850		44,850
Fugitive Emissions	1,489					1,489
Mobile Combustion	441					441
Purchased Electricity		38,612	278			38,889
Stationary Combustion	2,716		111			2,827
Planning			**18,157**			**18,157**
Mobile Combustion			17,996			17,996
Purchased Electricity			161			161
Stationary Combustion			0			0
Port	**3,514**	**1,953**	**153,368**	**864,024**		**1,022,859**
Attracted Travel				864,024		864,024
Fugitive Emissions	2,963					2,963
Mobile Combustion			144,922			144,922
Purchased Electricity		1,953	6,961			8,914
Stationary Combustion	551		1,485			2,036
Real Estate	**584**	**2,266**	**82,530**	**334,906**		**420,287**
Energy Production				334,906		334,906
Purchased Electricity		2,266	62,818			65,085
Stationary Combustion	584		19,712			20,296
Tunnels, Bridges, & Bus Terminals	**3,046**	**22,326**	**2,548**	**220,992**		**248,912**
Attracted Travel				220,992		220,992
Fugitive Emissions	536					536
Purchased Electricity		16,986	2,067			19,054
Purchased Steam		5,339				5,339
Stationary Combustion	2,510		480			2,990
World Trade Center	**1,562**	**15,829**	**46,906**	**16,921**		**81,218**
Fugitive Emissions	1,562					1,562
Purchased Electricity		12,006	46,906	16,921		75,833
Purchased Steam		3,823				3,823
TOTAL	**60,026**	**160,236**	**2,845,089**	**2,277,123**	**19,638**	**5,362,113**

Note: Totals may not match the column sums due to rounding.

Table 1-9. Port Authority 2019 GHG Emissions by Emissions Category and Activity (metric tons CO_2e)

Emissions Category and Activity	Scope 1	Scope 2	Scope 3			Total
	Ops. Control		*Tenants & Partners*	*Customers*	*Employees*	
Aircraft			**2,261,671**			**2,261,671**
Aircraft Movements			2,008,827			2,008,827
Auxiliary Power Units			39,177			39,177
Ground Support Equipment			213,667			213,667
Attracted Travel				**1,868,559**		**1,868,559**
Air Cargo				58,424		58,424
Airport Passenger				680,269		680,269
Commercial Marine Vessels				182,337		182,337
Drayage Trucks [a]				316,405		316,405
Drayage Trucks [b]				365,282		365,282
PATH Passenger				44,850		44,850
Queued Traffic				34,941		34,941
Through Traffic				186,051		186,051
Construction			**21,762**			**21,762**
Non-Road Diesel Engines			21,762			21,762
Energy Production				**391,642**		**391,642**
Electricity Sold to Market				391,642		391,642
Fugitive Emissions	**8,505**					**8,505**
Landfill Gas	2,942					2,942
Refrigeration/Fire Suppression	5,563					5,563
Mobile Combustion	**18,891**		**171,664**		**19,638**	**210,193**
AMT, Vehicle Movements			406			406
CAD Main Fleet	11,514					11,514
Cargo Handling Equipment			120,625			120,625
Employee Commuting					19,436	19,436
Executive Fleet	0					0
Ferry Movements			17,996			17,996
PATH Non-Road Equipment	441					441
Rail Locomotives			23,891			23,891
Business Travel					202	202
Tenant Fleet (Formerly Shadow Fleet)	6,936					6,936
Shadow Fleet: Aviation			8,663			8,663
Shadow Fleet: Non-Aviation			82			82
Purchased Cooling		**5,751**	**13,355**			**19,107**
Buildings		5,751	12,568			18,319
Rail Systems			787			787
Purchased Electricity		**142,094**	**321,702**	**16,921**		**480,718**
Economic Recovery Program				16,921		16,921
Buildings		108,071	300,607			408,678
CAD Main Fleet		0				0
Rail Systems		34,023	21,095			55,118
Purchased Heating		**3,228**	**8,777**			**12,005**
Buildings		3,228	7,995			11,223
Rail Systems			782			782
Purchased Steam		**9,163**				**9,163**
Buildings		9,163				9,163
Stationary Combustion	**32,630**		**46,158**			**78,788**
Buildings	31,778		46,158			77,936
Emergency Gen. and Fire Pumps	852					852
Welding	1					1
TOTAL	**60,026**	**160,236**	**2,845,089**	**2,277,123**	**19,638**	**5,362,113**

[a] Travel distance to NYNJLINA boundary.
[b] Travel distance from NYNJLINA boundary to first point of rest.
Note: Totals may not match the column sums due to rounding.

Since the 2006 GHG emissions inventory was conducted, Port Authority has expanded its airports, increased its shipping and rail capacity, and brought online the entire World Trade Center (WTC) complex. Port Authority faces a significant challenge in simultaneously reducing its GHG emissions while it continues to expand the services it provides. This report includes normalized emissions to account for the impact Port Authority expansions have had on emissions. This normalization is done at the department level. For example, at the ports, the total cargo tonnage and twenty-foot equivalent units have increased since 2006. Dividing the emissions from Port facilities by the cargo tonnage for each year yields normalized port emissions over time. Normalized department-level emissions are then combined into a single agency-wide total, weighted based on each department's portion of total emissions.

This normalization method can be applied within reason to both Port Authority's operational control and scope 3 emissions using each department's relevant activity metric. Emissions under operational control scale with Port Authority's operations, which enable and are correlated with the services provided to some extent. In that sense, it is reasonable, while imperfect, to normalize emissions under operational control on the basis of increased services such as additional cargo or airport passengers.

Figure 1-4 shows the normalized change in operational control emissions since 2006 relative to the actual emissions. The red bars show absolute emissions in metric tons, which have declined by 20% since 2006. The blue line shows those same emissions normalized by the services Port Authority is providing, relative to 2006 emission levels. Normalized emissions have declined by 33% between 2006 and 2019. This decline is greater than the change in operational control emissions without normalization because the total services provided by Port Authority have increased since 2006, while agency-wide emissions have declined.

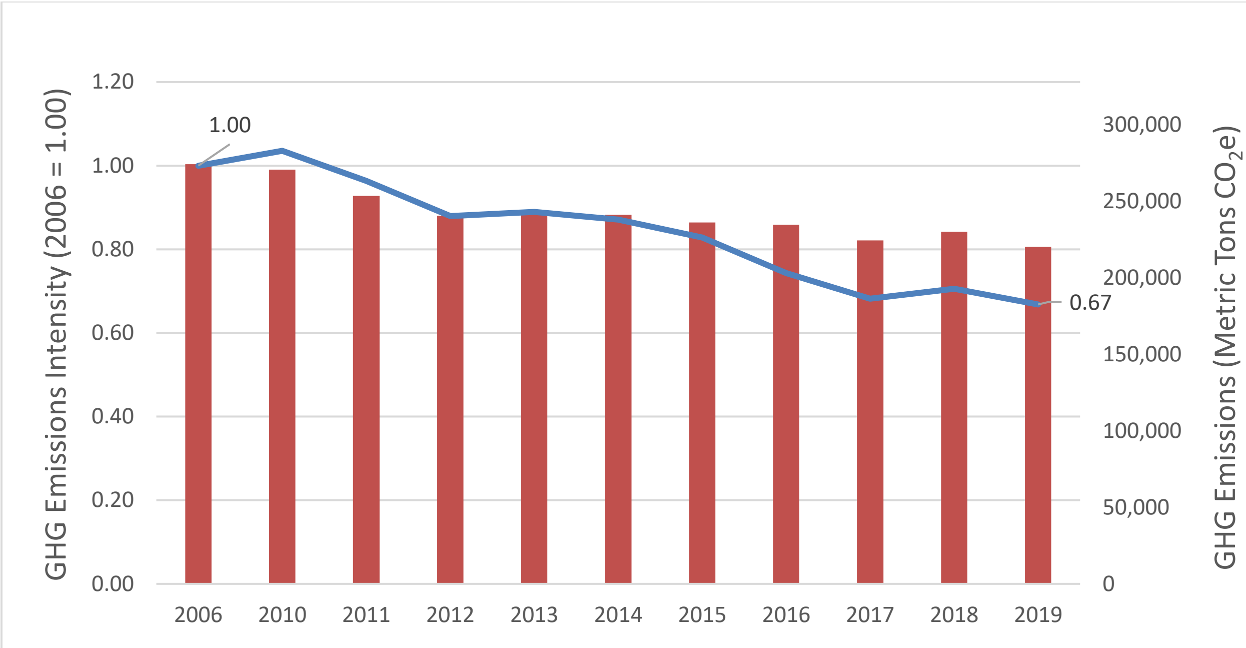

Figure 1-4. Comparing Port Authority Absolute and Normalized GHG Emissions Under Operational Control (Blue Line is Normalized Emissions, Red Bars are Absolute Emissions in Metric Tons)

2.0 STATIONARY COMBUSTION (SCOPE 1)

This chapter covers direct emissions from the combustion of fossil fuels in stationary equipment under the operational control of the Port Authority. Stationary combustion emissions are further broken down by three activities: building heating, emergency generators and fire pumps, and welding emissions associated with routine building maintenance.

2.1 Buildings

The 2019 inventory assesses fuel combusted in buildings to produce heat or hot water using equipment in a fixed location. Natural gas is the predominant fuel for building heating, followed by heating oil at select facilities, and propane. The latter is associated with fire training exercises at JFK.

2.1.1 Activity Data

The Port Authority's Office of Environmental and Energy Programs centrally collects information relating to natural gas purchases. The natural gas consumption collected by Port Authority is compiled in EmSys.[2] The natural gas information from EmSys was corroborated against natural gas invoices from suppliers, namely Central Hudson, ConEdison, Direct Energy, Elizabethtown Gas, Great Eastern Energy, National Grid, and Public Service Electric & Gas (PSEG). Data filling was conducted where consumption information was identified as missing from EmSys. In those cases, the monthly consumption for each facility was filled based on the natural gas consumption obtained from the original natural gas invoice from the supplier. Additionally, the natural gas consumption was prorated or trimmed, as needed, for the months of January and December to capture consumption within the calendar year of the assessment in cases where the billing period did not span the entire month. Heating oil consumption is monitored at the facility level, and this information is collected from the facilities for the purposes of the inventory. Table 2-1 summarizes stationary fuel consumption in buildings by commodity.

[2] The Port Authority stores energy purchases in EmSys, a data management system that compiles supplier invoicing data by digitally importing electricity invoicing information and manually entering natural gas information.

Table 2-1. 2019 Fuel Consumption in Buildings

Department	Facility	Commodity	Consumption	Units
Aviation	JFK Airport	Heating Oil	31,017	gal
		Natural Gas	1,638,346	therm
		Propane	60,862	gal
	LGA Airport	Heating Oil	1,145	gal
		Natural Gas	179,659	therm
	EWR Airport	Heating Oil	97,831	gal
		Natural Gas	2,258,023	therm
	SWF Airport	Natural Gas	90,485	therm
	TEB Airport	Natural Gas	93,223	therm
Central Administration	PANYNJ Leased Office Space NJ	Natural Gas	202,125	therm
PATH	PATH Buildings	Heating Oil	31,247	gal
		Natural Gas	450,232	therm
Port	NJ Marine Terminals	Natural Gas	58,071	therm
	NY Marine Terminals	Natural Gas	45,552	therm
Real Estate	Real Estate NJ	Natural Gas	79,426	therm
	Real Estate NY	Natural Gas	30,328	therm
Tunnels, Bridges, & Bus Terminals	Bus Terminals	Natural Gas	119,024	therm
	Tunnels and Bridges	Natural Gas	352,854	therm

2.1.2 Method

Emission estimates were developed in accordance with general reporting protocol (GRP) Chapter 12, "Direct Emissions from Stationary Combustion" (TCR 2019). The GHG emission factors used to calculate the GHG emissions are shown in Table 2-2. The values in Table 2-2 are representative of U.S. pipeline-grade natural gas, No. 2 fuel oil (i.e., heating oil), and propane. The emission factors for CO_2 were then taken from GRP Table 1.1, and the emission factors for CH_4 and N_2O were taken from GRP Table 1.10 (TCR 2019). When applicable, unit conversion was applied to match the unit of measurement of the activity data. To maintain consistency with the CAP emission factors in Table 2-3, an average high heating value of 1,026 British thermal units (Btu) per standard cubic foot was taken from the U.S. Environmental Protection Agency's (EPA's) AP-42, "Compilation of Air Pollutant Emission Factors" (EPA 1995; hereafter referred to as "EPA AP-42"), Section 1.4.

Table 2-2. Stationary Combustion GHG Emission Factors

Commodity	Units	CO_2	CH_4	N_2O
Natural Gas	kg/therm	5.31	4.70×10^{-4}	1.00×10^{-5}
Heating Oil (No. 2 Fuel Oil)	kg/gal	10.21	1.38×10^{-3}	8.28×10^{-5}
Propane	kg/gal	5.72	9.10×10^{-4}	5.46×10^{-5}

The CAP emission factors are based on values recommended by EPA AP-42, Chapters 1.3, "Fuel Oil Combustion," and 1.4, "Natural Gas Combustion" (EPA 1995). The sulfur dioxide (SO_2) emission factor is based on assuming a 100 percent fuel sulfur conversion. The NO_x and particulate matter (PM) emission factors are based on the premise that the natural gas was combusted in small (<100 million Btus (MMBtu) per hour (hr)) uncontrolled boilers. These values are presented in Table 2-3.

Table 2-3. Stationary Combustion CAP Emission Factors

Commodity	Units	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Natural Gas	kg/therm	2.65×10^{-5}	4.42×10^{-3}	3.36×10^{-4}	3.36×10^{-4}
Heating Oil (No. 2 Fuel Oil)	kg/gal	9.66×10^{-5}	9.07×10^{-3}	6.99×10^{-4}	1.04×10^{-3}
Propane	kg/gal	2.21×10^{-5}	5.90×10^{-3}	3.18×10^{-4}	3.18×10^{-4}

2.1.3 Results

Table 2-4 summarizes stationary combustion GHG emissions by facility and department. Table 2-5 presents stationary combustion CAP emissions.

Table 2-4. 2019 GHG Emissions from Stationary Combustion by Department (metric tons)

Department	Facility	CO_2	CH_4	N_2O	CO_2e
Aviation	JFK Airport	9,358	0.87	0.0223	9,383
	LGA Airport	965	0.09	0.0019	967
	EWR Airport	12,980	1.20	0.031	13,015
	SWF Airport	480	0.043	0.001	481
	TEB Airport	496	0.044	0.001	496
Central Administration	PANYNJ Leased Office Space NJ	1,072	0.095	0.002	1,075
PATH	PATH Buildings	2,708	0.255	0.007	2,716
Port	NJ Marine Terminals	308	0.027	0.001	309
	NY Marine Terminals	242	0.021	0.001	242
Real Estate	Real Estate NJ	421	0.037	0.001	422
	Real Estate NY	161	0.014	0.000	161
Tunnels, Bridges, & Bus Terminals	Bus Terminals	632	0.06	0.001	633
	Tunnels and Bridges	1,872	0.166	0.004	1,877
TOTAL		31,692	2.922	0.074	31,777

Note: Totals may not match the column sums due to rounding.

Table 2-5. 2019 CAP Emissions from Stationary Combustion by Department (metric tons)

Department	Facility	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Aviation	JFK Airport	0.05	7.89	0.59	0.60
	LGA Airport	0.01	0.80	0.06	0.06
	EWR Airport	0.07	10.87	0.83	0.86
	SWF Airport	0.00	0.40	0.03	0.03
	TEB Airport	0.00	0.41	0.03	0.03
Central Administration	PANYNJ Leased Office Space NJ	0.01	0.89	0.07	0.07
PATH	PATH Buildings	0.02	2.27	0.17	0.18
Port	NJ Marine Terminals	0.00	0.26	0.02	0.02
	NY Marine Terminals	0.00	0.20	0.02	0.02
Real Estate	Real Estate NJ	0.00	0.35	0.03	0.03
	Real Estate NY	0.00	0.13	0.01	0.01
Tunnels, Bridges, & Bus Terminals	Bus Terminals	0.00	0.53	0.04	0.04
	Tunnels and Bridges	0.01	1.56	0.12	0.12
TOTAL		0.17	26.56	2.02	2.07

Note: Totals may not match the column sums due to rounding.

2.2 Emergency Generators and Fire Pumps

Most facilities under the Port Authority's operational control have stationary engine generators for use in emergency situations. The World Trade Center and Central Automotive Department are exceptions: CAD does not have any emergency generators, and WTC uses fuel cells for backup power generation. The decision was also made to exclude PATH trains, as they use a significant amount of electricity but are unlikely to have emergency generators. These emergency generators and fire pumps are typically diesel fired, but the Port Authority does have some gasoline- and natural gas-fired generators. The emergency generators and fire pumps are tested periodically throughout the year.

2.2.1 Activity Data

The Port Authority provided annual runtime and fuel usage data for emergency generators and fire pumps at John F. Kennedy, LaGuardia, Stewart, Newark, Teterboro, New York Marine Terminals (NYMT), New Jersey Marine Terminals (NJMT), Tunnels and Bridges, and Real Estate New Jersey. Actual annual runtime or fuel usage data for emergency generators and fire pumps were not available for other Port Authority facilities. Electricity usage data are a reasonable surrogate for emergency generator and fire pump usage data (a facility with higher electricity needs will maintain more back-up generators than a facility with lower electricity needs), and electricity usage data were available for all Port Authority facilities. For these facilities, estimated emissions were calculated using the surrogate emission factors described above and applying them against the electricity usages for each facility. These methodologies are based on engineering estimates and are qualified as *de minimis*.

2.2.2 Method

GHG and CAP emissions for the nine facilities with actual activity data (i.e., JFK, LGA, SWF, EWR, TEB, NYMT, NJMT, Tunnels and Bridges, and Real Estate NJ) were estimated using standard emission factors (TCR 2019) and EPA AP-42, Section 3.3, "Gasoline and Diesel Industrial Engines" (EPA 1995). The emission factors are shown in Table 2-6.

Table 2-6. Emergency Generator and Fire Pump Emission Factors

Pollutant	Fuel	Gasoline	Units
CO_2	Gasoline	8.78	kg/gal
CH_4	Gasoline	5.91×10^{-5}	kg/gal
N_2O	Gasoline	3.57×10^{-5}	kg/gal
NO_x	Gasoline	1.63	lb/MMBtu
SO_x	Gasoline	8.4×10^{-2}	lb/MMBtu
PM	Gasoline	0.10	lb/MMBtu
CO_2	Diesel	10.21	kg/gal
CH_4	Diesel	6.00×10^{-4}	kg/gal
N_2O	Diesel	3.64×10^{-4}	kg/gal
NO_x	Diesel	4.41	lb/MMBtu
SO_x	Diesel	0.29	lb/MMBtu
PM	Diesel	0.31	lb/MMBtu

Pollutant	Fuel	Gasoline	Units
CO_2	Natural Gas	5.31	kg/therm
CH_4	Natural Gas	4.70×10^{-4}	kg/therm
N_2O	Natural Gas	1.00×10^{-5}	kg/therm
NO_x	Natural Gas	4.08	lb/MMBtu
SO_x	Natural Gas	5.88×10^{-4}	lb/MMBtu
PM	Natural Gas	1.01×10^{-2}	lb/MMBtu

GHG and CAP emissions for the remaining Port Authority facilities were estimated using an engineering estimate. Alternate GHG and CAP emission factors were developed as the 3-year rolling average ratio of actual emergency generator and fire pump emissions and electricity consumption. Table 2-7 provides the relative emission factors for emergency generators and fire pumps applied to this assessment.

Table 2-7. Emergency Generator and Fire Pump Alternate Emission Factors

Pollutant	Unit	Emergency Generator	Fire Pump
CO_2	kg/MWh	2.01×10^{-3}	1.23×10^{-3}
CH_4	kg/MWh	1.19×10^{-7}	7.23×10^{-8}
N_2O	kg/MWh	7.16×10^{-8}	4.34×10^{-8}
NO_x	kg/MWh	5.48×10^{-5}	3.36×10^{-5}
SO_x	kg/MWh	3.60×10^{-6}	2.21×10^{-6}
$PM_{2.5}$	kg/MWh	3.85×10^{-6}	2.36×10^{-6}
PM_{10}	kg/MWh	3.85×10^{-6}	2.36×10^{-6}

2.2.3 Results

Total emergency generator and fire pump GHG and CAP emission estimates are shown in Table 2-8.

Table 2-8. 2019 GHG & CAP Emissions from Emergency Generators and Fire Pumps

Pollutant	Emissions (metric tons)
CO_2e	851.85
CO_2	841.53
CH_4	0.05
N_2O	0.03
SO_x	1.50
NO_x	22.85
$PM_{2.5}$	1.60
PM_{10}	1.60

Note: Totals may not match the column sums due to rounding.

2.3 Welding Gases

Limited welding activity takes place within the boundary for the Port Authority inventory, and its impact on Port Authority emissions is negligible. An engineering estimate was developed to quantify the level of welding gas emissions, correlating the emitting activity to the dollar amount of welding gas purchased. When surveyed for the 2010 inventory, LGA reported spending $866 on welding gas (Port Authority 2012). Typically, acetylene costs $1.24 per standard cubic foot (WeldingWeb 2012). Assuming that all purchased welding gas was acetylene and that all purchased gas was used, it was determined by stoichiometry that 77.8 kilograms (kg) of CO_2 were emitted at

LGA. Furthermore, assuming that the same level of welding activity occurred at all five airports and at the two marine terminals, total welding gas emissions at the Port Authority were estimated to be 0.5 metric tons of CO_2 in 2010. The same engineering emission estimate (or *de minimis*) was carried over to calendar year 2019.

3.0 MOBILE COMBUSTION (SCOPE 1)

Mobile combustion emissions result from the combustion of fuels by on-road vehicles, non-road vehicles, and portable equipment that is owned and operated by the Port Authority. The Port Authority's CAD oversees the procurement and maintenance of on-road vehicles, most non-road vehicles, and some portable equipment. There is also a fleet of vehicles that are owned and fueled by the Port Authority but operated on a day-to-day basis by tenants. Additionally, PATH operates and services a small number of non-road vehicles and portable equipment.

3.1 Central Automotive Division Fleet

CAD is in charge of purchasing and maintaining the Port Authority's fleet of vehicles. CAD relies on records either from the fuel management system or from fuel vendor invoices—as in the case of compressed natural gas (CNG)—to track fleet fuel consumption. Additionally, CAD encourages on-road vehicle operators to log mileage information when filling up to better estimate methane, N_2O, and CAP emissions. The CAD fleet consumes conventional fuels such as gasoline and diesel as well as alternative fuels such as CNG, gasoline with an 85 percent ethanol blend (E85), liquified petroleum gas (LPG), and diesel with a 20 percent biodiesel blend (B20). Table 3-1 summarizes CAD fleet fuel consumption by fuel type in 2019 (Sprague 2021).

Table 3-1. 2019 CAD Fuel Consumption

Activity	Commodity	Units	Consumption
CAD Main Fleet	Biodiesel (B20)	gal	135,122
CAD Main Fleet	CNG	scf	2,819,232
CAD Main Fleet	Diesel	gal	74,066
CAD Main Fleet	LPG	gal	1,628
CAD Main Fleet	Gasoline (E10)	gal	1,174,271
CAD Main Fleet	E85	gal	44,477
Executive Fleet	Diesel	gal	0
Executive Fleet	Gasoline (E10)	gal	0

3.1.1 Activity Data

For the purpose of the fuel tracking, the CAD fleet is divided between the CAD main fleet and the executive fleet, which is a subset of vehicles assigned to specific functions within the Port Authority. The main fleet is composed of 2,683 vehicles, which includes on-road and non-road vehicles as well as portable equipment. CAD retains the services of Sprague, a fuel management contractor, to track the volume of fuel dispensed from a network of authorized fuel stations by means of dedicated fuel cards. For each fuel type, the volume of fuel dispensed was used to calculate CO_2 emissions from the main fleet. CAD also rents vehicles for various projects on an as-needed basis. There are approximately 300 such vehicles being rented at any given time (Port Authority 2019b). The fuel consumption from these rental vehicles is also tracked by Sprague and included in all CAD fuel consumption totals.

There is also some CNG consumption, which is purchased through the CNG vendor, Clean Energy (Port Authority 2020h). There is also a small amount of propane consumption, which is used to power LPG forklifts. The Port Authority was unable to retrieve 2019 propane fuel consumption, so 2018 LPG use was used (Port Authority 2019c).

The Port Authority Office of the Treasury tracks fuel consumption for a subset of vehicles by means of branded fuel cards (e.g., Shell Fuel Card). This fleet has recently converted to electric vehicles, therefore, no fuel consumption is attributed to the executive fleet for year 2019 (Port Authority 2020i).

Activity data for estimating CAP emissions came from CAD in the form of vehicle activity. Vehicle activity came in different units of measurement according to the specific segments of the fleet. For most highway vehicles, activity data consisted of recorded miles traveled. For smaller segments of the fleet, such as the executive fleet and non-highway vehicles (e.g., forklifts), fuel consumption served as the activity data. The selection of the best emission factor based on available activity data is discussed in Section 3.1.2 below for each fleet segment.

3.1.2 Method

GHG emission estimates were calculated as the product of fuel use and fuel- specific emission factors. Carbon dioxide emissions were estimated by multiplying the fuel use by the appropriate emission factor from GRP Table 2.1 (TCR 2019). Most of the fuel consumed by the Port Authority contains some biofuel (either 10 percent ethanol (E10) or B20). For these biofuel blends, attention was given to distinguishing between anthropogenic and biogenic emissions. This was accomplished by correlating the fossil fuel-specific emission factor to the volume of fossil fuel consumed. For example, for a volume of 100 gallons of E10, anthropogenic CO_2 emissions equal:

$$100 \text{ gal of E10} \times 90 \text{ percent fossil fuel by volume} \times 8.78 \text{ kg } CO_2/\text{gal} = 790.2 \text{ kg } CO_2$$

Biogenic CO_2 emission estimates (i.e., those generated during the combustion or decomposition of biologically based material such as biodiesel or ethanol) are calculated by correlating the biofuel-specific emission factor to the volume of biofuel consumed. For example, for a volume of 100 gallons of E10, biogenic CO_2 emissions equal:

$$100 \text{ gal of E10} \times 10 \text{ percent ethanol by volume} \times 5.75 \text{ kg } CO_2/\text{gal} = 57.5 \text{ kg } CO_2$$

For all fuel types, CH_4 and N_2O emissions were assessed using an engineering estimate, based on the ratio of CO_2 to CH_4 and N_2O emissions taken from GRP Table 13.9 (TCR 2019). The emission factors used to calculate the emissions are presented in Table 3-2.

Table 3-2. Emission Factors for On-road Transportation Fuels

Fuel Type	Percentage Biofuels	Fossil Fuel CO_2 (kg/gal or kg/ccf)	Biogenic CO_2 (kg/gal)	CH_4 (kg/kg of CO_2)	N_2O (kg/kg of CO_2)
Gasoline (E10)	10%	8.78	5.75	0.000059	0.000036
Diesel #2	0%	10.21	9.45	0.000059	0.000036
Biodiesel (B20)	20%	10.21	9.45	0.000059	0.000036
Renewable Diesel (R50)	50%	10.21	9.45	0.000059	0.000036
E85	85%	8.78	5.75	0.000059	0.000036
CNG	0%	5.4	0	0.000059	0.000036
Propane	0%	5.72	0	0.000059	0.000036

Because a number of commercial transportation fuels combine petroleum and biofuel products, it is necessary to adjust the standard emission factors to differentiate between anthropogenic and biogenic mobile combustion emissions. The latter correspond to the combustion of the biofuel volume in a given commercial fuel blend. For instance, commercial gasoline (E10) is a mixture of a petroleum product (90 percent) and bioethanol (10 percent); therefore, the effective biogenic emission factor for commercial gasoline was calculated as the product of the ethanol carbon content and the concentration of ethanol in the commercial fuel blend. Table 3-3 shows the effective CO_2 emission factors for petroleum and biofuel blends consumed by the CAD fleet.

Table 3-3. Effective CO_2 Emission Factors of Biofuel Blends

Fuel Type	Percentage Biofuels	Anthropogenic CO_2 (kg/gal)	Biogenic CO_2 (kg/gal)
Gasoline (E10)	10%	7.90	0.58
Biodiesel (B20)	20%	8.17	1.89
E85	85%	1.32	4.89

CAP emission factors for highway vehicles are from the EPA Motor Vehicle Emissions Simulator (MOVES2014b) (EPA 2018b). These emission factors are expressed in units of grams per mile based on model year and vehicle type for the 2019 inventory. CAP emissions from diesel vehicles were assumed to come from B20 fuel, because that is the primary diesel fuel used at the Port Authority. Similarly, CAP emissions from vehicles using E10 fuel used MOVES emission factors that were modeled with the properties of E10 fuel. Flex-fueled vehicles were assumed to be burning E85. These emission factors were then multiplied by the 2019 estimates of mileage per vehicle provided by CAD to obtain CAP emissions. There were no mileage data available for the rental vehicles that CAD uses. Since these vehicles are primarily light-duty pickups, the average vehicle miles traveled (VMT) from CAD light-duty trucks (6,526 miles per vehicle in 2019) was used as a stand-in. This VMT is then multiplied by the number of rental vehicles (approximately 300) and the MOVES2014b emissions factor for a 2019 light-duty pickup truck to estimate CAP emissions from rental vehicles.

CAP emissions for LPG and diesel (0 percent biodiesel) fuel were calculated by multiplying total fuel consumption by the national average emission factors from EPA’s Market Allocation (MARKAL) model database (Pechan 2010).

3.1.3 Results

Table 3-4 presents GHG emission estimates for the CAD fleet by fuel type. Table 3-5 shows the CAP emissions by fuel type. Because of the reliance on biofuel blends, the portion of biogenic CO_2 emissions for CAD is sizable, amounting to 1,148 tons of CO_2e in 2019.

Table 3-4. 2019 GHG Emissions from Fleet Vehicles (metric tons)

Commodity	CO_2	CH_4	N_2O	CO_2e	Biogenic CO_2
Biodiesel B20	1,103.7	0.1	0.0	1,120.4	255.4
CNG	153.5	0.0	0.0	155.4	
Diesel	756.2	0.0	0.0	765.5	
E85	58.6	0.0	0.0	62.0	217.4
Gasoline E10	9,279.1	0.6	0.4	9,401.6	675.2
LPG	9.2	0.0	0.0	9.6	
Total	**11,360.3**	**0.7**	**0.4**	**11,514.5**	**1,148.0**

Note: Totals may not match the column sums due to rounding.

Table 3-5. 2019 CAP Emissions from Fleet Vehicles (metric tons)

Commodity	SO_x	NO_x	$PM_{2.5}$	PM_{10}
Biodiesel B20	0.01	3.87	0.22	0.57
CNG	0.01	0.07	0.01	0.07
Diesel	0.01	0.88	0.07	0.07
E85	0.04	0.37	0.14	0.88
Gasoline E10	0.04	0.39	0.07	0.41
LPG	0.00	0.09	0.00	0.00
Total	**0.10**	**5.66**	**0.52**	**2.01**

Note: Totals may not match the column sums due to rounding.

3.2 Tenant Fleet

The tenant fleet consists of vehicles that are owned and fueled by the Port Authority but are operated on a day-to-day basis by contractors. Emissions from these vehicles were formerly included in the scope 3 shadow fleet category. However, once it became known that the Port Authority paid for the fuel for a portion of the shadow fleet, emissions from those vehicles with fuel purchased by the Port Authority have now been reallocated to the scope 1 tenant fleet category. This category includes shuttle buses at all airports as well as a few light-duty vehicles (e.g., security vehicles) operating at JFK, LGA, and EWR. This is a change from previous inventories.

3.2.1 Activity Data

Data on the tenant fleet were provided by the Port Authority (Sprague 2021, Ortiz 2021, Port Authority 2019g). In 2019, the tenant fleet consisted of shuttle buses at JFK, EWR, and LGA, and a fleet of light-duty vehicles, such as security vehicles, at EWR and LGA. Port Authority was not able to obtain an estimate of 2019 fuel consumption from JFK shuttle buses, so 2018 data was used. The number of vehicles at each facility are shown in Table 3-6.

Table 3-6. Number of Tenant Fleet Vehicles by Airport

Type of Fleet	JFK	EWR	LGA	SWF	TEB
Shuttle Buses	40	✓	✓	0	0
Light-Duty Security Vehicles	0	✓	✓	0	0

Note: A check mark indicates that these vehicles are part of the shadow fleet and fuel records are available, but there is no vehicle count available at this time.

3.2.2 Method

The Port Authority provided diesel and gasoline fuel consumption from the tenant fleet. These were then multiplied by the appropriate TCR emission factors to estimate GHG emissions (TCR 2019).

Criteria pollutant emission factors were created for this analysis by multiplying the grams per mile (g/mi) emission factor for a 10-year-old vehicle with the average miles per gallon of each vehicle type to get a vehicle type-specific grams per gallon emissions factor. For example, the grams per gallon (g/gal) emissions factor for NO_x for diesel buses was calculated by multiplying the g/mi NO_x emission factor from MOVES2014b (2.6 g/mi) by the average fuel economy of a shuttle bus (6.0 miles per gallon) from the Annual Energy Outlook (EIA 2020). This gives an emission factor of 15.7 grams of NO_x per gallon for diesel shuttle buses. These grams per gallon emission factors were then multiplied by fuel consumption to estimate criteria pollutant emissions.

3.2.3 Results

GHG and CAP emission estimates are summarized by airport in Table 3-7 and Table 3-8. The majority of tenant fleet emissions come from shuttle buses.

Table 3-7. 2019 GHG Emissions from Tenant Fleet by Fuel Type (metric tons)

Airport	CO_2	CH_4	N_2O	CO_2e	Biogenic CO_2
Biodiesel B20	3,557.2	0.1	0.1	3,586.5	823.1
Diesel	2,975.8	0.2	0.1	3,012.4	
E85	0.3	0.0	0.0	0.3	1.2
Gasoline E10	332.7	0.0	0.0	337.1	24.2
Total	**6,865.9**	**0.3**	**0.2**	**6,936.3**	**848.5**

Note: Totals may not match the column sums due to rounding.

Table 3-8. 2019 CAP Emissions from Tenant Fleet by Fuel Type (metric tons)

Airport	SO_x	NO_x	$PM_{2.5}$	PM_{10}
Biodiesel B20	0.05	6.83	0.30	1.39
Diesel	0.04	3.80	0.19	0.89
E85	0.00	0.00	0.00	0.00
Gasoline E10	0.01	0.05	0.02	0.10
Total	**0.09**	**10.68**	**0.50**	**2.38**

3.3 PATH Diesel Equipment

PATH owns and operates certain track maintenance vehicles that are not accounted for by CAD. PATH equipment includes a small number of non-road vehicles and portable equipment.

3.3.1 Activity Data

PATH non-road and portable equipment burns both diesel fuel and fuel oil. Annual fuel consumption is tracked for each individual piece of equipment and was provided by the Port Authority (2020j). This information serves as the activity data for GHG and CAP emission assessments.

Total GHG and CAP emissions for PATH diesel equipment are shown in Table 3-9.

Table 3-9. 2019 GHG & CAP Emissions from PATH Diesel Equipment (metric tons)

CO_2	CH_4	N_2O	CO_2e	SO_x	NO_x	$PM_{2.5}$	PM_{10}
435.2	0.0	0.0	440.6	0.01	0.51	0.04	0.04

3.3.2 Method

Carbon dioxide emission estimates are calculated based on the gallons of diesel fuel multiplied by the appropriate emission factor from GRP Table 2.1 (TCR 2019). Methane and nitrous oxide emission estimates are calculated based on the per-gallon diesel emission factor for non-highway equipment, from GRP Table 2.7 (TCR 2019).

The emission factors for CAP for diesel equipment used in the PATH system were calculated based on emission factors from the EPA MARKAL database (Pechan 2010).

4.0 FUGITIVE EMISSIONS (SCOPE 1)

Fugitive emissions are intentional and unintentional releases of GHGs that are not the result of fossil fuel combustion. This chapter covers fugitive emissions from equipment or activities under the operational control of the Port Authority. More specifically, refrigeration and fire protection equipment charged with substitutes for ozone-depleting substances (ODSs), as well as biogas gas emanating from a historical landfill.

4.1 Use of Refrigerants

Emissions of HFCs and PFCs from stationary and mobile AC equipment are the result of fugitive release over the operational life of the equipment. Note that not all refrigerants are reportable according to best carbon accounting practices. ODSs such as refrigerants R-22, R-12, and R-11 are not required to be reported for carbon management purposes because their production is already being phased out under the Montreal Protocol.

4.1.1 Method

Emission estimates were developed in accordance with GRP Chapter 16, "Direct Fugitive Emissions from the Use of Refrigeration and Air Conditioning Equipment" (TCR 2013). Refrigerant emissions are assessed based on best available information in accordance with the decision tree shown in Figure 4-1. The 2019 inventory was informed by an AC equipment survey update conducted for Teterboro airport and New Jersey Marine Terminal. For all other facilities, refrigerant emissions were assessed based on AC equipment profiles gathered in past inventory efforts. All refrigerant fugitive emission estimates were developed using method Option 2.

Option 1: The methodology relies on a mass-balance approach to account for changes in refrigerant inventory levels (additions as well as subtractions) and net increases in nameplate capacity.

Option 2: Refrigerant fugitive emission estimates using Option 2 rely on an AC equipment count and information about the type of refrigerant, typical annual utilization, the equipment's nameplate refrigerant charge, and equipment's application (e.g., chiller or residential/commercial AC, including heat pump). Rates of refrigerant release are then correlated to each AC equipment profile. The resulting emission estimates for each HFC and PFC are then converted to units of CO_2e using the appropriate GWP factors to determine total HFC and PFC emissions.

Refrigerant emissions were assessed using GRP equation 16e (TCR 2013). For most Port Authority facilities, the refrigerant charge or capacity was known based on information obtained from facility surveys. However, in certain cases, survey information provided only cooling equipment capacity. In those cases, existing available data were used to develop a correlation between the equipment capacity in tons of refrigeration and refrigerant charge in kg for various size units in Btu/hr. The following linear equation was developed and used to estimate the refrigerant capacity for those facilities where only the cooling capacity was available: y (kg of charge) = 0.574x (tons capacity) + 7.187.

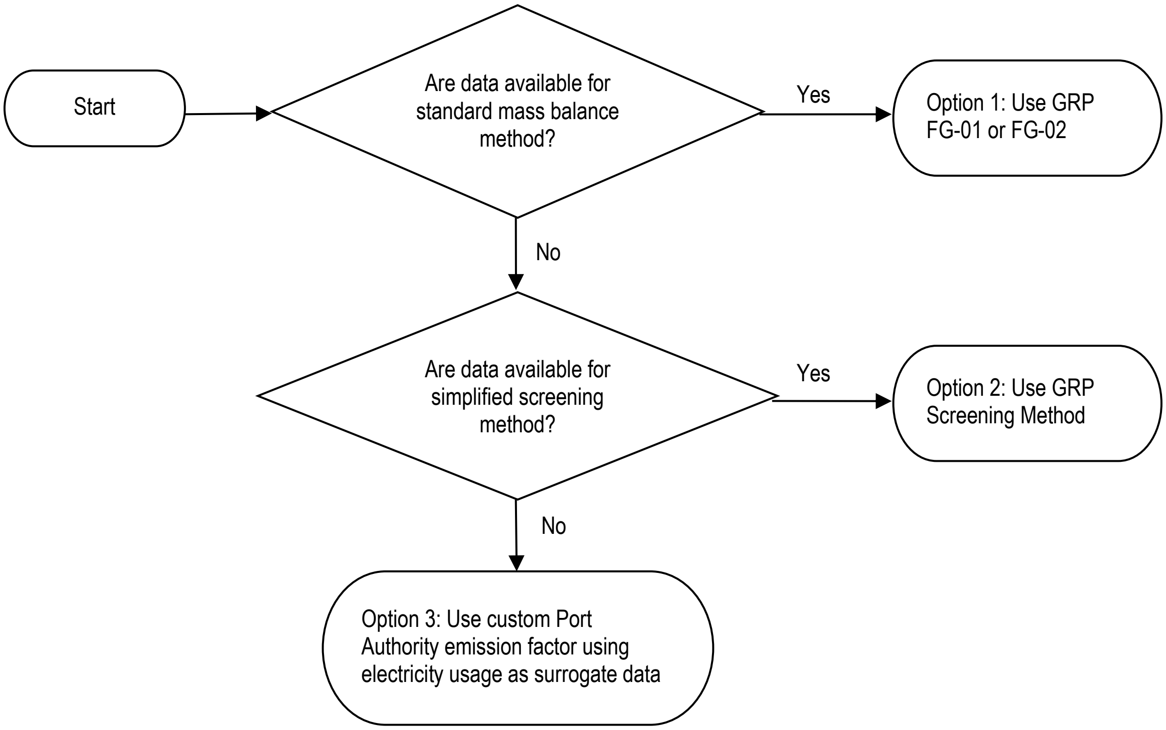

Figure 4-1. Method Selection to Quantify Fugitive Emissions from AC Equipment

4.1.2 Results

GHG emission estimates from refrigerants are shown in Table 4-1. This table excludes non-reportable hydrochlorofluorocarbons (HCFCs) and chlorofluorocarbons (CFCs), such as R-22. Shaded cells refer to facilities for which air conditioning systems have been previously surveyed and found not to contain any GHGs, such as JFK Airport.

Table 4-1. 2019 Refrigerant Emissions by Facility and ODS Substitute (metric tons CO_2e)

Facility	HFC-134a	HFC-227ea	R-134A	R-401A	R-401C	R-404A	R-407C	R-410A	R-438A	Total
Aviation										
JFK Airport										
LGA Airport			0.1					15.8		15.9
SWF Airport	2.3						1.2	8.2		11.8
EWR Airport	1,531.4	140.0								1,671
TEB Airport	0.1							3.9		4.0
Central Automotive							196.5			196.5
Port										
NY Marine Terminals								9.9		9.9
Port Elizabeth Marine Terminal								1.5		1.5
Port Jersey			<0.1			<0.1		2.1		2.1

Facility	HFC-134a	HFC-227ea	R-134A	R-401A	R-401C	R-404A	R-407C	R-410A	R-438A	Total
Port Newark Marine Terminal				<0.1				7.9		7.9
PATH										
PATH Trains							1,041.9		165.9	1,207.6
PATH Buildings	280.7									281.0
Tunnels, Bridges & Bus Terminals										
George Washington Bridge	0.1					0.9		2.1		3.1
Holland Tunnel	<0.1									0.0
Lincoln Tunnel	0.1									0.1
Staten Island Bridges										
GW Bridge Bus Station								3.8		3.8
Port Authority Bus Terminal	3.1									3.1
Real Estate										
Bathgate Industrial Park										
Teleport										
World Trade Center	1,562.1									1,562.1
TOTAL	**3,380**	**140**	**0.10**	**0.0**	**0.0**	**0.9**	**1,240**	**55.2**	**165.9**	**4,981.5**

Note: Totals may not match the column sums due to rounding.

4.2 Use of Fire Suppressants

Fire protection systems charged with reportable ODS substitutes often service areas with specialized equipment such as high-value electronics, including server and communication rooms.

For previous inventory years, a survey was distributed to facility managers requesting a list of fire protection equipment (e.g., centralized system, hand-held devices), the nature of the fire suppressant used to charge such equipment, and the amount of fire suppressant purchased for equipment recharge (as a proxy for GHG releases). Based on the survey responses, CO_2 and FM-200 are the common GHGs to be reported in the event of equipment discharge. Previous surveys indicated that the following facilities use reportable GHGs as fire suppressants:

- LaGuardia (LGA) Airport: FM-200
- Stewart (SWF) Airport: FM-200
- Newark (EWR) Airport: FM-200
- George Washington Bridge: FM-200
- Holland Tunnel: FM-200
- Lincoln Tunnel: FM-200
- Staten Island Bridges: FM-200
- GWB Bus Station: FM-200
- PATH Buildings: CO_2

The first step in quantifying emissions from fire suppressants for the 2019 inventory year was to survey these facilities known to have fire protection equipment that uses reportable GHGs. The Port Authority indicated that in

2019 there were fire suppressant releases totaling 582 metric tons of CO_2e. The CO_2 emissions released in 2019 are attributed to routine testing at Newark Airport, a release at George Washington Bridge Bus Station, and portable fire extinguishers associated with PATH buildings. There was also a fire suppressant foam incident at George Washington Bridge in 2019, but it was determined that no GHGs were present in the foam, No other releases occurred from the facilities surveyed for the 2019 inventory year. Table 4-2 summarizes the results of the 2019 fire suppressant survey.

Table 4-2. 2019 Fugitive Emissions from Fire Protection Equipment (metric tons CO_2e)

Facility	CO_2	FM-200
LGA Airport	N/A	No release
SWF Airport	No release	N/A
EWR Airport	N/A	55.3
George Washington Bridge	N/A	No release
George Washington Bridge Bus Station	N/A	526.2
Holland Tunnel	N/A	No release
Lincoln Tunnel	N/A	No release
Staten Island Bridges	N/A	No release
PATH Buildings	0.13	N/A

4.3 Historic Elizabeth Landfill

The Port Authority property known as “Port Elizabeth” in Elizabeth, New Jersey, is part of the Port department. The Port Elizabeth property sits atop a former landfill site where household and industrial waste was dumped until the landfill closed in 1970. It is believed that dumping began at the Elizabeth Landfill (a.k.a. the Kapkowski Road Landfill) site sometime in the 1940s (Wiley 2002). Although the historic landfill boundary cannot be determined with certainty, the current landfill boundary based on land ownership is known and defined as the area south of Bay Avenue between the Conrail railroad tracks to the west and McLester Street to the east for a total surface area of 178 acres.

Although the Port Elizabeth property is leased to tenants, the Port Authority maintains shared operational control of property improvement activities. These activities are governed by the Tenant Construction and Alteration Process, which requires close coordination between the Port Authority and its business partners (i.e., tenants) when making “alterations and minor works at existing [Port Authority] facilities in addition to all new construction” (Port Authority 2020n, p. 1). Therefore, fugitive landfill gas emissions are reported as scope 1 emissions.

4.3.1 Activity Data

Air emissions from landfills come from gas generated by the decomposition of waste in the landfill. The composition of landfill gas is roughly 50 percent CH_4 and 50 percent CO_2 by volume, with additional relatively low concentrations of other air pollutants, including volatile organic compounds (VOCs). Activity data in the form of total solid waste deposited (short tons) in the historic Elizabeth Landfill were used to estimate the CH_4 emissions from the landfill using the first-order decay model.

Because of a lack of waste emplacement records, the annual mass of waste received at the site was calculated as the product of the average refuse depth of 8.33 feet as measured by a geological survey (Port Authority 1974), refuse density of 0.58 tons (EPA 1997), and the area of the historical landfill under current Port Authority operational control of 178 acres.[3] Thus, waste emplaced was estimated to be on the order of 1.39 million short tons. Assuming that the landfill operated from 1940 through 1970, the annual rate of waste emplacement was determined to be 44,735 tons per year.

4.3.2 Method

Emissions estimates were developed in accordance with "Local Government Operations Protocol," Chapter 9, "Solid Waste Facilities" (TCR et al. 2010). Default values were applied for the percentage of waste that is anaerobically degradable organic carbon. The model runs with the assumptions that the CH_4 fraction of the landfill gas is 50 percent and that 10 percent of the CH_4 is oxidized prior to being emitted into the atmosphere. The decay constant (i.e., k-value) was set at 0.057, corresponding to areas that regularly receive more than 40 inches of annual rainfall. The model calculates biogenic CO_2 emissions, which are reported separately from anthropogenic emissions.

4.3.3 Results

The 2019 GHG and CAP emission estimates for the historic Elizabeth Landfill are shown in Table 4-3. Additionally, the historic Elizabeth Landfill emitted 470 tons of biogenic CO_2.

Table 4-3. 2019 GHG & CAP Emissions from the Historic Elizabeth Landfill (metric tons)

CH_4	CO_2e
140.09	2,941.87

[3] This value was measured in an ArcGIS environment from maps provided by Port Authority staff, filenames "PNPEFacMap2007draft5-07.pdf" and "Refuse_fill_rev.pdf."

5.0 PURCHASED ELECTRICITY (SCOPE 2)

5.1 Buildings

This section discusses electricity purchases for buildings and commercial space under the operational control of the Port Authority. For a total of five facilities (JFK, LGA, PABT, Teleport, and WTC), electricity is purchased by the Port Authority and sub-billed to its tenants; therefore, the portion of electricity consumption attributed to the Port Authority is the difference between total electricity purchased and the amount sub-billed to tenants. Note that emissions resulting from electricity consumption by tenants is reported as a scope 3 source.

5.1.1 Activity Data

The Port Authority's Office of Environmental and Energy Programs centrally collects information relating to electricity purchases from utility invoices. The electricity consumption collected by Port Authority is compiled in EmSys.[4] The electricity information was corroborated against monthly statements supplied by the electric utilities, namely, Central Hudson, New York Power Authority, and PSEG. Data filling was conducted where consumption information was identified as missing from EmSys. In those cases, the monthly consumption for each facility was filled based on the electricity consumption obtained from the original electricity invoice from the supplier. Additionally, the electricity consumption was prorated or trimmed, as needed, for the months of January and December to capture consumption within the calendar year of the assessment in cases where the billing period did not span the entire month. Note that for 2019, new information became available on the split between Port Authority and tenant consumption at the New Jersey Ports. This resulted in some electricity consumption that had previously been considered under Port Authority's operational control being moved to into tenant Scope 3.

Table 5-1 presents electricity consumption by facility, where consumption is summed by taking into consideration the carbon content of the electricity supply as explained in Section 5.1.2 Method.

5.1.2 Method

Emission estimates were developed in accordance with GRP Chapter 14, "Indirect Emissions from Electricity Use" (TCR 2013). According to this methodology, the emissions factor corresponds to the carbon content of electricity delivered if that information is known by the supplier. This is the case of electricity delivered by the Kennedy International Airport Cogeneration (KIAC) to JFK. In all other cases, a reference carbon content from the Emissions & Generation Resource Integrated Database (eGRID) was assigned based on the geographical location of the end

[4] The Port Authority stores energy purchases in EmSys, a data management system that compiles supplier invoicing data by digitally importing electricity invoicing information and manually entering natural gas information.

user (EPA 2020). For facilities located in New York City, the emission factors for the Northeast Power Coordinating Council (NPCC) - New York City/Westchester (NYCW) eGRID subregion were used. For facilities located in upstate New York, the NPCC Upstate State New York (NYUP) eGRID subregion factors were applied. For facilities located in New Jersey, the emission factors for the Reliable First Corporation East (RFCE) eGRID subregion were used. The emission factors used to estimate the GHG emissions associated with electricity consumption are shown in Table 5-2.

Table 5-1. 2019 Building Electricity Consumption by Facility

Department	Facility	eGRID Region/ Generator	Consumption (kWh)
Aviation	JFK Airport	Electricity-KIAC	74,049,312
		Electricity-NYCW	5,402
	LGA Airport	Electricity-NYCW	23,254,216
	EWR Airport	Electricity-RFCE	81,740,053
	SWF Airport	Electricity-NYUP	4,041,980
	TEB Airport	Electricity-RFCE	2,368,408
Central Administration	PANYNJ Leased Office Space NJ	Electricity-RFCE	10,560,866
	PANYNJ Leased Office Space NY	Electricity-NYCW	79,303
PATH	PATH Buildings	Electricity-NYCW	4,617
		Electricity-RFCE	14,050,553
Port	NJ Marine Terminals	Electricity-RFCE	5,509,933
	NY Marine Terminals	Electricity-NYCW	567,613
Real Estate	Real Estate NJ	Electricity-RFCE	3,137,169
	Real Estate NY	Electricity-NYCW	4,580,656
Tunnels, Bridges & Bus Terminals	Bus Terminals	Electricity-NYCW	22,137,167
	Tunnels and Bridges	Electricity-NYCW	14,366,235
		Electricity-RFCE	21,712,062
WTC	WTC	Electricity-NYCW	44,276,522
TOTAL			**326,442,068**

Note: Totals may not match the column sums due to rounding.

Table 5-2. Electricity Consumption GHG Emission Factors

eGRID Subregion/Generator	Unit	CO_2	CH_4	N_2O
NYCW	kg/kWh	2.71×10^{-1}	9.98×10^{-6}	1.36×10^{-6}
NYUP	kg/kWh	1.15×10^{-1}	8.16×10^{-6}	9.07×10^{-7}
RFCE	kg/kWh	3.25×10^{-1}	2.77×10^{-5}	3.63×10^{-6}
KIAC	kg/kWh	4.36×10^{-1}	3.13×10^{-5}	7.41×10^{-6}

Table 5-3 shows the CAP emission factors used for the 2019 electricity emission estimates. eGRID provided SO_2 and NO_x emission factors for eGRID regions (EPA 2020). Emission factors for PM were calculated in proportion to SO_2 emissions assessed by the 2017 EPA National Emissions Inventory (NEI) (EPA 2019c). This is a reasonable approach because SO_2 is a significant contributor of total PM and thus a strong indicator of PM levels. To find the proportion to use, total emissions from all electric generating processes were summed for plants in each state for SO_2, $PM_{2.5}$, and PM_{10} in the 2017 NEI. PM emission factors were calculated as the product of statewide PM emissions and the SO_2 emission factor divided by the sum of statewide SO_2 emissions, as shown in Equation 5-1:

$$Ef_{PM} = Ef_{SO_2} x \frac{\sum_{State} PM}{\sum_{State} SO_2} \quad (5\text{-}1)$$

Where:

Ef_{PM} = emission factor for either $PM_{2.5}$ or PM_{10}

Ef_{SO2} = emission factor for SO_2 provided by eGRID

PM = value of particulate matter state emissions for either $PM_{2.5}$ or PM_{10}

SO_2 = value of sulfur dioxide state emissions

Table 5-3. Electricity Consumption CAP Emission Factors

eGRID Subregion/Generator	Unit	SO_2	NO_x	$PM_{2.5}$	PM_{10}
NYCW	kg/kWh	1.18×10^{-5}	1.18×10^{-5}	4.04×10^{-6}	4.40×10^{-6}
NYUP	kg/kWh	4.17×10^{-5}	6.17×10^{-5}	1.43×10^{-5}	1.56×10^{-5}
RFCE	kg/kWh	2.18×10^{-4}	1.51×10^{-4}	6.34×10^{-5}	6.58×10^{-5}
KIAC	kg/kWh	2.09×10^{-6}	9.39×10^{-5}	2.47×10^{-5}	2.47×10^{-5}

5.1.3 Results

Table 5-4 summarizes GHG emissions from purchased electricity in buildings. CAP emission totals are presented in Table 5-5.

Table 5-4. 2019 GHG Emissions from Electricity Consumption in Buildings by Department (metric tons)

Department	Facility	CO_2	CH_4	N_2O	CO_2e
Aviation	JFK Airport	32,353	2.32	0.55	32,572
	LGA Airport	6,291	0.23	0.03	6,306
	EWR Airport	26,546	2.26	0.30	26,685
	SWF Airport	464	0.03	0.004	466
	TEB Airport	769	0.07	0.0086	773
Central Administration	PANYNJ Leased Office Space NJ	3,430	0.292	0.038	3,448
	PANYNJ Leased Office Space NY	21.45	0.0008	0.0001	21.5
PATH	PATH Buildings	4,564	0.39	0.05	4,588
Port	NJ Marine Terminals	1,789	0.15	0.02	1,799
	NY Marine Terminals	154	0.006	0.0008	154
Real Estate	Real Estate NJ	1,019	0.087	0.0114	1,024
	Real Estate NY	1,239	0.046	0.006	1,242
Tunnels, Bridges & Bus Terminals	Bus Terminals	5,989	0.22	0.0301	6,003
	Tunnels and Bridges	10,938	0.74	0.098	10,984
WTC	WTC	11,978	0.44	0.06	12,006
TOTAL		**107,544**	**7.28**	**1.21**	**108,072**

Note: Totals may not match the column sums due to rounding.

Table 5-5. 2019 CAP Emissions for Electricity Consumption in Buildings by Department (metric tons)

Department	Facility	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Aviation	JFK Airport	0.16	6.95	1.83	1.83
	LGA Airport	0.27	2.65	0.09	0.10
	EWR Airport	17.80	12.35	5.18	5.38
	SWF Airport	0.17	0.25	0.06	0.06
	TEB Airport	0.52	0.36	0.15	0.16
Central Administration	PANYNJ Leased Office Space NJ	2.30	1.60	0.67	0.670
	PANYNJ Leased Office Space NY	0.001	0.01	0.0003	0.0003
PATH	PATH Buildings	3.06	2.12	0.89	0.93
Port	NJ Marine Terminals	1.20	0.83	0.34	0.36
	NY Marine Terminals	0.007	0.06	0.002	0.003
Real Estate	Real Estate NJ	0.68	0.47	0.20	0.21
	Real Estate NY	0.05	0.52	0.019	0.02
Tunnels, Bridges & Bus Terminals	Bus Terminals	0.26	2.52	0.09	0.10
	Tunnels and Bridges	4.90	4.92	1.43	1.49
WTC	WTC	0.52	5.04	0.18	0.19
TOTAL		**31.90**	**40.65**	**11.13**	**11.50**

Note: Totals may not match the column sums due to rounding.

The electricity GHG emissions shown in Table 5-4, as well as the total Port Authority emissions in Chapter 1, are estimated using market-based emission factors. This market-based methodology derives emission factors from contractual instruments, such as a contract between two parties for the sale and purchase of energy bundled with attributes about that electricity generation. In contrast, a location-based methodology estimates emissions solely based on the emissions intensity of the electricity grid. If Port Authority were to estimate GHG emissions from electricity using the location-based methodology, the same eGRID emission factors shown in Table 5-1 would be used, with one exception. All the electricity emissions associated with JFK would be estimated using the NYCW emission factors, rather than the KIAC-specific emission factors. Table 5-6 below shows the difference in GHG emissions from electricity consumption, based on either a market-based or location-based emissions calculation methodology. The market-based CO_2e emissions total is the same as the CO_2e emissions total shown in Tables 5-4 (JFK and Aviation Building emissions) and 1-6 (All Port Authority Emissions). The location-based total is lower because the eGRID emission factor is lower (on a CO_2e per MWh basis) than the KIAC-specific emission factor.

Table 0-6. GHG Emissions by Market or Location-Based Methodology (metric tons CO2e)

Methodology	JFK Building Electricity	All Aviation Building Electricity	All Port Authority Scope 2 Emissions
Market-Based	32,572	66,802	163,764
Location-Based	20,079	54,310	147,744

5.2 Rail Systems

The Port Authority owns three rail systems: PATH, AirTrain JFK, and AirTrain Newark. The Port Authority maintains operational control of PATH, while the AirTrain systems are operated by Bombardier Transportation. This section covers the development of emissions resulting from indirect purchased electricity from the PATH system, which is under the operational control of the Port Authority. Emissions for the AirTrain systems are categorized as scope 3 and are discussed in Section 11.2.

5.2.1 Activity Data

The Port Authority's Office of Environmental and Energy Programs centrally collects information relating to electricity purchases from Constellation Energy and South Jersey Energy associated with electricity purchases for PATH trains. This information was corroborated against monthly statements supplied by the electric utility. Additionally, electricity consumption was prorated for the months of January and December to capture consumption within the calendar year of the assessment. Total consumption in 2019 amounted to 104,217,880 kilowatt hours (kWh).

5.2.2 Method

As described in Section 5.1.3, emission estimates are developed in accordance with GRP Chapter 14, "Indirect Emissions from Electricity Use" (TCR 2013). The GHG emission factors used to calculate the GHGs associated with electricity consumption are shown in **Error! Reference source not found.**. For the PATH Rail System, the emission factors for the RFCE subregion were applied. **Error! Reference source not found.** shows the CAP emission factors used for the 2019 electricity emission estimates.

5.2.3 Results

GHG emission estimates were developed from records of electricity consumption (i.e., utility statements). Table 5-7 summarizes GHG and CAP emissions associated with operation of the PATH Rail System.

Table 5-7. 2019 GHG & CAP Emissions from Electricity Consumption in Rail Systems (metric tons)

Activity	CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
PATH Rail System	33,846	2.88	0.38	34,023	22.7	15.7	6.61	6.86

6.0 PURCHASED STEAM, HEATING, AND COOLING (SCOPE 2)

This chapter discusses indirect emissions associated with energy purchases or acquisitions in the form of steam, heating, and cooling from the KIAC facility and ConEdison.

6.1 KIAC Heating and Cooling

The Port Authority purchases thermal energy in the form of heating and cooling from KIAC to service JFK. While the KIAC facility is owned by the Port Authority and sits within Port Authority property, emissions from the plant do not fall within the operational control boundary because the facility is operated by Calpine Corporation. On the other hand, the Port Authority reports emissions associated with thermal energy purchases. These are calculated as a function of energy purchases multiplied by a KIAC-specific emission metric.

6.1.1 Activity Data

The Port Authority provided separate monthly thermal energy purchase data for JFK. Thermal energy in the form of cooling and heating was billed separately. Thermal consumption for heating and cooling amounted to 52,415 and 93,389 MMBtu respectively.

6.1.2 Method

The heating and cooling GHG and PM emission factors for KIAC were determined as described in Section 7.1. The resulting heating and cooling emission factors are presented in Table 6-1.

Table 6-1. KIAC Thermal Emission Factors

Metric	CO_2	CH_4	N_2O	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Heating (kg/MMBtu)	61.17	4.38×10^{-3}	1.04×10^{-3}	2.93×10^{-4}	1.31×10^{-2}	3.45×10^{-3}	3.45×10^{-3}
Cooling (kg/MMBtu)	61.17	4.38×10^{-3}	1.04×10^{-3}	2.93×10^{-4}	1.31×10^{-2}	3.45×10^{-3}	3.45×10^{-3}

6.1.3 Results

Table 6-2 provides GHG and CAP emission estimates for the heating and cooling purchased from KIAC by the Port Authority to service JFK.

Table 6-2. 2019 GHG & CAP Emissions from KIAC Thermal Energy Purchases (metric tons)

Commodity	CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Purchased Heating	3,206	0.23	0.05	3,228	0.02	0.69	0.18	0.18
Purchased Cooling	5,713	0.41	0.10	5,751	0.03	1.23	0.32	0.32
TOTAL	**8,919**	**0.64**	**0.15**	**8,979**	**0.05**	**1.92**	**0.50**	**0.50**

Note: Totals may not match the column sums due to rounding.

6.2 ConEdison Steam

The PABT and WTC purchase steam from ConEdison for building heating purposes. The attributes of the ConEdison 59th Street Generating Station were used to assess the carbon intensity of steam deliveries.

6.2.1 Activity Data

The Port Authority monitors monthly steam consumption data at PABT and WTC. Annual consumption in 2019 was 70,635 and 50,578 thousand pounds of steam (Mlbs) at PABT and WTC, respectively.

6.2.2 Method

The attributes of the ConEdison 59th Street Generating Station served as the basis for calculating the emission factors associated with ConEdison steam purchases. For each pollutant, the emission factor was assessed as the ratio of the station's emissions to its energy intake. The station's primary energy consumption was available from EPA's Facility Information on GreenHouse Gases Tool (FLIGHT) database (EPA 2019a). Plant emissions were retrieved from multiple sources. GHG emissions were retrieved from the FLIGHT database, while NO_X emissions came from EPA's Air Market Division Database (EPA 2019b). PM emissions were calculated using AP-42 emission factors for oil and natural gas- fired boilers (EPA 1995). Table 6-3 presents the emission factors for purchased steam as provided by ConEdison.

Table 6-3. ConEdison Steam Emission Factors

Metric	CO_2	CH_4	N_2O	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Steam (kg/Mlbs)	75.51	1.51×10^{-3}	1.67×10^{-4}	3.97×10^{-4}	7.84×10^{-2}	6.20×10^{-3}	6.20×10^{-3}

6.2.3 Results

Table 6-4 presents GHG and CAP emissions associated with ConEdison purchased steam for PABT and WTC.

Table 6-4. 2019 GHG & CAP Emissions from ConEdison Steam Purchases (metric tons)

Facility	CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
PABT	5,333	0.11	0.01	5,339	0.03	5.54	0.44	0.44
WTC	3,819	0.08	0.008	3,823	0.02	3.97	0.31	0.31
TOTAL	**9,152**	**0.18**	**0.02**	**9,163**	**0.05**	**9.51**	**0.75**	**0.75**

Note: Totals may not match the column sums due to rounding.

7.0 ENERGY PRODUCTION (SCOPE 3)

This chapter discusses the emitting activities associated with power generation at the Kennedy International Airport Cogeneration (KIAC) facility located in Queens County, New York, which is owned by the Port Authority.

7.1 Kennedy International Airport Cogeneration

This section describes how plant-level operational data were used to assess plant-level emissions, as well as the steps taken for distributing these emissions between end users, including the Port Authority, JFK airport tenants, and downstream consumers of KIAC electricity. The Port Authority leases the KIAC facility to KIAC Partners, a partnership wholly owned by the Calpine Corporation, pursuant to a long-term lease agreement expiring on January 31, 2020. KIAC Partners is responsible for the operation and maintenance of the KIAC facility. The current business model features an energy purchase agreement with the Port Authority for electricity and thermal energy needs of the JFK airport in which excess electricity is sold to market and excess thermal energy is resold to JFK tenants (Port Authority 2014).

7.1.1 Activity Data

The KIAC facility is a combined-cycle power plant equipped with two identical gas combustion turbines and one steam generator fed by two heat recovery steam generators (HRSGs). The gas combustion turbines and HRSGs run primarily on natural gas with jet "A" fuel as a secondary fuel source. The KIAC facility produces both electricity and thermal energy.

The plant operator, Calpine Corporation, provided all necessary information to assess plant-specific electricity and thermal production metrics in terms of mass of air pollutants over electricity or thermal energy sold. Key operational data included fuel input, electric power output, and thermal production output (Calpine 2020).

7.1.2 Plant Emissions Method

This analysis used a fuel-based methodology, whereby the natural gas and jet "A" fuel inputs were converted to emissions using default emission factors. The CO_2 emission factors are fuel specific to natural gas and jet "A" fuel, and the N_2O and CH_4 emission factors are fuel type and power generation technology specific (e.g., combined cycle, natural gas combustion). PM emission factors were obtained from EPA AP-42, Chapter 3 Table 3.1-2a (EPA 1995), where the industry-average emission rate is expressed in terms of PM mass per unit of heat input. Note that PM_{10} and $PM_{2.5}$ emissions were assumed to be the same as a conservative measure. Emission factors used in the assessment are presented in Table 7-1 and Table 7-2. NO_x and SO_2 emissions were obtained from environmental compliance public records (EPA 2020).

Table 7-1. Emission Factors for Natural Gas Combustion at Combined Cycle Power Plant

Pollutant	Value	Units	Source
CO_2	53.06	kg/MMBtu	TCR 2019, Table 1.1
CH_4	3.8	g/MMBtu	TCR 2019, Table 1.5
N_2O	0.9	g/MMBtu	TCR 2019, Table 1.5
$PM_{2.5}$	0.0066	lbs/MMBtu	EPA 1995
PM_{10}	0.0066	lbs/MMBtu	EPA 1995

Table 7-2. Emission Factors for Jet "A" Fuel Combustion at Combined Cycle Power Plant

Pollutant	Value	Units	Source
CO_2	72.22	kg/MMBtu	TCR 2019, Table 1.1
CH_4	0.9	g/MMBtu	TCR 2019, Table 1.5
N_2O	0.4	g/MMBtu	TCR 2019, Table 1.5
$PM_{2.5}$	0.01	lbs/MMBtu	EPA 1995
PM_{10}	0.01	lbs/MMBtu	EPA 1995

7.1.3 Electricity and Thermal Emission Factors

KIAC supplies electricity and thermal (heating and cooling) energy for the benefit of Port Authority operations and tenants. Best carbon accounting practices require that emissions from a combined heat and power (CHP) plant be allocated to end users by means of electricity, heating, and cooling-specific emission factors. These emission factors were calculated first by allocating plant emissions in accordance with the specification of TCR (see **Error! Reference source not found.**) to each useful energy output of the KIAC plant, and then dividing allocated emissions by the corresponding amount of useful energy. The resulting emission factors are presented in Table 7-3 for each useful energy output, namely electricity, heating, and cooling. These plant emission factors were used to estimate Port Authority indirect emissions from electricity and thermal energy consumption from KIAC, as described in Sections 5.1.2 and 6.1.2, respectively.

Equation 12k	Allocating CHP Emissions to Steam and Electricity

Step 1: $E_H = (H \div e_H) \div [(H \div e_H) + (P \div e_P)] \times E_T$

Step 2: $E_P = E_T - E_H$

Where:

E_H = Emissions allocated to steam production
H = Total steam (or heat) output (MMBtu)
e_H = Efficiency of steam (or heat) production
P = Total electricity output (MMBtu)
e_P = Efficiency of electricity generation
E_T = Total direct emissions of the CHP system
E_P = Emissions allocated to electricity production

Source: TCR 2013

Figure 7-1. CHP Distributed Emissions Methodology

Table 7-3. KIAC Electricity and Thermal Emission Factors by Pollutant

Commodity	CO_2	CH_4	N_2O	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Heating (kg/MMBtu)	61.17	0.0044	0.0010	0.0003	0.0131	0.0035	0.0035
Cooling (kg/MMBtu)	61.17	0.0044	0.0010	0.0003	0.0131	0.0035	0.0035
Electricity (kg/MWh)	436.90	0.0313	0.0074	0.0021	0.0939	0.0247	0.0247

7.1.4 Results

KIAC plant emissions are presented in Table 7-4. KIAC plant emissions distributed by energy stream and end-user are presented in Table 7-5.

Table 7-4. KIAC Plant GHG & CAP Emissions Summary (metric tons)

CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
247,161	17.70	4.19	248,833	1.18	53.11	13.95	13.95

Table 7-5. 2019 KIAC Plant Emissions Distributed by End User (metric tons)

End-User	Emission Category	CO_2e
Port Authority	Purchased Cooling	5,751
	Purchased Electricity	32,571
	Purchased Heating	3,228
Tenants	Purchased Cooling	13,355
	Purchased Electricity	128,415
	Purchased Heating	8,777
Customers	Energy Production	56,736
TOTAL		**248,833**

Note: Totals may not match the column sums due to rounding.

8.0 AIRCRAFT (SCOPE 3)

The Port Authority manages and operates the following airports:

- John F. Kennedy International Airport (JFK)
- Newark Liberty International Airport (EWR)
- LaGuardia Airport (LGA)
- Stewart International Airport (SWF)
- Teterboro Airport (TEB)

JFK has been recognized for decades as the premier U.S. gateway for passengers and cargo and is the busiest airport in the New York City metropolitan area. In 2019, the airport handled a record 62.5 million passengers, and more than 1.4 million tons of cargo. About 80 airlines operate out of the airport, serving about 170 nonstop destinations. EWR is among the busiest North American and international airports. In 2019, over 46 million passengers used the airport, an all-time record. About 35 airlines operate out of the airport, serving more than 160 nonstop destinations. LGA is one of the nation's leading domestic gateways for business travel and is the primary business/short-haul airport for New York City. LGA had approximately 31 million passengers in 2019. Eleven airlines serve 73 nonstop destinations at LGA. SWF is a convenient alternative to the New York/New Jersey metropolitan region's airports. Several commercial and charter airlines operate at the airport, offering direct access to a number of major U.S. hubs. SWF handled about 530,000 passengers and more than 22,000 tons of cargo in 2018. TEB, designated as a reliever airport for general aviation in the New York-New Jersey region, is a 24-hour public-use facility. The airport does not permit scheduled commercial operations and prohibits aircraft with operating weights in excess of 100,000 pounds.

This chapter covers emitting activities within the organizational boundary of the Port Authority associated with the operation of aircraft, auxiliary power units (APU), and ground support equipment (GSE). While the Port Authority maintains financial control over the airport's infrastructure, it does not have operational control over aircraft movements or GSE operations. For that reason, GHG emissions reflected in this chapter correspond to tenant emissions (i.e., scope 3 emissions) over which the Port Authority has no operational control.

The primary modeling tool for assessing aircraft and GSE emissions is the Federal Aviation Administration's (FAA's) Aviation Environmental Design Tool (AEDT), version 3c, released June 2020 (AEDT 2020). This model replaces version 2d, which was used in developing all Port Authority aviation emission inventories between 2014 and 2018. The FAA's Emission and Dispersion Modeling System (EDMS) model was used prior to 2014.

AEDT models emissions as a function of the volume of operations (i.e., annual number of arrivals and departures) and aircraft fleet mix at each airport. Additional model inputs include annual average taxi in/out times, extent of gate electrification with preconditioned air (PCA) supply, and GSE profiles. Because AEDT provides partial GHG emissions information limited to CO_2 emissions for aircraft, most emission factors for GHGs of interest, such as CH_4 and N_2O, were developed using Intergovernmental Panel on Climate Change (IPCC) guidance. Supplemental emission factors were taken from The Climate Registry's GRP and EPA's MARKet ALlocation (MARKAL) database to improve the estimate for GSE. The general structure of the emissions inventory in terms of activity data, methods, and emissions factor sources utilized to develop emissions estimates is presented in **Error! Reference source not found.**.

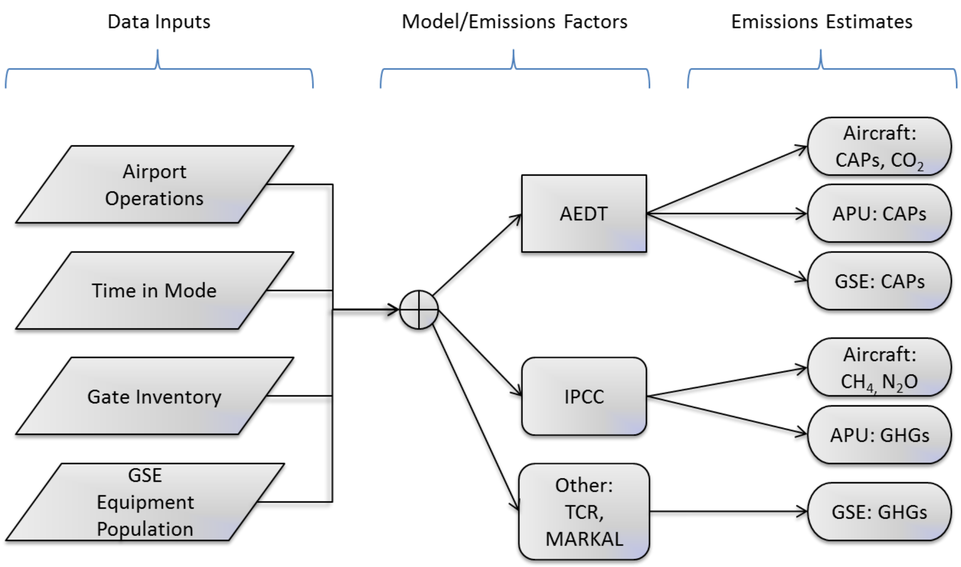

Figure 8-1 Schematic of the Aircraft, APU, and GSE Inventory

8.1 Aircraft Movements and Auxiliary Power Units

For aircraft emissions, the inventory boundary encompasses aircraft operations that FAA defines as itinerant and local. Itinerant operations are operations performed by an aircraft that lands at the airport, arriving from outside the airport area, or departs from the airport leaving the airport area. Local operations are those operations performed by aircraft that remain in the local traffic pattern, execute simulated instrument approaches or low passes at the airport, and the operations to or from the airport and a designated practice area within a 20-mile radius of the tower (FAA 2012). Additionally, the inventory boundary includes aircraft emissions associated with the following six times-in-mode that together constitute a landing and take-off (LTO) cycle.

1. Approach – portion of the flight from the time that the aircraft reaches the mixing height (approximately 3,000 feet altitude) to touchdown on the runway

2. Taxi In – the landing ground roll segment from touchdown to the runway exit of an arriving aircraft and the taxiing from the runway exit to a gate
3. Startup – aircraft main engine startup emissions quantified for aircraft with International Civil Aviation Organization (ICAO) certified engines
4. Taxi Out – the taxiing from the gate to a runway end
5. Takeoff – the portion from the start of the ground roll on the runway, through wheels off, and the airborne portion of the ascent up to cutback during which the aircraft operates at maximum thrust
6. Climb out – the portion from engine cutback to the mixing height

This chapter also covers emissions from the use of APUs. These are on-board generators that provide electrical power to the aircraft while its engines are shut down. Excluded from this chapter are aircraft cruising emissions (i.e., emissions generated above mixing height between departure and arrival airports) because the study focuses on local emissions.

8.1.1 Activity Data

Operations data by aircraft type were provided for the five airports by the Aviation department (Port Authority 2020k, Port Authority 2020l). The data set for each airport contains the number of arrivals and departures grouped by ICAO aircraft code, based on the Port Authority's AEROBAHN dataset. As a quality assurance/quality control measure, total operations for each airport are normalized using airport operations data as reported in the FAA Air Traffic Activity Data System (ATADS) (FAA 2020). For example, the Aviation department recorded 464,311 operations in 2019 for EWR. On the other hand, the ATADS database shows 449,543 operations (FAA 2020). For consistency with FAA records, operations are adjusted to match the ATADS database. Total 2019 operations and passenger count by airport are shown in Table 8-1.

Table 8-1. 2019 Port Authority Operations and Passenger Traffic by Airport

Airport	FAA ATADS Operations	Passenger Count [a]
JFK	463,198	62,551,072
EWR	449,543	46,336,452
LGA	374,539	31,084,894
SWF	40,238	529,545
TEB	173,625	No Data

[a] Port Authority (2020c).

Error! Reference source not found. below presents a distribution of operations based on aircraft size as measured by their arrival weight. Small aircraft have a weight less than 50,000 pounds, medium aircraft have a weight between 50,000 and 100,000 pounds, and large aircraft have a weight greater than 100,000 pounds. The distribution of operations across the aircraft fleet mix is provided in Appendix B: 2019 Operations By Aircraft Code for each of the five Port Authority airports.

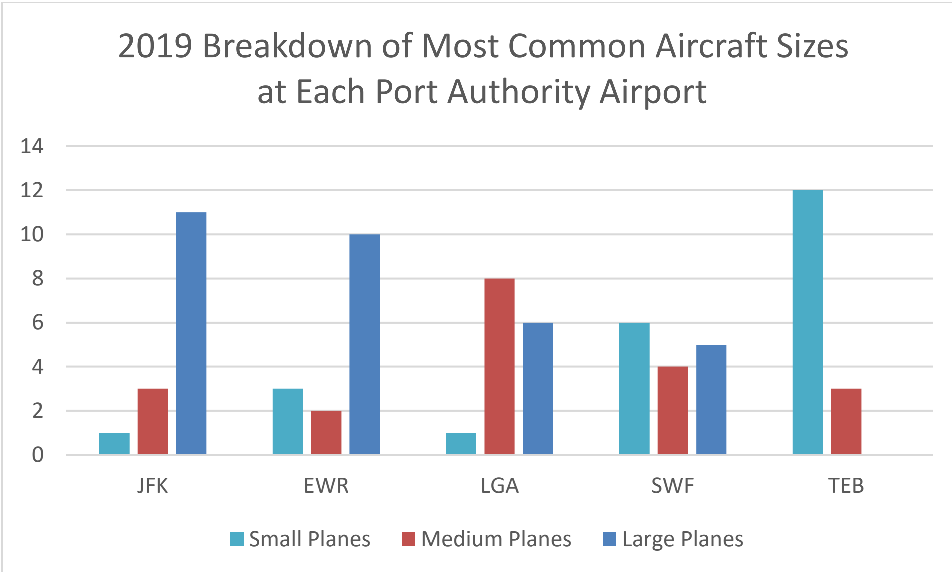

Figure 8-2. Aircraft Distribution by Size and Airport

The 2019 taxi times were provided by the Aviation department for JFK, EWR, and LGA (Port Authority 2020k) and are displayed in Table 8-2. No taxi times were available for SWF and TEB, so the AEDT defaults were used.

Table 8-2. Average Taxi In and Taxi Out Times by Airport

Airport	Taxi In (minutes)	Taxi Out (minutes)
JFK	11:30	23:46
EWR	9:44	20:09
LGA	11:07	19:47
SWF	AEDT Default	
TEB	AEDT Default	

The percentage availability of PCA and gate electrification at each airport in 2019 was provided by the Port Authority. This information was used to postprocess AEDT APU results to reflect the decline of APU utilization with greater availability of PCA and gate electrification at the terminals. This information is summarized in Table 8-3.

Table 8-3. Gate Electrification and PCA Available at Port Authority Airports

Airport	Percentage of gates with gate power (400hz)	Percentage of gates with preconditioned air
JFK	98%	92%
EWR	100%	75%
LGA	95%	47%
SWF	100%	100%
TEB	0%	0%

8.1.2 Method

AEDT models emissions as a function of the volume of operations (i.e., annual number of arrivals and departures) by aircraft type, as well as performance parameters, including the duration of each mode of operation (e.g., taxi in and taxi out).

A crosswalk was used to correlate aircraft types between the ICAO aircraft codes to the AEDT aircraft codes. Operations for which an exact match was not found were distributed proportionately across the correlated aircraft mix to ensure that the sum of operations by AEDT aircraft code is consistent with ATADS. In all cases, more than 77 percent of all aircraft operations had a matching AEDT aircraft code. In general, this rate is higher at the three larger airports (greater than 98 percent match for EWR, LGA, and JFK), whereas the rate is slightly lower for TEB (97 percent) and SWF (77 percent).

AEDT estimates emissions for CO_2, VOC, NO_x, SO_x, PM_{10}, and $PM_{2.5}$. Because this study is also interested in CH_4 and N_2O emissions, these pollutant estimates were prepared using the Tier I methodology found in the 2006 IPCC Guidelines for National Greenhouse Gas Emissions Inventories (IPCC 2006), Volume 2, Chapter 3, Table 3.6.9. The Tier I methodology estimates CH_4 and N_2O emissions as a function of LTO. IPCC emission factors were correlated to the fleet mix by means of the ICAO designators. Because the IPCC emission factors list is incomplete, there were instances where a match could not be established. Instead, a default CH_4 and N_2O emission factor was calculated for each airport as the average of emission factors for matching aircraft types at that airport and was applied to the total number of LTOs at that airport. The average aircraft CH_4 and N_2O emission factors by airport are presented in Table 8-4.

Table 8-4. Average Aircraft CH_4 and N_2O Emission Factors

Airport	CH_4	N_2O	Unit
JFK	0.104	0.132	kg/LTO
EWR	0.082	0.093	kg/LTO
LGA	0.094	0.100	kg/LTO
SWF	0.147	0.091	kg/LTO
TEB	0.179	0.076	kg/LTO

APUs are most often on-board generators that provide electrical power to the aircraft while its engines are shut down. The on-board APU is, in effect, a small jet engine, and the emissions assessment is similar to that of an aircraft engine operating in one power setting only. For a given aircraft, APU emissions are modeled as the product of operations, APU running time, and engine emission factors. APU CAP emissions were modeled in AEDT as a function of operations with default APU assignments by aircraft code. GHG emissions for APUs are not included in AEDT and, therefore, were estimated outside of the model. CO_2 emissions were estimated using the CO_2/SO_2 stoichiometric ratio as evaluated for aircraft engine emissions. CH_4 and N_2O emissions were estimated based on the CH_4/CO_2 and N_2O/CO_2 airport-wide emission ratios assessed for aircraft engines.

Based on guidance from the FAA Voluntary Airport Low Emissions Program, 2019 APU estimates were revised downward in cases where PCA and gate electrification are available. When gate power and PCA are both provided to the parked aircraft, APU emissions are eliminated except for the default of 7 minutes needed on average to connect and disconnect gate services. In all other cases, the default APU run time of 26 minutes was applied.

The percentage availability of PCA and gate electrification at each airport is displayed in Table 8-3. In cases where both gate power and PCA are less than 100 percent, the lower of the two figures is used for calculations (for example, JFK is assumed to have 92 percent of gates with both gate power and PCA).

8.1.3 Results

Emission estimates from aircraft engines are summarized by airport in Table 8-5. In general, GHG emissions increased slightly from 2018 to 2019.

Table 8-5. 2019 GHG & CAP Emissions from Aircraft by Airport (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O	SO_x	NO_x	$PM_{2.5}$	PM_{10}
JFK	934,027	924,030	24.2	30.6	343.0	3,942.4	33.4	33.4
LGA	376,254	370,087	17.7	18.7	137.4	1,184.7	14.0	14.0
EWR	602,721	595,883	18.5	20.8	221.2	2,396.2	18.7	18.7
SWF	26,754	26,128	2.9	1.8	9.7	104.4	1.0	1.0
TEB	69,072	66,700	15.5	6.6	24.8	164.3	3.9	3.9
TOTAL	**2,008,827**	**1,982,828**	**78.8**	**78.5**	**736.1**	**7,792.1**	**70.8**	**70.8**

Note: Totals may not match the column sums due to rounding.

APU GHG and CAP emissions are displayed in Table 8-6. These results reflect the effects of PCA and gate electrification where installed, which decreases the demand of running APUs and lowers emissions compared to a scenario without supplied PCA and gate electrification.

Table 8-6. 2019 GHG & CAP Emissions from APU by Airport (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O	SO_x	NO_x	$PM_{2.5}$	PM_{10}
JFK	11,698	11,573	0.3	0.4	4.3	34.9	4.4	4.4
LGA	10,702	10,527	0.5	0.5	3.9	27.0	3.7	3.7
EWR	11,366	11,237	0.3	0.4	4.2	32.0	4.0	4.0
SWF	412	402	0.0	0.0	0.1	1.0	0.1	0.1
TEB	4,999	4,827	1.1	0.5	1.8	10.0	1.5	1.5
TOTAL	**39,177**	**38,566**	**2.3**	**1.8**	**14.3**	**104.9**	**13.7**	**13.7**

Note: Totals may not match the column sums due to rounding.

8.2 Ground Support Equipment

GSE service aircraft upon arrival and prior to departure from the date. During aircraft arrivals, GSE are used to unload baggage and service the lavatory and cabin. Prior to aircraft departure, GSE are present to load baggage, food, and fuel. Additionally, a tug may be used to push or tow the aircraft away from the gate and to the taxiway (AEDT 2020).

8.2.1 Activity Data

The Port Authority did not provide new GSE inventories for 2019. GSE inventories for 2018 were provided by the Port Authority (Port Authority 2019a, Port Authority 2019e) for the three large international airports (i.e., JFK, EWR, and LGA). These inventories are based on the inventory of GSE maintained by the Port of New York and provide information about the make-up of the GSE fleet, the number of units by equipment type, and model year (e.g., 2 counts of a 2005 model year, diesel, TUG MA 50 Tractor).

Additionally, a crosswalk was developed to establish a direct correspondence between equipment types as reported by airlines and the equivalent equipment type from the GSE menu in AEDT. This crosswalk enables the assignment of default GSE parameters, most notably the average annual utilization hours per equipment and engine load.

It was noted that AEDT does not have an equipment profile for diesel deicers. Because there are a significant number of diesel deicers at Port Authority airports, these emissions were modeled separately, using the equipment profile of the most similar unit in AEDT's GSE menu with regard to horsepower (hp) and load factor (LF).

Because GSE inventorying efforts have not yet been conducted at TEB and SWF, their GSE equipment counts were developed using EDMS default GSE assignments, which correspond to each airport's unique aircraft mix. In general, EDMS assigns a greater number of GSEs and utilization values (i.e., minutes per operation) to large and medium size aircraft than to regional or business jets. Note that EDMS default GSE assignments were used at TEB and SWF because the current version of AEDT does not have an equivalent function. The default assignments for TEB and SWF from EDMS calendar year (CY) 2013 were used to create an estimate of what the GSE inventory at these airports is expected to be in 2019. The hours of operation from this 2013 EDMS inventory were then scaled to CY2019 based on the ratio of 2019 to 2013 LTOs and input into AEDT to estimate emissions for CY2019 (FAA 2020).

Appendix C: 2019 Ground Support Equipment Profiles, provides a summary of GSE profiles and utilization for all five airports.

8.2.2 Method

GSE CAP emissions were modeled in AEDT using the activity data described in Section 8.2.1. The GSE module in AEDT is a variation of EPA's MOVES2014 model, which estimates GSE emissions as a function of equipment type (e.g., aircraft tractor and belt loader), utilization (i.e., hours per year), fuel type (e.g., diesel or gasoline), engine capacity, average load, model year, and emission rates. When available, model year information was specified as a parameter in AEDT. In all other cases, a default model year value was applied based on the EPA-derived national fleet average age for a given equipment type.

AEDT generates estimates of criteria pollutants associated with GSE but does not provide estimates of CO_2, CH_4, or N_2O. For that reason, GHG emissions were assessed based on the quantitative relationship (i.e., stoichiometry) between SO_2 emissions and CO_2 emissions. This relationship was used because both SO_2 and CO_2 emissions are directly proportional to the mass of fuel combusted. That is, for any given concentration of sulfur, the CO_2/SO_2 ratio is constant. Then, CH_4/CO_2 and N_2O/CO_2 emission ratios—derived from standard fuel-based emission factors—were applied to CO_2 emissions to determine CH_4 and N_2O emissions.

The SO_2 emission factors used in AEDT version 3c, and used for the Port Authority EY2019 GHG inventory, are based on MOVES2014, which assumes a gasoline sulfur content of 23.4 parts per million (ppm). Because the current gasoline sulfur limit is 10 ppm in 2019 (EPA 2016), gasoline SO_2 emissions modeled in AEDT were multiplied by a factor of 0.4 (i.e., 10/23.4) to properly reflect the current federal gasoline sulfur standard. Based on AEDT's sulfur content, the CO_2/SO_2 ratio for gasoline equals 66,064. This ratio was applied to the AEDT unadjusted SO_2 gasoline emissions to estimate CO_2. At the current diesel sulfur concentration of 11 ppm, the CO_2/SO_2 ratio for diesel combustion equals 144,199 (EPA 2009). The CO_2/SO_2 ratio for other fuels (e.g., LPG) was derived from EPA's MARKAL model (Pechan 2010) and applied to AEDT SO_x estimates in order to calculate CO_2 emissions.[5] Then, CH_4/CO_2 and N_2O/CO_2 ratios—derived from standard non-highway vehicle emission factors—were applied to CO_2 emissions in order to determine CH_4 and N_2O emissions (TCR 2019). All GHG emissions ratios applied in developing GSE emissions are shown in **Error! Reference source not found.**.

Table 8-7. Emissions Ratios Applied to AEDT GSE Output

Concept	Fuel Type	Ratio Value
CO_2/SO_2	Gasoline	66,064
CH_4/CO_2	Gasoline	0.000313
N_2O/CO_2	Gasoline	0.000029
CO_2/SO_2	Diesel	144,199
CH_4/CO_2	Diesel	0.000029
N_2O/CO_2	Diesel	0.000048
CO_2/SO_2	LPG	203,214
CH_4/CO_2	LPG	0.000077
N_2O/CO_2	LPG	0.000073

[5] Sulfur oxides (SO_x) is the term referring to a set of compounds of sulfur and oxygen, of which sulfur dioxide (SO_2) is the predominant form found in the lower atmosphere. The estimates of GSE CO_2 emissions assumed that all SO_x was in the form of SO_2.

CO_2/SO_2	CNG	178,689
CH_4/CO_2	CNG	0.000139
N_2O/CO_2	CNG	0.000050

8.2.3 Results

Table 8-8 shows the GHG and CAP emission estimates for GSE by airport.

Table 8-8. 2019 GHG & CAP Emissions from GSE by Airport (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O	SO_2	NO_x	$PM_{2.5}$	PM_{10}
JFK	93,088	91,647	17.0	3.5	0.6	624.4	43.5	45.1
LGA	29,915	29,457	3.9	1.2	0.2	257.6	21.1	21.8
EWR	88,831	87,469	18.8	3.1	0.6	713.3	32.7	34.1
SWF	676	666	0.1	0.0	0.0	1.7	0.1	0.1
TEB	1,156	1,139	0.1	0.1	0.0	3.4	0.2	0.2
TOTAL	**213,666**	**210,378**	**39.9**	**7.9**	**1.4**	**1,600.4**	**97.6**	**101.3**

Note: Totals may not match the column sums due to rounding.

9.0 ATTRACTED TRAVEL (SCOPE 3)

Attracted travel refers to customer motorized travel to access Port Authority infrastructure and includes a range of activities. For emission year (EY) 2019, attracted travel was assessed for all travel to Port Authority airports as well as Port Authority Tunnels, Bridges and Terminals.

9.1 Airport Passengers

For attracted travel related to passenger access to airports (excluding cargo-related vehicles), the established boundary includes the trip to or from the airport up to a maximum of 100 miles. This boundary was developed based on the trip origin data received from the Port Authority's Aviation department (Port Authority 2018). There were no updated 2018 or 2019 trip origin data for EWR, JFK, and LGA, so 2017 data were used. Trip origin data for SWF were not available for 2019, so the latest available year (2014) was used (Port Authority 2015). The airport passenger portion includes emissions associated with all vehicle trips that are attracted by airport facilities. Vehicle types (also referred to as travel mode) include privately owned vehicles, taxis, buses, rental cars, limousines, vans, shuttle buses, public buses, Uber/Lyft, parking at the airport, dropped off by personal car, and off-airport parking. VMT for the airport facilities were calculated by mode, and for the trip to or from the airport.

9.1.1 Activity Data

The data inputs to the attracted travel analysis were (1) the 2017 passenger survey data (Port Authority 2018), which provided the passenger origin/destination information, (2) the 2019 total passenger data (Port Authority 2020c) for information on the total number of passengers, and (3) data on average travel party size (National Transit Database 2018; FHWA 2018; Port Authority 2019d).

The 2019 total passenger data were adjusted to exclude in-transit passengers (passengers with a connection in a Port Authority airport prior to their destination) because these passengers do not induce attracted travel. The percentage of passengers on connecting flights by airport (Port Authority 2020c) used to adjust total passenger volumes is presented in Table 9-1.

Table 9-1. Percentage of Total Passengers on Connecting Flights

Airport	Percent of Passengers
JFK	27%
EWR	24%
LGA	14%
SWF	2%
TEB	0%

Passengers are assumed to take a one-way trip (either to or from the airport) to their destination. For JFK, EWR, and LGA, personal car trips were divided between those where passengers were dropped off at an airport and those where passengers parked at an airport. Trips where the passenger parked at the airport use a one-way distance, whereas drop-offs use the round-trip distance. For SWF, there was no subdivision of the personal car category. Instead, passengers are divided between airport parkers and airport drop-offs based on the number of paid parked cars at SWF (Port Authority 2020c). Passengers who paid to park their car at SWF use the one-way distance, while all other passenger cars are assumed to be a pickup/drop off and, therefore, the round-trip distance is used.

9.1.2 Method

For each airport except TEB, the number of passengers was allocated by travel mode and trip origin prior to estimating the number of vehicles. The number of vehicles by travel mode and trip origin was estimated using the number of passengers, trip distributions by travel mode to each passenger origin, average travel party size, and estimated distance traveled. Trip distributions by mode to each passenger origin were obtained from the Port Authority's Aviation department (Port Authority 2018). A complete trip distribution survey has not been conducted since 2017, but 2019 data on passenger mode (independent of passenger origin/destination) was available in the 2019 Air Traffic Report (Port Authority 2020c). This 2019 passenger travel mode data was used to reallocate 2017 passenger modes to better reflect 2019 travel patterns.

Information on the estimated trip distances and average travel party size are listed in Table 9-2 and Table 9-3, respectively. Table 9-2 lists the trip origins for airport attracted travel with the corresponding estimated one-way travel distances by airport, except for TEB. Trip origin and travel mode data were not available for TEB. The methodologies used to estimate attracted travel emissions for TEB are discussed in a separate section later in this chapter. Distances reported in Table 9-2 were estimated using Google Maps roadway trip lengths. The surrogate location associated with each origin/destination represents the most populous locality within the county or jurisdiction.

Table 9-2. One-Way Travel Distances Associated with Airport Facilities

Origin/Destination		Miles to/from[b]			
County/Jurisdiction	**Surrogate Location**	**JFK**	**LGA**	**EWR**	**SWF**
New York City					
Bronx	Bronx	17	10	27	
Brooklyn	Brooklyn	11	16	20	
Manhattan <14th St.	E. 10th St., NYC	18	10	14	66
Manhattan 14th–96th Sts.	E. 50th St., NYC	17	9	17	65
Manhattan > 96th St.	E. 110th St., NYC	18	7	20	64
Nassau	Mineola	13	17	45	
Queens	Queens	8	7	26	
Staten Island	Staten Island	28	26	13	
Suffolk	Hauppauge	42	40	62	
Westchester	Yonkers	27	17	29	54

Origin/Destination		Miles to/from[b]			
County/Jurisdiction	Surrogate Location	JFK	LGA	EWR	SWF
Other NY Counties					
Allegheny	Wellsville	100		100	
Albany	Albany	100	100	100	90
Broome	Binghamton	100	100	100	
Cayuga	Auburn	100	100		
Cattaraugus	Olean		100		
Chautauqua	Jamestown	100			
Chemung	Elmira	100	100		
Clinton	Plattsburgh	100	100	100	
Columbia	Kinderhook	100			
Cortland	Cortland	100	100	100	
Delaware	Sidney			100	
Dutchess	Poughkeepsie	89	82	87	26
Erie	Buffalo	100	100	100	
Essex	North Elba	100			100
Herkimer	German Flatts	100			
Livingston	Geneseo		100		
Madison	Oneida	100			
Monroe	Rochester	100		100	100
Montgomery	Amsterdam		100		
Niagara	Niagara Falls	100			
Onondaga	Syracuse	100	100	100	
Oneida	Utica	100			100
Orange	Newburgh	75	66	71	6
Orleans	Albion			100	
Otsego	Oneonta	100			
Putnam	Carmel	100	56	69	35
Rensselaer	Troy	100		100	
Rockland	Nanuet	45	31	40	38
Saratoga	Saratoga Springs	100	100	100	
Seneca	Seneca Falls		100		
Steuben	Corning		100		
Suffolk	Brookhaven			59	
Sullivan	Monticello	100		100	39
Tompkins	Ithaca	100	100	100	
Ulster	Kingston	100	100	100	40
Washington	Kingsbury	100			
Warren	Glen Falls			100	
Yates	Milo	100		100	100
Other NY[a]			100	100	
NJ Counties					
Atlantic	Egg Harbor Township	100	100	100	
Bergen	Hackensack	29	18	20	55
Burlington	Evesham Township	100	100	76	
Camden	Camden	100	100	76	
Cape May	Cape May			100	
Cumberland	Vineland	100		100	
Essex	Newark	44	25	12	
Gloucester	Washington Township	100	100	91	
Hudson	Union City	22	15	13	
Hunterdon	Raritan Township		77	49	
Mercer	Hamilton Township	76	76	50	
Middlesex	Edison	46	46	20	
Monmouth	Middletown	57	54	32	
Morris	Parsippany-Troy Hills	51	50	24	
Ocean	Lakewood Township	82		48	
Passaic	Paterson	36	26	20	

Origin/Destination		Miles to/from[b]			
County/Jurisdiction	**Surrogate Location**	**JFK**	**LGA**	**EWR**	**SWF**
Salem	Salem			100	
Somerset	Franklin Township	53	55	27	
Sussex	Vernon Township	70	65	59	
Union	Elizabeth	32	27	4	
Warren	Philipsburg			60	
Other NJ		100	100	100	
CT Counties					
Fairfield	Bridgeport	62	55	76	
Hartford	Hartford	100	100	100	
Litchfield	Torrington	100	100	100	
Middlesex	Middletown		100	100	
New Haven	New Haven	80	73	95	
New London	New London	100	100	100	
Tolland	Vernon		100		
Other CT		100	100	100	
PA Counties					
Adams	Gettysburg	100			
Allegheny	Pittsburgh	100	100	100	
Armstrong	Kittanning	100		100	
Beaver	Aliquippa	100		100	
Bedford	Bedford			100	
Berks	Reading	100		100	
Blair	Altoona	100			
Bradford	Towanda			100	
Bucks	Bensalem	100		67	
Cameron	Emporium			100	
Carbon	Lehighton			99	
Centre	Bellefonte	100		100	
Chester	West Chester	100		100	
Clinton	Lock Haven		100		
Columbia	Bloomsburg			100	
Cumberland	Carlisle			100	
Dauphin	Harrisburg	100	100	100	
Delaware	Chester	100		100	
Franklin	Chambersburg			100	
Lackawanna	Scranton	100		100	
Lancaster	Lancaster	100		100	
Lawrence	New Castle			100	
Lebanon	Lebanon	100			
Lehigh	Allentown	100		82	
Luzerne	Wilkes-Barre	100		100	
Lycoming	Williamsport			100	
Monroe	Stroudsburg	98	100	77	
Montgomery	Lower Merion	100	100	91	
Northampton	Bethlehem	100	100	72	
Philadelphia	Philadelphia	100	100	83	100
Pike	Matamoros	100		76	37
Schuylkill	Pottsville			100	
Union	Lewisburg	100			
Washington	Washington	100		100	
Wayne	Honesdale	100		100	
York	York	100		100	
Other PA[a]		100	100	100	100
Other U.S.[a]		100	100	100	100

[a] These are cases where no county information was provided by survey respondent, and consequently a default distance was assigned.
[b] Trip distances are capped at a maximum of 100 miles.

Table 9-3. Average Travel Party Size by Travel Mode and Facility

Travel Mode	Average Travel Party Size by Facility			
	JFK	LGA	EWR	SWF
Rental Car[a]	2.7	1.6	2.0	2.1
Taxi[a]	2.3	3.4	2.0	2.6
Limo/Towncar[a]	2.3	1.8	1.8	2.0
Shared-Ride Van[c]	6.1	6.1	6.1	6.1
Airport/Charter/Tour Bus[b]	16.8	16.8	16.8	16.8
Public/City Bus[b]	16.8	16.8	16.8	16.8
Hotel/Motel Shuttle Van[c]	6.1	6.1	6.1	6.1
Off-Airport Parking[a]	2.4	1.9	2.7	2.4
Uber/Lyft[a]	1.9	1.8	1.6	1.8
Dropped Off via Pers. Car[a]	2.3	2.2	2.3	2.3
On-Airport Parking[a]	2.3	1.9	1.7	2.0

[a] Port Authority (2019g).
[b] FHWA (2018).
[c] National Transit Database (2018).

The trip distance data presented in Table 9-2 and the average party size data, which are shown in Table 9-3, along with the trip distribution data, were applied to develop the total VMT accumulated due to airport attracted travel. The methodology for estimating VMT is consistent for private cars, limousines, chartered buses, hotel/motel/off-airport shuttle buses, Uber/Lyft, parking at airport, and van services vehicle categories, and is estimated using Equation 9-1. Airport drop-offs also use this methodology, but the trip length is the round-trip distance, since the drop-off vehicle would need to return home in that single trip.

$$VMT = \frac{N \times \%D}{P} \times L \qquad (9\text{-}1)$$

Where:
VMT = vehicle miles traveled
N = number of passengers
%D = percent distribution by trip origin and travel mode
P = travel party size or vehicle occupancy in case of buses and shuttles
L = trip length (one-way, miles)

The calculation of VMT for taxis and rental cars are based on the number of vehicle trips rather than the number of passengers, since the number of these vehicles is known. For taxis servicing JFK, LGA, and EWR, the number of taxis dispatched comes from the Port Authority's 2019 Air Traffic Report (Port Authority 2020c), and data on total rental car transactions for these airports were also provided by the Port Authority for 2017, as 2018 and 2019 data were not available (Port Authority 2017). These numbers of vehicle trips are allocated by trip origin/destination utilizing the percentage of airport passengers by trip origin/destination. The number of vehicle trips is then multiplied by the one-way trip distance for each origin/destination location to estimate rental car or taxi VMT. Taxi and rental car transactions data from SWF were not available, so VMT from taxis and rental cars at SWF are estimated like other travel modes. Because no vehicle travel attraction statistics were available for TEB, based on the types of flights that use TEB, the number of passengers at TEB was estimated as the number of aircraft movements (Port Authority 2020c). The TEB attracted travel VMT was estimated assuming an average trip length of 16.2 miles, based on the distance from TEB to Manhattan, with all trips assigned to personal cars at a vehicle occupancy of 1.0.

Once VMT estimates were developed for all attracted travel modes, VMT was summed by facility and mode. Emission factors for attracted travel at airports were calculated using EPA's MOVES model (EPA 2018b) based on input data for the 10 New York metropolitan counties (NYDOT 2020). For personal vehicle travel (personal car, rental car, taxi, limo/town car, off-airport parking), the emission factors were based on the weighted average of the MOVES passenger car, passenger truck, and motorcycle vehicle types over the 10 counties. Emission factors for shared-ride van and hotel/motel shuttle van were based on the 10-county weighted average small/medium truck emission factors. Emission factors for public/city bus and airport/charter/tour bus were based on the 10-county weighted average transit bus emission factors. Emissions estimates for all pollutants were developed by multiplying VMT by the corresponding emission factors (in grams per mile).

Cold-start emissions associated with the startup of a cooled vehicle engine were estimated for the following travel modes: personal car, dropped off via personal car, on-airport parkers, rental cars, and off-airport parking. Vehicle emissions for this category were calculated by multiplying the number of vehicle trips by the corresponding weighted cold-start emission factor for each vehicle type, assuming one cold start per trip. Total vehicle trips were estimated by dividing the total number of passengers for each affected travel mode by the vehicle occupancy for that mode for each airport/travel mode combination. The exception was for rental cars, where vehicle trips were assumed to be equivalent to the number of rental car transactions. The cold-start emission factors (in grams per start) by vehicle type were derived from the EPA MOVES model (EPA 2018b).

9.1.3 Results

Total airport attracted travel GHG emission estimates are displayed in Table 9-4 below. Carbon dioxide accounted for more than 99 percent of all attracted travel CO_2e emissions. **Error! Reference source not found.** shows the CO_2 emissions broken down by both travel mode and airport. The travel modes are simplified into four broad categories: personal car (including on airport parking and drop-offs), rental cars, taxi/limo/Uber/Lyft, and other (including buses, shuttle vans, and off-airport parking). Total GHG and CAP emission estimates are broken down by airport, as shown in Table 9-5.

Table 9-4. 2019 Airport Passenger Attracted Travel GHG Emissions by Mode (metric tons CO_2)

Travel Mode	JFK	LGA	EWR	SWF	TEB
Personal Car [a]	0	0	0	0	1,250

Travel Mode	JFK	LGA	EWR	SWF	TEB
Dropped Off Via Pers. Car	134,806	54,667	146,032	2,801	0
On-Airport Parkers	23,602	2,889	31,096	1,430	0
Rental Car	11,238	6,856	13,766	1,261	0
Taxi	22,951	9,633	10,388	24	0
Limo/Town Car	23,244	14,589	40,119	130	0
Uber/Lyft	31,155	15,383	32,915	0	0
Shared-Ride Van	6,720	697	2,730	11	0
Mass Transit to AirTrain	0	0	0	0	0
Any Bus	0	0	0	0	0
Airport/Charter/Tour Bus	4,028	1,569	3,767	0	0
Public/City Bus	379	2,014	635	0	0
Hotel/Motel Shuttle Van	1,526	497	4,034	5	0
Off-Airport Parking	4,629	936	11,820	0	0
Total	**264,277**	**109,731**	**297,301**	**5,662**	**1,250**

[a] The Personal Car total is only for TEB, as this broad category is not used at EWR, JFK, LGA, and SWF.

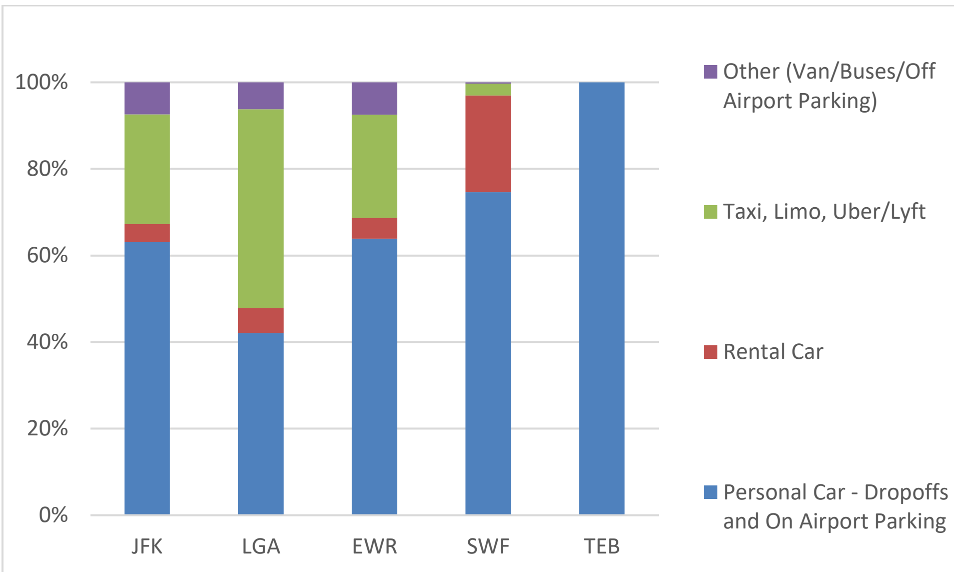

Figure 9-1. Attracted Travel Emissions Distributed by Mode

Table 9-5. 2019 Airport Passenger Attracted Travel GHG & CAP Emissions by Airport (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O	SO_2	NO_x	$PM_{2.5}$	PM_{10}
JFK	265,073	264,277	6.05	2.16	3.74	114.86	9.34	42.58
EWR	298,166	297,301	6.27	2.37	4.21	123.45	10.36	47.81
LGA	110,097	109,731	3.82	0.92	1.55	48.56	3.88	17.83
SWF	5,678	5,662	0.05	0.05	0.08	2.02	0.19	0.90
TEB	1,255	1,250	0.02	0.02	0.02	0.50	0.04	0.20
TOTAL	**680,269**	**678,221**	**16.2**	**5.5**	**9.6**	**289.4**	**23.8**	**109.3**

Note: Totals may not match the column sums due to rounding.

9.2 Air Cargo

In addition to direct passenger service, Port Authority airports handle air cargo. The movement of air cargo to and from the air terminals induces vehicular traffic near the airports. The boundary is defined as the roadway distance between the airport and the first access/egress route as shown in **Error! Reference source not found.**.

Figure 9-2. Attracted Travel Air Cargo Boundary for JFK

9.2.1 Activity Data

The primary data source for estimating attracted travel emissions from cargo shipments at the airports is a 2002 air cargo truck movement study for JFK (URS 2002). This provides data detailing cargo trips by route and vehicle type and is used as a surrogate for cargo shipping at all Port Authority airports.

9.2.2 Method

JFK VMT for cargo-related travel was derived by multiplying the number of cargo trips by the estimated trip length of the access and egress routes obtained from the air cargo truck movement study conducted for JFK airport (URS 2002). Trip length by origin was estimated using Google Maps (see Table 9-6).

Table 9-6. One-Way Travel Distance at JFK Airport for Cargo Travel

Origin/Destination	Miles to/from
Van Wyck	5.1
On Airport	6.7
Rockway Blvd	2.8
Belt Parkway/Southern State	8.2
Other Routes	5.7

Note: Only passenger vehicles are permitted on the Belt Parkway/Southern State Parkway. Therefore, only cargo trips using cars or mini-vans were allocated to this route.

Source: Google Maps Average distance based on Van Wyck, On Airport, Rockaway Blvd., and Belt Parkway/Southern State trip length.

The number of cargo trips at JFK in 2019 was estimated by scaling the number of trips estimated from the 2002 study by vehicle type based on the ratio of 2019 to 2002 freight cargo at JFK (Port Authority 2006; Port Authority 2020c). The resulting 2019 cargo VMT for JFK by vehicle type was then scaled to LGA, EWR, and SWF airports using the 2019 ratio of cargo tons from JFK to the cargo tons at LGA, EWR, and SWF airports (Port Authority 2020c). EY2019 air cargo tonnage by airport is displayed in Table 9-7.

Table 9-7. 2019 Air Cargo Tonnage by Airport

Airport	Annual Cargo Tonnage
JFK	1,336,521
EWR	824,932
LGA	6,376
SWF	22,674
TEB	0
TOTAL	2,190,503

Note: Totals may not match the column sums due to rounding.

GHG and CAP g/mi and g/start emission factors come from EPA's MOVES2014b model (EPA 2018b). There are three different vehicle types included: light-duty vehicles, small trucks (such as single unit trucks and 3- and 4-axle tractor trailers) and large trucks (5- and 6-axle tractor trailers). VMT was divided between these vehicle types based on the results of the JFK freight cargo survey (URS 2002). This analysis assumes a round-trip VMT and two starts per trip.

9.2.3 Results

The GHG and CAP emission estimates from cargo trucks by airport are summarized in Table 9-8. JFK accounts for the majority of emissions from cargo shipments. TEB has no cargo shipments, and LGA and SWF have only a small amount.

Table 9-8. 2019 GHG & CAP Emissions from Air Cargo Attracted Travel by Airport (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O	SO_2	NO_X	$PM_{2.5}$	PM_{10}
JFK	35,647	35,463	1.662	0.480	0.399	56.531	2.999	8.054
EWR	22,002	21,889	1.026	0.296	0.246	34.892	1.851	4.971
LGA	170	169	0.008	0.002	0.002	0.270	0.014	0.038
SWF	605	602	0.028	0.008	0.007	0.959	0.051	0.137
TEB	0	0	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	**58,424**	**58,123**	**2.7**	**0.8**	**0.7**	**92.7**	**4.9**	**13.2**

Note: Totals may not match the column sums due to rounding.

9.3 Tunnels, Bridges, and Terminals – Through Traffic

This section provides emissions estimates for vehicle travel across the Port Authority's tunnels, bridges, and bus terminals. The vehicle emissions reflect travel through the facilities, as well as bus idling and vehicle starts within the bus terminals.

9.3.1 Methodology: Tunnels and Bridges

The established boundaries for vehicle travel over the Port Authority's bridges and tunnels are the length of each bridge and the average length of each tunnel (Port Authority 2020a). Table 9-9 provides the roadway length and 2019 traffic volume for each facility.

Table 9-9. Tunnels and Bridges Roadway Length and Traffic Volume by Facility

Facility Type	Facility Name	Roadway Length[a] (miles)	2019 Annual Traffic Volume[b] (one way)
Bridges	George Washington Bridge	0.90	51,960,666
	Bayonne Bridge	1.36	3,354,733
	Goethals Bridge	1.38	17,665,107
	Outerbridge Crossing	1.67	15,078,456
Tunnels	Lincoln Tunnel	1.50	18,534,201
	Holland Tunnel	1.60	15,634,294

[a] Port Authority (2020a).
[b] Port Authority (2020d).

Activity data for highway vehicles traveling via the Port Authority's tunnels and bridges were developed based on the annual traffic volume and roadway length of the facility (see Table 9-9), using data from the Port Authority (Port Authority 2020a; Port Authority 2020d). The 2019 traffic volumes represent one-way eastbound traffic, and the facility roadway lengths represent the published (one-way) length of each facility. Westbound traffic volumes were estimated by multiplying the 2019 eastbound traffic volume by the 2016 ratio of eastbound to westbound traffic volumes for each facility and vehicle type based on data from a New York City Bridge Traffic report (NYCDOT 2018). (Note that this bridge traffic report represents 2016 volumes, but comparable data for later years have not been published.) VMT accumulated during travel across the tunnel and bridge facilities was derived by multiplying the total eastbound plus westbound annual traffic volumes by the roadway length in miles, as shown in Table 9-9. This was done separately for each of the four Port Authority vehicle types: autos, buses, small trucks, and large trucks.

Emission factors used to estimate emissions from vehicle travel across the bridges and tunnels were derived from runs of EPA's MOVES2014b model (EPA 2018b). The inputs to this model represented the local conditions for the New York counties in which each facility is located as well as the road type associated with each facility. Local inputs included vehicle age-specific distribution data, speed distribution data, fuel properties, meteorological data, and the mix of vehicle types crossing each facility. The resulting emission factors in grams per mile were multiplied by the corresponding VMT for each vehicle type and facility to estimate 2019 emissions.

9.3.2 Methodology: Bus Terminals

Two bus terminals are included in this analysis: George Washington Bridge Bus Station (GWBBS) and the Port Authority Bus Terminal (PABT). In the estimation of emissions associated with these bus terminals, the boundary was defined as the property lines of the terminals. Defining the boundary in this way eliminates double-counting of emissions from trips through or across the Port Authority tunnels and bridges. Three components of emissions are included in the analysis: running emissions that occur during bus and vehicle travel within the terminals, idling emissions that occur as buses idle in the facility, and start-up emissions that occur when a vehicle parked within the terminal starts its engine.

GHG emissions were estimated from buses traveling through the bus terminals and from personal vehicles parking in the bus terminals. The primary source of bus activity data is the number of bus movements at GWBBS and PABT, which is included the Port Authority 2019 Annual Report (Port Authority 2020b). Note that a bus arrival and departure are counted as two separate bus movements. Additional activity data used in estimating emissions from buses include the average mileage traveled within the terminals per bus trip and the average amount of time spent idling in the terminals during 2019. The activity for the personal vehicles is the total number of vehicles parked in the terminals, the mileage traveled by these vehicles within the terminals, and the number of vehicle starts within the terminals during 2019. Activity data were multiplied by emission factors for CO_2, CH_4, and N_2O from EPA's MOVES2014b model (EPA 2018b) to estimate emissions within the Port Authority bus terminals.

Two components of bus emissions were calculated: (1) emissions that occur while traveling within the bus terminals, and (2) emissions that occur while buses are idling. The activity associated with buses traveling within the terminals is VMT. This was estimated by multiplying the total number of bus movements at each terminal by the estimated distance that the bus travels within the terminal and dividing by 2 (since arriving at and departing the terminal count as two separate movements). The average distance traveled within a bus terminal was estimated to be twice the length plus the width of the dimensions of the bus terminal. To estimate bus idling emissions, the key activity is the hours of idling time. The average time spent idling per bus was estimated from data in a Port Authority report that surveyed and analyzed bus movements within the PABT (Port Authority 2007). From the data in this report, the average time each bus spends within the terminal was calculated, and then the amount of time it would take a bus to travel the specified distance through the facility at a nominal speed of 5 miles per hour was subtracted. The remaining time was assumed to be the average bus idling time per bus trip. Total bus idling time was then calculated by multiplying the average idling time per bus trip by the number of bus movements divided by 2 (two bus movements per bus trip).

Table 9-10 summarizes the total 2019 bus movements, the dimensions of both bus terminals, and the idling time per bus trip, along with the corresponding data sources. Note that analyses in previous years included additional bus VMT to account for extra circulation on city streets during times when diversions are required. The Port Authority has noted that these diversions stopped in 2016 and are no longer taking place (Saviet 2018).

Table 9-10. 2019 Bus Terminal Activity Data

Terminal	Terminal Length (feet)	Terminal Width (feet)	Bus Movements[a]	Idling Time (minutes/bus trip)	Parked Vehicles
George Washington Bridge Bus Station	400[b]	185[b]	332,000	9.33	0
Port Authority Bus Terminal	800[c]	450[c]	2,380,000	9.33	394,116[d]

[a] Source: Port Authority (2020b).
[b] Source: Terminal dimensions for GWBBS based on Google Earth Pro and map of GWBBS at https://www.panynj.gov/bus-terminals/en/george-washington.html.
[c] Terminal dimensions for PABT were obtained based on Google Earth Pro, and map of PABT at http://www.panynj.gov/bus-terminals/pabt-terminal-map_levelM.html, PABT extends from 8th Ave. to 9th Ave. (about 800 ft) and from 40th to 42nd Street (about 450 ft).
[d] Source: Port Authority 2020o. (Sum of # of Transient Tix Collected and (20 * # of Monthly Parkers) for 2019 Annual Period,.

Two components of emissions for the vehicles parked within the Port Authority Bus terminal were calculated: (1) emissions that occur while the vehicles travel within the bus terminals to parking spaces and (2) emissions that occur when the vehicle is started after having been parked (cold-start emissions). The vehicles parked at the bus terminals were assumed to be a mix of light-duty cars, light-duty trucks, and motorcycles. The per-vehicle VMT that accrues when a vehicle is traveling through a bus terminal was estimated in the same manner as the bus VMT (twice the length plus the width of the dimensions of the bus terminal). The per-vehicle VMT was then multiplied by the total number of vehicles parked at the bus terminals during 2019, as shown in Table 9-10. The number of vehicle starts was assumed to be equal to the number of vehicles parked during 2019. After its renovation, no vehicle parking was assumed to occur at GWBBS, so no vehicle emissions were assessed for this terminal.

Emission factors for both buses and personal vehicles were estimated using the EPA's Motor Vehicle Emission Simulator (MOVES) model, specifically version MOVES2014b. Inputs to this model were specific to 10 counties in the New York City area, as provided by NYDOT (2020). The bus emission factors represent the transit bus vehicle category and are based on weighted 10-county New York averages of bus characteristics. The running emission factors are expressed in units of mass per VMT and the bus idling emission factors are expressed in units of mass per hour. The running emission factors were multiplied by the total bus VMT within the bus terminals. Similarly, the idling emission factors were multiplied by the total number of bus idling hours. The bus emission factors account for a mix of diesel, CNG, and gasoline buses. Emission factors for vehicles were also estimated using EPA's MOVES2014b model, based on the weighted 10-county New York averages of passenger cars, passenger trucks, and motorcycles. Running emission factors were multiplied by VMT, and start-up emission factors were multiplied by the number of vehicle starts, assumed to be equal to the number of parked vehicles.

The resulting emissions from the buses and vehicles were then totaled by bus terminal. The CO_2, CH_4, and N_2O emissions totals were multiplied by their GWP coefficients to calculate total CO_2e emissions.

9.3.3 Results

Table 9-11 summarizes the scope 3 GHG emission estimates from attracted travel by facility associated with the Port Authority's tunnels, bridges, and bus terminals. This includes traffic over and through the bridges and tunnels, bus travel and idling within the bus terminals, and vehicle travel and starts within the bus terminals. Emissions from GHGs and CAPs are included in this table.

Table 9-11. GHG & CAP Emissions from Tunnels, Bridges, and Bus Terminals Attracted Travel

Facility	Metric Tons							
	CO_2	CH_4	N_2O	CO_2e	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Bridges								
George Washington Bridge	45,791	1.2	0.2	45,882	41	0.6	8.5	2.5
Bayonne Bridge	4,847	0.1	0.0	4,859	3	0.1	1.0	0.2
Goethals Bridge	19,910	0.3	0.1	19,938	18	0.3	2.5	0.9
Outerbridge Crossing	28,592	0.4	0.2	28,663	17	0.4	6.1	1.4
Tunnels								
Lincoln Tunnel	62,169	9.9	0.6	62,572	76	0.7	16.4	4.6
Holland Tunnel	21,507	0.6	0.1	21,555	11	0.3	3.5	0.8
Subtotal Bridges and Tunnels	182,816	12.5	1.3	183,470	166	2.3	38.2	10.5
Bus Terminals								
George Washington Bridge Bus Station	253	0.1	0.00	255	2	0.0	0.0	0.0
Port Authority Bus Terminal	2,298	0.7	0.0	2,326	12	0.0	0.5	0.3
Subtotal Bus Terminals	2,551	0.8	0.0	2,581	14	0.0	0.5	0.3
TOTAL	**185,367**	**13.3**	**1.3**	**186,051**	**180**	**2.3**	**38.7**	**10.8**

9.4 Tunnels, Bridges and Terminals – Queued Traffic

The boundary for queuing on the bridges and tunnels includes the volume of queued vehicles on roadway links accessing toll facilities on the bridge and tunnel crossings, as well as the outbound queues that occur at the Lincoln and Holland Tunnels and the George Washington Bridge. The following facilities are included in this analysis:

- George Washington Bridge
- Bayonne Bridge
- Goethals Bridge
- Outerbridge Crossing
- Lincoln Tunnel
- Holland Tunnel

9.4.1 Activity Data

Activity data for queuing activity on the tunnels and bridges, in terms of vehicle-hours of delay, were multiplied by emission factors, in terms of mass per hour of idling activity, to estimate emissions. The activity used for queuing was the number of hours of vehicle delay estimated for 2019 (TRANSCOM 2020). The estimated number of vehicle hours of delay was then multiplied by emission factors (mass emissions per hour) to calculate the emissions resulting from queuing at the toll facilities.

9.4.2 Method

The TRANSCOM Data Fusion Engine Tool provides a detailed database of actual travel times on major roadway links within the New York-New Jersey metropolitan area. For each of the Port Authority tunnels and bridges, the roadway links leading to the bridges and tunnels listed above were identified, and the 2019 average travel data for these links was then extracted from the Tool. The 2019 data represented travel during an average weekday, broken into 15-minute segments for the AM and PM peak traffic periods.

For each facility and peak period, the TRANSCOM-based travel data were used to estimate the excess travel time by 15-minute segments within each peak period on travel links with queues directly leading to the bridges and tunnels. Excess travel time was defined as the difference between the TRANSCOM average 2019 travel time for a specific link minus the amount of time that it would take to travel that same road link at the free flow speed defined for that link. These excess travel times were summed by hour for each link and then multiplied by the average 2019 hourly travel volume on the corresponding facility (Port Authority 2020d). The hourly total vehicle-hours of delay were then summed over all hours for each link, and for facilities with more than one link, the link-level vehicle delay hours were averaged over the links contributing to a given facility. This resulted in an estimate of the average daily vehicle-hours of delay for each facility. The total annual vehicle hours of delay were calculated by multiplying these weekday estimates by 365 days. Table 9-12 summarizes the 2019 average daily vehicle-hours of delay by facility. Once the 2019 annual vehicle hours of delay were estimated for each facility, they were allocated by vehicle type using ratios of the traffic volumes by vehicle type (derived for the attracted travel analysis of the bridges and tunnels) to the total facility traffic volumes.

Table 9-12. Daily Average Vehicle-Hours of Delay by Tunnel and Bridge Facility

Facility	2019 Average Daily Vehicle-Hours of Delay
George Washington Bridge	16,898
Bayonne Bridge	0
Goethals Bridge	116
Outerbridge Crossing	66
Lincoln Tunnel	4,833
Holland Tunnel	2,502
TOTAL	***24,415***

Emission factors for idling were calculated using MOVES2014b. To obtain emission factors for idling, operating mode distributions inputs were developed, with 100 percent of the hours of vehicle operation occurring in the idling mode. MOVES runs were executed using these operating mode distributions along with the county-specific inputs for New York County and Richmond County, New York (the two New York counties where these facilities are located). The resulting MOVES idling emission factors by Port Authority vehicle type were multiplied by the annual vehicle hours of delay for the corresponding vehicle type to obtain queuing emissions for 2019.

9.4.3 Results

Table 9-13 summarizes the scope 3 GHG emission estimates from queueing by facility associated with travel delays approaching the Port Authority's tunnels and bridges. Emissions from GHGs and CAPs are included in this table.

Table 9-13. GHG & CAP Emissions from Queueing on Tunnels and Bridges

Facility	(metric tons)							
	CO_2	CH_4	N_2O	CO_2e	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Bridges								
GW Bridge	23,720	0.5	0.5	23,873	20.8	0.3	3.1	1.7
Bayonne Bridge	0	0.0	0.0	0	0.0	0.0	0.0	0.0
Goethals Bridge	163	0.0	0.0	164	0.1	0.0	0.0	0.0
Outerbridge Crossing	88	0.0	0.0	88	0.1	0.0	0.0	0.0
Tunnels								
Lincoln Tunnel	7,374	0.8	0.2	7,446	11.2	0.1	1.1	0.7
Holland Tunnel	3,348	0.1	0.1	3,370	1.5	0.0	0.3	0.1
TOTAL	**34,692**	**1.4**	**0.7**	**34,941**	**33.7**	**0.5**	**4.6**	**2.5**

10.0 MOBILE COMBUSTION (SCOPE 3)

10.1 Shadow Fleet

The shadow fleet consists of vehicles that are owned by the Port Authority but are operated and fueled on a day-to-day basis by contractors. Because they are not operated or fueled by the Port Authority directly, they do not fall within the purview of vehicles under Port Authority's operational control (discussed in Chapter 3.0) and are therefore considered scope 3 sources. Shadow fleet emissions at all five airports were estimated for EY2019. Note that airport shuttle buses and light-duty security vehicles at LGA and EWR had been included in the shadow fleet in previous inventory years. However, as the Port Authority recently indicated that the fuel for those vehicles was paid for by the Port Authority, emissions from those vehicles are instead included in the scope 1 tenant fleet in EY2019.

10.1.1 Activity Data

Data on the shadow fleet were provided by the Port Authority (Port Authority 2019f, Port Authority 2019h, Port Authority 2020e, Port Authority 2020f, Port Authority 2020g). In 2019, the shadow fleet consisted of fuel trucks at JFK, EWR, and LGA and a fleet of light-duty vehicles at SWF and TEB. The number of vehicles at each facility are shown in Table 10-1.

Table 10-1. Number of Shadow Fleet Vehicles by Airport

Type of Fleet	JFK	EWR	LGA	SWF	TEB
Fuel Trucks	✓	✓	✓	0	0
Miscellaneous Light-Duty Vehicles	0	0	0	80	24

Note: A check mark indicates that these vehicles are part of the shadow fleet and fuel records are available, but there is no vehicle count available at this time.

10.1.2 Method

Port Authority provided diesel and gasoline fuel consumption from the shadow fleet. These were then multiplied by the appropriate TCR emission factors to estimate GHG emissions (TCR 2019).

Criteria pollutant emission factors were created for this analysis by multiplying the g/mi emission factor for a 10-year-old vehicle with the average miles per gallon of each vehicle type to get a vehicle type-specific grams per gallon emissions factor. For example, the g/gal emissions factor for NO_x for heavy-duty diesel fuel trucks was calculated by multiplying the g/mi NO_x emission factor from MOVES2014b (2.44 g/mi) by the average fuel economy of a heavy-duty diesel truck (6.0 miles per gallon) from the Annual Energy Outlook (EIA 2020). This gives an emission factor of 14.7 grams of NO_x per gallon for diesel fuel trucks. These grams per gallon emission factors were then multiplied by fuel consumption to estimate criteria pollutant emissions.

10.1.3 Results

GHG and CAP emission estimates are summarized by airport in Table 10-2. The majority of shadow fleet emissions come from fuel trucks at JFK and EWR.

Table 10-2. 2019 GHG & CAP Emissions from Shadow Fleet by Airport (metric tons)

Airport	CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
JFK	4,062	0.24	0.15	4,112	0.05	4.44	0.22	1.19
EWR	2,751	0.16	0.10	2,785	0.04	3.61	0.18	0.97
LGA	980	0.06	0.04	992	0.01	1.17	0.06	0.31
TEB	248	0.01	0.01	251	0.00	0.04	0.01	0.06
SWF	516	0.03	0.02	523	0.01	0.10	0.02	0.13
Total	**8,558**	**0.51**	**0.31**	**8,663**	**0.12**	**9.36**	**0.50**	**2.66**

Note: Totals may not match the column sums due to rounding.

10.2 Employee Business Travel

Port Authority employees sometimes travel for business on commercial flights, intercity rail, and rental cars. The Port Authority does not operate these planes, trains, or automobiles; however, it influences when and where Port Authority employees travel for business. Therefore, the emissions are considered scope 3 sources.

10.2.1 Activity Data

Data on bookings for air, rail, and car travel were provided by the Port Authority (2020m).

10.2.2 Method

Air: The Port Authority provided mileage for each flight booked by a Port Authority employee in 2019. The flights were then assigned to one of three categories based on length of trip (short-haul, medium-haul, long-haul) and multiplied by the appropriate EPA emission factors to estimate GHG emissions (EPA 2018a). Note that most of the business air travel took off or landed at one of the five regional airports operated by the Port Authority; therefore, GHG emissions from a portion of each flight (i.e., the LTO cycle at the Port Authority airport) have also been estimated with the aircraft movements estimates in Section 8.1 of this report. However, no attempt to avoid the double counting was made because the total amount of business travel emissions qualifies as *de minimis*, and the overlap is only a small portion of the total business travel emissions.

Rail: The Port Authority provided mileage for all rail trips booked by Port Authority employees in 2019. The total distance traveled by rail was multiplied by the appropriate EPA emission factors to estimate GHG emissions (EPA 2018a).

Car: The Port Authority provided the number of rental days for each car rental booked by a Port Authority employee in 2019. The total rental days was converted to total gallons of gasoline using average values for miles per day per rental and fuel economy and multiplied by the appropriate EPA emission factors to estimate GHG emissions (Enterprise 2008; EPA 2018a).

10.2.3 Results

GHG emission estimates are summarized in Table 10-3. The majority of employee business travel emissions come from air travel.

Table 10-3. 2019 GHG Emissions from Employee Business Travel (metric tons)

Mode of Travel	CO_2	CH_4	N_2O	CO_2e
Air	184.96	0.000855	0.005878	186.80
Rail	9.46	0.000588	0.000209	9.53
Car	5.70	0.000345	0.000200	5.77
TOTAL	**200.11**	**0.00**	**0.01**	**202.10**

Note: Totals may not match the column sums due to rounding.

11.0 TENANT ENERGY CONSUMPTION (SCOPE 3)

Chapter 11 discusses tenant energy consumption and emissions assessments for all tenants of the Aviation department. The assessment of tenant energy consumption covers three commodities: electricity, natural gas, and thermal energy.

11.1 Buildings

11.1.1 Electricity

Building electricity consumption was either compiled from metered electricity consumption statements or assessed from the share of building space corresponding to tenant occupancy. The Port Authority had access to metered electricity data at two facilities, JFK and LGA.

For facilities without tenant sub-billing, electricity consumption was estimated based on tenant building occupancy. Tenant electricity consumption was assessed as the product of tenant-occupied space, energy consumption intensity, and the fraction of energy consumption attributable to electricity consumption. This method is presented in Equation 11-1. Tenant-occupied space was compiled for the purposes of the inventory and is summarized in Table 11-1. The values used for energy consumption intensity (*Ij*) and fraction of total energy consumption attributable to electricity usage (*Sj*) are summarized in Table 11-2, which comes from the EIA's Commercial Buildings Energy Consumption Survey (EIA 2016).

$$C = \left(\sum_J A_j \times I_j \times S_j\right) \times K \qquad (11\text{-}1)$$

Where:

C = consumption of electricity (kWh)

A = tenant occupancy area specific to building activity j (square foot)

I_j = total energy consumption intensity for building activity j (kBtu/square foot)

S_j = share of total energy consumption attributable to electricity usage specific to building activity j (unitless)

K = conversion factor from kBtu to kWh

Table 11-1. Tenant Occupancy by Facility (square foot)

Facility	Warehouse and Storage	Lodging	Office	Vacant	Food Service	All Other	Total
EWR	2,573,864	547,462	38,910	0	132,440	2,985,202	6,277,878
SWF	1,230,593	142,337	191,653	182,094	20,000	317,901	2,084,578
TEB	795,316	0	356,791	0	0	0	1,152,107
WTC One	0	0	2,010,000	990,000	0	0	3,000,000
TOTAL	**10,811,769**	**4,976,799**	**4,357,388**	**1,172,094**	**916,234**	**7,330,574**	**29,564,858**

Note: Totals may not match the column sums due to rounding.

Table 11-2. Energy Use Intensities (EUI) by Building Activity

Building Activity	EUI (kBtu/square foot/year)	Electricity Allocation
Education	68.8	53%
Food sales	209.5	71%
Food service	282.7	39%
Health care	172.7	47%
Inpatient	231.1	46%
Outpatient	94.8	59%
Lodging	96.9	45%
Mercantile	89.0	61%
Retail (other than mall)	67.0	69%
Enclosed and strip malls	109.3	61%
Office	77.8	72%
Public assembly	86.3	49%
Public order and safety	92.2	48%
Religious worship	38.0	46%
Service	60.3	38%
Warehouse and storage	34.1	62%
Other	145.1	74%
Vacant	24.4	58%

Source: EIA (2016).

Electricity consumption emissions were calculated as the product of energy consumption (C) and emission per unit of energy consumed for any given pollutant (i.e., the emission factor, EF_i), as shown in Equation 11-2. The GHG and CAP emission factors utilized with Equation 11-2 correspond to those used for the estimation of scope 2 purchased electricity emissions and listed on Table 5-2 and Table 5-3.

$$Emissions = C \times EF_i \tag{11-2}$$

Where:

C = consumption of electricity (kWh)

EF_i = electricity emission factor for pollutant i (kg pollutant/kWh)

i = GHG or CAP pollutant

Application of the methodology with best available activity data resulted in the GHG and CAP emission estimates presented in Table 11-3, with the exception of JFK and LGA, where the emissions were calculated based on metered electricity consumption.

Table 11-3. 2019 GHG & CAP Emissions from Tenant Electricity Consumption in Buildings (metric tons)

Facility	CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
EWR	38,950	3	0	39,148	29	30	9	9
SWF	1,927	0	0	1,936	1	2	0	0
TEB	3,721	0	0	3,740	3	3	1	1
JFK	111,681	8	2	112,437	1	24	6	6
LGA	24,103	1	0	24,156	1	10	0	0
WTC One	46,803	2	0	46,906	1	19	0	0
TOTAL	**227,186**	**13**	**3**	**228,322**	**36**	**88**	**17**	**17**

Note: Totals may not match the column sums due to rounding.

11.1.2 Natural Gas

The tenant emissions from natural gas consumption were estimated based on the amount of space occupied by tenants in Port Authority-owned facilities. Table 11-1 summarizes tenant occupancy by building activity and airport. Note that at JFK, heating is also supplied in the form of thermal energy from KIAC; consequently, only JFK tenants who are not serviced by KIAC are included in the tenant natural gas consumption assessment. There are no natural gas emissions associated with the WTC, because that facility gets its heating from electricity, not from natural gas.

Natural gas consumption was assessed as the product of tenant occupancy in terms of square footage, the energy consumption intensity per unit area of occupied space, and the fraction of energy consumption attributable to natural gas consumption (EIA 2016). This methodology assumes that energy use not attributable to electricity consumption pertains to natural gas consumption. This assumption is informed by the energy supply profile of Port Authority facilities where the Port Authority has operational control. The methodology is summarized in Equation 11-3. The values used for energy consumption intensity (I_j) and share of total energy consumption attributable to electricity usage (S_j) are listed in Table 11-2.

$$G = \left(\sum_j A_j \times I_j \times \left[1 - S_j\right]\right) \times L \qquad (11\text{-}3)$$

Where:

G = consumption of natural gas (therms)

A = tenant occupancy area specific to building activity j (square foot)

I_j = total energy consumption intensity for building activity j (kBtu/square foot)

S_j = share of total energy consumption attributable to electricity usage specific to building activity j (unitless)

L = conversion factor from kBtu to therm

The GHG and CAP emission factors utilized with Equation 11-3 correspond to those used for the estimation of scope 1 stationary combustion emissions and listed in Table 2-2 and Table 2-3. Table 11-4 shows the GHG and CAP emissions estimates from natural gas broken down by facility.

Table 11-4. 2019 GHG & CAP Emissions from Tenant Natural Gas Consumption in Buildings (metric tons)

Airport	CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
EWR	10,096	0.89	0.02	10,121	0.05	8.41	0.64	0.64
SWF	1,767	0.16	0.00	1,771	0.01	1.47	0.11	0.11
TEB	953	0.08	0.00	955	0.00	0.79	0.06	0.06
JFK	9,014	0.80	0.02	9,036	0.05	7.51	0.57	0.57
LGA	2,192	0.19	0.00	2,197	0.01	1.83	0.14	0.14
TOTAL	**24,022**	**2**	**0**	**24,080**	**0**	**20**	**2**	**2**

Note: Totals may not match the column sums due to rounding.

11.1.3 Thermal

JFK is the only location where tenant thermal energy consumption occurs for heating and cooling applications. Tenant thermal energy consumption information was available from Port Authority sub-billing records.

Emissions from thermal energy consumption were estimated as the product of energy consumption and the pollutant intensity of the thermal energy delivered (i.e., the emission factor). The emission factors are specific to the KIAC facility, which is the supplier of thermal energy. The derivation of these emission factors is discussed in detail in Chapter 7 (see Table 7-3).

Port Authority records indicate that there were nearly 130,000 MMBtu of thermal heating and 204,000 MMBtu of thermal cooling consumed by JFK tenants. Associated GHG and CAP emissions are shown in Table 11-5.

Table 11-5. 2019 GHG & CAP Emissions from Tenant Thermal Consumption in Buildings (metric tons)

Commodity	CO_2	CH_4	N_2O	CO_2e	SO_x	NO_x	$PM_{2.5}$	PM_{10}
KIAC Heating	7,941.2	0.569	0.135	7,995	0.038	1.706	0.448	0.448
KIAC Cooling	12,483.6	0.894	0.212	12,568	0.060	2.683	0.704	0.704

11.2 Rail Systems

The Port Authority owns the AirTrain JFK and AirTrain Newark, but these monorail systems are operated by Bombardier Transportation, and thus are reported as a scope 3 source. AirTrain JFK operates with service between JFK and two passenger stations in Queens. AirTrain Newark operates with service between EWR and the Northeast Corridor transfer station.

11.2.1 Electricity

For electricity consumption of the AirTrain systems, the Port Authority provided consumption data by month for each service location in kWh. Emission estimates were assessed on the basis of metered electricity consumption in combination with the most relevant set of emission factors listed in Table 5-2 and Table 5-3. For AirTrain JFK, two separate sets of emission factors were applied. When electricity was sourced from KIAC, plant-level emission factors were applied. In all other instances, the NYCW emission factors were used for AirTrain JFK. For AirTrain Newark, the RFCE emission factors were applied. Table 11-6 presents GHG and CAP emissions associated with train electricity usage for each system.

Table 11-6. 2019 GHG & CAP Emissions from Tenant Electricity Consumption in Rail Systems (metric tons)

Facility	CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
AirTrain JFK	15,871	1.14	0.27	15,978	0.08	3.41	0.90	0.90
AirTrain Newark	5,091	0.34	0.06	5,117	3.83	3.96	1.12	1.16
TOTAL	**20,962**	**1.47**	**0.33**	**21,095**	**3.91**	**7.37**	**2.01**	**2.05**

Note: Totals may not match the column sums due to rounding.

11.2.2 Thermal

The Port Authority has a record of thermal energy in the form of heating and cooling delivered by KIAC for consumption at AirTrain JFK. This record of consumption is multiplied by the KIAC-specific emission factors shown in Table 6-1 to estimate emissions. Table 11-7 summarizes emissions from thermal energy consumption by AirTrain JFK.

Table 11-7. 2019 GHG & CAP Emissions from Tenant Thermal Consumption in JFK AirTrain (metric tons)

Commodity	CO_2	CH_4	N_2O	CO_2e	SO_2	NO_x	$PM_{2.5}$	PM_{10}
KIAC Heating	777	0.06	0.01	782	0.00	0.17	0.04	0.04
KIAC Cooling	782	0.06	0.01	787	0.00	0.17	0.04	0.04
TOTAL	**1,559**	**0.11**	**0.03**	**1,569**	**0.01**	**0.33**	**0.09**	**0.09**

Note: Totals may not match the column sums due to rounding.

12.0 REFERENCES

ACRP 2009. Airport Cooperative Research Program. *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories.* Airport Cooperative Research Program, Report 11. Available at http://www.trb.org/Publications/Blurbs/160829.aspx

AEDT 2020. Aviation Environmental Design Tool, version 3c. Released June 2020. Available at https://aedt.faa.gov/3c_information.aspx

Calpine 2020. *RE: KIAC Annual Data*. Email correspondence from Wayne Goonan, Calpine Operations Manager, August 25, 2020.

EIA 2016. Commercial Buildings Energy Consumption Survey, 2012. Table E2. Major fuel consumption intensities (Btu) by end use, 2012. Released May 2016. U.S. Energy Information Administration. Available at https://www.eia.gov/consumption/commercial/data/2012/index.php?view=consumption#e1-e11

EIA 2017. *EIA Weekly Retail Data, for Middle Atlantic Region*, U.S. Energy Information Administration. Accessed in June 2020 at http://www.eia.gov/oil_gas/petroleum/data_publications/wrgp/mogas_history.html

EIA 2020. *U.S. Energy Information Administration, Annual Energy Outlook 2020*. Release date February 3, 2021. Accessed on July 2021 for download at AEO 2020 subtab_49.xlsx and AEO 2020 subtab_50.xlsx, https://www.eia.gov/outlooks/aeo/tables_ref.php

Enterprise 2008. Enterprise Rent-A-Car, *Enterprise Rent-A-Car, National Car Rental and Alamo Rent A Car Launch Customer Carbon Offset Program*, CSRwire. Accessed November 1, 2018. Available at http://www.csrwire.com/press_releases/16081-Enterprise-Rent-A-Car-National-Car-Rental-and-Alamo-Rent-A-Car-Launch-Customer-Carbon-Offset-Program.

EPA 1995. *Compilation of Air Pollutant Emission Factors* (AP-42), U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. January 1995. Available at https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors

EPA 1997. *Emission Factor Documentation for AP-42 Section 2.4: Municipal Solid Waste Landfills Revised*, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. August 1997. Available at https://www.epa.gov/sites/production/files/2020-10/documents/b02s04_0.pdf

EPA 2009. *Suggested Nationwide Average Fuel Properties*, EPA-420-B-09-018, U.S. Environmental Protection Agency, Assessment and Standards Division, Office of Transportation and Air Quality. April 2009.

EPA 2016. *Gasoline Sulfur Standards*. EPA-420-B-16-004. U.S. Environmental Protection Agency Office of Transportation and Air Quality. March 2016. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100O9ZH.pdf

EPA 2018a. *Emission Factors for Greenhouse Gas Inventories*, U.S. Environmental Protection Agency. March 9, 2018. Accessed August 2019. Available at https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

EPA 2018b. *Motor Vehicle Emissions Simulator MOVES2014b*, U.S. Environmental Protection Agency. December 2018. Available at http://www.epa.gov/otaq/models/moves/

EPA 2019a. *2019 Greenhouse Gas Emissions from Large Facilities*, EPA FLIGHT Database. Available at http://ghgdata.epa.gov/ghgp/main.do

EPA 2019b. *Air Markets Program Data*, U.S. Environmental Protection Agency. Available at http://ampd.epa.gov/ampd/

EPA 2019c. *2017 National Emissions Inventory (NEI) Data*, U.S. Environmental Protection Agency. Available at https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data

EPA 2020. *eGRID 2018v2.* U.S. Environmental Protection Agency. Released March 9, 2020. Accessed on November 2020 at https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

FAA 2012. *Glossary*, Federal Aviation Administration. Available at http://aspmhelp.faa.gov/index.php/Glossary

FAA 2020. Federal Aviation Administration, online Air Traffic Activity System. Accessed August 2020. Available at https://aspm.faa.gov/opsnet/sys/main.asp

FHWA 2018. *Average Vehicle Occupancy Factors for Computing Travel Time Reliability Measures and Total Peak Hour Excessive Delay Metrics*, Federal Highway Administration. April 2018. Available at https://www.fhwa.dot.gov/tpm/guidance/avo_factors.pdf

IPCC 1996. *Working Group I: The Science of Climate Change: Contribution of Working Group 1 to the Second Assessment Report of the Intergovernmental Panel on Climate Change*, Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge and New York. 1996.

IPCC 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Intergovernmental Panel on Climate Change, Hayama, Kanagawa, Japan. 2006. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

National Transit Database 2018. *New Jersey Transit Corporation: 2017 Annual Agency Profile*. Available at https://www.transit.dot.gov/sites/fta.dot.gov/files/transit_agency_profile_doc/2017/20080.pdf

NYCDOT 2018. *2016 New York City Bridge Traffic Volumes*, New York City Department of Transportation. February 2018. Available at http://www.nyc.gov/html/dot/downloads/pdf/nyc-bridge-traffic-report-2016.pdf

NYDOT 2020. New York Department of Transportation provided MOVES inputs for New York City area counties in an attachment to a personal email communication (NYMTC County Excel Files March 26 2019.zip)from A. Aiyedun, NYDOT to M. Mullen, SC&A, September 16, 2020.

Ortiz 2021. Oscar Ortiz, Academy Bus, "EWR 2019 Fuel Consumption.pdf," provided via email, 2021.

Pechan 2010. *Documentation of MARKAL Emission Factor Updates*, Draft Memorandum prepared by E.H. Pechan & Associates, Inc., to Dan Loughlin, EPA Office of Research and Development, Contract No. EP-D-07-097, Work Assignment 4-07. December 1, 2010.

Port Authority 1974. *Elizabeth Port Authority Marine Terminal Annex, Area West of Kapkowski Road, Geological Profiles,* Drawing No. EPAMT-SL-068. January 3, 1974.

Port Authority 2006. *2006 Annual Airport Traffic Report*, Port Authority of New York & New Jersey. 2006. Available at https://www.panynj.gov/airports/en/statistics-general-info.html

Port Authority 2007. *Port Authority Bus Terminal Bus Operations – Data Collection*, Port Authority of New York and New Jersey, Tunnels, Bridges, and Terminals, Technical Memorandum, Final Draft, prepared by Port Authority of NJ and NJ Engineering Department, in association with Edwards and Kelcey. October 2, 2007.

Port Authority 2012. *RE: GHG Inventory Verification Question*, email communication from Rubi Rajbanshi, Port Authority, to Juan Maldonado, TranSystems, December 19, 2012.

Port Authority 2014. *Request for Information for Replacement, Rehabilitation or Redesign of the Cogeneration Plant and Related Infrastructure at John F. Kennedy International Airport*, Port Authority of New York & New Jersey. May 8, 2014.

Port Authority 2015. "2014 GHG Inventory Master Spreadsheet Dec2015.xlsx." Provided by N. Kimball in December 2015 email.

Port Authority 2017. Email communication from Nate Kimball, Port Authority. Multiple spreadsheets attached: "JFK Comparison 2015 -2017.xlsx," "LaGuardia Comparison 2015 -2017.xlsx," "Newark Comparison 2015-2017.xlsx," "NY and NJ Transaction Data Report.xlsx," "NY Port Authority Airport transaction data - Sept 2017 request.xlsx," and "Port Authority Transactions & Days Avis Budget Payless rental data 2007 – 2017.xlsx." October 2017.

Port Authority 2018. "2017 TxT Dep O-D Pax Transportation Mode By Trip Origin." Provided by Port Authority September 25, 2018.

Port Authority 2019a. Spreadsheet provided via August 27, 2019, email by Petra Kandus, Port Authority, "PONYA database plate update 8_27_2019.xlsx."

Port Authority 2019b. "RE 2018 CAD Data Request.pdf." Email communication with Jeff Trilling. June 18, 2018.

Port Authority 2019c. Data Received from Joseph Korman, Port Authority, via email April 16, 2019, "RE 2018 LPG Forklift Fuel Consumption.pdf."

Port Authority 2019d. Data received from Alex Cassidy, Port Authority, via email July 9, 2019, "2017 TxT CSS Dep-Arr Party Size By main Modal Access By Airport.xlsx."

Port Authority 2019e. Data Received from Samantha Smith, Port Authority, via email October 30, 2019, in "SCA Inspection Dates.xlsx."

Port Authority 2019f. Data Received from Alex Cassidy, Port Authority, via email July 12, 2019, in "2018 TEB Shadow Fleet GHG Inventory.xlsx," "EWR 2018 fuel truck consumption.xlsx," and "JFK fuel truck consumption.xlsx."

Port Authority 2019g. Data Received from Elizabeth Ellis, Port Authority, via email June 25, 2019, in "LGA Shadow Fleet Mobile Combustion Request.xlsx" and "JFK 2018 Mobile Com Emissions Bus Fleet Fuel Use.xlsx." Provided by Elizabeth Ellis on.

Port Authority 2019h. "JFK fuel truck consumption.xlsx," provided to SC&A via email from E. Ellis, Port Authority of New York and New Jersey. June 25, 2019.

Port Authority 2020a. *Bridges and Tunnels*, Facts section for each facility, Port Authority of New York and New Jersey. Accessed January 27, 2020, at https://www.panynj.gov/bridges-tunnels/en/index.html

Port Authority 2020b. *Raising the Bar: 2019Annual Report*, Port Authority of New York and New Jersey. Available at https://corpinfo.panynj.gov/documents/2019/

Port Authority 2020c. *2019 Airport Traffic Report*, Port Authority of New York and New Jersey. April 2020. Available at https://www.panynj.gov/content/dam/airports/statistics/statistics-general-info/annual-atr/ATR2019.pdf

Port Authority 2020d. "Monthly trf 2000-2019 by facility by type.xlsx," provided to SC&A via email from N. Wilson, Port Authority of New York and New Jersey. October 19, 2020.

Port Authority 2020e. "EWR 2018 fuel truck consumption.xlsx" (containing 2019 LGA fuel truck data), provided to SC&A via email from J. Paredes, Port Authority of New York and New Jersey. August 13, 2020.

Port Authority 2020f. "EWR 2019 fuel truck consumption.xlsx," provided to SC&A via email from K. Gregory, Port Authority of New York and New Jersey. August 7, 2020.

Port Authority 2020g. "PANYNJ Stewart Transactions.xlsx,: provided to SC&A via email from E. Ellis, Port Authority of New York and New Jersey. July 16, 2020.

Port Authority 2020h. Data received from Prescott Miller, Port Authority of New York and New Jersey, in two emails: *RE RE 2020 GHG Inventory Data Collection CAD* on September 18, 2020, and *RE RE 2020 GHG Inventory Data Collection CAD (Dec 2019)* on October 8, 2020.

Port Authority 2020i. Email communication from Andrew Varruzo, Port Authority of New York and New Jersey, *RE: 2019 GHG Data Request Executive Fleet*. December 1, 2020.

Port Authority 2020j. Email communication from Ginamarie Sicinski, Port Authority of New York and New Jersey, *RE: Approximate Diesel Usage for Non Road Equipment*. September 18, 2020.

Port Authority 2020k. Email communication from Alex Cassidy, Port Authority of New York and New Jersey, *FW: 2019 data needed GHG Inventory; ATADS, Fleet Mix and Taxi Time*. August 26, 2020.

Port Authority 2020l. Email communication from Adeel Yousef, Port Authority of New York and New Jersey, *RE: 2019 data needed GHG Inventory; ATADS, Fleet Mix and Taxi Time*. August 20, 2020.

Port Authority 2020m. Email communication from Nick Holcombe, Port Authority of New York and New Jersey, *RE: RPR-1360 Port Authority of New York-New Jersey-CO2 Report*. June 19, 2020.

Port Authority 2020n. *Tenant Construction and Alteration Process Manual,* Port Authority of New York & New Jersey. June 2020.

Port Authority 2020o. "090240 8192020.pdf," containing 2019 leased parking at PABT, provided to SC&A via email from N. Wilson, Port Authority of New York and New Jersey. September 28, 2020.

Saviet 2018: N. Saviet, Port Authority of New York and New Jersey, Tunnels, Bridges, and Terminals, email communication to M. Mullen, SC&A (RE_TB&T Data Request for Port Authority GHG Inventory_6_12_18.pdf), June 12, 2018.

Sprague 2021. Data received from Ileana Ayala, Sprague, via email January 21, 2021, "Port Authority Customer Volume 2018-2019-2020.xlsx."

Starcrest 2020. Starcrest Consulting Group, LLC, *The Port Authority of New York and New Jersey Port Department 2019 Multi-Facility Emissions Inventory*, prepared for the Port Authority of New York and New Jersey, December 2020.

TCR et al. 2010. *Local Government Operations Protocol: For the Quantification and Reporting of Greenhouse Gas Emissions Inventories*, Version 1.1, The Climate Registry, California Air Resources Board, California Climate Action Registry, and ICLEI – Local Governments for Sustainability. May 2010. Available at https://s3.amazonaws.com/icleiusaresources/lgo_protocol_v1_1_2010-05-03.pdf

TCR 2013. *General Reporting Protocol: Version 2.0*, The Climate Registry. March 2013. Available at http://www.theclimateregistry.org/wp-content/uploads/2014/11/TCR_GRP_Version_2.0-1.pdf

TCR 2019. *2019 Climate Registry Default Emission Factors.* The Climate Registry. May 2019.

TRANSCOM 2020. TRANSCOM, SPATEL Data Fusion Engine Tool, extracts from data archive, September 2020 and January 2021.

URS 2002. *John F. Kennedy International Airport – Air Cargo Truck Movement Study,* URS Corporation. Prepared for Port Authority of New York & New Jersey Traffic Engineering. May 2002.

WeldingWeb 2012. *Acetylene Prices*. Accessed December 20, 2012, at http://www.weldingweb.com/showthread.php?t=62953

Wiley 2002. Wiley III, Joseph B. *Redevelopment Potential of Landfills: A Case Study of Six New Jersey Projects.* Presented to Federation of New York Solid Waste Associations, Solid Waste/Recycling Conference, Lake George, NY. May 6, 2002.

WPCI 2010. World Ports Climate Initiative. "Carbon Footprinting for Ports: Guidance Document." Prepared by Carbon Footprint Working Group. June 2010.

WRI 2004. World Resources Institute and World Business Council for Sustainable Development. *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised Edition*. March 2004.

APPENDIX A: SCOPE 3 GHG EMISSIONS BY YEAR OF ASSESSMENT

Department	Emission Category	Activity	Last EY Assessment
Aviation	Aircraft	Aircraft Movements	2019
		Auxiliary Power Units	2019
		Ground Support Equipment	2019
	Attracted Travel	Air Cargo	2019
		Airport Passenger	2019
	Energy Production	Electricity Sold to Market	2019
	Purchased Cooling	Buildings	2019
		Rail Systems	2019
	Purchased Electricity	Buildings	2019
		Rail Systems	2019
	Purchased Heating	Buildings	2019
		Rail Systems	2019
	Stationary Combustion	Buildings	2019
Central Administration	Mobile Combustion	Shadow Fleet	2017
Engineering	Construction	Non-Road Diesel Engines	2017
Multi-Department	Mobile Combustion	Business Travel	2019
	Mobile Combustion	Employee Commuting	2017
PATH	Attracted Travel	PATH Passenger	2017
	Purchased Electricity	Buildings	2017
	Stationary Combustion	Buildings	2017
Planning	Mobile Combustion	Ferry Movements	2018
	Purchased Electricity	Buildings	2017
	Stationary Combustion	Buildings	2017
Port	Attracted Travel	Commercial Marine Vessels	2019
		Drayage Trucks – to NYNJLINA boundary	2019
		Drayage Trucks – from NYNJLINA to first point of rest	2017
	Mobile Combustion	Auto Marine Terminal, Vehicle Movements	2017
		Cargo Handling Equipment	2019
		Rail Locomotives	2019
	Purchased Electricity	Buildings	2017
	Stationary Combustion	Buildings	2017
Real Estate	Energy Production	Electricity Sold to Market	2017
	Purchased Electricity	Buildings	2017
	Stationary Combustion	Buildings	2017
Tunnels, Bridges, & Bus Terminals	Attracted Travel	Queued Traffic	2019
		Through Traffic	2019
	Purchased Electricity	Buildings	2017
	Stationary Combustion	Buildings	2017
World Trade Center	Purchased Electricity	Buildings	2019
	Purchased Electricity	Economic Recovery Program	2019

APPENDIX B: 2019 OPERATIONS BY AIRCRAFT CODE

Airport	ID	Description	Model	Operations
EWR	BEC58P	BARON 58P/TS10-520-L	Aerostar PA-60	26
EWR	737700	BOEING 737-700/CFM56-7B24	Airbus A220-100	1,088
EWR	A300-622R	A300-622R\PW4158	Airbus A300F4-600 Series	2,579
EWR	A310-304	A310-304\GE CF6-80 C2A2	Airbus A310-200 Series	34
EWR	A319-131	A319-131\IAE V2522-A5	Airbus A318-100 Series	3
EWR	A319-131	A319-131\IAE V2522-A5	Airbus A319-100 Series	14,620
EWR	A320-211	A320-211\CFM56-5A1	Airbus A320-200 Series	46,068
EWR	A320-271N	A320-271N\PW1127G-JM with mod160734 engines	Airbus A320-NEO	284
EWR	A321-232	A321-232\V2530-A5	Airbus A321-100 Series	8,602
EWR	A321-232	A321-232\V2530-A5	Airbus A321-NEO	696
EWR	A330-301	A330-301\GE CF6-80 E1A2	Airbus A330-200 Series	1,330
EWR	A330-301	A330-301\GE CF6-80 E1A2	Airbus A330-300 Series	3,962
EWR	A330-343	A330-343\RR TRENT 772B	Airbus A330-900N Series (Neo)	371
EWR	A340-211	A340-211\CFM56-5C2	Airbus A340-300 Series	436
EWR	A340-642	A340-642\Trent 556	Airbus A340-600 Series	248
EWR	A350-941	A350-941\RR trent XWB-84	Airbus A350-900 series	2,072
EWR	B206L	Bell 206L Long Ranger	Bell 206 JetRanger	1
EWR	717200	BOEING 717-200/BR 715	Boeing 717-200 Series	5,052
EWR	727100	BOEING 727-100/JT8D-7	Boeing 727-100 Series	35
EWR	727200	BOEING 727-200/JT8D-7	Boeing 727-200 Series	10
EWR	737300	BOEING 737-300/CFM56-3B-1	Boeing 737-300 Series	72
EWR	737400	BOEING 737-400/CFM56-3C-1	Boeing 737-400 Series	268
EWR	737500	BOEING 737-500/CFM56-3C-1	Boeing 737-500 Series	4
EWR	737700	BOEING 737-700/CFM56-7B24	Boeing 737-700 Series	20,538
EWR	737MAX8	737MAX8\CFMLeap1B27	Boeing 737-8	143
EWR	737800	BOEING 737-800/CFM56-7B26	Boeing 737-800 Series	45,330
EWR	737800	BOEING 737-800/CFM56-7B26	Boeing 737-9	3
EWR	737800	BOEING 737-800/CFM56-7B26	Boeing 737-900 Series	40,151
EWR	747400	BOEING 747-400/PW4056	Boeing 747-400 Series	170
EWR	7478	Boeing 747-8F/GEnx-2B67	Boeing 747-8	725
EWR	757PW	BOEING 757-200/PW2037	Boeing 757-200 Series	30,974
EWR	757300	BOEING 757-300/RB211-535E4B	Boeing 757-300 Series	318
EWR	767300	BOEING 767-300/CF6-80A	Boeing 767-200 ER	423
EWR	767300	BOEING 767-300/CF6-80A	Boeing 767-300 Series	14,064
EWR	767400	BOEING 767-400ER/CF6-80C2B(F)	Boeing 767-400	7,610
EWR	777200	BOEING 777-200ER/GE90-90B	Boeing 777-200 Series	8,675
EWR	777300	BOEING 777-300/TRENT892	Boeing 777-200-LR	926
EWR	7773ER	Boeing 777-300ER/GE90-115B-EIS	Boeing 777-300 ER	5,623
EWR	777300	BOEING 777-300/TRENT892	Boeing 777-300 Series	24
EWR	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-10 Dreamliner	4,751
EWR	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-8 Dreamliner	836
EWR	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-9 Dreamliner	2,670
EWR	DC1030	DC10-30/CF6-50C2	Boeing DC-10-30 Series	730
EWR	MD11GE	MD-11/CF6-80C2D1F	Boeing MD-11	4,617
EWR	MD81	MD-81/JT8D-217	Boeing MD-81	3
EWR	MD82	MD-82/JT8D-217A	Boeing MD-82	6
EWR	MD83	MD-83/JT8D-219	Boeing MD-83	25
EWR	MD83	MD-83/JT8D-219	Boeing MD-87	2
EWR	MD83	MD-83/JT8D-219	Boeing MD-88	2,327
EWR	MD9025	MD-90/V2525-D5	Boeing MD-90	745
EWR	CL600	CL600/ALF502L	Bombardier Challenger 300	508
EWR	CL600	CL600/ALF502L	Bombardier Challenger 600	213
EWR	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	1,806
EWR	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	3,672
EWR	CRJ9-LR	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-705-LR	5,252
EWR	DHC830	DASH 8-300/PW123	Bombardier de Havilland Dash 8 Q200	1
EWR	BD-700-1A11	BD-700-1A11\BR700-710A2-20	Bombardier Global 5000 Business	121
EWR	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global 7000 Business	12
EWR	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global Express	336
EWR	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 31	14
EWR	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 35	72
EWR	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 40	20

Airport	ID	Description	Model	Operations
EWR	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 45	50
EWR	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 55	15
EWR	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 60	101
EWR	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 70	3
EWR	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 75	24
EWR	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	3
EWR	CNA182	Cessna 182H / Continental O-470-R	Cessna 182 R (FAS)	2
EWR	CNA20T	CESSNA T206H / LYCOMING TIO-540-AJ1A	Cessna 206	3
EWR	PA42	Piper PA-42 / PT6A-41	Cessna 208 Caravan	4,117
EWR	BEC58P	BARON 58P/TS10-520-L	Cessna 310	8
EWR	BEC58P	BARON 58P/TS10-520-L	Cessna 414	5
EWR	BEC58P	BARON 58P/TS10-520-L	Cessna 421 Piston	1
EWR	CNA441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	3
EWR	CNA500	CIT 2/JT15D-4	Cessna 500 Citation I	1
EWR	CNA500	CIT 2/JT15D-4	Cessna 525 CitationJet	15
EWR	CNA500	CIT 2/JT15D-4	Cessna 525C CitationJet	29
EWR	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	21
EWR	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	299
EWR	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	68
EWR	CIT3	CIT 3/TFE731-3-100S	Cessna 650 Citation III	12
EWR	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	132
EWR	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680-A Citation Latitude	252
EWR	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	112
EWR	COMSEP	1985 1-ENG COMP	Cirrus SR20	2
EWR	COMSEP	1985 1-ENG COMP	Cirrus SR22	54
EWR	CNA208	Cessna 208 / PT6A-114	DAHER TBM 900/930	1
EWR	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	6
EWR	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000-EX	90
EWR	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 50	77
EWR	GIV	GULFSTREAM GIV-SP/TAY 611-8	Dassault Falcon 8X	3
EWR	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 900	72
EWR	727EM2	FEDX 727-200/JT8D-15	Dassault Mercure 100	4
EWR	DHC8	DASH 8-100/PW121	DeHavilland DHC-8-100	8,389
EWR	GASEPV	1985 1-ENG VP PROP	Diamond DA40	1
EWR	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dornier 328 Jet	5
EWR	GASEPV	1985 1-ENG VP PROP	EADS Socata TBM-700	2
EWR	ECLIPSE500	Eclipse 500 / PW610F	Eclipse 500 / PW610F	4
EWR	CNA510	510 CITATION MUSTANG	Embraer 500	13
EWR	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	266
EWR	EMB120	EMBRAER 120 ER/ PRATT & WHITNEY PW118	Embraer EMB120 Brasilia	4
EWR	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	25,931
EWR	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145-XR	50,749
EWR	EMB170	ERJ170-100	Embraer ERJ170	29,570
EWR	EMB175	ERJ170-200	Embraer ERJ175	7,596
EWR	EMB175	ERJ170-200	Embraer ERJ175-LR	23,293
EWR	EMB190	ERJ190-100	Embraer ERJ190	3,825
EWR	EMB195	ERJ190-200	Embraer ERJ195-E2	2
EWR	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	2
EWR	CNA510	510 CITATION MUSTANG	Embraer Legacy 450 (EMB-545)	28
EWR	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 500 (EMB-550)	19
EWR	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 650	16
EWR	GIV	GULFSTREAM GIV-SP/TAY 611-8	Falcon 7X	79
EWR	GASEPF	1985 1-ENG FP PROP	Grumman AA-5A/B (FAS)	1
EWR	GV	GULFSTREAM GV/BR 710	Gulfstream Aerospace Gulfstream G500 (G-7)	1
EWR	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G150	17
EWR	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	60
EWR	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G280	160
EWR	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	2
EWR	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	275
EWR	GV	GULFSTREAM GV/BR 710	Gulfstream G500	297
EWR	G650ER	G650ER\BR-700-725A1-12	Gulfstream G650	312
EWR	HS748A	HS748/DART MK532-2	Gulfstream I	1
EWR	LEAR35	LEAR 36/TFE731-2	Hawker HS-125 Series 700	127
EWR	MU3001	MU300-10/JT15D-5	Honda HA-420 Hondajet	7
EWR	IA1125	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	6
EWR	GASEPV	1985 1-ENG VP PROP	Mooney M20-K	1
EWR	CNA208	Cessna 208 / PT6A-114	Pilatus PC-12	204

Airport	ID	Description	Model	Operations
EWR	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Pilatus PC-24	16
EWR	GASEPF	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	2
EWR	BEC58P	BARON 58P/TS10-520-L	Piper PA-31 Navajo	24
EWR	CNA441	CONQUEST II/TPE331-8	Piper PA-31T Cheyenne	6
EWR	GASEPV	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	6
EWR	BEC58P	BARON 58P/TS10-520-L	Piper PA-34 Seneca	10
EWR	BEC58P	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	12
EWR	MU3001	MU300-10/JT15D-5	Raytheon Beechjet 400	122
EWR	DHC6	DASH 6/PT6A-27	Raytheon C-12 Huron	23
EWR	LEAR35	LEAR 36/TFE731-2	Raytheon Hawker 1000	9
EWR	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	12
EWR	DHC6	DASH 6/PT6A-27	Raytheon King Air 100	2
EWR	DHC6	DASH 6/PT6A-27	Raytheon King Air 90	26
EWR	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	8
EWR	DHC6	DASH 6/PT6A-27	Raytheon Super King Air 300	99
EWR	BEC58P	BARON 58P/TS10-520-L	Rockwell Commander 500	2
EWR	LEAR35	LEAR 36/TFE731-2	Rockwell Sabreliner 65	2
EWR	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	11
EWR	CNA441	CONQUEST II/TPE331-8	SOCATA TBM 850	4
JFK	BEC58P	BARON 58P/TS10-520-L	Aerostar PA-60	5
JFK	737700	BOEING 737-700/CFM56-7B24	Airbus A220-100	1,178
JFK	737700	BOEING 737-700/CFM56-7B24	Airbus A220-300	1
JFK	A300-622R	A300-622R\PW4158	Airbus A300F4-600 Series	685
JFK	A310-304	A310-304\GE CF6-80 C2A2	Airbus A310-200 Series	21
JFK	A319-131	A319-131\IAE V2522-A5	Airbus A318-100 Series	526
JFK	A319-131	A319-131\IAE V2522-A5	Airbus A319-100 Series	7,885
JFK	A320-211	A320-211\CFM56-5A1	Airbus A320-200 Series	62,340
JFK	A320-271N	A320-271N\PW1127G-JM with mod160734 engines	Airbus A320-NEO	319
JFK	A321-232	A321-232\V2530-A5	Airbus A321-100 Series	70,630
JFK	A321-232	A321-232\V2530-A5	Airbus A321-NEO	2,320
JFK	A330-301	A330-301\GE CF6-80 E1A2	Airbus A330-200 Series	9,590
JFK	A330-301	A330-301\GE CF6-80 E1A2	Airbus A330-300 Series	16,009
JFK	A330-343	A330-343\RR TRENT 772B	Airbus A330-900N Series (Neo)	426
JFK	A340-211	A340-211\CFM56-5C2	Airbus A340-200 Series	12
JFK	A340-211	A340-211\CFM56-5C2	Airbus A340-300 Series	355
JFK	A340-642	A340-642\Trent 556	Airbus A340-600 Series	3,474
JFK	A350-941	A350-941\RR trent XWB-84	Airbus A350-1000 Series	1,283
JFK	A350-941	A350-941\RR trent XWB-84	Airbus A350-900 series	3,102
JFK	A380-841	A380-841\RR trent970	Airbus A380-800 Series	6,763
JFK	717200	BOEING 717-200/BR 715	Boeing 717-200 Series	8,184
JFK	727100	BOEING 727-100/JT8D-7	Boeing 727-100 Series	2
JFK	727200	BOEING 727-200/JT8D-7	Boeing 727-200 Series	2
JFK	737300	BOEING 737-300/CFM56-3B-1	Boeing 737-300 Series	536
JFK	737400	BOEING 737-400/CFM56-3C-1	Boeing 737-400 Series	16
JFK	737700	BOEING 737-700/CFM56-7B24	Boeing 737-600 Series	68
JFK	737700	BOEING 737-700/CFM56-7B24	Boeing 737-700 Series	1,102
JFK	737MAX8	737MAX8\CFMLeap1B27	Boeing 737-8	32
JFK	737800	BOEING 737-800/CFM56-7B26	Boeing 737-800 Series	31,521
JFK	737800	BOEING 737-800/CFM56-7B26	Boeing 737-900 Series	28,525
JFK	74710Q	BOEING 747-100/JT9D-7QN	Boeing 747-100 Series	11
JFK	747400	BOEING 747-400/PW4056	Boeing 747-400 Series	8,827
JFK	7478	Boeing 747-8F/GEnx-2B67	Boeing 747-8	2,841
JFK	757PW	BOEING 757-200/PW2037	Boeing 757-200 Series	23,059
JFK	757300	BOEING 757-300/RB211-535E4B	Boeing 757-300 Series	236
JFK	767300	BOEING 767-300/CF6-80A	Boeing 767-200 ER	103
JFK	767300	BOEING 767-300/CF6-80A	Boeing 767-300 Series	13,915
JFK	767400	BOEING 767-400ER/CF6-80C2B(F)	Boeing 767-400	5,665
JFK	777200	BOEING 777-200ER/GE90-90B	Boeing 777-200 Series	11,900
JFK	777300	BOEING 777-300/TRENT892	Boeing 777-200-LR	1,837
JFK	7773ER	Boeing 777-300ER/GE90-115B-EIS	Boeing 777-300 ER	19,508
JFK	777300	BOEING 777-300/TRENT892	Boeing 777-300 Series	189
JFK	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-10 Dreamliner	4
JFK	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-8 Dreamliner	3,145
JFK	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-9 Dreamliner	9,006
JFK	DC1030	DC10-30/CF6-50C2	Boeing DC-10-30 Series	158
JFK	MD11GE	MD-11/CF6-80C2D1F	Boeing MD-11	1,804
JFK	MD83	MD-83/JT8D-219	Boeing MD-83	2

Airport	ID	Description	Model	Operations
JFK	MD83	MD-83/JT8D-219	Boeing MD-88	3
JFK	MD9025	MD-90/V2525-D5	Boeing MD-90	14
JFK	CL600	CL600/ALF502L	Bombardier Challenger 300	433
JFK	CL600	CL600/ALF502L	Bombardier Challenger 600	190
JFK	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	13,408
JFK	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	490
JFK	CRJ9-LR	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-705-LR	35,568
JFK	BD-700-1A11	BD-700-1A11\BR700-710A2-20	Bombardier Global 5000 Business	40
JFK	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global 7000 Business	2
JFK	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global Express	104
JFK	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 31	13
JFK	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 35	301
JFK	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 40	3
JFK	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 45	45
JFK	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 55	16
JFK	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 60	56
JFK	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 70	2
JFK	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 75	11
JFK	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	8
JFK	GASEPV	1985 1-ENG VP PROP	Cessna 177 Cardinal RG (FAS)	1
JFK	CNA182	Cessna 182H / Continental O-470-R	Cessna 182	2
JFK	CNA182	Cessna 182H / Continental O-470-R	Cessna 182 R (FAS)	1
JFK	PA42	Piper PA-42 / PT6A-41	Cessna 208 Caravan	16
JFK	BEC58P	BARON 58P/TS10-520-L	Cessna 310	2
JFK	BEC58P	BARON 58P/TS10-520-L	Cessna 340	1
JFK	BEC58P	BARON 58P/TS10-520-L	Cessna 402	433
JFK	BEC58P	BARON 58P/TS10-520-L	Cessna 414	8
JFK	BEC58P	BARON 58P/TS10-520-L	Cessna 421 Piston	3
JFK	CNA441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	1
JFK	CNA500	CIT 2/JT15D-4	Cessna 500 Citation I	1
JFK	CNA500	CIT 2/JT15D-4	Cessna 525 CitationJet	42
JFK	CNA500	CIT 2/JT15D-4	Cessna 525C CitationJet	47
JFK	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	32
JFK	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	337
JFK	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	92
JFK	CIT3	CIT 3/TFE731-3-100S	Cessna 650 Citation III	22
JFK	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	177
JFK	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680-A Citation Latitude	267
JFK	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 700 Citation Longitude	2
JFK	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	143
JFK	CNA510	510 CITATION MUSTANG	CESSNA CITATION 510	18
JFK	ECLIPSE500	Eclipse 500 / PW610F	CIRRUS SF-50 Vision	8
JFK	COMSEP	1985 1-ENG COMP	Cirrus SR20	7
JFK	COMSEP	1985 1-ENG COMP	Cirrus SR22	62
JFK	CNA208	Cessna 208 / PT6A-114	DAHER TBM 900/930	7
JFK	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	22
JFK	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000-EX	135
JFK	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 50	30
JFK	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 900	68
JFK	727EM2	FEDX 727-200/JT8D-15	Dassault Mercure 100	21
JFK	DHC8	DASH 8-100/PW121	DeHavilland DHC-8-100	1
JFK	GASEPV	1985 1-ENG VP PROP	Diamond DA40	2
JFK	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Diamond DA62	2
JFK	GASEPV	1985 1-ENG VP PROP	EADS Socata TBM-700	1
JFK	ECLIPSE500	Eclipse 500 / PW610F	Eclipse 500 / PW610F	8
JFK	CNA510	510 CITATION MUSTANG	Embraer 500	4
JFK	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	320
JFK	EMB120	EMBRAER 120 ER/ PRATT & WHITNEY PW118	Embraer EMB120 Brasilia	3
JFK	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	1,869
JFK	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145-XR	1
JFK	EMB170	ERJ170-100	Embraer ERJ170	3,000
JFK	EMB175	ERJ170-200	Embraer ERJ175	2,292
JFK	EMB175	ERJ170-200	Embraer ERJ175-LR	6,373
JFK	EMB190	ERJ190-100	Embraer ERJ190	24,685
JFK	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	10,599
JFK	CNA510	510 CITATION MUSTANG	Embraer Legacy 450 (EMB-545)	59
JFK	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 500 (EMB-550)	7

Airport	ID	Description	Model	Operations
JFK	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 650	30
JFK	CNA208	Cessna 208 / PT6A-114	EPIC LT/Dynasty	1
JFK	GIV	GULFSTREAM GIV-SP/TAY 611-8	Falcon 7X	23
JFK	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G150	26
JFK	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	41
JFK	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G280	57
JFK	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	1
JFK	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	195
JFK	GV	GULFSTREAM GV/BR 710	Gulfstream G500	160
JFK	G650ER	G650ER\BR-700-725A1-12	Gulfstream G650	27
JFK	HS748A	HS748/DART MK532-2	Gulfstream I	2
JFK	LEAR35	LEAR 36/TFE731-2	Hawker HS-125 Series 1	1
JFK	LEAR35	LEAR 36/TFE731-2	Hawker HS-125 Series 700	186
JFK	MU3001	MU300-10/JT15D-5	Honda HA-420 Hondajet	37
JFK	IA1125	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	7
JFK	GASEPV	1985 1-ENG VP PROP	Lancair Legacy 2000 (FAS)	2
JFK	GASEPV	1985 1-ENG VP PROP	Mooney M20-K	6
JFK	DHC6	DASH 6/PT6A-27	Piaggio P.180 Avanti	8
JFK	CNA208	Cessna 208 / PT6A-114	Pilatus PC-12	280
JFK	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Pilatus PC-24	5
JFK	GASEPF	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	2
JFK	BEC58P	BARON 58P/TS10-520-L	Piper PA-31 Navajo	43
JFK	CNA441	CONQUEST II/TPE331-8	Piper PA-31T Cheyenne	8
JFK	GASEPV	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	16
JFK	BEC58P	BARON 58P/TS10-520-L	Piper PA-34 Seneca	16
JFK	PA42	Piper PA-42 / PT6A-41	Piper PA-42 Cheyenne Series	5
JFK	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA44 (FAS)	2
JFK	PA31	PIPER NAVAJO CHIEFTAIN PA-31-350 / TIO-5	Piper PA46 Meridian	3
JFK	GASEPV	1985 1-ENG VP PROP	Piper PA46-TP Meridian	5
JFK	1900D	BEECH 1900D / PT6A67	Raytheon Beech 1900-C	466
JFK	BEC58P	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	10
JFK	MU3001	MU300-10/JT15D-5	Raytheon Beechjet 400	165
JFK	DHC6	DASH 6/PT6A-27	Raytheon C-12 Huron	64
JFK	LEAR35	LEAR 36/TFE731-2	Raytheon Hawker 1000	11
JFK	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	9
JFK	DHC6	DASH 6/PT6A-27	Raytheon King Air 100	4
JFK	DHC6	DASH 6/PT6A-27	Raytheon King Air 90	27
JFK	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	8
JFK	DHC6	DASH 6/PT6A-27	Raytheon Super King Air 300	151
JFK	BEC58P	BARON 58P/TS10-520-L	Rockwell Commander 500	2
JFK	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	3
JFK	CNA441	CONQUEST II/TPE331-8	SOCATA TBM 850	20
LGA	737700	BOEING 737-700/CFM56-7B24	Airbus A220-100	6,418
LGA	A319-131	A319-131\IAE V2522-A5	Airbus A319-100 Series	17,391
LGA	A320-211	A320-211\CFM56-5A1	Airbus A320-200 Series	37,896
LGA	A320-271N	A320-271N\PW1127G-JM with mod160734 engines	Airbus A320-NEO	59
LGA	A321-232	A321-232\V2530-A5	Airbus A321-100 Series	34,948
LGA	A321-232	A321-232\V2530-A5	Airbus A321-NEO	2
LGA	717200	BOEING 717-200/BR 715	Boeing 717-200 Series	9,668
LGA	727200	BOEING 727-200/JT8D-7	Boeing 727-200 Series	3
LGA	737400	BOEING 737-400/CFM56-3C-1	Boeing 737-400 Series	4
LGA	737700	BOEING 737-700/CFM56-7B24	Boeing 737-600 Series	1,955
LGA	737700	BOEING 737-700/CFM56-7B24	Boeing 737-700 Series	28,084
LGA	737MAX8	737MAX8\CFMLeap1B27	Boeing 737-8	1,148
LGA	737800	BOEING 737-800/CFM56-7B26	Boeing 737-800 Series	22,974
LGA	737800	BOEING 737-800/CFM56-7B26	Boeing 737-900 Series	347
LGA	757PW	BOEING 757-200/PW2037	Boeing 757-200 Series	77
LGA	767300	BOEING 767-300/CF6-80A	Boeing 767-300 Series	28
LGA	MD83	MD-83/JT8D-219	Boeing MD-83	2
LGA	MD83	MD-83/JT8D-219	Boeing MD-88	13
LGA	MD9025	MD-90/V2525-D5	Boeing MD-90	33
LGA	CL600	CL600/ALF502L	Bombardier Challenger 300	719
LGA	CL600	CL600/ALF502L	Bombardier Challenger 600	252
LGA	CL600	CL600/ALF502L	Bombardier CRJ-100	6
LGA	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	14,227
LGA	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	4,147
LGA	CRJ9-LR	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-705-LR	41,214

Airport	ID	Description	Model	Operations
LGA	BD-700-1A11	BD-700-1A11\BR700-710A2-20	Bombardier Global 5000 Business	124
LGA	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global Express	208
LGA	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 31	6
LGA	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 35	8
LGA	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 40	1
LGA	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 45	27
LGA	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 55	6
LGA	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 60	26
LGA	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 70	2
LGA	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 75	21
LGA	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	1
LGA	CNA182	Cessna 182H / Continental O-470-R	Cessna 182	1
LGA	PA42	Piper PA-42 / PT6A-41	Cessna 208 Caravan	1
LGA	BEC58P	BARON 58P/TS10-520-L	Cessna 310	3
LGA	BEC58P	BARON 58P/TS10-520-L	Cessna 402	1
LGA	BEC58P	BARON 58P/TS10-520-L	Cessna 414	4
LGA	BEC58P	BARON 58P/TS10-520-L	Cessna 421 Piston	2
LGA	CNA500	CIT 2/JT15D-4	Cessna 525 CitationJet	22
LGA	CNA500	CIT 2/JT15D-4	Cessna 525C CitationJet	13
LGA	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	6
LGA	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	289
LGA	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	41
LGA	CIT3	CIT 3/TFE731-3-100S	Cessna 650 Citation III	11
LGA	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	181
LGA	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680-A Citation Latitude	326
LGA	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	125
LGA	COMSEP	1985 1-ENG COMP	Cirrus SR22	16
LGA	CNA208	Cessna 208 / PT6A-114	DAHER TBM 900/930	3
LGA	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	4
LGA	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000-EX	122
LGA	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 50	21
LGA	GIV	GULFSTREAM GIV-SP/TAY 611-8	Dassault Falcon 8X	4
LGA	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 900	277
LGA	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dornier 328 Jet	2
LGA	ECLIPSE500	Eclipse 500 / PW610F	Eclipse 500 / PW610F	2
LGA	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	328
LGA	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	2,791
LGA	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145-XR	584
LGA	EMB170	ERJ170-100	Embraer ERJ170	18,587
LGA	EMB175	ERJ170-200	Embraer ERJ175	40,067
LGA	EMB175	ERJ170-200	Embraer ERJ175-LR	37,224
LGA	EMB190	ERJ190-100	Embraer ERJ190	22,272
LGA	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	27,814
LGA	CNA510	510 CITATION MUSTANG	Embraer Legacy 450 (EMB-545)	81
LGA	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 500 (EMB-550)	16
LGA	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 650	10
LGA	GIV	GULFSTREAM GIV-SP/TAY 611-8	Falcon 7X	35
LGA	GV	GULFSTREAM GV/BR 710	Gulfstream Aerospace Gulfstream G500 (G-7)	7
LGA	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G150	4
LGA	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	17
LGA	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G280	69
LGA	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	265
LGA	GV	GULFSTREAM GV/BR 710	Gulfstream G500	118
LGA	G650ER	G650ER\BR-700-725A1-12	Gulfstream G650	179
LGA	LEAR35	LEAR 36/TFE731-2	Hawker HS-125 Series 700	88
LGA	MU3001	MU300-10/JT15D-5	Honda HA-420 Hondajet	3
LGA	IA1125	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	7
LGA	GASEPV	1985 1-ENG VP PROP	Mooney M20-K	2
LGA	CNA208	Cessna 208 / PT6A-114	Pilatus PC-12	182
LGA	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Pilatus PC-24	4
LGA	GASEPF	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	2
LGA	BEC58P	BARON 58P/TS10-520-L	Piper PA-31 Navajo	8
LGA	GASEPV	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	5
LGA	BEC58P	BARON 58P/TS10-520-L	Piper PA-34 Seneca	4
LGA	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA44 (FAS)	2
LGA	PA31	PIPER NAVAJO CHIEFTAIN PA-31-350 / TIO-5	Piper PA46 Meridian	2
LGA	GASEPV	1985 1-ENG VP PROP	Piper PA46-TP Meridian	2

Airport	ID	Description	Model	Operations
LGA	BEC58P	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	11
LGA	GASEPV	1985 1-ENG VP PROP	Raytheon Beech Bonanza 36	3
LGA	MU3001	MU300-10/JT15D-5	Raytheon Beechjet 400	78
LGA	DHC6	DASH 6/PT6A-27	Raytheon C-12 Huron	20
LGA	LEAR35	LEAR 36/TFE731-2	Raytheon Hawker 1000	3
LGA	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	27
LGA	DHC6	DASH 6/PT6A-27	Raytheon King Air 90	11
LGA	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	3
LGA	DHC6	DASH 6/PT6A-27	Raytheon Super King Air 300	78
LGA	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	4
SWF	SA350D	Aerospatiale SA-350D Astar (AS-350)	Aerospatiale SA-350D Astar (AS-350)	18
SWF	BEC58P	BARON 58P/TS10-520-L	Aerostar PA-60	171
SWF	A109	Agusta A-109	Agusta A-109	4
SWF	A300B4-203	AIRBUS A300B4-200/CF6-50C2	Airbus A300B2-100 Series	14
SWF	A300-622R	A300-622R\PW4158	Airbus A300F4-600 Series	845
SWF	A310-304	A310-304\GE CF6-80 C2A2	Airbus A310-200 Series	14
SWF	A319-131	A319-131\IAE V2522-A5	Airbus A318-100 Series	2
SWF	A319-131	A319-131\IAE V2522-A5	Airbus A319-100 Series	569
SWF	A320-211	A320-211\CFM56-5A1	Airbus A320-200 Series	1,260
SWF	A321-232	A321-232\V2530-A5	Airbus A321-100 Series	35
SWF	A330-301	A330-301\GE CF6-80 E1A2	Airbus A330-200 Series	7
SWF	A330-301	A330-301\GE CF6-80 E1A2	Airbus A330-300 Series	772
SWF	A340-211	A340-211\CFM56-5C2	Airbus A340-200 Series	4
SWF	A340-211	A340-211\CFM56-5C2	Airbus A340-300 Series	7
SWF	A340-642	A340-642\Trent 556	Airbus A340-500 Series	2
SWF	A350-941	A350-941\RR trent XWB-84	Airbus A350-900 series	4
SWF	C130	C-130H/T56-A-15	AIRBUS A-400M	18
SWF	74720B	BOEING 747-200/JT9D-7Q	Antonov 124 Ruslan	18
SWF	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Aviat Husky A1B	4
SWF	GASEPF	1985 1-ENG FP PROP	Beech 23 Musketeer Sundowner (FAS)	9
SWF	GASEPF	1985 1-ENG FP PROP	Beech 24 Musketeer Super Sierra (FAS)	2
SWF	BEC58P	BARON 58P/TS10-520-L	Beechcraft 76 Duchess	16
SWF	B206L	Bell 206L Long Ranger	Bell 206 JetRanger	63
SWF	B407	Bell 407	Bell 407 / Rolls-Royce 250-C47B	317
SWF	B429	Bell 429	Bell 429	11
SWF	B212	Bell 212 Huey (UH-1N) (CH-135)	Bell UH-1 Iroquois	183
SWF	GASEPV	1985 1-ENG VP PROP	Bellanca Viking (FAS)	4
SWF	727200	BOEING 727-200/JT8D-7	Boeing 727-200 Series	47
SWF	737300	BOEING 737-300/CFM56-3B-1	Boeing 737-300 Series	16
SWF	737400	BOEING 737-400/CFM56-3C-1	Boeing 737-400 Series	9
SWF	737500	BOEING 737-500/CFM56-3C-1	Boeing 737-500 Series	4
SWF	737700	BOEING 737-700/CFM56-7B24	Boeing 737-700 Series	96
SWF	737MAX8	737MAX8\CFMLeap1B27	Boeing 737-8	659
SWF	737800	BOEING 737-800/CFM56-7B26	Boeing 737-800 Series	94
SWF	737800	BOEING 737-800/CFM56-7B26	Boeing 737-900 Series	47
SWF	747200	BOEING 747-200/JT9D-7	Boeing 747-200 Series	383
SWF	747400	BOEING 747-400/PW4056	Boeing 747-400 Series	334
SWF	7478	Boeing 747-8F/GEnx-2B67	Boeing 747-8	7
SWF	757PW	BOEING 757-200/PW2037	Boeing 757-200 Series	1,563
SWF	767300	BOEING 767-300/CF6-80A	Boeing 767-200 ER	30
SWF	767300	BOEING 767-300/CF6-80A	Boeing 767-300 Series	68
SWF	767400	BOEING 767-400ER/CF6-80C2B(F)	Boeing 767-400	14
SWF	777200	BOEING 777-200ER/GE90-90B	Boeing 777-200 Series	56
SWF	7773ER	Boeing 777-300ER/GE90-115B-EIS	Boeing 777-300 ER	9
SWF	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-10 Dreamliner	9
SWF	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-8 Dreamliner	4
SWF	7878R	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-9 Dreamliner	131
SWF	C17	F117-PW-100 NM	Boeing C-17A	195
SWF	DC1030	DC10-30/CF6-50C2	Boeing DC-10-30 Series	405
SWF	DC870	DC8-70/CFM56-2C-5	Boeing DC-8 Series 70	21
SWF	CL600	CL600/ALF502L	Bombardier Challenger 300	317
SWF	CL600	CL600/ALF502L	Bombardier Challenger 600	372
SWF	CL600	CL600/ALF502L	Bombardier CRJ-100	14
SWF	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	3,182
SWF	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	25
SWF	CRJ9-LR	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-705-LR	44
SWF	DHC8	DASH 8-100/PW121	Bombardier de Havilland Dash 8 Q100	9

Airport	ID	Description	Model	Operations
SWF	BD-700-1A11	BD-700-1A11\BR700-710A2-20	Bombardier Global 5000 Business	167
SWF	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global 7000 Business	4
SWF	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global Express	287
SWF	LEAR25	LEAR 25/CJ610-8	Bombardier Learjet 25	4
SWF	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 31	32
SWF	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 35	54
SWF	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 40	14
SWF	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 45	567
SWF	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 55	42
SWF	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 60	176
SWF	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 70	171
SWF	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 75	273
SWF	GASEPF	1985 1-ENG FP PROP	Cessna 150 Series	91
SWF	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 170 (FAS)	2
SWF	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	1,321
SWF	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 175 (FAS)	7
SWF	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 177 (FAS)	181
SWF	GASEPV	1985 1-ENG VP PROP	Cessna 177 Cardinal RG (FAS)	9
SWF	CNA182	Cessna 182H / Continental O-470-R	Cessna 182	433
SWF	CNA182	Cessna 182H / Continental O-470-R	Cessna 182 R (FAS)	11
SWF	CNA182	Cessna 182H / Continental O-470-R	Cessna 185 Skywagon	14
SWF	GASEPV	1985 1-ENG VP PROP	Cessna 205 (FAS)	2
SWF	CNA20T	CESSNA T206H / LYCOMING TIO-540-AJ1A	Cessna 206	155
SWF	GASEPV	1985 1-ENG VP PROP	Cessna 207 (Turbo) Stationair (FAS)	4
SWF	PA42	Piper PA-42 / PT6A-41	Cessna 208 Caravan	23
SWF	GASEPV	1985 1-ENG VP PROP	Cessna 210 Centurion	42
SWF	BEC58P	BARON 58P/TS10-520-L	Cessna 303 Crusader (FAS)	32
SWF	BEC58P	BARON 58P/TS10-520-L	Cessna 310	37
SWF	BEC58P	BARON 58P/TS10-520-L	Cessna 335/340 (FAS)	2
SWF	BEC58P	BARON 58P/TS10-520-L	Cessna 337 Skymaster	4
SWF	BEC58P	BARON 58P/TS10-520-L	Cessna 340	4
SWF	GASEPV	1985 1-ENG VP PROP	Cessna 400 (FAS)	2
SWF	BEC58P	BARON 58P/TS10-520-L	Cessna 414	25
SWF	BEC58P	BARON 58P/TS10-520-L	Cessna 421 Piston	14
SWF	CNA441	CONQUEST II/TPE331-8	Cessna 425 Conquest I	32
SWF	CNA441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	2
SWF	CNA500	CIT 2/JT15D-4	Cessna 500 Citation I	28
SWF	CNA500	CIT 2/JT15D-4	Cessna 501 Citation ISP	4
SWF	CNA500	CIT 2/JT15D-4	Cessna 525 CitationJet	14
SWF	CNA525C	Cessna Model 525C CJ4	Cessna 525 CitationJet	423
SWF	CNA500	CIT 2/JT15D-4	Cessna 525A CitationJet	150
SWF	CNA500	CIT 2/JT15D-4	Cessna 525C CitationJet	294
SWF	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	216
SWF	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	584
SWF	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	322
SWF	CIT3	CIT 3/TFE731-3-100S	Cessna 650 Citation III	214
SWF	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	409
SWF	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680-A Citation Latitude	176
SWF	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	654
SWF	CNA182	Cessna 182H / Continental O-470-R	Cessna Aircraft Company 180F	25
SWF	CNA510	510 CITATION MUSTANG	CESSNA CITATION 510	190
SWF	ECLIPSE500	Eclipse 500 / PW610F	CIRRUS SF-50 Vision	18
SWF	COMSEP	1985 1-ENG COMP	Cirrus SR20	136
SWF	COMSEP	1985 1-ENG COMP	Cirrus SR22	541
SWF	GASEPV	1985 1-ENG VP PROP	Columbia Aircraft Lancair (COL3/4 All Types) (FAS)	9
SWF	GASEPV	1985 1-ENG VP PROP	Commander 114/115 (FAS)	9
SWF	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	16
SWF	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000-EX	247
SWF	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 50	80
SWF	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 900	355
SWF	727EM2	FEDX 727-200/JT8D-15	Dassault Mercure 100	9
SWF	DHC6	DASH 6/PT6A-27	DeHavilland DHC-6-300 Twin Otter	42
SWF	DHC8	DASH 8-100/PW121	DeHavilland DHC-8-100	16
SWF	GASEPV	1985 1-ENG VP PROP	Diamond DA40	105
SWF	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Diamond DA42 Twin Star	4
SWF	GASEPV	1985 1-ENG VP PROP	EADS Socata TB-20 Trinidad	16

Airport	ID	Description	Model	Operations
SWF	GASEPF	1985 1-ENG FP PROP	EADS Socata TB-9 Tampico	4
SWF	GASEPV	1985 1-ENG VP PROP	EADS Socata TBM-700	21
SWF	ECLIPSE500	Eclipse 500 / PW610F	Eclipse 500 / PW610F	14
SWF	CNA510	510 CITATION MUSTANG	Embraer 500	4
SWF	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	468
SWF	DHC6	DASH 6/PT6A-27	Embraer EMB110 Bandeirante	4
SWF	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	5,087
SWF	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145-XR	7
SWF	EMB190	ERJ190-100	Embraer ERJ190	3,387
SWF	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	2
SWF	CNA510	510 CITATION MUSTANG	Embraer Legacy 450 (EMB-545)	32
SWF	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 500 (EMB-550)	9
SWF	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 650	25
SWF	GASEPV	1985 1-ENG VP PROP	Express 2000 (FAS)	2
SWF	GASEPV	1985 1-ENG VP PROP	EXTRA EA-300 (FAS)	16
SWF	GIV	GULFSTREAM GIV-SP/TAY 611-8	Falcon 7X	28
SWF	GASEPV	1985 1-ENG VP PROP	Glasair (FAS)	21
SWF	GASEPF	1985 1-ENG FP PROP	Grumman AA-5A/B (FAS)	70
SWF	GV	GULFSTREAM GV/BR 710	Gulfstream Aerospace Gulfstream G500 (G-7)	16
SWF	GASEPF	1985 1-ENG FP PROP	Gulfstream American GA-7 Cougar (FAS)	4
SWF	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G150	96
SWF	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	70
SWF	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G280	14
SWF	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	7
SWF	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	553
SWF	GV	GULFSTREAM GV/BR 710	Gulfstream G500	1,172
SWF	G650ER	G650ER\BR-700-725A1-12	Gulfstream G650	614
SWF	LEAR35	LEAR 36/TFE731-2	Hawker HS-125 Series 1	4
SWF	LEAR35	LEAR 36/TFE731-2	Hawker HS-125 Series 700	398
SWF	MU3001	MU300-10/JT15D-5	Honda HA-420 Hondajet	49
SWF	DHC6	DASH 6/PT6A-27	Mitsubishi MU-2	56
SWF	GASEPV	1985 1-ENG VP PROP	Mooney M20-K	136
SWF	GASEPV	1985 1-ENG VP PROP	North American T-6 Texan (FAS)	11
SWF	DHC6	DASH 6/PT6A-27	Piaggio P.180 Avanti	42
SWF	CNA208	Cessna 208 / PT6A-114	Pilatus PC-12	1,330
SWF	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Pilatus PC-24	18
SWF	GASEPF	1985 1-ENG FP PROP	Piper PA-18-150 (FAS)	2
SWF	BEC58P	BARON 58P/TS10-520-L	Piper PA-23 Apache/Aztec	2
SWF	GASEPV	1985 1-ENG VP PROP	Piper PA-24 Comanche	49
SWF	BEC58P	BARON 58P/TS10-520-L	Piper PA-27 Aztec	32
SWF	GASEPF	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	146
SWF	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA-30 Twin Comanche	75
SWF	BEC58P	BARON 58P/TS10-520-L	Piper PA-31 Navajo	153
SWF	CNA441	CONQUEST II/TPE331-8	Piper PA-31T Cheyenne	42
SWF	GASEPV	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	73
SWF	BEC58P	BARON 58P/TS10-520-L	Piper PA-34 Seneca	77
SWF	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA44 (FAS)	14
SWF	PA31	PIPER NAVAJO CHIEFTAIN PA-31-350 / TIO-5	Piper PA46 Meridian	54
SWF	GASEPV	1985 1-ENG VP PROP	Piper PA46-TP Meridian	63
SWF	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Piper Pacer (FAS)	2
SWF	CNA208	Cessna 208 / PT6A-114	Quest Kodiak 100	9
SWF	DHC6	DASH 6/PT6A-27	Raytheon Beech 18	7
SWF	1900D	BEECH 1900D / PT6A67	Raytheon Beech 1900-C	4
SWF	BEC58P	BARON 58P/TS10-520-L	Raytheon Beech 55 Baron	63
SWF	DHC6	DASH 6/PT6A-27	Raytheon Beech 99	16
SWF	BEC58P	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	308
SWF	GASEPV	1985 1-ENG VP PROP	Raytheon Beech Bonanza 36	263
SWF	MU3001	MU300-10/JT15D-5	Raytheon Beechjet 400	160
SWF	DHC6	DASH 6/PT6A-27	Raytheon C-12 Huron	200
SWF	LEAR35	LEAR 36/TFE731-2	Raytheon Hawker 1000	9
SWF	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	68
SWF	DHC6	DASH 6/PT6A-27	Raytheon King Air 90	124
SWF	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	65
SWF	DHC6	DASH 6/PT6A-27	Raytheon Super King Air 300	395
SWF	H500D	Hughes 500D	Robinson R22	504
SWF	R44	Robinson R44 Raven / Lycoming O-540-F1B5	Robinson R44 Raven / Lycoming O-540-F1B5	419
SWF	DHC6	DASH 6/PT6A-27	Rockwell Commander 690	32

Airport	ID	Description	Model	Operations
SWF	SF340	SF340B/CT7-9B	Saab 340-A	4
SWF	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	708
SWF	S70	Sikorsky S-70 Blackhawk (UH-60A)	Sikorsky S-92	4
SWF	CNA441	CONQUEST II/TPE331-8	SOCATA TBM 850	141
SWF	T-38A	NORTHRUP TALON T-38A NM	T-38 Talon	4
SWF	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Tecnam P2006T (FAS)	47
SWF	GASEPV	1985 1-ENG VP PROP	Vans RV10 (FAS)	2
SWF	GASEPV	1985 1-ENG VP PROP	Vans RV6 (FAS)	9
SWF	GASEPV	1985 1-ENG VP PROP	Vans RV-7	11
SWF	GASEPV	1985 1-ENG VP PROP	Vans RV8 (FAS)	4
TEB	BEC58P	BARON 58P/TS10-520-L	Aerostar PA-60	42
TEB	GASEPF	1985 1-ENG FP PROP	Beech 23 Musketeer Sundowner (FAS)	2
TEB	GASEPF	1985 1-ENG FP PROP	Beech 24 Musketeer Super Sierra (FAS)	4
TEB	BEC58P	BARON 58P/TS10-520-L	Beech 95 (FAS)	9
TEB	BEC58P	BARON 58P/TS10-520-L	Beechcraft 76 Duchess	2
TEB	CNA208	Cessna 208 / PT6A-114	Beechcraft T-6 Texan 2 (FAS)	1
TEB	BEC58P	BARON 58P/TS10-520-L	Beechcraft Twin Bonanza (FAS)	4
TEB	GASEPV	1985 1-ENG VP PROP	Bellanca Viking (FAS)	2
TEB	MD83	MD-83/JT8D-219	Boeing MD-87	2
TEB	CL600	CL600/ALF502L	Bombardier Challenger 300	17,612
TEB	CL600	CL600/ALF502L	Bombardier Challenger 600	1,016
TEB	CL600	CL600/ALF502L	Bombardier Challenger 604	8,490
TEB	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	101
TEB	CRJ9-ER	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	22
TEB	DHC830	DASH 8-300/PW123	Bombardier de Havilland Dash 8 Q300	2
TEB	BD-700-1A11	BD-700-1A11\BR700-710A2-20	Bombardier Global 5000 Business	2,878
TEB	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global 7000 Business	89
TEB	BD-700-1A10	BD-700-1A10\BR700-710A2-20	Bombardier Global Express	7,674
TEB	LEAR25	LEAR 25/CJ610-8	Bombardier Learjet 24	38
TEB	LEAR25	LEAR 25/CJ610-8	Bombardier Learjet 25	10
TEB	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 31	586
TEB	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 35	1,793
TEB	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 40	2,391
TEB	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 45	260
TEB	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 55	931
TEB	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 60	3,563
TEB	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 70	108
TEB	LEAR35	LEAR 36/TFE731-2	Bombardier Learjet 75	266
TEB	BEC58P	BARON 58P/TS10-520-L	Britten-Norman BN-2 Islander	2
TEB	SF340	SF340B/CT7-9B	CASA CN-235-100	2
TEB	GASEPF	1985 1-ENG FP PROP	Cessna 140 (FAS)	2
TEB	GASEPF	1985 1-ENG FP PROP	Cessna 150 Series	13
TEB	GASEPF	1985 1-ENG FP PROP	Cessna 162 (FAS)	8
TEB	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 170 (FAS)	2
TEB	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	179
TEB	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 177 (FAS)	10
TEB	GASEPV	1985 1-ENG VP PROP	Cessna 177 Cardinal RG (FAS)	4
TEB	CNA182	Cessna 182H / Continental O-470-R	Cessna 182	120
TEB	CNA182	Cessna 182H / Continental O-470-R	Cessna 185 Skywagon	6
TEB	CNA20T	CESSNA T206H / LYCOMING TIO-540-AJ1A	Cessna 206	32
TEB	PA42	Piper PA-42 / PT6A-41	Cessna 208 Caravan	365
TEB	GASEPV	1985 1-ENG VP PROP	Cessna 210 Centurion	54
TEB	BEC58P	BARON 58P/TS10-520-L	Cessna 310	84
TEB	BEC58P	BARON 58P/TS10-520-L	Cessna 335/340 (FAS)	4
TEB	BEC58P	BARON 58P/TS10-520-L	Cessna 337 Skymaster	1
TEB	BEC58P	BARON 58P/TS10-520-L	Cessna 340	46
TEB	GASEPV	1985 1-ENG VP PROP	Cessna 400 (FAS)	8
TEB	BEC58P	BARON 58P/TS10-520-L	Cessna 402	9
TEB	BEC58P	BARON 58P/TS10-520-L	Cessna 414	145
TEB	BEC58P	BARON 58P/TS10-520-L	Cessna 421 Piston	137
TEB	CNA441	CONQUEST II/TPE331-8	Cessna 425 Conquest I	2
TEB	CNA441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	64
TEB	CNA500	CIT 2/JT15D-4	Cessna 500 Citation I	53
TEB	CNA500	CIT 2/JT15D-4	Cessna 501 Citation ISP	77
TEB	CNA500	CIT 2/JT15D-4	Cessna 525 CitationJet	2
TEB	CNA525C	Cessna Model 525C CJ4	Cessna 525 CitationJet	4,803
TEB	CNA500	CIT 2/JT15D-4	Cessna 525A CitationJet	2

Airport	ID	Description	Model	Operations
TEB	CNA500	CIT 2/JT15D-4	Cessna 525C CitationJet	4
TEB	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	1,072
TEB	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	9,081
TEB	CNA560U	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	2,528
TEB	CIT3	CIT 3/TFE731-3-100S	Cessna 650 Citation III	558
TEB	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	5,238
TEB	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 680-A Citation Latitude	5,300
TEB	CNA680	Cessna Model 680 Sovereign / PW306C	Cessna 700 Citation Longitude	64
TEB	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	5,993
TEB	CNA182	Cessna 182H / Continental O-470-R	Cessna Aircraft Company 180F	2
TEB	CNA510	510 CITATION MUSTANG	CESSNA CITATION 510	152
TEB	ECLIPSE500	Eclipse 500 / PW610F	CIRRUS SF-50 Vision	102
TEB	COMSEP	1985 1-ENG COMP	Cirrus SR20	108
TEB	COMSEP	1985 1-ENG COMP	Cirrus SR22	1,425
TEB	GASEPV	1985 1-ENG VP PROP	Columbia Aircraft Lancair (COL3/4 All Types) (FAS)	11
TEB	GASEPV	1985 1-ENG VP PROP	Commander 114/115 (FAS)	5
TEB	CNA441	CONQUEST II/TPE331-8	COMMANDER980/1000	28
TEB	CNA208	Cessna 208 / PT6A-114	DAHER TBM 900/930	18
TEB	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	93
TEB	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000-EX	6,534
TEB	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 50	1,793
TEB	GIV	GULFSTREAM GIV-SP/TAY 611-8	Dassault Falcon 8X	256
TEB	FAL900EX	FAL900EX\TFE731-60	Dassault Falcon 900	4,524
TEB	727EM2	FEDX 727-200/JT8D-15	Dassault Mercure 100	78
TEB	GASEPV	1985 1-ENG VP PROP	Diamond DA40	32
TEB	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Diamond DA42 Twin Star	5
TEB	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Diamond DA62	22
TEB	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dornier 328 Jet	69
TEB	GASEPV	1985 1-ENG VP PROP	EADS Socata TBM-700	391
TEB	ECLIPSE500	Eclipse 500 / PW610F	Eclipse 500 / PW610F	232
TEB	CNA510	510 CITATION MUSTANG	Embraer 500	376
TEB	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	7,015
TEB	DHC6	DASH 6/PT6A-27	Embraer EMB110 Bandeirante	2
TEB	EMB120	EMBRAER 120 ER/ PRATT & WHITNEY PW118	Embraer EMB120 Brasilia	6
TEB	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	18
TEB	EMB190	ERJ190-100	Embraer ERJ190	22
TEB	EMB145	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	123
TEB	CNA510	510 CITATION MUSTANG	Embraer Legacy 450 (EMB-545)	1,149
TEB	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 500 (EMB-550)	1,217
TEB	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Embraer Legacy 650	1,685
TEB	CNA208	Cessna 208 / PT6A-114	EPIC LT/Dynasty	2
TEB	GASEPV	1985 1-ENG VP PROP	Express 2000 (FAS)	2
TEB	GASEPV	1985 1-ENG VP PROP	EXTRA EA-300 (FAS)	2
TEB	DHC6	DASH 6/PT6A-27	Fairchild SA-227-AC Metro III	4
TEB	GIV	GULFSTREAM GIV-SP/TAY 611-8	Falcon 7X	2,363
TEB	GASEPF	1985 1-ENG FP PROP	Grumman AA-5A/B (FAS)	14
TEB	C130	C-130H/T56-A-15	Grumman E-2 Hawkeye	2
TEB	GV	GULFSTREAM GV/BR 710	Gulfstream Aerospace Gulfstream G500 (G-7)	114
TEB	GASEPF	1985 1-ENG FP PROP	Gulfstream American GA-7 Cougar (FAS)	2
TEB	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G150	611
TEB	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	1,919
TEB	IA1125	ASTRA 1125/TFE731-3A	Gulfstream G280	2,319
TEB	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	36
TEB	GIV	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	14,087
TEB	GV	GULFSTREAM GV/BR 710	Gulfstream G500	8,053
TEB	GV	GULFSTREAM GV/BR 710	Gulfstream G600	22
TEB	G650ER	G650ER\BR-700-725A1-12	Gulfstream G650	4,409
TEB	HS748A	HS748/DART MK532-2	Gulfstream I	40
TEB	GII	GULFSTREAM GII/SPEY 511-8	Gulfstream II	14
TEB	LEAR35	LEAR 36/TFE731-2	Hawker HS-125 Series 1	2
TEB	LEAR35	LEAR 36/TFE731-2	Hawker HS-125 Series 700	7,922
TEB	MU3001	MU300-10/JT15D-5	Honda HA-420 Hondajet	578
TEB	IA1125	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	316
TEB	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	Lancair 360	2
TEB	GASEPV	1985 1-ENG VP PROP	Lancair Evolution (FAS)	12
TEB	LEAR35	LEAR 36/TFE731-2	Lockheed L-1329 Jetstar II	38

Airport	ID	Description	Model	Operations
TEB	GASEPV	1985 1-ENG VP PROP	Maule MT-7-235	2
TEB	DHC6	DASH 6/PT6A-27	Mitsubishi MU-2	31
TEB	MU3001	MU300-10/JT15D-5	Mitsubishi MU-300 Diamond	2
TEB	GASEPV	1985 1-ENG VP PROP	Mooney M20-K	2
TEB	DHC6	DASH 6/PT6A-27	Piaggio P.180 Avanti	234
TEB	CNA208	Cessna 208 / PT6A-114	Pilatus PC-12	8,016
TEB	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Pilatus PC-24	274
TEB	GASEPV	1985 1-ENG VP PROP	Piper PA-24 Comanche	5
TEB	BEC58P	BARON 58P/TS10-520-L	Piper PA-27 Aztec	60
TEB	GASEPF	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	43
TEB	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA-30 Twin Comanche	4
TEB	BEC58P	BARON 58P/TS10-520-L	Piper PA-31 Navajo	432
TEB	GASEPV	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	129
TEB	BEC58P	BARON 58P/TS10-520-L	Piper PA-34 Seneca	176
TEB	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA44 (FAS)	8
TEB	PA31	PIPER NAVAJO CHIEFTAIN PA-31-350 / TIO-5	Piper PA46 Meridian	242
TEB	GASEPV	1985 1-ENG VP PROP	Piper PA46-TP Meridian	99
TEB	CNA208	Cessna 208 / PT6A-114	Quest Kodiak 100	2
TEB	1900D	BEECH 1900D / PT6A67	Raytheon Beech 1900-C	3
TEB	BEC58P	BARON 58P/TS10-520-L	Raytheon Beech 55 Baron	9
TEB	BEC58P	BARON 58P/TS10-520-L	Raytheon Beech 60 Duke	2
TEB	DHC6	DASH 6/PT6A-27	Raytheon Beech 99	2
TEB	BEC58P	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	491
TEB	GASEPV	1985 1-ENG VP PROP	Raytheon Beech Bonanza 36	92
TEB	MU3001	MU300-10/JT15D-5	Raytheon Beechjet 400	3,988
TEB	DHC6	DASH 6/PT6A-27	Raytheon C-12 Huron	1,058
TEB	LEAR35	LEAR 36/TFE731-2	Raytheon Hawker 1000	662
TEB	CNA750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	955
TEB	DHC6	DASH 6/PT6A-27	Raytheon King Air 100	34
TEB	DHC6	DASH 6/PT6A-27	Raytheon King Air 90	969
TEB	CNA55B	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	316
TEB	DHC6	DASH 6/PT6A-27	Raytheon Super King Air 300	768
TEB	BEC58P	BARON 58P/TS10-520-L	Rockwell Commander 500	16
TEB	DHC6	DASH 6/PT6A-27	Rockwell Commander 690	13
TEB	LEAR35	LEAR 36/TFE731-2	Rockwell Sabreliner 65	83
TEB	GASEPV	1985 1-ENG VP PROP	Ryan Navion B	1
TEB	HS748A	HS748/DART MK532-2	Saab 2000	2
TEB	CNA441	CONQUEST II/TPE331-8	SOCATA TBM 850	27
TEB	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Tecnam P2006T (FAS)	6
TEB	GASEPV	1985 1-ENG VP PROP	Vans RV10 (FAS)	2
TEB	GASEPF	1985 1-ENG FP PROP	Vans RV4 (FAS)	1
TEB	GASEPV	1985 1-ENG VP PROP	Vans RV-7	2
TEB	GASEPV	1985 1-ENG VP PROP	Vans RV8 (FAS)	10
TEB	GASEPV	1985 1-ENG VP PROP	Vans RV9 (FAS)	2

APPENDIX C: 2019 GROUND SUPPORT EQUIPMENT PROFILES

Fuel Type/Equipment Name	Annual Utilization (hours)				
	JFK	EWR	LGA	SWF	TEB
Diesel	**1,482,328**	**1,045,274**	**679,842**	**7,762**	**4,894**
(None specified. EPA default data used.) - Generator	9,780	30,970	9,780	411	257
(None specified. EPA default data used.) - Lift	73,656	18,755	8,184	34	21
(None specified. EPA default data used.) - Other					
ACE 180 - Air Start	11,322	10,656	3,996	168	30
ACE 300/400 - Air Start				6	
ACE 802 - Air Conditioner	58,984	58,984	60,600		
Deicer - Use Diesel Stewart Stevenson Tug GT-35 MC in Separate Run	76,000	74,500	40,000		
Eagle Bobtail / F350 - Bobtail	42,941	3,734	1,867		
F250 / F350 - Hydrant Truck	4,581	13,743	1,527	439	86
F250 / F350 - Service Truck	19,320		840	727	455
F750 Dukes Transportation Services DART 3000 to 6000 gallon - Fuel Truck	40,608	18,612	28,764	1,499	1,862
FMC Commander 15 - Cargo Loader	159,500	73,700	7,700	925	
Hi-Way / TUG 660 chasis - Cabin Service Truck	32,000	187,200	38,400	257	257
Hi-Way / TUG 660 chasis - Catering Truck					
Hi-Way F650 - Cabin Service Truck				1090	134
Stewart & Stevenson TUG 660 - Belt Loader	276,900	111,800	88,400	121	116
Stewart & Stevenson TUG GT-35 MC - Aircraft Tractor	219,200	166,400	69,600	82	43
Stewart & Stevenson TUG GT-50H - Aircraft Tractor				48	9
Stewart & Stevenson TUG MA 50 - Baggage Tractor	210,000	159,000	238,500		
Stewart & Stevenson TUG MC - Aircraft Tractor				274	321
Stewart & Stevenson TUG MT - Cargo Tractor					
Stewart & Stevenson TUG T-750 - Aircraft Tractor				89	
Tennant - Sweeper	984	120	48		
TLD 1410 - Lavatory Truck				321	209
TLD 28 VDC - Ground Power Unit	188,800	76,800	70,400	822	856
Toyota 5,000 lb - Fork Lift	35,136	29,280	4,880		
Wollard CMPS170 / CMPS228 - Passenger Stand	6,204	2,068	1,880		
Wollard TLS-770 / F350 - Lavatory Truck	16,412	8,952	4,476	278	27
TLD, 400 Hz AC - Ground Power Unit				171	214
Gasoline	**1,188,110**	**1,406,536**	**242,183**	**6,621**	**4,027**
(None specified. EPA default data used.) - Generator	5,400	900			
(None specified. EPA default data used.) – Lift	56,400	53,392	18,048		
ACE 180 - Air Start			333		
Eagle Bobtail / F350 - Bobtail	125,089	26,138			
F250 / F350 - Hydrant Truck	24,432	15,270	10,689		
F250 / F350 - Service Truck	8,487		1,845		
F750 Dukes Transportation Services DART 3000 to 6000 gallon - Fuel Truck	2,820	1,128	564		
FMC Commander 15 - Cargo Loader	18,700	2,200			
FMC Tempest II Single engine - Deicer	13,500	9,000	2,500		
Hi-Way / TUG 660 chasis - Cabin Service Truck	1,600	49,600	3,200		
Hi-Way / TUG 660 chasis - Catering Truck					
Stewart & Stevenson TUG 660 - Belt Loader	170,300	286,000	62,400	1617	860
Stewart & Stevenson TUG GT-35 MC - Aircraft Tractor	102,400	136,000	17,600		
Stewart & Stevenson TUG MA 50 - Baggage Tractor	607,500	766,500	93,000	3289	1,412
Stewart & Stevenson TUG MT - Cargo Tractor					
Taylor Dunn - Cart	1,600	1,700	600	34	21
Tennant - Sweeper	2,534	1,448	724		
TLD - Ground Power Unit		8,000	3,200	1199	1,669
Toyota 5,000 lb - Fork Lift	15,616	12,688	976		
Wollard CMPS170 / CMPS228 - Passenger Stand	3,384	2,256	2,632		
TLD 1410 - Lavatory Truck				51	64
TLD 28 VDC - Ground Power Unit					
Wollard TLS-770 / F350 - Lavatory Truck	28,348	34,316	23,872		
LPG	**278,729**	**111,993**	**5,221**		
(None specified. EPA default data used.) - Lift	341	1,705	341		
FMC Commander 15 - Cargo Loader	1,100				
Stewart & Stevenson TUG 660 - Belt Loader					
Stewart & Stevenson TUG MA 50 - Baggage Tractor	1,500				
Tennant - Sweeper	556				
Toyota 5,000 lb - Fork Lift	275,232	110,288	4,880		
CNG	**2,276**	**3,032**	**9,586**		
Stewart & Stevenson TUG 660 - Belt Loader	1,300				
Stewart & Stevenson TUG MA 50 - Baggage Tractor		1,500	1,500		
Tennant - Sweeper		556	278		
Toyota 5,000 lb - Fork Lift	976	976	7,808		
Electric	**321,538**	**147,380**	**45,746**	**1,055**	**135**
(None specified. EPA default data used.) - Lift	7,502	7,161	2,046		
Dukes Transportation Services THS-400 - Hydrant Cart	152,700	77,877			
Stewart & Stevenson TUG 660 - Belt Loader	28,800		11,200		

Fuel Type/Equipment Name	Annual Utilization (hours)				
	JFK	EWR	LGA	SWF	TEB
Stewart & Stevenson TUG GT-35, MC - Aircraft Tractor	12,800	24,000	22,400		
Stewart & Stevenson TUG MA 50 - Baggage Tractor	29,000	27,000	10,000		
Taylor Dunn - Cart	5,100	4,500	100		
Tennant - Sweeper	724	362			
Gate Service - Water Service				308	39
None - Air Conditioner				747	96
TLD, 28 VDC - Ground Power Unit		1,600			
Toyota 5,000 lb - Fork Lift	84,912	4,880			
TOTAL	**3,272,981**	**2,714,215**	**982,578**	**14,973**	**9,056**

Note: Totals may not match the column sums due to rounding.