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

Calendar Year 2015

Final Report

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November 2017

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ACRONYMS AND ABBREVIATIONS

AC	air conditioning
AEDT	Aviation Environmental Design Tool
AMT	Auto Marine Terminal
APU	Auxiliary Power Unit
ATADS	Air Traffic Activity Data System
B20	20 percent biodiesel
Btus	British thermal units
CAD	Central Automotive Division
CAP	criteria air pollutant
ccf	100 cubic feet
CEMS	continuous emission monitoring system
CFCs	chlorofluorocarbons
CFR	Code of Federal Regulations
CH_4	methane
CHP	combined heat and power
CNG	compressed natural gas
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
Con Edison	Consolidated Edison Co. of N.Y., Inc.
DF	deterioration factor
ECRR	Essex County Resource Recovery
EDMS	Emission and Dispersion Modeling System
EF	emission factor
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
ESP	electrostatic precipitator
EWR	Newark Liberty International Airport
EY	emission year
FAA	Federal Aviation Administration
FLIGHT	EPA's Facility Level Information on GreenHouse gases Tool
g	gram(s)
gal	gallon
GGRP	Greenhouse Gas Reporting Program
GHG	greenhouse gas
GRP	General Reporting Protocol
GSE	Ground Support Equipment
GW Bridge	George Washington Bridge
GWP	global warming potential
HCs	hydrocarbons
HCFC	hydrochlorofluorocarbon
HFCs	hydrofluorocarbons
hp	horsepower
hr	hour
hrs/yr	hours per year
HSRG	heat recovery steam generator
Hz	hertz
ICAO	International Civil Aviation Organization
IPCC	Intergovernmental Panel on Climate Change
JFK	John F. Kennedy International Airport

kg	kilogram
KIAC	Kennedy International Airport Cogeneration
kWh	kilowatt hour
LandGEM	EPA's Landfill Gas Emissions Model
lbs	pounds
LF	load factor
LGA	LaGuardia Airport
LSP	Liberty State Park
LTO	landing and take-off
MARKAL	EPA's MARKet ALlocation database
MMBtu	million British thermal units
MOVES	EPA's Motor Vehicle Emissions Simulator
MSW	municipal solid waste
MWh	megawatt hour(s)
National Grid	National Grid USA Service Company, Inc.
NYNNJLINA	New York/Northern New Jersey/Long Island Non-Attainment Area
N_2O	nitrous oxide
NA	not applicable
NG	natural gas
No.	number
NO_x	nitrogen oxides
NPCC	Northeast Power Coordinating Council
NQ	not quantified
NYC	New York City
NYCW	NPCC NYC/Westchester
NYUP	NPCC Upstate NY
ODS	ozone-depleting substance
PABT	Port Authority Bus Terminal
PAS	Park Avenue South
PATC	Port Authority Technical Center
PATH	Port Authority Trans-Hudson
PCA	preconditioned air
PCNJ	Port Commerce, New Jersey
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
QA/QC	quality assurance/quality control
RECs	renewable energy certificates
RFCE	Reliable First Corporation East
scf	standard cubic foot
SEM	Simplified Estimation Method
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
SO_x	sulfur oxides
Southern	Southern Research Institute
SWF	Stewart International Airport
TCAP	Tenant Construction and Alteration Process manual
TCR	The Climate Registry
TEB	Teterboro Airport
TPY	tons per year of pollutant

ULSD	ultra-low sulfur diesel
VALE	Voluntary Airport Low Emissions Program
VMT	vehicle miles traveled
VOCs	volatile organic compounds
WFC	World Financial Center
WIP	work in place
WTC	World Trade Center

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; Staten Island Bridges: Bayonne Bridge, Goethals Bridge, and 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 formally 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. The cornerstone of this policy is the dual goal of (a) reducing GHG emissions related to its facilities, including tenants and customers, by 80 percent from 2006 levels by 2050; and (b) pursuing a net zero GHG emissions goal for its operations (Port Authority 2008).

The Port Authority retained the services of Southern Research Institute (Southern) and 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 2006 inventory was the first comprehensive assessment of GHG and CAP emissions and established the initial baseline for measuring progress toward the goals specified in the 2008 Environmental Sustainability Policy. The 2006 baseline was updated in 2007 and 2008; together these inventories helped the Port Authority map key emission sources by line department. The Port Authority sponsored a detailed 2009 emissions inventory for the newly acquired Stewart International Airport instead of a comprehensive inventory.

At the time of the 2010 inventory, the Port Authority became a member of The Climate Registry (TCR), a not-for-profit organization that assists its members to voluntarily measure, report, and verify their carbon footprints. The 2010 inventory received certification by an independent verification body attesting that the Port Authority's operational control GHG emissions inventory (i.e., scope 1 and scope 2) was complete, accurate, and transparent. Similarly, the Port Authority submitted the 2011 and 2012 inventories to TCR and had them independently verified.

For the 2013 and 2014 inventories, the Port Authority revised and updated the criteria for scope 3 emissions to better align the characterization of scope 3 sources with the 2008 Environmental Sustainability Policy. This effort led to the development of a definitive characterization of emission sources for all scopes of the operational boundary (i.e., scope 1, scope 2, and scope 3 sources) and inventory years assessed to-date.

Building on the insight and experience gained from past inventories, the Port Authority is publishing this 2015 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. The Port Authority received third-party certification that the 2015 GHG inventory was a fair and accurate representation of the agency's carbon footprint.

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 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 resulting 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 equipment, 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 directly 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, there 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 Figure 1-1.

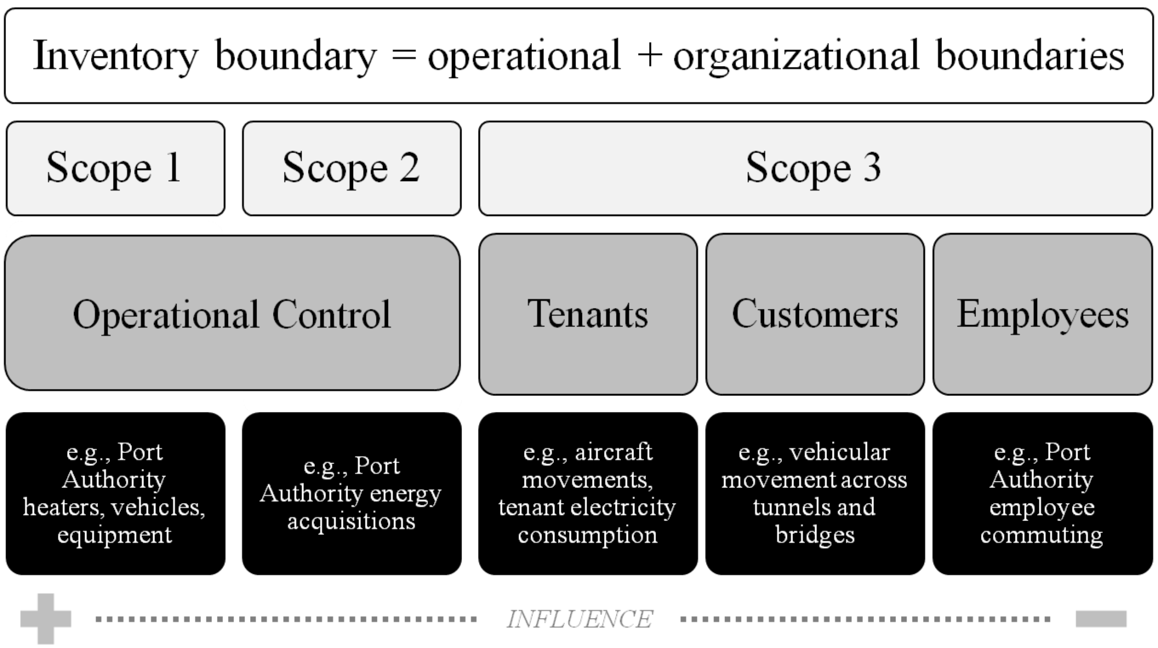

Figure 1-1. Schematic of the Port Authority's Inventory Boundary

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 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) developed 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 for the most commonly measured GHGs in its Second Assessment Report (IPCC 1996). In 2001, the IPCC published its Third Assessment Report (IPCC 2001), which adjusted the GWPs to reflect new information on atmospheric lifetimes and an improved calculation of the radiative forcing of CO_2. The IPCC adjusted these GWPs again during 2007 in its Fourth Assessment Report (IPCC 2007). However, Second Assessment Report GWPs are still used by international convention to maintain consistency with international practices, including by the United States and Canada when reporting under the United Nations Framework Convention on Climate Change. GWP values from the Second Assessment Report were used and are presented in Table 1-1.

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

Common Name	Formula	Chemical Name	GWP
Carbon dioxide	CO_2	NA	1
Methane	CH_4	NA	21
Nitrous oxide	N_2O	NA	310
Sulfur hexafluoride	SF_6	NA	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	fluorothane	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

Table 1-1: Global Warming Potential Factors for Reportable GHGs			
Common Name	**Formula**	**Chemical Name**	**GWP**
Perfluorocyclobutane	c-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 yield very accurate results and ensure that the operational control inventory meets 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 TCR. As part of the TCR registration, these GHG inventories were independently verified to be complete, transparent, and materially accurate. Since 2015, the Port Authority also voluntarily discloses its carbon footprint to CDP, a not-for-profit organization that provides a global system for companies and cities to measure, disclose, manage, and share vital environmental information.

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 Central Automotive Division fleet are referred to as the “CAD fleet,” and 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 on 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 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 Fleet	✓		✓
	PATH Non-Road Equipment	✓		
Purchased Electricity	Buildings		✓	
	Rail Systems		✓	
Purchased Cooling	Buildings		✓	
	Rail Systems		✓	
Purchased Heating	Buildings		✓	
	Rail Systems		✓	
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 heating, cooling and steam; 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 World Financial Center (WFC) terminal. "Rail Locomotive" refers to mobile emissions from such equipment on Port Authority property. "Rail Systems" refers to emissions from energy acquisitions at the AirTrain light rail lines and stations. "Shadow Fleet" corresponds to mobile emissions from vehicles owned by, but not operated by, the Port Authority. "Auto Marine Terminal, 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

Emission Category	Activity	Scope	
		3	Biogenic
Stationary Combustion	Buildings	✓	
Mobile Combustion	Ferry Movements	✓	
	Rail Locomotives	✓	
	Cargo Handling Equipment	✓	
	Shadow Fleet	✓	✓
	AMT, Vehicle Movements	✓	
Purchased Electricity	Buildings	✓	
	Rail Systems	✓	
Purchased Cooling	Buildings	✓	
	Rail Systems	✓	
Purchased Heating	Buildings	✓	
	Rail Systems	✓	
Construction	Non-Road Diesel Engines	✓	
Aircrafts	Aircraft Movements	✓	
	Auxiliary Power Units	✓	
	Ground Support Equipment	✓	

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 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[1]. "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.

Table 1-4: Characterization of Customer Sources

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

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.

Table 1-5: Characterization of Employee Sources

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

[1] "Through Traffic" and "Queued Traffic" emissions were las conducted as part of the EY2012 GHG and CAP inventory assessment (Port Authority 2015g). Please consult the latter document for a complete description of boundaries, methods and results.

1.3 SUMMARY OF GHG EMISSIONS RESULTS

This section presents the results of the 2015 GHG inventory for anthropogenic emissions, unless otherwise specified. CAP emissions were estimated as co-pollutants and those emissions results are presented thematically at the end of each chapter.

In 2015, the Port Authority had a total carbon footprint (scopes 1+2+3) of 5,878 thousand metric tons CO_2e. This represents an increase of 1.9 percent relative to the 2006 baseline. 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 emission in check despite growing customer demand for Port Authority infrastructure in recent years. For instance, cargo volumes processed at the maritime ports have increased by 28 percent between 2006 and 2015 from 5.0 to 6.4 million twenty-foot equivalent units. Similarly, passenger access to the PATH system increased from 67 to 76.6 million annual passengers between 2006 and 2015 (Port Authority, 2016g). A comparison of the 2015 carbon footprint with the 2006 baseline is presented in Figure 1-2.

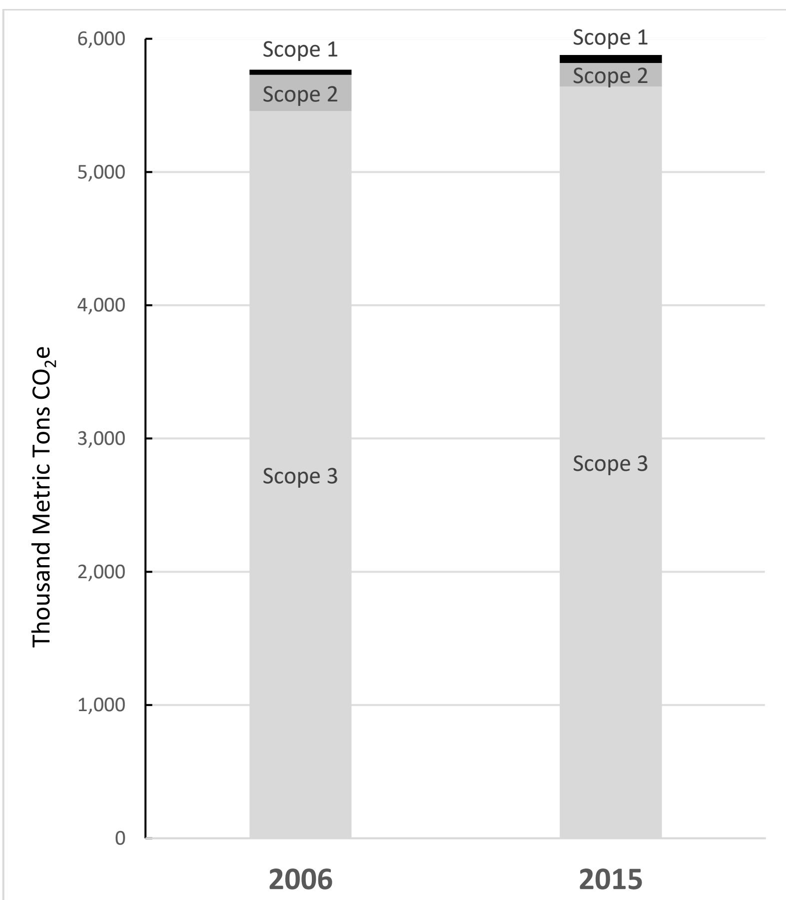

Figure 1-2. 2015 GHG Inventory Comparison with the 2006 Baseline

The carbon footprint of the Port Authority's operations (scopes 1+2) amounted to 236,195 metric tons of CO_2e in 2015. Since 2006, the Port Authority achieved a reduction of 49,135 metric tons CO_2e through changes in operations and implementation of numerous sustainability initiatives. This level of carbon mitigation corresponds to a 17 percent reduction relative to the 2006 base year. The goal of achieving carbon neutrality for Port Authority operations is attainable with the help of market instruments and additional operational improvements. Most notably, the Port Authority could mitigate 69 percent of scope 2 electricity purchases emissions by retiring renewable energy certificates (RECs) against 429,576 MWh consumed. An additional 6 percent of emissions could be mitigated by means of fuel switching to biofuels and/or further electrification of the CAD fleet. Residual emissions accounting for 26 percent of the operational control inventory could be offset with the purchases of high quality carbon credits in the voluntary carbon market. A comparison of the 2015 and 2006 operation control GHG emission inventories is shown in Figure 1-3.

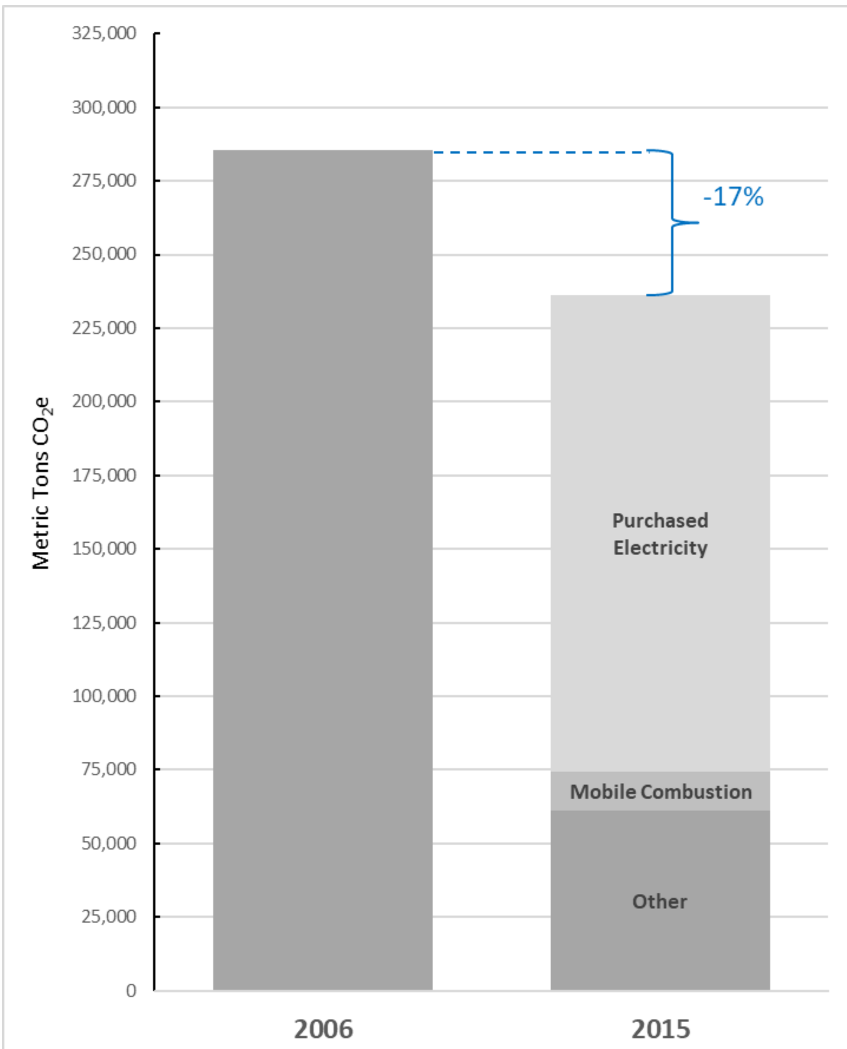

Figure 1-3. 2015 Operational Control GHG Emissions Comparison with the 2006 Baseline

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 5,877,964 metric tons CO_2e. Customer emissions account for over half of total emissions (51.1 percent), followed by tenant emissions (44.5 percent). Operational control emissions are relatively small, amounting to just 4 percent. Employee emissions are the smallest, making up less than 1 percent of the entire Port Authority inventory. Note that the Port Authority inventory program requires that emissions from scope 1 and scope 2 sources be conducted annually and assessment of scope 3 emissions to be done periodically. For that reason, total scope 3 emissions of 5,641,769 metric tons CO_2e for 2015 represent a composite value of the most recent assessment for a given source. An account of scope 3 emission estimates by last year of assessment is provided as supplemental information in Appendix A.

Table 1-6: Port Authority 2015 GHG Emissions Summary (metric tons CO_2e)

Carbon Management Level	Scope 1	Scope 2	Scope 3[a]	Total	Total %
Operational Control	60,024	176,170		236,195	4.0%
Tenants			2,616,905	2,616,711	44.5%
Customers			3,004,368	3,004,368	51.1%
Employees			20,496	20,496	0.3%
TOTAL	**60,024**	**176,170**	**5,641,769**	**5,877,964**	**100.0%**

[a] The sum of scope 3 emissions reflects emission values for the most recent assessment of a given source.

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 CO_2 bi-product of municipal solid waste decomposition released from the closed Elizabeth Landfill and combustion of biofuels by the CAD 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 2014 Biogenic GHG Emissions Summary

Carbon Management Level	Source	Biogenic
Operational Control	Elizabeth Landfill	590
	CAD Fleet	1,775
Tenants	Shadow Fleet	1,190
Customers	Essex County Resource Recovery	474,214
Employees	Employee Commuting	907
TOTAL		**478,676**

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 Truck 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 compliments the results of the Port Commerce Department's 2014 Multi-Facility Emission Inventory (Starcrest, 2016) by estimating incremental emissions from the 16-county NYNJLINA boundary to the first point of rest. Note that the Port Authority inventory program requires that scope 3 emissions assessments be done periodically. For that reason, scope 3 emissions represent a composite value of the most recent assessment for a given source. An account of scope 3 emission estimates by last year of assessment is provided as supplemental information in Appendix A.

Table 1-8: Port Authority 2015 GHG Emissions by Line Department (metric tons CO_2e)						
Department/Emissions Category	**Scope 1**	**Scope 2**	**Scope 3**			**Total**
	Ops. Control		*Tenants*	*Customers*	*Employees*	
Aviation	**33,290**	**86,257**	**2,289,606**	**941,736**		**3,350,890**
Aircraft			2,047,780			2,047,780
Attracted Travel				788,756		788,756
Energy Production				152,980		152,980
Fugitive Emissions	1,015		27			1,042
Purchased Cooling		5,619	13,923			19,542
Purchased Electricity		77,932	188,447			266,379
Purchased Heating		2,706	9,056			11,761
Stationary Combustion	32,275		30,374			62,650
Central Administration	**14,258**	**6,522**	**11,404**			**32,183**
Fugitive Emissions	259					259
Mobile Combustion	12,550		11,404			23,954
Purchased Electricity		6,522				6,522
Stationary Combustion	1,449					1,449
Engineering			**15,849**			**15,849**
Construction			15,849			15,849
Multi-Department	**748**				**20,496**	**21,244**
Mobile Combustion					20,496	20,496
Stationary Combustion	748					748
PATH	**4,646**	**45,476**	**99**	**60,064**		**110,285**
Attracted Travel				60,064		60,064
Fugitive Emissions	1,329					1,329
Mobile Combustion	462					462
Purchased Electricity		45,476	70			45,546
Stationary Combustion	2,855		30			2,885
Planning [a]			**11,794**			**11,794**
Mobile Combustion			11,622			11,622
Purchased Electricity			123			123
Stationary Combustion			50			50
Port Commerce	**4,219**	**6,268**	**133,821**	**1,106,892**		**1,251,200**
Attracted Travel				1,106,892		1,106,892
Fugitive Emissions	3,707					3,707
Mobile Combustion			122,949			122,949
Purchased Electricity		6,268	7,615			13,883
Stationary Combustion	512		3,257			3,769
Real Estate	**116**	**2,364**	**151,688**	**349,636**		**503,804**
Energy Production				349,636		349,636
Purchased Electricity		2,364	104,162			106,527
Stationary Combustion	116		47,525			47,641
Tunnels, Bridges & Bus Terminals	**2,747**	**29,284**	**2,644**	**546,040**		**580,715**
Attracted Travel				546,040		546,040
Fugitive Emissions	8					8
Purchased Electricity		23,392	2,281			25,672
Purchased Steam		5,892				5,892
Stationary Combustion	2,739		364			3,102
TOTAL	**60,0244**	**176,1700**	**2,616,905**	**3,004,36888**	**20,496**	**5,877,964**

[a] Emissions associated with the operation of the World Financial Center ferry terminal.

Table 1-9: Port Authority 2015 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*	*Customers*	*Employees*	
Aircraft			**2,047,780**			**2,047,780**
Aircraft Movements			1,839,735			1,839,735
Auxiliary Power Units			36,053			36,053
Ground Support Equipment			171,992			171,992
Attracted Travel				**2,501,752**		**2,501,752**
Air Cargo				57,073		57,073
Airport Passenger				731,683		731,683
Commercial Marine Vessels				154,996		154,996
Drayage Trucks [a]				266,862		266,862
Drayage Trucks [b]				685,034		685,034
PATH Passenger				60,064		60,064
Queued Traffic				22,107		22,107
Through Traffic				523,933		523,933
Construction			**15,849**			**15,849**
Non-Road Diesel Engines			15,849			15,849
Energy Production				**502,616**		**502,616**
Electricity Sold to Market				502,616		502,616
Fugitive Emissions	**6,318**		**27**			**6,344**
Landfill Gas	3,695					3,695
Refrigeration/Fire Suppression	2,623		27			2,649
Mobile Combustion	**13,012**		**145,975**		**20,496**	**179,483**
Auto Marine Terminal, Vehicle			402			402
CAD Fleet	12,550					12,550
Cargo Handling Equipment			104,525			104,525
Employee Commuting					20,496	20,496
Ferry Movements			11,622			11,622
PATH Non-Road Equipment	462					462
Rail Locomotives			18,022			18,022
Shadow Fleet			11,404			11,404
Purchased Cooling		**5,619**	**13,923**			**19,542**
Buildings		5,619	13,193			18,812
Rail Systems			730			730
Purchased Electricity		**161,954**	**302,697**			**464,651**
Buildings		123,129	279,379			402,508
Rail Systems		38,824	23,318			62,143
Purchased Heating		**2,706**	**9,056**			**11,761**
Buildings		2,706	8,318			11,024
Rail Systems			738			738
Purchased Steam		**5,892**				**5,892**
Buildings		5,892				5,892
Stationary Combustion	**40,694**		**81,599**			**122,294**
Buildings	39,946		81,599			121,351
Emergency Generators and Fire	748					748
Welding	1					1
TOTAL	**60,024**	**176,170**	**2,616,905**	**3,004,368**	**20,496**	**5,877,964**

[a] Travel distance to NYNJLINA boundary.
[b] Travel distance from NYNJLINA boundary to first point of rest.

2.0 STATIONARY COMBUSTION (SCOPE 1)

2.1 BUILDINGS

The 2015 inventory considered buildings (including, but not limited to, Port Authority Central Administration buildings) where fuel was combusted to produce heat or motive power using equipment in a fixed location. Natural gas is the predominant fuel for building heating and in some facilities Number (No.) 2 fuel oil is used. Table 2-1 lists Port Authority facilities where fuel was combusted during 2014. Note that not every building within the Port Authority's operational boundary combusts fuel; therefore, Table 2-1 only lists facilities where stationary combustion occurs.

Table 2-1: Port Authority Facilities with Stationary Combustion

Department	Facility	Fuel Type	Natural Gas Supplier
Aviation	JFK	Natural Gas Fuel Oil Propane	National Grid
	LGA	Natural Gas Fuel Oil	National Grid
	EWR	Natural Gas Fuel Oil	PSEG
	SWF	Natural Gas	Central Hudson Energy Group
	TEB	Natural Gas	PSEG
Central Administration	225 PAS	Natural Gas	Consolidated Edison Co. of N.Y., Inc. (Con Edison)
	777 Jersey Ave	Natural Gas	Public Service Electric and Gas (PSEG)
	PATC	Natural Gas	Hess Corporation and PSEG
PATH	PATH Buildings	Natural Gas Fuel Oil	PSEG
Port Commerce	PCNJ	Natural Gas	PSEG
Real Estate	The Teleport	Natural Gas	National Grid
Tunnels, Bridges & Bus Terminals	Bayonne Bridge	Natural Gas	National Grid
	Brooklyn Marine Terminal	Natural Gas	Hess Corp. and National Grid
	George Washington Bridge	Natural Gas	PSEG
	George Washington Bridge Bus Station	Natural Gas	Con Edison
	Goethals Bridge	Natural Gas	National Grid
	Holland Tunnel	Natural Gas	PSEG and Con Edison
	Howland Hook	Natural Gas	National Grid
	Lincoln Tunnel	Natural Gas	PSEG and Con Edison
	Outerbridge Crossing	Natural Gas	National Grid
	Port Authority Bus Terminal	Natural Gas	Con Edison

Note: Many facilities include multiple buildings. Fuel oil and Propane suppliers were not identified by the Port Authority.

2.1.1 Activity Data

For natural gas combustion, the Port Authority provided natural gas consumption data by month for each applicable building in units of therms or hundreds of cubic feet (ccf). In rare cases where there were gaps in the data provided by the Port Authority's consumption summary files, Southern either downloaded data from the provider's website in the form of screen shots converted to portable document format (PDF) or transcribed data from the website into a Microsoft Excel® workbook.

Data on the use of No. 2 Fuel Oil were provided by the Port Authority in the form of gallons of fuel oil consumed, by month, for each building.

Table 2-2: Fuel Consumption by Commodity

Department	Facility	Commodity	Consumption	Units
Aviation	JFK	Fuel Oil	103,726	gal
		Natural Gas	1,781,560	therm
		Propane	127,547	gal
	LGA	Fuel Oil	115,613	gal
		Natural Gas	650,378	therm
	EWR	Fuel Oil	283,134	gal
		Natural Gas	2,324,319	therm
	SWF	Natural Gas	103,427	therm
	TEB	Natural Gas	96,032	therm
Central Administration	225 PAS	Natural Gas	0	therm
	777 Jersey	Natural Gas	45,850	therm
	PATC	Natural Gas	226,563	therm
PATH	PATH Buildings	Fuel Oil	33,300	gal
		Natural Gas	472,199	therm
Port Commerce	Brooklyn Marine Terminal	Natural Gas	29,755	therm
	Howland Hook	Natural Gas	6,580	therm
	PCNJ	Natural Gas	59,974	therm
Real Estate	Teleport	Natural Gas	21,806	therm
Tunnels, Bridges & Bus Terminals	Bayonne Bridge	Natural Gas	9,167	therm
	George Washington Bridge	Natural Gas	151,807	therm
	George Washington Bridge Bus Station	Natural Gas	138,902	therm
	Goethals Bridge	Natural Gas	31,160	therm
	Holland Tunnel	Natural Gas	109,374	therm
	Lincoln Tunnel	Natural Gas	27,618	therm
	Outerbridge Crossing	Natural Gas	40,054	therm
	Port Authority Bus Terminal	Natural Gas	6,794	therm

2.1.2 Method

The GHG emission factors used to calculate the GHGs associated with stationary fuel combustion in buildings are shown in Table 2-3. The values in Table 2-3 are representative of U.S. pipeline-grade natural gas and No. 2 Fuel Oil. In order to maintain consistency with the CAP emission factors in Table 2-4, an average high heating value of 1,026 British thermal units (Btus) 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. The emission factors for CO_2 were then taken from GRP Table 12.1, and the emission factors for CH_4 and N_2O were taken from GRP Table 12.9 (TCR 2016), using the heating value from EPA's AP-42. The GHG emission factors for No. 2 fuel oil were taken directly from GRP Tables 12.1 and 12.9.

Table 2-3: Stationary Combustion GHG Emission Factors

Units	CO_2	CH_4	N_2O
Kilograms (kg)/ccf of natural gas (NG)	5.44	4.92×10^{-4}	1.03×10^{-5}
kg/therm of NG	5.31	4.80×10^{-4}	1.00×10^{-5}
kg/gallon of No. 2 Fuel Oil	10.26	1.40×10^{-3}	8.40×10^{-5}
kg/gallon of Propane	5.56	8.10×10^{-5}	5.60×10^{-4}

Source: TCR 2016.

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 assumption that the natural gas was combusted in a small [<100 million Btus (MMBtu) per hour (hr)] uncontrolled boiler. These values are presented in Table 2-4.

Table 2-4: Stationary Combustion CAP Emission Factors

Units	SO_2	NO_x	PM total
kg/ccf of NG	2.72×10^{-5}	4.54×10^{-3}	3.45×10^{-4}
kg/therm of NG	2.65×10^{-5}	4.42×10^{-3}	3.36×10^{-4}
kg/gallon of No. 2 Fuel Oil	1.29×10^{-2}	9.07×10^{-3}	1.50×10^{-3}
kg/gallon of Propane	3.48×10^{-2}	5.90×10^{-3}	3.18×10^{-4}

2.1.3 Results

Emission estimates were developed in accordance with GRP Chapter 12, "Direct Emissions from Stationary Combustion" (TCR 2013a), using the emission factors presented in Section 2.1.2. In a small number of cases, stationary combustion data were not available from the energy provider as natural gas bills, meter readings, or purchase records. For example, if no records existed for a given month, the consumption was estimated by assigning the seasonal maximum. Additionally, if no records existed for a period of several months, natural gas consumption was estimated using historical data from 2012 through 2014. In accordance with GRP guidelines, emission estimates developed from engineering calculations or a simplified estimation method (SEM) are distinguished from those using the GRP standard method.

Table 2-5 summarizes stationary combustion emissions by department, and Figure 2-1 presents the percentage of these emissions by department. The Aviation department is the primary emitter of CO_2e related to stationary combustion, because the Port Authority assumes responsibility for heating large portions of terminal space. Table 2-6 identifies stationary combustion emissions by facility. CAP emissions totals are given by department and facility in Table 2-7 and Table 2-8, respectively. Emissions from natural gas combustion at the Port Authority leased properties in New York have dropped to zero for 2015 through the consolidation of office properties; as a result of this consolidation, the Port Authority is no longer responsible for any natural gas combustion emissions in their leased offices. This usage was responsible for approximately 67 metric tons CO2e in the 2014 emissions inventory.

Table 2-5: 2015 GHG Emissions from Stationary Combustion by Department (metric tons)

Department	CO_2	CH_4	N_2O	CO_2e
Aviation	32,160	3.0925	0.1632	32,275
Central Administration	1,445	0.1308	0.0027	1,449
PATH	2,847	0.2733	0.0075	2,855
Port Commerce	511	0.0462	0.0010	512
Real Estate	116	0.0105	0.0002	116
Tunnels, Bridges, and Bus Terminals	2,732	0.2471	0.0051	2,739
TOTAL	**39,811**	**3.8004**	**0.1798**	**39,946**

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

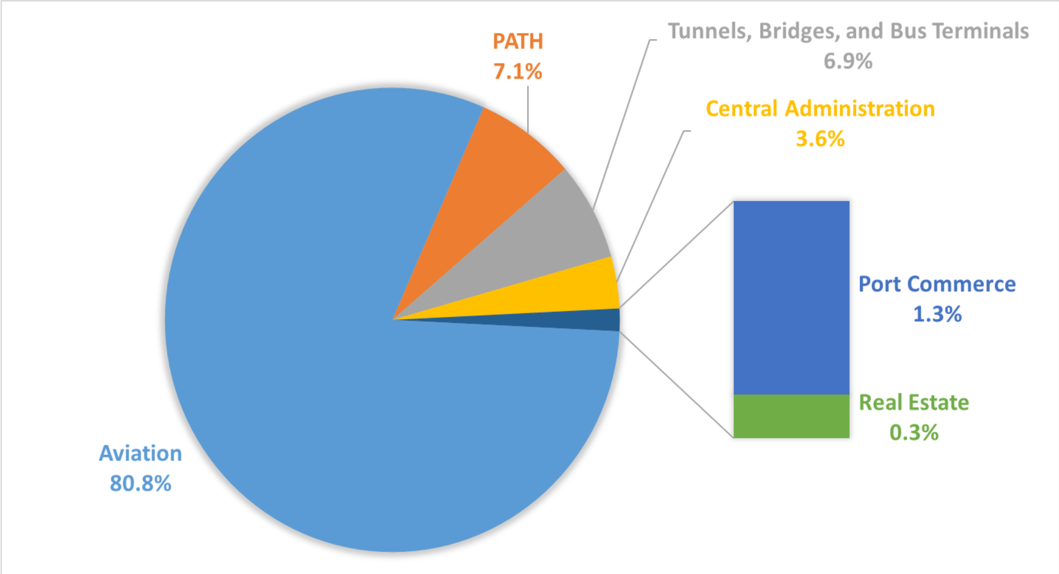

Figure 2-1: 2015 GHG Emissions Distribution from Stationary Combustion by Department

Table 2-6: 2015 GHG Emissions from Stationary Combustion by Facility (metric tons)				
Building/Facility	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
EWR	15,238	1.5121	0.0470	15,284
JFK	11,226	1.0107	0.0980	11,278
LGA	4,637	0.4740	0.0162	4,652
PATH Buildings	2,847	0.2733	0.0075	2,855
PATC	1,202	0.1088	0.0023	1,205
George Washington Bridge	805	0.0729	0.0015	807
George Washington Bridge Bus Station	737	0.0667	0.0014	739
Holland Tunnel	580	0.0525	0.0011	582
SWF	549	0.0496	0.0010	550
TEB	510	0.0461	0.0010	511
PCNJ	318	0.0288	0.0006	319
777 Jersey	243	0.0220	0.0005	244
Outerbridge Crossing	213	0.0192	0.0004	213
Goethals Bridge	165	0.0150	0.0003	166
Brooklyn Marine Terminal	158	0.0143	0.0003	158
Lincoln Tunnel	147	0.0133	0.0003	147
Teleport	116	0.0105	0.0002	116
Bayonne Bridge	49	0.0044	0.0001	49
Port Authority Bus Terminal	36	0.0033	0.0001	36
Howland Hook	35	0.0032	0.0001	35
225 PAS	0	0.0000	0.0000	0
TOTAL	**39,811**	**3.8004**	**0.1798**	**39,946**

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

Table 2-7: 2015 CAP Emissions from Stationary Combustion by Department (metric tons)			
Department	**SO_2**	**NO_x**	**PM**
Aviation	6.6093	27.2273	2.4584
Central Administration	0.0072	1.2047	0.0916
PATH	0.4416	2.3904	0.2086
Port Commerce	0.0026	0.4259	0.0324
Real Estate	0.0006	0.0964	0.0073
Tunnels, Bridges, and Bus Terminals	0.0137	2.2769	0.1730
TOTAL	**7.0750**	**33.6215**	**2.9713**

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

Table 2-8: 2015 CAP Emissions from Stationary Combustion by Facility (metric tons)			
Facility	**SO_2**	**NO_x**	**PM**
EWR	3.7100	12.8479	1.2051
LGA	1.5070	3.9252	0.3917
JFK	1.3870	9.5720	0.7946
PATH Buildings	0.4416	2.3904	0.2086
PATC	0.0060	1.0019	0.0761
George Washington Bridge	0.0040	0.6713	0.0510
George Washington Bridge Bus Station	0.0037	0.6143	0.0467
Holland Tunnel	0.0029	0.4837	0.0368

Table 2-8: 2015 CAP Emissions from Stationary Combustion by Facility (metric tons)			
Facility	**SO_2**	**NO_x**	**PM**
SWF	0.0027	0.4574	0.0348
TEB	0.0025	0.4247	0.0323
PCNJ	0.0016	0.2652	0.0202
777 Jersey	0.0012	0.2028	0.0154
Outerbridge Crossing	0.0011	0.1771	0.0135
Goethals Bridge	0.0008	0.1378	0.0105
Brooklyn Marine Terminal	0.0008	0.1316	0.0100
Lincoln Tunnel	0.0007	0.1221	0.0093
Teleport	0.0006	0.0964	0.0073
Bayonne Bridge	0.0002	0.0405	0.0031
Port Authority Bus Terminal	0.0002	0.0300	0.0023
Howland Hook	0.0002	0.0291	0.0022
225 PAS	0.0000	0.0000	0.0000
TOTAL	**7.0750**	**33.6215**	**2.9713**

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

2.2 EMERGENCY GENERATORS AND FIRE PUMPS

All facilities under Port Authority's operational control have stationary engine generators for use in emergency situations. These emergency generators and fire pumps are typically diesel fired, but the Port Authority does have some gasoline- and natural gas-fired generators.

2.2.1 Activity Data

The Port Authority provided the analysts with Microsoft Excel spreadsheets containing actual annual runtime and/or fuel usage data for emergency generators and fire pumps. Information on typical fuel consumption (in terms of gallons per hour of operation) was determined for the specific engine/generator make and model and used to estimate the total annual fuel consumption for the equipment. Based on these data and using standard emission factors (TCR 2016), and EPA AP-42, Section 3.3, "Gasoline and Diesel Industrial Engines" (EPA 1995), surrogate GHG and CAP emission factors were developed based on each facility's electricity usage [in tons per year of pollutant (TPY) per MWh]. However, actual annual runtime or fuel usage data for emergency generators and fire pumps were not available for all 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 SEM.

2.2.2 Method

Table 2-9 provides the emission factors developed for emergency generators during this exercise.

Table 2-9: Emergency Generator and Fire Pump GHG and CAP Emission Factors		
Pollutant	Emergency Generator (TPY/MWh)	Fire Pump (TPY/MWh)
CO_2	1.41×10^{-3}	7.65×10^{-5}
CH_4	1.89×10^{-7}	1.03×10^{-8}
N_2O	1.13×10^{-8}	6.20×10^{-10}
NO_x	3.83×10^{-5}	2.07×10^{-6}
SO_x	2.48×10^{-6}	1.36×10^{-7}
PM	2.65×10^{-6}	1.45×10^{-7}

2.2.3 Results

Total emergency generator GHG emissions estimates are shown in Table 2-10. Total emergency generator CAP emission estimates are shown in Table 2-11.

Table 2-10: 2015 GHG Emissions from Emergency Generators and Fire Pumps (metric tons)		
Pollutant	Emergency Generators	Fire Pumps
CO_2	714.9	28.8
CH_4	0.0955	0.0039
N_2O	0.0057	0.0002
CO_2e	718.64	28.99

Table 2-11: 2015 CAP Emissions from Emergency Generators (metric tons)		
Pollutant	Emergency Generators	Fire Pumps
NO_x	19.3813	0.7799
SO_x	1.2544	0.0513
PM	1.3417	0.0548

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 2012a). 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 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 SEM,) was ascribed to calendar year 2015.

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 Central Automotive Division (CAD) oversees the procurement and maintenance of on-road vehicles, most non-road vehicles, and some portable equipment. 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, nitrous oxide and CAP emissions. The CAD fleet consumes conventional fuels like gasoline and diesel as well as alternative fuels such as compressed natural gas (CNG), gasoline with an 85 percent ethanol blend (E85), and diesel with a 20 percent biodiesel blend (B20). Table 3-1 summarizes CAD fleet fuel consumption by fuel type in 2015.

Table 3-1: 2015 CAD Fleet Fuel Consumption

Fuel	Consumption	Units
Gasoline (E10)	1,126,268	Gallons
#2 Diesel	19,452	Gallons
Biodiesel (B20)	303,026	Gallons
E85	110,109	Gallons
CNG	50,927	CCF
Propane	1,132	Gallons

3.1.1 Activity Data

For the purpose of fuel tracking, the CAD fleet is divided between the main fleet and a subset of vehicles assigned to specific functions within the Port Authority as shown in Figure 3-1. The main fleet is composed of 3,023 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. The CAD also rents vehicles for various projects on an as-needed basis. There are approximately 250 such vehicles being rented at any given time (Port Authority, 2016e). The fuel consumption from these rental vehicles is also tracked by Sprague and included in all CAD fuel consumption totals.

The Port Authority Office of the Treasury tracks fuel consumption for all the other CAD vehicles by means of branded fuel cards (e.g., Shell Fuel Card). This includes 25 vehicles designated as the executive fleet, 35 security vehicles associated with the Port Authority's Inspector General's office, and two vehicles used in association with training activities in Morris County, New Jersey. The Office of the Treasury maintains a financial record of fuel purchases, so in order to convert expenditures to fuel volume, the 2015 annual average fuel price of $2.52 per gallon for the middle Atlantic region was applied (EIA 2016). This analysis also assumed that 99 percent of fuel consumption was gasoline and the remaining 0.1 percent was diesel based on the actual record for 2012, when information on fuel volume by fuel type was available.

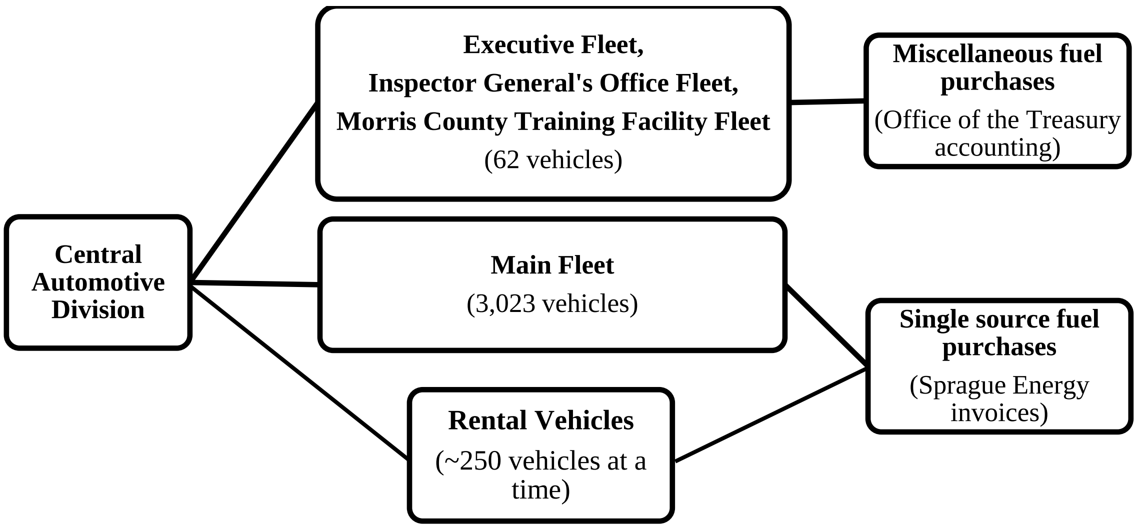

Figure 3-1: Recordkeeping for CAD Fleets

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. CO_2 emissions were estimated by multiplying the fuel use by the appropriate emission factor from GRP Table 13.1 (TCR 2013a). The majority of fuel consumed by Port Authority contains some biofuel (either 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 gallons of E10 × 90 percent fossil fuel by volume × 8.78 kg CO_2/gal = 790.2 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 gallons of E10 × 10 percent ethanol by volume × 5.75 kg CO_2/gal = 57.5 kg CO_2

For all fuel types, CH_4 and N_2O emissions were estimated using SEMs, based on the ratio of CO_2 to CH_4 and N_2O emissions taken from GRP Table 13.9 (TCR 2013a). The emission factors used to calculate the emissions are presented in Table 3-2.

Table 3-2: Standard Emission Factors for the CAD Fleet

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	0.000062	0.000070
#2 Diesel	0%	10.21	9.45	0.000062	0.000070
Biodiesel (B20)	20%	10.21	9.45	0.000062	0.000070
E85	85%	8.78	5.75	0.000062	0.000070
CNG	0%	5.4	0	0.000062	0.000070
Propane	0%	5.59	0	0.000062	0.000070

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 corresponds 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 for the CAD Fleet

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 (MOVES 2014a) (EPA 2014a). These emission factors are expressed in units of grams per mile based on model year and vehicle type for the 2015 inventory. CAP emissions from diesel vehicles were assumed to come from B20 fuel, because that is the primary diesel fuel used at Port Authority. Similarly, CAP emissions from vehicles using E10 fuel were assumed to be the same as for gasoline vehicles. Flex Fueled vehicles were assumed to be burning E85. These emission factors were then multiplied by the 2015 estimates of mileage per vehicle provided by the CAD to obtain CAP emissions. There was no mileage data available for the rental vehicles that CAD uses. Since these vehicles are primarily light duty pickups, the average VMT from CAD pickup trucks (6,841 miles in 2015) was used as a stand-in. This VMT is then multiplied by the number of rental vehicles (approximately 250) and the MOVES 2014 emissions factor for a 2015 light duty pickup truck to estimate CAP emissions from rental vehicles.

There were many cases in which highway vehicles reported zero fuel consumption but had significant mileage recorded for the vehicle. In these cases, the MOVES 2014 per mile emission factors for that model year and vehicle type were multiplied by the vehicle's annual mileage driven to estimate CAP emissions.

Non-highway CAP emissions were calculated by multiplying total fuel consumption by the national average emission factors from EPA's MARKet ALlocation (MARKAL) model database (Pechan 2010).

CAP emissions for bulk CNG and propane were estimated by multiplying total fuel consumption by the appropriate MARKAL emission factors.

The CAP estimates for the executive fleet and the security and training vehicles were based on the per-gallon emission factors from EPA's MARKAL database (Pechan 2010), because no information on mileage per vehicle was available.

3.1.3 Results

Table 3-4 presents GHG emission estimates for CAD's main fleet by fuel type. Table 3-5 shows the emissions by fuel type from the executive fleet, security and training vehicles (i.e., Non-Main Fleet), tracked by the Office of the Treasury. Biogenic emissions from the main fleet, executive fleet, security and training vehicles totaled 1,775 tCO2e in 2015.

Table 3-4: 2015 GHG Emissions for Main Fleet Vehicles (metric tons)

Fuel Type	CO_2	Biogenic CO_2	CH_4	N_2O
Gasoline (E10)	8,899.8	647.6	5.9E-01	6.7E-01
#2 Diesel	198.6	0.0	1.2E-02	1.4E-02
Biodiesel (B20)	2,475.1	572.7	1.9E-01	2.1E-01
E85	145.0	538.2	4.3E-02	4.8E-02
CNG	275.0	0.0	1.7E-02	1.9E-02
Propane	6.3	0.0	3.9E-04	4.4E-04
TOTAL	**11,999.8**	**1,758.5**	**8.6E-01**	**9.6E-01**

Table 3-5: 2015 GHG Emissions for Non-Main Fleet Vehicles (metric tons)				
Department	**CO_2**	**Biogenic CO_2**	**CH_4**	**N_2O**
Gasoline (E10)	229.0	16.7	0.015	0.017
#2 Diesel	0.3	0	<0.001	<0.001
TOTAL	**229.3**	**16.7**	**0.015**	**0.017**

Table 3-6 summarizes anthropogenic GHG emission for the entire CAD fleet by selected calculation methodology; note CO_2 emissions use a standard method, while the CH_4 and N_2O emissions use SEMs.

Table 3-6: 2015 GHG Emissions for the CAD Fleet by Method (metric tons)				
Emission Method	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Standard Method	12,000	0.0	0.0	12,000
SEM	229	0.9	1.0	550
TOTAL	**12,229**	**1**	**1**	**12,550**

Table 3-7 shows the CAP emission estimates for the entire CAD fleet. Note that vehicles labeled "Zero Fuel Recorded" refers to a subset of highway and non-highway vehicles for which emissions were estimated based on mileage information.

Table 3-7: 2015 CAP Emissions for the CAD Fleet (metric tons)				
Vehicle Type	**SO_x**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
Highway Vehicles	0.11	5.17	0.45	1.70
Non-highway Vehicles	0.00	2.81	0.06	0.06
Zero Fuel Recorded	0.03	3.91	0.25	0.61
Bulk CNG	0.01	3.21	0.05	0.05
Propane	0.00	0.06	0.00	0.00
Rental Fleet	0.02	0.10	0.03	0.18
Executive/Security Fleet	0.08	1.32	0.34	0.37
TOTAL	**0.25**	**16.58**	**1.17**	**2.96**

3.2 PATH DIESEL EQUIPMENT

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

3.2.1 Activity Data

PATH non-road and portable equipment burns diesel fuel exclusively. Annual fuel consumption is tracked for each individual piece of equipment. This information serves as the activity data for GHG and CAP emission assessments. For the 2015 inventory, diesel fuel consumption was provided by Port Authority (Port Authority, 2016f).

3.2.2 Method

CO_2 emission estimates are calculated based on the gallons of diesel fuel multiplied by the appropriate emission factor from GRP Table 13.1 (TCR 2016). CH_4 and N_2O emission estimates are calculated based on the per-gallon diesel emission factor for non-highway equipment, from GRP Tables 13.7 and 13.8, respectively (TCR 2013a).

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

3.2.3 Results

Total GHG emissions for PATH diesel equipment are shown in Table 3-8.

Table 3-8: 2015 GHG Emissions from PATH Diesel Equipment (metric tons)			
CO_2	**CH_4**	**N_2O**	**CO_2e**
457.8	0.026	0.012	462.0

Table 3-9 shows CAP emissions for PATH non-road vehicles and portable equipment.

Table 3-9: 2015 CAP Emissions from PATH Diesel Equipment (metric tons)			
SO_x	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
0.007	0.53	0.04	0.04

4.0 FUGITIVE EMISSIONS (SCOPE 1)

Fugitive emissions are intentional and unintentional releases of GHGs that are not the result of fossil fuel combustion. Equipment or activities responsible for fugitive emissions controlled by the Port Authority are included in this inventory as scope 1. Such sources include the use of substitutes for ozone-depleting substances (ODSs), generally found in refrigerants and fire suppressants, as well as biogas gas emanating from a closed landfill.

4.1 USE OF REFRIGERANTS

Emissions of HFCs and PFCs from stationary and mobile AC equipment result from the fugitive release over the operational life of the equipment. While common refrigerants, such as R-22, R-12, and R-11 [i.e., hydrochlorofluorocarbons (HCFCs) or chlorofluorocarbons (CFCs)], have a climate forcing effect, they are not required to be reported to TCR because production of HCFCs and CFCs is already being phased out under the Montreal Protocol.

4.1.1 Method

The 2015 approach for estimating refrigerant fugitive emissions is consistent with previous years' assessments, and follows the decision tree shown in Figure 4-1. The 2015 inventory has taken a significant step forward in getting survey information wherever possible, and thus all emission estimates were developed using method options 2.

A brief description of each of the method options follows.

<u>Option 1</u>

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.

<u>Option 2</u>

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. This method is incorporated into the GRP as an approved SEM (TCR 2013a).

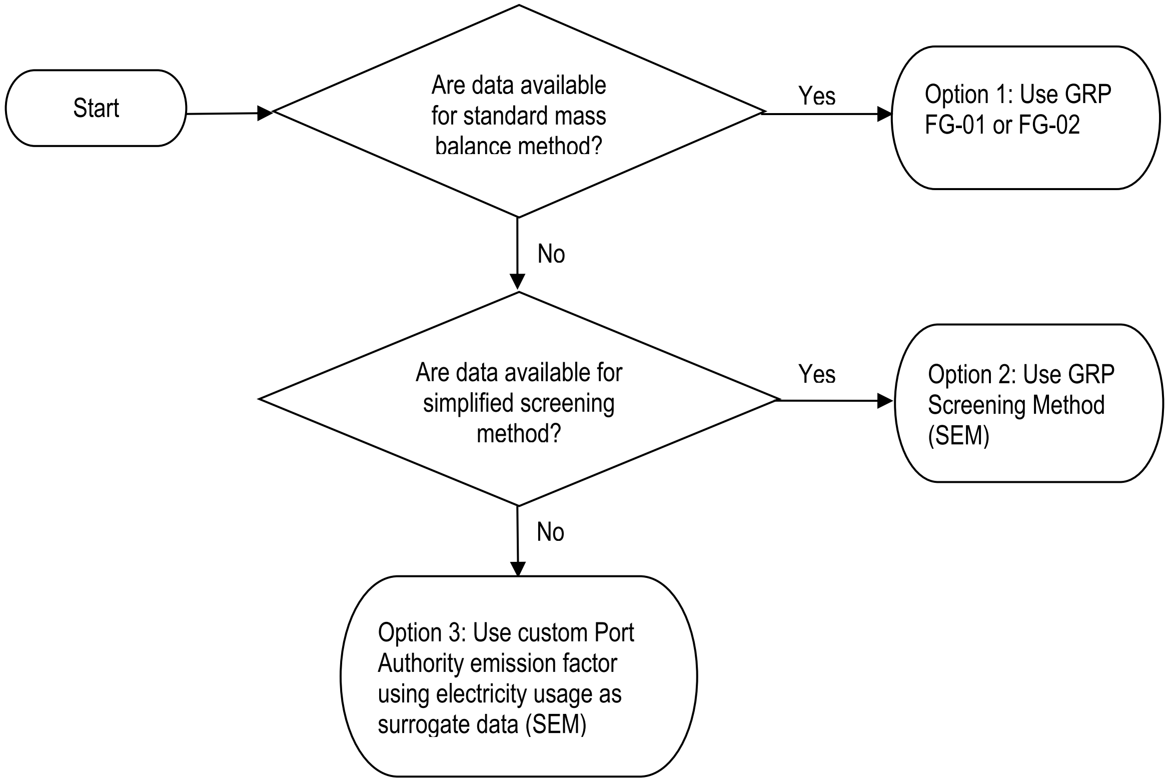

Figure 4-1: Selection of Method to Quantify Fugitive Emissions from AC Equipment

Option 3

In the absence of data for application of the simplified method, refrigerant emissions are estimated using an emissions metric expressed as the mass of refrigerant in terms of CO_2e per unit of electricity consumption. For example, the average emissions metric for Port Authority airports was determined as the average ratio of refrigerant emissions to electricity purchases at SWF and EWR. Emission estimates developed using this option are categorized as SEMs (TCR 2013a, p. 128).

4.1.2 Results

GHG emission estimates for refrigerants used by the Port Authority during 2015 are shown in Table 4-1. This table excludes non-reportable HCFCs and CFCs, such as R-22. Shaded cells refer to facilities for which air conditioning systems were surveyed and found not to contain any GHGs.

Table 4-1: 2015 Refrigerant Emissions by Facility and Reportable GHG (metric tons CO_2e)							
Facility Description	**HFC-134a**	**HFC-227ea**	**R-134A**	**R-404A**	**R-407C**	**R-410A**	**Total**
Central Automotive					258.6		258.6
JFK Airport							
LaGuardia Airport			6.7			0.6	7.3
Stewart Airport	2.3					1.7	4.1
Newark Airport	859.8	140.3					1,000.0
Teterboro Airport	0.1					3.9	4.0
Brooklyn Cruise Terminal							
Brooklyn Marine Terminal						2.4	2.4
Howland Hook/Port Ivory						2.4	2.4
Port Elizabeth Marine Terminal						1.5	1.5
Port Jersey			<0.1			1.8	1.8
Port Newark Marine Terminal	0.1			0.3		3.1	3.6
George Washington Bridge	0.1			0.9		2.1	3.1
Holland Tunnel	<0.1	<0.1					<0.1
Lincoln Tunnel	0.1						0.1
Staten Island Bridges							
GW Bridge Bus Station	<0.1			1.3		2.5	3.8
Port Authority Bus Terminal	1.4						1.4
AirTrain JFK						3.9	3.9
AirTrain Newark					22.9		22.9
PATH Trains					1,043.9		1,043.9
PATH Buildings	284.4						284.4
Bathgate Industrial Park							
The Teleport							
TOTAL	**1,148.3**	**140.3**	**6.7**	**2.6**	**1,325.4**	**26.0**	**2,649.2**

4.2 USE OF FIRE SUPPRESSANTS

The first step for quantifying potential emissions from fire suppressants was to identify the set of facilities that use potentially reportable GHGs as fire suppressants. 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. According to the GRP (TCR 2013a), FM-200 fire suppression systems in communication rooms for the transit sector may be disclosed as excluded minuscule sources without the need to quantify actual fire suppressant releases. Facility use of latent GHGs in fire protection equipment is summarized in **Error! Reference source not found.**2.

Table 4-2: Fire Protection Equipment by Facility and Suppressant Type				
Facility Description	**Type of Fire Suppressant**			
	CO_2	**FM-200**	**No GHG**	**Unknown**
JFK			X	
LGA		X		
SWF	X		X	
EWR		X		
TEB			X	
Brooklyn Cruise Terminal			X	
Brooklyn Marine Terminal (Red Hook/Brooklyn Piers)			X	
Howland Hook Marine Terminal			X	
Elizabeth Port Authority Marine Terminal			X	
Port Jersey			X	
Port Newark Marine Terminal			X	
George Washington Bridge		X		
Holland Tunnel		X		
Lincoln Tunnel		X	X	
Staten Island Bridges		X		
George Washington Bridge Bus Station				X
PABT			X	
PATH Buildings	X	X	X	
Bathgate Industrial Park			X	
The Teleport			X	

Fire protection systems charged with reportable ODS substitutes often service areas with specialized equipment such as high-value electronics, including server and communication rooms. The Port Authority indicated that in 2015 there were small fire suppressant releases totaling 261 kilograms of CO_2.

4.3 HISTORIC ELIZABETH LANDFILL

The Port Authority property known as "Port Elizabeth" in Elizabeth, New Jersey, is part of the Port Commerce 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" (TCAP 2010, 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 prescribed by TCR (TCR 2013a). A similar model, EPA's Landfill Gas Emissions Model (LandGEM) (EPA 2005), was used to estimate VOC emissions. 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.[2] Thus, waste emplaced was estimated to be on the order of 1.38 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 Management," as prescribed by TCR (TCR 2010). The project team used the default values from the model for the percentage of waste that is anaerobically degradable organic carbon, as no specific information was available on the waste disposal rates. The model was also run 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. CO_2 emissions that are calculated by the model are reported in **Error! Reference source not found.**3, but they are classified as biogenic and not included in the CO_2e emissions total for the site.

4.3.3 Results

The 2015 GHG emission estimates for the historic Elizabeth Landfill are shown in **Error! Reference source not found.**3. The GHG emission estimates are just for the landfill portion that is under the operational control of the Port Authority. In addition to GHG emissions, the historic Elizabeth Landfill also emits VOCs, a precursor to CAPs. In 2015, the historic Elizabeth Landfill emitted 0.742 metric tons of VOCs.

Table 4-3: 2015 GHG Emissions from the Historic Elizabeth Landfill

Biogenic CO_2 (metric tons)	CH_4 (metric tons)	CH_4 (metric tons CO_2e)
590	176	3,695

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

5.0 PURCHASED ELECTRICITY (SCOPE 2)

Table 5-1 lists indirect emissions from electricity purchases to serve Port Authority operations by department and facility, including buildings and the PATH rail system.

Table 5-1: Port Authority Electricity Consumptions by Facility	
Facility	**Consumption (MWh)**
115 Broadway	390.6
116 Nassau St	179.3
225 PAS	1,115.5
233 PAS	361.0
4 World Trade Center	3,263.1
777 Jersey	1,498.2
96 Broadway	726.9
Bathgate Industrial Park	102.0
Bayonne Bridge	588.3
Brooklyn Marine Terminal	460.5
EWR	80,198.1
Gateway Newark	775.3
George Washington Bridge	5,623.3
George Washington Bridge Bus Station[3]	2,150.4
Goethals Bridge	2,278.1
Holland Tunnel	11,076.2
Howland Hook	221.1
JFK	73,162.6
LGA	43,947.8
Lincoln Tunnel	19,141.8
Outerbridge Crossing	1,329.1
PATC	12,149.1
PATH Buildings	16,998.9
PATH Rail System	99,218.0
PCNJ	15,465.5
Port Authority Bus Terminal	26,473.8
SWF	3,941.8
TEB	2,639.2
Teleport	4,100.9
TOTAL	**429,576.2**

[3] In EY2015, electricity consumption reflects facility restoration activities at George Washington Bridge Bus Station and was not representative of regular operations.

5.1 BUILDINGS

This section considers all buildings where electricity was consumed by the Port Authority. For a total of five facilities (JFK, LGA, SWF, PABT, and Teleport), total electricity consumption was shared by the Port Authority and its tenants; therefore, the total electricity consumption was split between the Port Authority and the tenant. For facilities where total dollars spent on electricity through lease agreements were not available, consumption was divided based on each consumer's share of square footage. All GHGs associated with the consumption of electricity in common areas maintained or provided as a service to the tenant by the Port Authority, such as street lights and lobby cooling, are considered scope 2 emissions for the Port Authority. All GHGs associated with the consumption of electricity by tenants are considered scope 3 emissions for the Port Authority.

5.1.1 Activity Data

The Port Authority provided data on electricity consumption by month for each facility in kilowatt hours (kWh). It transcribed some of the data directly from the utility's website into a Microsoft Excel workbook and provided additional data in the form of bill copies from the utility or landlord. In some cases, data were not immediately available, so the analysts downloaded data from the provider's website in the form of screen shots converted to PDF or transcribed data from the website into an Excel workbook.

5.1.2 Method

The GHG emission factors used to estimate the GHGs associated with electricity consumption are shown in Table 5-2.

Table 5-2: Electricity Consumption GHG Emission Factors

Emissions & Generation Resource Integrated Database (eGRID) 2012 Subregion/Provider	CO_2 (kg/kWh)	CH_4 (kg/kWh)	N_2O (kg/kWh)
NYCW (NPCC NYC/Westchester)	0.316	1.16×10^{-5}	1.33×10^{-6}
NYUP (NPCC Upstate NY)	0.185	7.07×10^{-6}	1.74×10^{-6}
RFCE (RFC East)	0.389	1.20×10^{-5}	5.21×10^{-6}
KIAC Facility (Kennedy International Airport Cogeneration)	0.419	3.00×10^{-5}	7.50×10^{-6}

For facilities located in New York, the emission factors for the Northeast Power Coordinating Council (NPCC) – New York City (NYC)/Westchester eGRID subregion were used (with one exception: SWF is in the NPCC – Upstate New York eGRID subregion). For facilities located in New Jersey, the emission factors for the Reliable First Corporation East subregion were used. These emission factors were extracted from the "2016 Climate Registry Default Emission Factors" (TCR 2016), and the boundaries were determined using the eGRID subregion map (EPA 2010a).

The eGRID emission factors include operational data such as emissions, different types of emission rates, generation, resource mix, and heat input within a specific region. For example, within NPCC – NYC/Westchester, 48 percent of electricity is generated from natural gas combustion and 29 percent is generated through nuclear means, with the balance from coal, oil and biomass combustion. In Reliable First Corporation East, 49 percent of electricity is generated from coal combustion and 28 percent through nuclear means, with the balance from oil, biomass, and hydro power (EPA 2015a). Because more GHGs are associated with coal combustion than with natural gas combustion, the emission factors in the Reliable First Corporation East subregion are higher than those in NPCC – NYC/Westchester.

The electricity GHG and PM emission factors for KIAC were determined as described in Section 7.1. The resulting KIAC electricity emission factors are presented in Table 5-2 for GHGs and Table 5-3 for CAPs. Note that electricity purchases from KIAC are limited to two service locations: JFK and AirTrain JFK.

For CAP emission factors associated with eGRID regions, SO_2 and NO_x emission factors were obtained from the EPA eGRID for each subregion (EPA 2015a). Emission factors for PM were calculated in proportion to the SO_2 emissions based on values derived from the 2011 EPA National Emissions Inventory (EPA 2013a). This is a valid approach because the electricity comes from a variety of power plant sources, and the major factor that contributes to the difference in PM emissions is the control device(s) used. In order 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}. These proportions were different because the percentage of plant types is different in the two states. 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 shows the CAP emission factors used for the 2014 electricity emission estimates.

Table 5-3: Electricity Consumption CAP Emission Factors (kg/kWh)				
eGRID 2012 Subregion/Provider	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
NPCC NYC/Westchester	2.91×10^{-5}	1.51×10^{-4}	3.21×10^{-6}	4.29×10^{-6}
NPCC Upstate NY	2.95×10^{-4}	1.25×10^{-4}	3.07×10^{-5}	4.10×10^{-5}
Reliable First Corporation East	6.40×10^{-4}	3.62×10^{-4}	8.20×10^{-4}	8.55×10^{-4}
KIAC	6.02×10^{-6}	8.37×10^{-5}	6.61×10^{-5}	6.61×10^{-5}

5.1.3 Results

Emission estimates were developed in accordance with GRP Chapter 14, “Indirect Emissions from Electricity” (TCR 2013a). In a small number of cases, when electricity consumption measurements were not available, engineering estimates were developed. For example, if no records existed for a given month, the electricity consumption was estimated by assigning the seasonal maximum. Additionally, if no records existed for a period of several months, electricity consumption was estimated using historical data from 2012 through 2014. In accordance with GRP guidelines, emissions developed from engineering calculations are reported separately as SEM for TCR reporting purposes. Emissions in 2015 associated with Real Estate and Leased Facilities has decreased relative to previous years as a result of the consolidation of Port Authority properties. Table 5-4 summarizes GHG emission from purchased electricity in buildings.

Table 5-4: 2015 GHG Emissions from Electricity Consumption in Buildings by Department (metric tons)				
Department	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Aviation	77,539	3.72	1.05	77,941
Central Administration	6,493	0.21	0.08	6,522
PATH	6,620	0.20	0.09	6,652
Port Commerce	6,238	0.19	0.08	6,268
Real Estate	2,359	0.09	0.01	2,364
Tunnels, Bridges, and Bus Terminals	23,320	0.80	0.18	23,392
TOTAL	**122,569**	**5.22**	**1.48**	**123,138**

The distribution of indirect emissions from purchased electricity is shown in Figure 5-1. Aviation is the department with the largest share of CO_2e emissions from electricity consumption. This is primarily due to the electricity demand associated with the operation of common areas at its terminals.

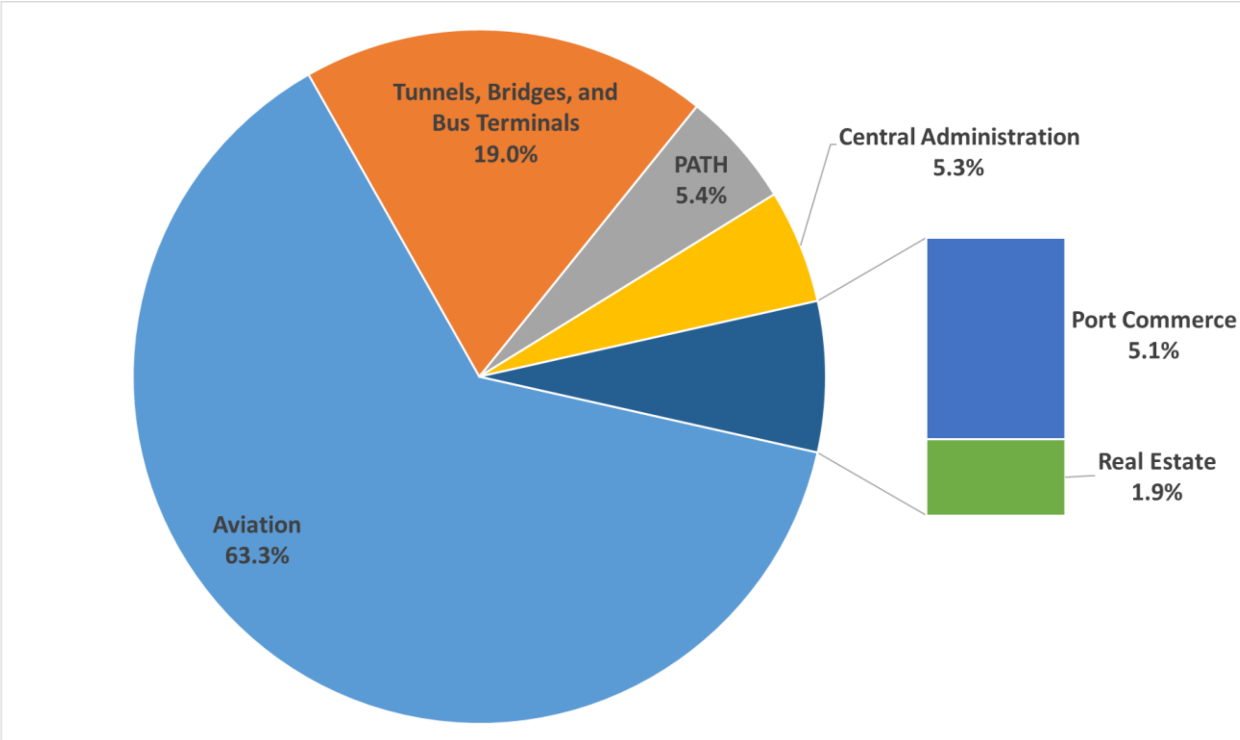

Figure 5-1. 2015 CO_2e Emissions from Electricity Consumption by Department

Table 5-5 shows GHG emission estimates by facility. Electricity consumed in New Jersey has higher emission factors, due to the specific fuel mix used to generate the electricity. This results in higher levels of CO_2e when compared to a similar quantity of electricity consumed in New York. CAP emission totals are presented by department and by facility in Table 5-6 and Table 5-7, respectively.

Table 5-5: 2015 GHG Emissions from Electricity Consumption in Buildings by Facility (metric tons)				
Facility	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
EWR	31,232	0.9618	0.4180	31,382
JFK	30,660	2.1933	0.5484	30,876
LGA	13,888	0.5085	0.0584	13,917
Port Authority Bus Terminal	8,366	0.3063	0.0352	8,384
Lincoln Tunnel	6,826	0.2260	0.0665	6,852
PATH Buildings	6,620	0.2039	0.0886	6,652
PCNJ	6,023	0.1855	0.0806	6,052
PATC	4,731	0.1457	0.0633	4,754
Holland Tunnel	3,893	0.1304	0.0355	3,906
George Washington Bridge	2,189	0.0674	0.0292	2,199
Teleport	1,296	0.0475	0.0055	1,299
4 World Trade Center	1,031	0.0378	0.0043	1,033
TEB	1,028	0.0317	0.0138	1,033
Goethals Bridge	744	0.0265	0.0043	746
SWF	731	0.0279	0.0068	734
George Washington Bridge Bus Station[4]	680	0.0249	0.0029	681
777 Jersey	583	0.0180	0.0078	586
Outerbridge Crossing	435	0.0155	0.0025	436
225 PAS	353	0.0129	0.0015	353
Gateway Newark	302	0.0093	0.0040	303
96 Broadway	230	0.0084	0.0010	230
Bayonne Bridge	188	0.0068	0.0009	188
Brooklyn Marine Terminal	146	0.0053	0.0006	146
115 Broadway	123	0.0045	0.0005	124
233 PAS	114	0.0042	0.0005	114
Howland Hook	70	0.0026	0.0003	70
116 Nassau St	57	0.0021	0.0002	57
Bathgate Industrial Park	32	0.0012	0.0001	32
TOTAL	**122,569**	**5.2156**	**1.4813**	**123,138**

Table 5-6: 2015 CAP Emissions for Electricity Consumption in Buildings by Department (metric tons)				
Department	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
Aviation	55.886	43.244	25.810	26.762
Central Administration	9.309	5.640	3.628	3.786
PATH	10.876	6.153	4.269	4.453
Port Commerce	9.916	5.701	3.886	4.054
Real Estate	0.217	1.129	0.015	0.020
Tunnels, Bridges, and Bus Terminals	15.488	15.036	5.641	5.911
TOTAL	**101.692**	**76.903**	**43.249**	**44.986**

[4] In EY2015, GHG emissions reflect facility restoration activities at George Washington Bridge Bus Station and were not representative of regular operations.

Table 5-7: 2015 CAP Emissions for Electricity Consumption in Buildings by Facility (metric tons)				
Facility	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
EWR	51.317	29.029	20.143	21.011
PATH Buildings	10.876	6.153	4.269	4.453
PCNJ	9.896	5.598	3.884	4.052
PATC	7.774	4.398	3.051	3.183
Lincoln Tunnel	7.023	5.126	2.676	2.797
George Washington Bridge	3.589	2.032	1.409	1.469
Holland Tunnel	3.586	2.801	1.353	1.415
TEB	1.689	0.955	0.663	0.691
LGA	1.278	6.644	0.088	0.117
SWF	1.162	0.493	0.080	0.107
777 Jersey	0.959	0.542	0.376	0.393
Port Authority Bus Terminal	0.770	4.002	0.053	0.071
Gateway Newark	0.496	0.281	0.195	0.203
JFK	0.441	6.122	4.836	4.836
Goethals Bridge	0.266	0.413	0.086	0.091
Outerbridge Crossing	0.160	0.243	0.052	0.055
Teleport	0.119	0.620	0.008	0.011
4 World Trade Center	0.095	0.493	0.007	0.009
George Washington Bridge Bus Station[5]	0.063	0.325	0.004	0.006
225 PAS	0.032	0.169	0.002	0.003
Bayonne Bridge	0.032	0.094	0.007	0.008
96 Broadway	0.021	0.110	0.001	0.002
Brooklyn Marine Terminal	0.013	0.070	0.001	0.001
115 Broadway	0.011	0.059	0.001	0.001
233 PAS	0.010	0.055	0.001	0.001
Howland Hook	0.006	0.033	0.000	0.001
116 Nassau St	0.005	0.027	0.000	0.000
TOTAL	**101.692**	**76.903**	**43.249**	**44.986**

5.2 RAIL SYSTEMS

The Port Authority owns three rail systems: PATH, AirTrain JFK, and AirTrain Newark. While the Port Authority maintains operational control of PATH, the AirTrain systems are operated by Bombardier Transportation. This section describes how PATH emissions were assessed. Section 11.2 discusses the emission assessment for the AirTrain systems.

[5] In EY2015, CAP emissions reflect facility restoration activities at George Washington Bridge Bus Station and were not representative of regular operations.

5.2.1 Activity Data

For electricity consumption for the PATH, the Port Authority provided consumption data by month for each building in kWh. It transcribed some of the data directly from the utility's website into a Microsoft Excel workbook and provided additional data in the form of copies of bills from the utility. In some cases, data were not immediately available, so the analysts downloaded data from the provider's website in the form of screen shots converted to PDF or transcribed data from the website into an Excel workbook.

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" (TCR 2013a). The GHG emission factors used to calculate the GHGs associated with electricity consumption are shown in Table 5-2. For the PATH Rail System, the emission factors for the Reliable First Corporation East subregion were applied.

5.2.3 Results

GHG emission estimates were developed from records of electricity consumption (i.e., utility statements). Table 5-8 provides specific quantities of GHG emissions associated with PATH rail system electricity usage. CAP emission estimates are given in Table 5-9.

Table 5-8: 2015 GHG Emissions from Electricity Consumption by PATH (metric tons)

Train	CO_2	CH_4	N_2O	CO_2e
PATH Rail System	38,639.07	1.1899	0.5171	38,824

Table 5-9: 2015 CAP Emissions from Electricity Consumption by PATH (metric tons)

Train	SO_2	NO_x	$PM_{2.5}$	PM_{10}
PATH Rail System	63.4879	35.9136	24.9207	25.9943

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

This chapter discusses emissions associated with energy purchases or acquisitions in the form of steam, heating, and cooling from the KIAC facility and Con Edison. Emissions associated with purchased steam, heating, and cooling are considered to be indirect, or scope 2, emissions.

6.1 JFK

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 TCR's definition of the operational control inventory 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.

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 for GHGs and Table 6-2 for CAPs.

Table 6-1: 2015 KIAC GHG Emission Factors

Product	CO_2	CH_4	N_2O
Heating (kg/MMBtu)	62.27	4.50×10^{-3}	1.10×10^{-3}
Cooling (kg/MMBtu)	62.27	4.50×10^{-3}	1.10×10^{-3}

Table 6-2: 2015 KIAC CAP Emission Factors

Product	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Heating (kg/MMBtu)	9.00×10^{-4}	1.24×10^{-2}	9.80×10^{-3}	9.80×10^{-3}
Cooling (kg/MMBtu)	9.00×10^{-4}	1.24×10^{-2}	9.80×10^{-3}	9.80×10^{-3}

6.1.3 Results

Table 6-3 provides GHG emission estimates for the heating and cooling purchased from KIAC by the Port Authority to service JFK. Table 6-4 presents CAP emission estimates.

Table 6-3: 2015 GHG Emissions from KIAC Energy Purchases (metric tons)				
Energy Use	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
JFK Heating	2,686.68	0.1922	0.0481	2,706
JFK Cooling	5,579.61	0.3992	0.0998	5,619
TOTAL	**8,266.29**	**0.5914**	**0.1479**	**8,325**

Table 6-4: 2015 CAP Emissions from KIAC Energy Purchases (metric tons)				
Energy Use	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
JFK Heating	0.0386	0.5364	0.4238	0.4238
JFK Cooling	0.0801	1.1140	0.8801	0.8801
TOTAL	**0.1187**	**1.6504**	**1.3039**	**1.3039**

6.2 PORT AUTHORITY BUS TERMINAL

The PABT reported steam usage for heating in 2015. Scope 2 indirect emissions for this heating were calculated by assuming a total generation and delivery efficiency of 75 percent, in accordance with the GRP (TCR 2013a). The steam was assumed to be generated by natural gas combustion with an energy content of 1,026 Btu per standard cubic foot, and by fuel oil with an energy content of 0.140 MMBTU per gallon.

6.2.1 Activity Data

For steam, the Port Authority provided consumption data by month in thousands of pounds. The Port Authority transcribed some of the data from the Con Edison website into a Microsoft Excel workbook. For data that were not immediately available, the analysts transcribed the data from the Con Edison website into an Excel workbook.

6.2.2 Method

Because the emission factors for the purchased steam were not available from Con Edison, they had to be estimated indirectly based on boiler efficiency, fuel mix, and fuel-specific emission factors in accordance with GRP Chapter 15, “Indirect Emissions from Imported Steam, District Heating, Cooling, and Electricity from a CHP Plant” (TCR 2013a). The steam purchased from Con Edison was generated by burning natural gas, and the project team assumed that the total efficiency factor was 93 percent. The emission factors for purchased steam are listed in Table 6-5.

Table 6-5: Con Edison GHG and CAP Emission Factors						
GHG/CAP	**CO_2**	**CH_4**	**N_2O**	**SO_2**	**NO_x**	**PM**
Emission Factor (kg/thousand pounds of steam)	81.76	9.08×10^{-3}	3.85×10^{-4}	6.54×10^{-4}	6.47×10^{-2}	7.80×10^{-3}

6.2.3 Results

Because the GHG emission estimates related to purchased steam were derived from data obtained from copies of bills, no simplified methods were necessary for calculation. Table 6-6 provides specific quantities of GHG emissions associated with purchased steam for the PABT. CAP emission totals of purchased steam for PABT are given in Table 6-7.

Table 6-6: 2015 PABT GHG Emissions from Con Edison Steam Purchases (metric tons)				
Building	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
PABT	5,870	0.6519	0.0276	5,892

Table 6-7: 2015 PABT CAP Emissions from Con Edison Steam Purchases (metric tons)				
Building	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
PABT	0.0470	4.6472	0.2766	0.2835

7.0 ENERGY PRODUCTION (SCOPE 3)

The Port Authority inventory program requires that scope 3 emissions be assessed periodically. An account of scope 3 emission estimates by year of assessment is provided as supplemental information in Appendix A.

Emissions from energy production were assessed as part of the EY2015 inventory effort. Sources included in the energy production Chapter include the Kennedy International Airport Cogeneration (KIAC) facility located in Queens County, New York, and the Essex County Resource Recovery (ECRR) facility located in Essex County, New Jersey.

7.1 KENNEDY INTERNATIONAL AIRPORT COGENERATION

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 2014b).

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 tenant, and downstream consumers of KIAC electricity.

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 on natural gas and jet “A” fuel. 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 2016).

7.1.2 Method

This analysis used a fuel-based methodology, whereby the natural gas and jet “A” fuel input was 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 not estimates but rather obtained from environmental compliance public records (EPA 2016).

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 2016, Table 12.1
CH_4	3.8	g/MMBtu	TCR 2016, Table 12.5
N_2O	0.95	g/MMBtu	TCR 2016, Table 12.5
$PM_{2.5}$	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 2016, Table 12.1
CH_4	0.9	g/MMBtu	TCR 2016, Table 12.5
N_2O	0.4	g/MMBtu	TCR 2016, Table 12.5
$PM_{2.5}$	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 Figure 7-1) 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 2013a.

Figure 7-1: Distributed Emissions Methodology

Table 7-3: 2015 KIAC Electricity and Thermal Emission Factors by Pollutant							
Useful Energy Type	**CO_2**	**CH_4**	**N_2O**	**NO_x**	**SO_2**	**$PM_{2.5}$**	**PM_{10}**
Heating (kg Pollutant/MMBtu	62.27	0.0045	0.0011	0.0124	0.0009	0.0098	0.0098
Cooling (kg Pollutant/MMBtu	62.27	0.0045	0.0011	0.0124	0.0009	0.0098	0.0098
Electricity (kg Pollutant/MWh)	419.08	0.0300	0.0075	0.0837	0.0060	0.0661	0.0661

7.1.4 Results

KIAC facility GHG emissions are presented in Table 7-4, and CAP emissions are summarized in Table 7-5. KIAC production emissions distributed by energy stream and end-user are presented in Table 7-6.

Table 7-4: 2015 KIAC Production GHG Emissions Summary (metric tons)			
CO_2	**CH_4**	**N_2O**	**CO_2e**
337,186	24.12	6.03	339,563

Table 7-5: 2015 KIAC CAP Emissions Summary (metric tons)			
NO_x	**SO_2**	**$PM_{2.5}$**	**PM_{10}**
67.32	4.84	53.19	53.19

Table 7-6: 2015 KIAC GHG and CAP Emissions Summary by End-User (metric tons)		
End-User	**Emission Category**	**CO_2e**
Port Authority	Purchased Electricity	30,873
	Purchased Cooling	5,619
	Purchased Heating	2,706
Tenants	Purchased Electricity	124,407
	Purchased Cooling	13,923
	Purchased Heating	9,056
Customers	Energy Production (electricity sold to market)	152,980
TOTAL		**339,563**

7.2 ESSEX COUNTY RESOURCE RECOVERY FACILITY

The Essex County Resource Recovery (ECRR) facility demonstrates the Port Authority's long-standing commitment to identifying and pursuing environmentally sound, economical solutions to the New York/New Jersey region's waste disposal needs. The facility, New Jersey's largest waste-to-energy plant, serves the refuse disposal needs of 22 municipalities in Essex County and the surrounding region.

Initially a joint undertaking of the Port Authority, Essex County and American Ref-Fuel Company of Essex County, Essex County Resource Recovery currently is operated by Covanta Energy under a long-term lease with the Port Authority. Using proven mass-burning technology, the plant processes about 2,750 tons of municipal solid waste (MSW) per day. Each year, the plant generates approximately 500 million kilowatts of electricity - enough electricity to operate the plant and 45,000 homes. The electrical energy recovered by the plant is sold on the open market.

Located in an industrially zoned area of Newark, the Essex County Resource Recovery facility consists of three mass-fired boilers with two turbine generators. Using technology developed by a leading German firm, high-temperature combustion destroys most pollutants. Additional control devices then limit further NOx, mercury, acid gasses and particulate emissions. The plant operates 24 hours a day, seven days per week, under strict environmental standards. It employs approximately 86 people.

The ECRR generates GHG and CAP emissions resulting from the combustion of MSW as the primary source of energy for electricity generation, and diesel fuel combustion as an auxiliary energy source. This emissions assessment excludes emissions associated with hauling and tipping of MSW.

7.2.1 Method

The ECRR facility is subject to mandatory reporting of GHG and CAP emissions. For that reason, emissions for the ECRR facility were compiled from public sources.

Under EPA's Greenhouse Gas Reporting Program (GGRP), defined under Title 40 of the Code of Federal Regulations (40 CFR) Part 98, large electricity producers must report general combustion CO_2 emissions as well as biogenic CO_2, CH_4, and N_2O emissions. The ECRR facility is subject to 40 CFR Part 98 reporting and annually submits to EPA quality-assured data from continuous emission monitoring systems (CEMSs). Part 98 reporting data were accessed through EPA's Facility Level Information on GreenHouse Gases Tool (FLIGHT) database (EPA 2016), for the "Covanta Essex Company" profile. A CEMS is the total equipment necessary for the determination of an emission rate using pollutant analyzer measurements at the stack. Emission estimates using CEMSs are verified by EPA and meet the highest standard of accuracy under the GGRP. GHG emissions, heat rating, and hours of operation data collected under EPA's GGRP served as the basis of the GHG analysis presented in this chapter (EPA 2016).

Additionally, the ECRR facility is subject to New Jersey's Emission Statement rule (N.J.A.C. 7:27-21) and annually reports to the New Jersey Department of Environmental Protection criteria pollutant emissions data. Criteria pollutant emissions for NO_x, SO_2, PM_{10}, and $PM_{2.5}$ were retrieved from the New Jersey Open Public Records Act Department of Environmental Protection Data Miner database (New Jersey 2016).

7.2.2 Results

Anthropogenic GHG emission from the ECRR facility are presented in Table 7-7. The ECCR facility uses MSW as primary fuel and No. 2 fuel oil as an auxiliary fuel. Emissions come almost exclusively from MSW combustion, with less than 0.8 percent resulting from No. 2 fuel oil combustion. The ECCR facility also had 474,214 tCO2e of biogenic emissions associated with the combustion of the organic materials, that largest component in MSW. CAP emission estimates are summarized in Table 7-8.

Table 7-7: 2015 Essex County Resource Recovery Facility GHG Emissions (metric tons)

Fuel Type	CO_2	CH_4	N_2O	CO_2e
MSW	330,247	270.20	35.46	346,915
Distillate No. 2 Fuel Oil	2,712	0.11	0.02	2,721
TOTAL	**332,959**	**270.31**	**35.49**	**349,636**

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

Table 7-8: 2015 Essex County Resource Recovery Facility CAP Emissions (metric tons)

NO_x	SO_2	PM_{10}	$PM_{2.5}$
598.41	87.47	41.58	38.97

8.0 AIRCRAFT (SCOPE 3)

The Port Authority inventory program requires that scope 3 emissions be assessed periodically. An account of scope 3 emission estimates by year of assessment is provided as supplemental information in Appendix A.

Emissions from aircraft movements were assessed as part of the EY2015 inventory effort for the following airports:

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

JFK has been recognized for decades as the premier U.S. gateway for passengers and cargo. JFK is the busiest airport in the New York City metropolitan area. In 2015, the airport handled a record 56.8 million passengers, and more than 1.3 million tons of cargo. About 85 airlines operate out of the airport, serving about 165 nonstop destinations. EWR is among the busiest North American and international airports. In 2015, about 37.5 million passengers used the airport, an all-time record. About 30 airlines operate out of the airport, serving more than 150 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 set a new all-time record in 2015 with more than 28.4 million passengers. Eleven airlines serve 75 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. Stewart handled about 282,000 passengers and more than 15,100 tons of cargo in 2015. 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 (Port Authority 2016d).

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, greenhouse 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 2b sp2, released December 2015 (AEDT, 2015). This model replaces FAA's Emission and Dispersion Modeling System (EDMS) model, which was used on all Port Authority aviation inventories 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 pre-conditioned air (PCA) supply, and ground support equipment profiles. Because AEDT provides partial GHG emissions information limited to CO_2 emissions for aircraft, most emission factors for GHGs of interest such as methane (CH_4) and nitrous oxide (N_2O), were developed using Intergovernmental Panel on Climate Change (IPCC) guidance. Supplemental emission factors were taken from The Climate Registry's General Reporting Protocol 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 Figure 8-1.

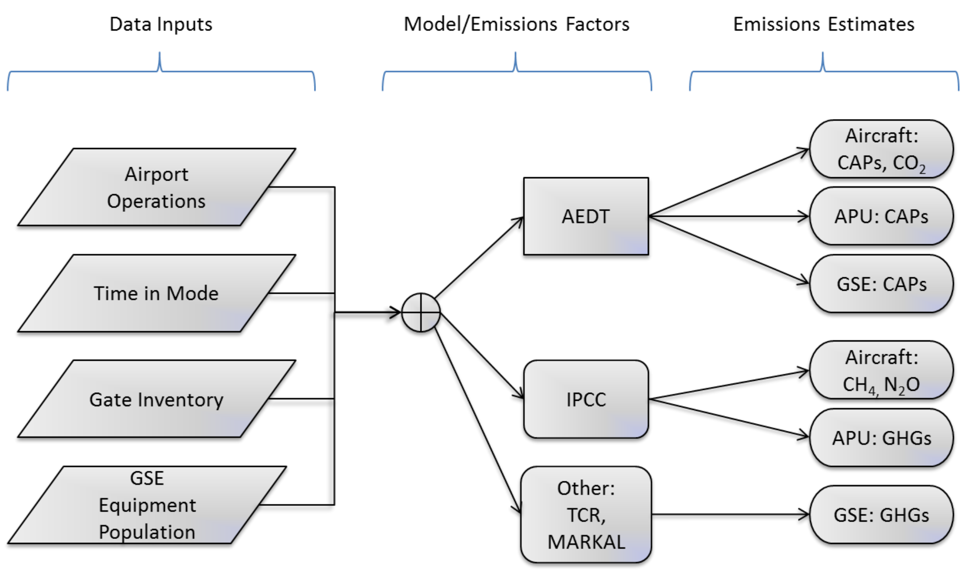

Figure 8-1. General Structure of the Port Authority Airports Emissions Inventory

8.1 AIRCRAFT MOVEMENTS AND AUXILIARY POWER UNITS

For aircraft emissions, the inventory boundary encompasses aircraft operations that the Federal Aviation Administration (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 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 auxiliary power units 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 2016c). This data set contained for each airport the number of arrivals and departures grouped by ICAO aircraft code. As a quality assurance/quality control (QA/QC) measure, total operations for each airport were normalized using airport operations data as reported in the FAA Air Traffic Activity Data System (ATADS) (FAA, 2016). For example, Aviation department recorded for EWR 417,028 operations in 2015. On the other hand, the ATADS database shows 416,947 operations (FAA, 2016). For consistency with FAA records, operations are adjusted to match the ATADS database. Total 2015 operations and passenger count by airport are shown in Table 8-1.

Figure 8-1 below presents a distribution of operations based on aircraft size as measured by their arrival weight. Small aircrafts have a weight less than 50,000 pounds, medium aircrafts have a weight between 50,000 and 100,000 pounds, and large aircrafts have a weight greater than 100,000 pounds. The distribution of operations across the aircraft fleet mix is provided in Appendix B for each of the five Port Authority airports.

Table 8-1: 2015 Port Authority Operations and Passenger Traffic by Airport		
Airport	**FAA ATADS Operations**	**Passenger Count [a]**
JFK	446,644	56,827,154
EWR	416,947	37,494,704
LGA	368,362	28,437,668
SWF	43,081	281,754
TEB	172,387	No Data

[a] Port Authority 2016d

Figure 8-2. Aircraft Distribution by Size and Airport

Airport-specific taxi times were provided by the Aviation department (Port Authority, 2016c), and are displayed in Table 8-2 below. For EWR and LGA, these taxi times only include domestic operations by major (non-regional) domestic carriers. For JFK, average taxi times reflect both domestic and international operations.

Table 8-2: 2015 Average Taxi In and Taxi Out Times by Airport		
Airport	**Taxi In (minutes)**	**Taxi Out (minutes)**
JFK	9:47	28:08
EWR	9:58	20:37
LGA	9:10	23:21
SWF	AEDT Default	
TEB	AEDT Default	

The percentage availability of PCA and gate electrification at each airport 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.

Table 8-3: 2015 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; Taxi Out).

A crosswalk was used to correlate aircraft types between the International Civil Aviation Organization (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 95% of all aircraft operations had a matching AEDT aircraft code. In general, this rate is higher at the three larger airports (greater than 99% match for EWR, LGA and JFK), whereas the rate is slightly lower for TEB (96%) and SWF (95%).

AEDT models for VOC, CO, NO_x, SO_x, PM_{10}, $PM_{2.5}$, and CO_2. 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 be not established. Instead, a default CH_4 and N_2O emission factor was assigned – which was calculated as the average of emission factor for matching aircraft types. The average aircraft CH_4 and N_2O emission factors are presented in Table 8-4.

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 engine.

Table 8-4: 2015 Average Aircraft CH_4 and N_2O Emission Factors		
Airport	**CH_4 (kg/LTO)**	**N_2O (kg/LTO)**
JFK	0.104	0.130
EWR	0.089	0.099
LGA	0.077	0.099
SWF	0.141	0.079
TEB	0.328	0.030

Based on guidance from the Federal Aviation Administration (FAA) Voluntary Airport Low Emissions Program (VALE), 2015 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 was provided by the Port Authority, and is displayed in Table 8-3**Error! Reference source not found.**. In cases where both gate power and PCA are less than 100%, the lower of the two values is used for calculations (for example, JFK is assumed to have 92% of gates with both gate power and PCA). The share of gates with available gate power and PCA by airport is shown in Figure 8-3.

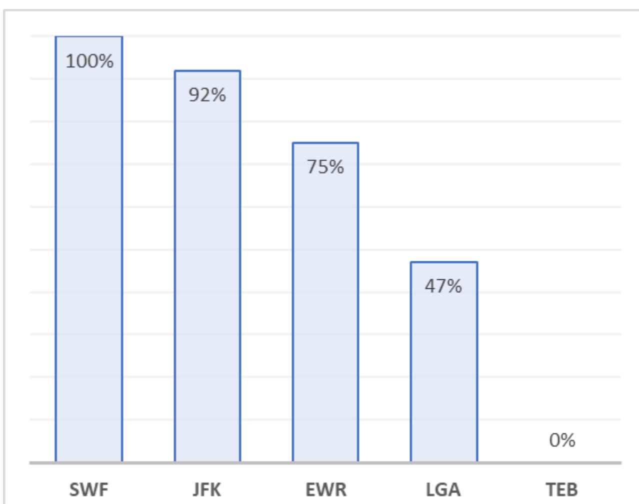

Figure 8-3. 2015 Share of Gates with Available Gate Power and PCA

8.1.3 Results

GHG emission estimates from aircraft engines are summarized by airport in Table 8-5.JFK aircraft CO_2e emissions increased 22% between 2014 and 2015. This is due a 30% increase in taxi out time and a 4% increase in aircraft movements between relative to 2014. Aircraft emissions at EWR increased 12% between 2014 and 2015. This is also due to a combination of taxi out time (19% increase) and aircraft movements (4% increase). The other three airports did not show such a significant change in estimated emissions between 2014 and 2015. Table 8-6 shows the aircraft CAP emissions, as estimated within the AEDT model.

APU GHG and CAP emissions are displayed in Table 8-7 and Table 8-8 respectively. These results reflect the effects of PCA and gate electrification where installed, which decrease the demand of running APU and lower emissions compared to a scenario without supplied PCA and gate electrification.

Table 8-5: 2015 Aircraft GHG Emissions by Airport (metric tons)

Airport	CO_2e	CO_2	Biogenic CO_2	CH_4	N_2O
JFK	937,074	927,606	0	23	29
EWR	468,886	462,116	0	19	21
LGA	357,389	351,446	0	14	18
SWF	19,109	18,517	0	3	2
TEB	57,277	55,879	0	28	3
TOTAL	**1,839,736**	**1,815,564**	**0**	**87**	**72**

Table 8-6: 2015 Aircraft CAP Emissions by Airport (metric tons)

Airport	SO_2	NO_x	$PM_{2.5}$	PM_{10}
JFK	344	3,316	24	24
EWR	172	1,553	13	13
LGA	130	937	10	10
SWF	7	57	1	1
TEB	21	144	2	2
TOTAL	**674**	**6,008**	**49**	**49**

Table 8-7: 2015 APU GHG Emissions by Airport (metric tons)

Airport	CO_2e	CO_2	Biogenic CO_2	CH_4	N_2O
JFK	10,128	10,025	0	0	0
EWR	10,047	9,902	0	0	0
LGA	13,061	12,844	0	1	1
SWF	274	265	0	0	0
TEB	2,543	2,481	0	1	0
TOTAL	**36,054**	**35,518**	**0**	**2**	**2**

Table 8-8: 2015 APU CAP Emissions by Airport (metric tons)				
Airport	**SO_2**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**
JFK	4	30	4	4
EWR	4	28	3	3
LGA	5	29	5	5
SWF	0	1	0	0
TEB	1	6	1	1
TOTAL	**13**	**93**	**12**	**12**

8.2 GROUND SUPPORT EQUIPMENT

8.2.1 Activity Data

GSE equipment inventories were provided by the Port Authority (Port Authority 2016c) for the three large international airports (i.e., JFK, EWR, and LGA). These inventories are based on airlines response to GSE surveys for equipment they operate, and served as the primary input for GSE emissions modeling. The inventories 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.

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 was used to create an estimate of what the GSE inventory at these airports is expected to be. This inventory from EDMS was then input into AEDT to estimate emissions for CY2015.

Appendix C provides a summary 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 the section 8.1.1. The GSE module in AEDT is a variation of EPA’s NONROAD2008 model, which estimates GSE emissions as a function of equipment type (e.g., aircraft tractor, belt loader), utilization (i.e., hours per year), fuel type (e.g., diesel or gasoline), engine capacity, average load, 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 determined 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 ratios—derived from standard fuel based emission factors — were applied to CO_2 emissions to determine CH_4 and N_2O emissions

Since 2006, 40 CFR Subpart H limits gasoline sulfur content of all reformulated and conventional gasoline and reformulated blendstock for oxygenate blending to 95 parts per million (ppm) (EPA, 2013). At this sulfur concentration, the CO_2/SO_2 ratio for gasoline equals 4,560. At the current diesel sulfur concentration of 11 ppm, the CO_2/SO_2 ratio for diesel combustion equals 144,199 ppm (EPA, 2009a). The CO_2/SO_2 ratio for other fuels [e.g., liquefied petroleum gas (LPG)] was derived from EPA's MARKAL model (Pechan, 2010) and applied to EMDS SO_x estimates in order to calculate CO_2 emissions[6]. 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, 2012). All GHG emissions ratios applied in developing GSE emissions are shown in Table 8-10.

Table 8-9: 2015 GHG Emissions Ratios Applied to EDMS GSE Emissions

Concept	Fuel Type	Ratio Value
CO_2/SO_2	Gasoline	4,560
CH_4/CO_2	Gasoline	0.000057
N_2O/CO_2	Gasoline	0.000023
CO_2/SO_2	Diesel	144,199
CH_4/CO_2	Diesel	0.000059
N_2O/CO_2	Diesel	0.000029
CO_2/SO_2	LPG	51,481
CH_4/CO_2	LPG	0.000058
N_2O/CO_2	LPG	0.000026
CO_2/SO_2	CNG	45,268
CH_4/CO_2	CNG	0.000058
N_2O/CO_2	CNG	0.000026

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

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 and load factor.

Finally, the SO_2 emission factor used in AEDT is based on NONROAD 2008, which assumes a gasoline sulfur content of 339 ppm. Because the current gasoline sulfur limit is 30 ppm (EPA, 2013), gasoline SO_2 emissions modeled in AEDT were adjusted down by a factor of 0.08 to reflect the current federal gasoline sulfur standard.

8.2.3 Results

Table 8-11shows the GHG emission estimates from GSEs by airport and Table 8-12 shows the CAP emission estimates by airport.

Table 8-10: 2015 GSE GHG Emissions by Airport (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O
JFK	74,077	73,381	4	2
EWR	67,575	66,971	4	2
LGA	29,268	28,988	2	1
SWF	433	429	0	0
TEB	637	630	0	0
TOTAL	**171,992**	**170,399**	**10**	**4**

Table 8-11: 2015 GSE CAP Emissions by Airport (metric tons)

Airport	SO_2	NO_x	$PM_{2.5}$	PM_{10}
JFK	1	537	41	42
EWR	1	777	33	35
LGA	0	226	16	17
SWF	0	3	0	0
TEB	0	4	0	0
TOTAL	**2**	**1,547**	**91**	**94**

9.0 ATTRACTED TRAVEL (SCOPE 3)

The Port Authority inventory program requires that scope 3 emissions be assessed periodically. An account of scope 3 emission estimates by year of assessment is provided as supplemental information in Appendix A.

Emissions from airport passenger access and cargo movement to and from the following airports were assessed as part of the EY2015 inventory effort:

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

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 2016c). The airport passengers 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. Vehicle miles traveled (VMTs) 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 the 2015 passenger survey data (Port Authority 2016c), which provided the passenger origin/destination information, the 2015 total passenger data (Port Authority 2016d) for information on the total number of passengers, and data on average travel party size to match the 2012 attracted travel methodology (Parsons Brinckerhoff et al. 2006; Excellent et al. 2008; Airlink et al. 2008; Port Authority, 2016b).

The 2015 total passenger data was adjusted down 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 connecting flights by airport used to adjust total passenger volumes is presented in Figure 9-1.

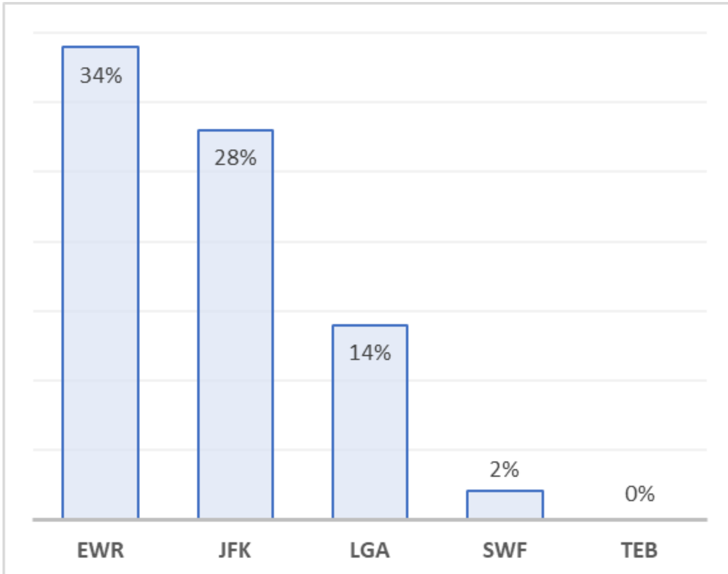

Figure 9-1. 2015 Share of Passengers on Connecting Flights

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 dropped off at airport and parked at 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, and therefore, passengers who are arriving/departing via personal car were assumed to be a pickup/drop off and therefore the round-trip distance is used. This assumption is made to be more conservative, and because pickup/drop-off is more common than parking at the airport at JFK, EWR and LGA.

9.1.2 Method

For each airport, except TEB, the number of passengers was allocated by travel mode and trip origin to obtain the number of vehicles. The number of vehicles by travel mode and trip origin was estimated using 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 2016c). Information on distance traveled and average travel party size are listed in Table 9-1 and Table 9-2, respectively.

Table 9-1 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 9-1 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 9-1: 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		
Westchester	Yonkers	27	17	29	54
Other NY Counties					
Albany	Albany	100	100	100	90
Broome	Binghamton		100		
Chautauqua	Jamestown	100			
Chemung	Elmira	100			
Clinton	Plattsburgh	100			
Delaware	Sidney			100	
Dutchess	Poughkeepsie	89	82	87	26
Essex	North Elba				100
Monroe	Rochester	100			100
Oneida	Utica				100
Orange	Newburgh	100		71	6
Putnam	Carmel	100			35
Rockland	Nanuet	42	31	40	38
Saratoga	Saratoga Springs	100			
Suffolk	Brookhaven			59	
Sullivan	Monticello				39
Tompkins	Ithaca	100		100	
Ulster	Kingston	100		100	40
Washington	Kingsbury	100			
Yates	Milo				100
Other NY[a]		100	100	100	
NJ Counties					
Atlantic	Egg Harbor Township	100		100	
Bergen	Hackensack	29	18	20	55
Burlington	Evesham Township	100	100	76	
Camden	Camden		100	76	
Essex	Newark	44	28	12	
Gloucester	Washington Township	50		91	
Hudson	Union City	22	15	13	

Table 9-1: One-Way Travel Distances Associated with Airport Facilities					
Origin/Destination		**Miles to/from [b]**			
County/Jurisdiction	**Surrogate Location**	**JFK**	**LGA**	**EWR**	**SWF**
Hunterdon	Raritan Township			49	
Mercer	Hamilton Township	76		50	
Middlesex	Edison	46	46	20	
Monmouth	Middletown	57		32	
Morris	Parsippany-Troy Hills	51	40	24	
Ocean	Lakewood Township			48	
Passaic	Paterson	36		20	
Somerset	Franklin Township	53		27	
Sussex	Vernon Township			59	
Union	Elizabeth	32		4	
Warren	Philipsburg			60	
Other NJ			100		
CT Counties					
Fairfield	Bridgeport	62	55	76	
Hartford	Hartford	100		100	
Litchfield	Torrington		100		
Middlesex	Middletown	100			
New Haven	New Haven	80	73	95	
Other CT		100	100	100	
PA Counties					
Beaver	Aliquippa	100			
Berks	Reading			100	
Bucks	Bensalem			67	
Centre	Bellefonte	100			
Chester	West Chester			100	
Lackawanna	Scranton			100	
Lancaster	Lancaster	100		100	
Lehigh	Allentown	100		82	
Luzerne	Wilkes-Barre	100			
Montgomery	Lower Merion	100		91	
Northampton	Bethlehem			72	
Philadelphia	Philadelphia	100		83	
Pike	Matamoros				37
Schuylkill	Pottsville			100	
Other PA[a]		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 9-2: Average Travel Party Size by Travel Mode and Facility				
Travel Mode	**JFK**	**LGA**	**EWR**	**SWF**
Personal Car[a]	1.8	1.5	1.5	1.7
Rental Car[a]	1.8	1.5	1.5	1.7
Taxi	1.72	1.86	1.69	1.8
Limo/Towncar[a]	1.8	1.7	1.6	1.7
Shared-Ride Van[c]	10.8	10.8	10.8	10.8
Airport/Charter/Tour Bus[b]	45.86	45.86	45.86	45.86
Public/City Bus[b]	45.86	45.86	45.86	45.86
Hotel/Motel Shuttle Van[c]	10.8	10.8	10.8	10.8
Off-Airport Parking[d]	2.2	1.7	1.9	2.0
Uber/Lyft	1.5	1.6	1.4	N/A
Dropped Off via Pers. Car	1.7	1.5	1.4	N/A
On-Airport Parking	2.28	1.5	1.8	N/A

[a]Parsons Brinckerhoff et al. 2006. [b]Excellent et al. 2008. [c]Airlink et al. 2008. [d] Port Authority, 2016b.

The trip distance data presented in Table 9-2 and the average party size data, which are shown in Table 9-2, 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,

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)

For taxis servicing JFK, LGA, EWR, and SWF, taxi party size was estimated using the number of taxis dispatched (Port Authority 2016c). The number of taxis dispatched was allocated by trip origin/destination utilizing the percentage of airport passengers by trip origin/destination. The total passengers who used taxis were divided by total taxis dispatched to estimate overall party size (see Table 9-2). Data on total rental car transactions from Port Authority (Port Authority 2016c) is used to estimate total one-way rental car trips for JFK, EWR, and LGA. These trips are then multiplied by trip origin data for each airport to estimate rental car VMT. Rental car transactions at SWF were not available, so emissions at SWF are estimated like other categories. 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 (FAA, 2016). 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 was estimated for attracted travel at TEB, emissions were calculated in the same manner as for the other airports.

Once VMT estimates were developed for all attracted travel, VMT was summed by facility and mode. Emission factors for attracted travel at airports were calculated using EPA's MOVES model (EPA 2014a) based on input data for the 10 New York metropolitan counties (NYMTC, 2016). For personal vehicle travel (personal car, rental car, taxi, limo/town car), 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, hotel/motel shuttle van, and off-airport parking 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 emission factors for CO_2, CH_4, and N_2O associated with the startup of a cooled vehicle engine were applied to all personal vehicle trips. Vehicle emissions for this category were calculated by multiplying the number of vehicle trips with the corresponding weighted cold-start emission factor for each vehicle type. Total vehicle trips were estimated by dividing the total VMT for each vehicle type by the average trip distance for each airport/vehicle type combination. The cold-start emission factors (in grams per start) by vehicle type and technology type were derived from the EPA MOVES model (EPA 2014a).

9.1.3 Results

Total airport attracted travel GHG emission estimates are displayed in Table 9-3 below. CO_2 accounted for more than 99% of all attracted travel CO_2e emissions. People using Uber or Lyft is a new category in the 2015 analysis.

Table 9-3: 2015 Airport Attracted Travel GHG Emissions by Mode (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O
Personal Car	487,523	485,794	5.7	5.2
Rental Car	22,967	22,858	0.3	0.3
Taxi	116,450	115,849	1.8	1.8
Limo/Town Car	50,518	50,279	0.7	0.7
Shared Ride Van	5,826	5,770	0.4	0.2
Airport/Charter/Tour Bus	3,595	3,558	1.4	0.0
Public/City Bus	1,540	1,524	0.6	0.0
Hotel/Motel Shuttle Van	3,329	3,297	0.2	0.1
Off-Airport Parking	17,424	17,361	0.2	0.2
Uber/Lyft	22,511	22,397	0.3	0.3
TOTAL	**731,683**	**728,688**	**12**	**9**

Total airport attracted travel CAP emission estimates are displayed in Table 9-4 below. Personal cars and taxis accounted for the largest share of all pollutants, although buses were also a significant contributor to NO_x and PM emissions. GHG and CAP emission estimates can also be broken down by airport, as shown in Table 9-5 and Table 9-6 respectively.

Table 9-4: 2015 Attracted Travel CAP Emissions by Mode (metric tons)

Airport	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Personal Car	9.6	299.4	16.9	73.3
Rental Car	0.5	15.2	0.8	3.5
Taxi	2.3	78.9	4.2	17.5
Limo/Town Car	1.0	33.4	1.8	7.6
Shared Ride Van	0.1	18.2	0.6	1.2
Airport/Charter/Tour Bus	0.0	36.1	1.8	2.5
Public/City Bus	0.0	15.5	0.8	1.1
Hotel/Motel Shuttle Van	0.1	10.4	0.3	0.7
Off-Airport Parking	0.3	10.7	0.6	2.6
Uber/Lyft	0.4	15.2	0.8	3.4
TOTAL	**14.4**	**533.0**	**28.7**	**113.3**

Table 9-5: 2015 Attracted Travel GHG Emissions by Airport (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O
JFK	354,665	353,267	6	4
EWR	250,719	249,736	4	3
LGA	119,445	118,857	2	2
SWF	5,491	5,472	0	0
TEB	1,363	1,356	0	0
TOTAL	**731,683**	**728,688**	**12**	**9**

Table 9-6: 2015 Attracted Travel CAP Emissions by Airport (metric tons)

Airport	SO_2	NO_x	$PM_{2.5}$	PM_{10}
JFK	7	260	14	55
EWR	5	173	9	38
LGA	2	96	5	19
SWF	0	3	0	1
TEB	0	1	0	0
TOTAL	**14**	**533**	**29**	**113**

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 induce vehicular traffic near the airports.

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 9-7).

Table 9-7: One-Way Travel Distance Associated with JFK Airport for Cargo Travel

Origin/Destination	Miles to/from
Van Wyck	5.10
On Airport	6.70
Rockway Blvd	2.80
Belt Parkway/Southern State	8.20
Other Routes	5.70

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 2015 was estimated by scaling the number of trips estimated from the 2002 study by vehicle type based on the ratio of 2015 to 2002 freight cargo at JFK (Port Authority 2006; Port Authority 2016d). The resulting 2015 cargo VMT for JFK by vehicle type was then scaled to LGA, EWR, and SWF airports using the 2015 ratio of cargo tons from JFK to the cargo tons at LGA, EWR, and SWF airports (Port Authority 2016d). 2015 cargo tonnage by airport is displayed in Table 9-9 below.

Table 9-8: 2015 Cargo Tonnage by Airport

Airport	Annual Cargo Tonnage
JFK	1,332,025
EWR	705,216
LGA	7,721
SWF	15,144
TEB	0
TOTAL	**2,060,106**

9.2.3 Results

The GHG emission estimates from cargo trucks by airport are summarized in Table 9-10 below. 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 9-11 shows the CAP emission estimates from attracted travel - cargo trucks at the five Port Authority airports.

Table 9-9: 2015 Cargo Truck Attracted Travel GHG Emissions by Airport (metric tons)

Airport	CO_2e	CO_2	CH_4	N_2O
JFK	36,902	36,666	1	1
EWR	19,537	19,412	1	0
LGA	214	213	0	0
SWF	420	417	0	0
TEB	0	0	0	0
TOTAL	**57,072**	**56,707**	**2**	**1**

Table 9-10: 2015 Cargo Truck Attracted Travel CAP Emissions by Airport (metric tons)

Airport	SO_2	NO_X	$PM_{2.5}$	PM_{10}
JFK	1	88	5	10
EWR	0	47	3	6
LGA	0	1	0	0
SWF	0	1	0	0
TEB	0	0	0	0
TOTAL	**1**	**136**	**8**	**16**

10.0 MOBILE COMBUSTION (SCOPE 3)

The Port Authority inventory program requires that scope 3 emissions be assessed periodically. An account of scope 3 emission estimates by year of assessment is provided as supplemental information in Appendix A.

Emissions from the Shadow Fleet were assessed as part of the EY2015 inventory effort.

10.1 SHADOW FLEET

The shadow fleet consists of vehicles that are owned by the Port Authority but are operated on a day-to-day basis by contractors or tenants. Because they are not operated by the Port Authority directly, they do not fall within the purview of the CAD (discussed in Chapter 3.0), and are considered scope 3 sources.

10.1.1 Activity Data

Data on the shadow fleet were provided by the Port Authority (Port Authority 2016c). In 2015, the shadow fleet consisted of fuel trucks and shuttle buses at JFK, EWR, and LGA, as well as a few vehicles at SWF and TEB.

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 and MARKAL emission factors to estimate the criteria pollutants.

10.1.3 Results

GHG emission estimates are summarized by airport in Table 10-1 below. The majority of shadow fleet emissions come from shuttle buses and fuel trucks at JFK and EWR. CAP emission estimates by airport are shown in Table 10-2.

Table 10-1: 2015 Shadow Fleet GHG Emissions by Airport (metric tons)

Airport	CO_2e	CO_2	Biogenic CO_2	CH_4	N_2O
JFK	5,597	5,471	428	0.3	0.4
EWR	4,450	4,350	406	0.3	0.3
LGA	1,597	1,561	183	0.1	0.1
SWF	908	887	0	0.1	0.1
TEB	235	230	0	0	0
TOTAL	**12,787**	**12,499**	**1,018**	**1**	**1**

Table 10-2: 2015 Shadow Fleet CAP Emissions by Airport (metric tons)				
Airport	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
JFK	0.4	40.3	2.5	2.6
EWR	0.3	38.0	1.7	1.8
LGA	0.0	10.7	0.2	0.2
SWF	0.1	2.7	0.6	0.7
TEB	0.0	0.7	0.1	0.2
TOTAL	**0.9**	**92.4**	**5.1**	**5.5**

11.0 TENANT ENERGY CONSUMPTION (SCOPE 3)

The Port Authority inventory program requires that scope 3 emissions be assessed periodically. An account of scope 3 emission estimates by year of assessment is provided as supplemental information in Appendix A.

Emissions from tenant energy consumption at Aviation department facilities were assessed as part of the EY2015 inventory effort. Tenants include airlines, airport concessions, fixed-base operators, and the AirTrain systems operated by Bombardier Transportation. The assessment of tenant energy consumption covers three commodities: electricity, natural gas, and thermal energy.

11.1 BUILDINGS

11.1.1. Electricity

Building energy consumption was either compiled from metered electricity consumption statements or assessed from the share of building space corresponding to tenant occupancy. The Port Authority sub-bills tenants for their electricity consumption at JFK and LGA, so metered electricity consumption informed the assessments at these two airports. For other airports, electricity consumption was estimated based on tenant building occupancy. Table 11-1 presents a summary of tenant electricity consumption.

Table 11-1: Tenant Electricity Consumption by Facility

Facility	Electricity Usage (MWh)
EWR	85,654
JFK	259,894
LGA	52,407
SWF	10,735
TEB	8,097
TOTAL	**416,787**

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 11-1. The GHG emission factors utilized with Equation 11-1 are shown in Table 11-2 (TCR 2016). The CAP emission factors are shown in Table 11-3 (EPA 2015a). These emission factors correspond to those used for the estimation of Scope 2 purchased electricity emissions as described in Chapter 5.

$$Emissions = C \times EF_i \quad (11\text{-}1)$$

where

C = consumption of electricity (kWh)

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

i = GHG or CAP pollutant

Table 11-2: Electricity Consumption GHG Emission Factors (kg/kWh)			
eGRID 2012 Subregion/Provider	**CO_2**	**CH_4**	**N_2O**
NYCW – NPCC NYC/Westchester	0.316	1.15×10^{-5}	1.33×10^{-6}
NYUP – NPCC Upstate NY	0.185	7.07×10^{-6}	1.74×10^{-6}
KIAC (Kennedy Int. Airport Cogeneration)	0.419	3.00×10^{-5}	7.50×10^{-6}

Table 11-3: Electricity Consumption CAP Emission Factors (kg/kWh)				
eGRID 2012 Subregion/Provider	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
NPCC NYC/Westchester	2.91×10^{-5}	1.51×10^{-4}	3.21×10^{-6}	4.29×10^{-6}
NPCC Upstate NY	2.95×10^{-4}	1.25×10^{-4}	3.07×10^{-5}	4.10×10^{-5}
KIAC	6.02×10^{-6}	8.37×10^{-5}	6.61×10^{-5}	6.61×10^{-5}

Source: EPA 2015a.

At EWR, SWF and TEB, tenant electricity consumption was assessed as the product of tenant occupancy (presented in Table 11-4), energy consumption intensity, and the fraction of energy consumption attributable to electricity consumption. This method is presented in Equation 11-2. The values used for energy consumption intensity (*Ij*) and fraction of total energy consumption attributable to electricity usage (*Sj*) are summarized in Table 11-5.

$$C = \left(\sum_J A_j \times I_j \times S_j\right) \times K \qquad (11\text{-}2)$$

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 11-4: Energy Use Intensities by Building Activity		
Building Activity	**EUI (kBTU/square foot/year)**	**Electricity Percentage**
Office	67.3	62%
ATB: Large Hub, Moderate Climate	158.2	50%
Non-refrigerated warehouse	28.5	56%
Retail store	47.1	64%
Convenience store with gas station	192.9	50%
Other-utility	78.8	52%
Food service	266.8	43%
Hotel	73.4	43%

Table 11-4: Energy Use Intensities by Building Activity		
Building Activity	**EUI (kBTU/square foot/year)**	**Electricity Percentage**
Other-public service	78.8	56%
Vacant	20.9 [a]	31%
Other	164.4 [a]	50%
Other-services	49.6	52%
Bank Branch	87	52%
Fire station	88.3	44%

Source: ACRP 2016 and Energy Star 2016 (for Site EUI) and EIA 2003 (for Electric Percentage).
[a] Source EIA 2003.

Table 11-5 shows the GHG emissions estimates from electricity broken down by facility. CAP emissions totals are presented by facility in Table 11-6.

Table 11-5: 2015 GHG Emissions from Tenant Electricity Consumption in Buildings (metric tons)				
Facility	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
JFK	108,915	7.79	1.95	109,683
LGA	16,561	0.61	0.07	16,596
ACY	0	0	0	0
EWR	33,357	1	0	33,517
SWF	1,991	0	0	1,998
TEB	3,153	0	0	3,168
TOTAL	**163,977**	**10**	**3**	**164,962**

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

Table 11-6: 2015 CAP Emissions from Tenant Electricity Consumption in Buildings (metric tons)				
Facility	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
JFK	1.56	21.75	17.18	17.18
LGA	1.52	7.92	0.10	0.14
ACY	0	0	0	0
EWR	54.81	31.00	21.51	22.44
SWF	3.16	1.34	0.22	0.29
TEB	5.18	2.93	2.03	2.12
TOTAL	**66**	**65**	**41**	**42**

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 11-7 summarizes tenant occupancy by building activity and airport. Note that at JFK, heating is also supplied in the form of thermal energy from KIAC. Only the JFK tenants who are not service by KIAC are included in the tenant natural gas consumption assessment.

Table 11-7: Tenant Occupancy by Airport Used for Building Energy Consumption Estimates (square foot)						
Building Activity	**EWR**	**SWF**	**TEB**	**JFK**	**LGA**	**Total**
Office	38,910	191,653	356,791	78,212	25,926	691,492
Airport Terminal Buildings	2,673,723	0		0	719,100	3,392,823
Medical Office	0	0		0	0	0
Non-refrigerated warehouse	2,573,864	1,230,593	795,316	4,358,694	310,100	9,268,567
Retail store	89,230	0		90,320	33,386	212,936
Parking	197,600	0		88,500	0	286,100
Energy/Power Station	0	0		0	0	0
Transportation Terminal/Station	0	0		0	0	0
Convenience store with gas station	2,110	0		10,000	3,440	15,550
Other-utility	20,015	1,733		1,100	2,925	25,773
Food service	132,440	20,000		625,312	48,600	826,352
Hotel	547,462	142,337		0	0	689,799
Other-public service	0	0		1,795	0	1,795
Vacant	0	182,094		0	0	182,094
Other	0	11,168		2,680	0	13,848
Other-services	0	0		8,450	0	8,450
Bank Branch	0	0		12,500	0	12,500
Fire station	0	0		15,760	352	16,112
TOTAL	**6,275,354**	**1,779,578**	**1,152,107**	**5,293,323**	**1,143,829**	**15,644,191**

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 2003). 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 summarized in Table 11-4.

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

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 emission factors used to calculate the GHGs associated with tenant natural gas consumption are shown in Table 11-8. The CAP emission factors are based on values recommended by EPA AP-42, Chapter 1.4, "Natural Gas Combustion" (EPA, 1998), and are present in Table 11-9.

Table 11-8: Natural Gas Combustion GHG Emission Factors			
Units	**CO_2**	**CH_4**	**N_2O**
kg/therm	5.31	4.80×10^{-4}	1.00×10^{-5}

Source: TCR 2016.

Table 11-9: Natural Gas Combustion CAP Emission Factors			
Units	**SO_2**	**NO_x**	**PM total**
kg/therm	2.65×10^{-5}	4.42×10^{-3}	3.36×10^{-4}

Source: EPA 1998.

Table 11-10 and Table 11-11, respectively, show the GHG and CAP emissions estimates from natural gas broken down by facility.

Table 11-10: 2015 GHG Emissions from Tenant Natural Gas Consumption in Buildings (metric tons)				
Facility	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
JFK	8,274	1	0	8,312
LGA	3,680	0.7603	0.0152	3,700
ACY	0	0	0	0
EWR	15,300	0.8556	0.0171	15,323
SWF	1,746	0.4937	0.0099	1,759
TEB	1,011	0.208	0.0042	1,017
TOTAL	**30,010**	**4**	**0**	**30,111**

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

Table 11-11: 2015 CAP Emissions from Tenant Electricity Consumption in Buildings (metric tons)				
Facility	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
JFK	0.04	6.90	0.52	0.52
LGA	0.02	3.07	0.23	0.23
ACY	0	0	0	0
EWR	0.08	12.75	0.97	0.97
SWF	0.01	1.45	0.11	0.11
TEB	0.01	0.84	0.06	0.06
TOTAL	**0.15**	**25.01**	**1.90**	**1.90**

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. These records did not cover all JFK tenants; emissions from tenants for which sub-billing was not performed are estimated based on square footage in the section above.

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). These emission factors are shown in Table 11-12 and Table 11-13 for GHG and criteria pollutants, respectively.

Table 11-12: KIAC Thermal Energy GHG Emission Factors

Units	CO_2	CH_4	N_2O
Heating (kg Pollutant/MMBtu	62.27	0.0045	0.0011
Cooling (kg Pollutant/MMBtu	62.27	0.0045	0.0011

Table 11-13: KIAC Thermal Energy CAP Emission Factors

Units	NO_x	SO_2	$PM_{2.5}$	PM_{10}
Heating (kg Pollutant/MMBtu)	0.0124	0.0009	0.0098	0.0098
Cooling (kg Pollutant/MMBtu)	0.0124	0.0009	0.0098	0.0098

Port Authority records indicate that there were nearly 133,000 MMBtu of thermal heating and just over 210,000 MMBtu of thermal cooling consumed by JFK tenants. Associated GHG and CAP emissions are shown in Table 11-14 and Table 11-15, respectively.

Table 11-14: 2015 GHG Emissions from Tenant Thermal Consumption in Buildings (metric tons)

Units	CO_2	CH_4	N_2O	CO_2e
KIAC Heating	8,260	1	0	8,318
KIAC Cooling	13,101	1	0	13,193

Table 11-15: 2015 CAP Emissions from Tenant Thermal Consumption in Buildings (metric tons)

Units	SO_2	NO_x	$PM_{2.5}$	PM_{10}
KIAC Heating	0.12	1.65	1.30	1.30
KIAC Cooling	0.19	2.62	2.07	2.07

11.2 RAIL SYSTEMS

The Port Authority owns the AirTrain JFK and AirTrain Newark, but these monorail systems are operated by Bombardier Transportation, thus 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 Natural Gas

The Port Authority has a record of natural gas consumption at AirTrain JFK. Total consumption in 2015 amounted to 54,453 therms. Fuel-based emission factors were applied to estimate GHG and CAP emissions in accordance with the method described in Section 2.1.2. Emission results are presented in Table 11-16 and Table 11-17 below.

Table 11-16: 2015 GHG Emissions from Stationary Combustion by AirTrain (metric tons)

Facility	CO_2	CH_4	N_2O	CO_2e
AirTrain JFK	288.93	0.0261	0.0005	290

Table 11-17: 2015 CAP Emissions from Stationary Combustion by AirTrain (metric tons)

Facility	SO_2	NO_x	$PM_{2.5}$	PM_{10}
AirTrain JFK	0.0014	0.2408	0.0183	0.0183

11.2.2 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. 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 NPCC – NYC/Westchester emission factors were used for AirTrain JFK and the Reliable First Corporation East emission factors for AirTrain Newark were applied. The GHG and CAP emission factors used in this assessment are presented in Table 5-2 and Table 5-3: Electricity Consumption CAP Emission Factors respectively.

Table 11-18 provides specific quantities of GHG emissions associated with train electricity usage for each system. CAP emission estimates from electricity consumption for the train systems are given in Table 11-19.

Table 11-18: 2015 GHG Emissions from Electricity Consumption by AirTrain (metric tons)

Rail System	CO_2	CH_4	N_2O	CO_2e
AirTrain JFK	16,302.23	1.1075	0.2686	16,409
AirTrain Newark	6,876.53	0.2118	0.0920	6,910
TOTAL	**23,178.76**	**1.3193**	**0.3606**	**23,318**

Table 11-19: 2015 CAP Emissions from Electricity Consumption by AirTrain (metric tons)

Rail System	SO_2	NO_x	$PM_{2.5}$	PM_{10}
AirTrain JFK	0.3646	3.7236	2.3169	2.3205
AirTrain Newark	11.2988	6.3915	4.4351	4.6262
TOTAL	**11.6635**	**10.1150**	**6.7520**	**6.9467**

11.2.3 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 and Table 6-2 to estimate emissions. Table 11-20 and Table 11-21 summarize emissions from thermal energy consumption by AirTrain.

Table 11-20: 2015 GHG Emissions from Thermal Consumption by AirTrain (metric tons)

Energy Use	CO_2	CH_4	N_2O	CO_2e
AirTrain Heating	732.44	0.0524	0.0131	738.60
AirTrain Cooling	725.17	0.0519	0.0130	730.28
TOTAL	**1,457.61**	**0.1043**	**0.0261**	**1,468**

Table 11-21: 2015 CAP Emissions from Thermal Consumption by AirTrain (metric tons)

Energy Use	SO_2	NO_x	$PM_{2.5}$	PM_{10}
AirTrain Heating	0.0105	0.1462	0.1155	0.1155
AirTrain Cooling	0.0104	0.1448	0.1144	0.1144
TOTAL	**0.0209**	**0.291**	**0.2299**	**0.2299**

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APPENDIX A: 2015 SCOPE 3 GHG EMISSIONS BY YEAR OF ASSESSMENT

Department	Emission Category	Activity	Metric Tons CO_2e	Year of Last Assessment
Aviation	Aircraft	Aircraft Movements	1,839,735	2015
		Auxiliary Power Units	36,053	2015
		Ground Support Equipment	171,992	2015
	Attracted Travel	Air Cargo	57,073	2015
		Airport Passenger	731,683	2015
	Energy Production	Electricity Sold to Market	152,980	2015
	Fugitive Emissions	Refrigeration/Fire Suppression	27	2015
	Purchased Cooling	Buildings	13,193	2015
		Rail Systems	730	2015
	Purchased Electricity	Buildings	165,128	2015
		Rail Systems	23,318	2015
	Purchased Heating	Buildings	8,318	2015
		Rail Systems	738	2015
	Stationary Combustion	Buildings	30,374	2015
Central Administration	Mobile Combustion	Shadow Fleet	11,404	2015
Engineering	Construction	Non-Road Diesel Engines	15,849	2013
Multi-Department	Mobile Combustion	Employee Commuting	20,496	2015
PATH	Attracted Travel	PATH Passenger	60,064	2012
	Purchased Electricity	Buildings	70	2013
	Stationary Combustion	Buildings	30	2013
Planning	Mobile Combustion	Ferry Movements	11,622	2014
	Purchased Electricity	Buildings	123	2013
	Stationary Combustion	Buildings	50	2013
Port Commerce	Attracted Travel	Commercial Marine Vessels	154,996	2014
		Drayage Trucks - to NYNJLINA boundary	266,862	2014
		Drayage Trucks - from NYNJLINA to first point of rest	685,034	2012
	Mobile Combustion	Auto Marine Terminal, Vehicle Movements	402	2012
		Cargo Handling Equipment	104,525	2014
		Rail Locomotives	18,022	2014
	Purchased Electricity	Buildings	7,615	2013
	Stationary Combustion	Buildings	3,257	2013
Real Estate	Energy Production	Electricity Sold to Market	349,636	2015
	Purchased Electricity	Buildings	104,162	2013
	Stationary Combustion	Buildings	47,525	2013
Tunnels, Bridges & Bus Terminals	Attracted Travel	Queued Traffic	22,107	2012
		Through Traffic	523,933	2014
	Purchased Electricity	Buildings	2,281	2013
	Stationary Combustion	Buildings	364	2013
Total Scope 3 Emissions			**5,641,769**	

APPENDIX B: 2015 OPERATIONS BY AIRCRAFT CODE

Airport	ICAO Code	Description	Model	Operations
JFK				
JFK	FA10	FEDX 727-200/JT8D-15	Dassault Mercure 100	79,350
JFK	LJ25	LEAR 25/CJ610-8	Bombardier Learjet 25	52,001
JFK	LJ60	LEAR 36/TFE731-2	Bombardier Learjet 60	35,477
JFK	A388	A380-841\RR trent970	Airbus A380-800 Series/Trent 970	34,300
JFK	TBM7	1985 1-ENG VP PROP	EADS Socata TBM-700	32,491
JFK	A345	A340-642\Trent 556	Airbus A340-500 Series	28,357
JFK	PC12	Cessna 208 / PT6A-114	Pilatus PC-12	22,260
JFK	AEST	BARON 58P/TS10-520-L	Aerostar PA-60	21,240
JFK	FA7X	CITATION X / ROLLS ROYCE ALLISON AE3007C	Falcon 7X	15,125
JFK	B734	BOEING 737-400/CFM56-3C-1	Boeing 737-400 Series	12,490
JFK	C441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	11,243
JFK	F900	1985 BUSINESS JET	Dassault Falcon 900	9,208
JFK	BE20	DASH 6/PT6A-27	Raytheon C-12 Huron	9,019
JFK	M20T	1985 1-ENG VP PROP	Mooney M20-K	8,851
JFK	MD83	MD-83/JT8D-219	Boeing MD-83	7,639
JFK	B407	Bell 407	Bell 407 / Rolls-Royce 250-C47B	6,862
JFK	A332	A330-301\GE CF6-80 E1A2	Airbus A330-200 Series	6,412
JFK	B748	Boeing 747-8F/GEnx-2B67	7478	6,229
JFK	B190	BEECH 1900D / PT6A67	Raytheon Beech 1900-C	5,757
JFK	E50P	510 CITATION MUSTANG	Embraer 500	3,820
JFK	C550	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	3,763
JFK	B733	BOEING 737-300/CFM56-3B-1	Boeing 737-300 Series	3,715
JFK	P28A	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	3,496
JFK	A320	A320-211\CFM56-5A1	Airbus A320-200 Series	3,417
JFK	B18T	DASH 6/PT6A-27	Raytheon Beech 18	3,256
JFK	C340	BARON 58P/TS10-520-L	Cessna 340	2,533
JFK	A319	A319-131\IAE V2522-A5	Airbus A319-100 Series	965
JFK	B742	BOEING 747-200/JT9D-7	Boeing 747-200 Series	961
JFK	C10T	1985 1-ENG VP PROP	Cessna 210 Centurion	926
JFK	SH33	SD330/PT6A-45AR	Shorts 330	924
JFK	B350	DASH 6/PT6A-27	Raytheon Super King Air 300	897
JFK	B789	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-900 Dreamliner	845
JFK	P180	DASH 6/PT6A-27	Piaggio P.180 Avanti	664
JFK	HUSK	CESSNA 172R / LYCOMING IO-360-L2A	Aviat Husky A1B	575
JFK	PA23	BARON 58P/TS10-520-L	Piper PA-23 Apache/Aztec	572
JFK	P32R	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	505
JFK	CL30	CL600/ALF502L	Bombardier Challenger 300	493
JFK	CRJ2	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	481
JFK	B712	BOEING 717-200/BR 715	Boeing 717-200 Series	474
JFK	ASTR	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	466
JFK	C500	CIT 2/JT15D-4	Cessna 500 Citation I	459
JFK	CRJ9	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-900	436
JFK	BE9L	DASH 6/PT6A-27	Raytheon King Air 90	406
JFK	TBM8	CONQUEST II/TPE331-8	SOCATA TBM 850	400
JFK	A318	A319-131\IAE V2522-A5	Airbus A318-100 Series	379
JFK	MD88	MD-83/JT8D-219	Boeing MD-88	347
JFK	B737	BOEING 737-700/CFM56-7B24	Boeing 737-700 Series	298
JFK	B732	BOEING 737/JT8D-9	Boeing 737-200 Series	286
JFK	B738	BOEING 737-800/CFM56-7B26	Boeing 737-800 Series	285
JFK	B752	BOEING 757-200/PW2037	Boeing 757-200 Series	283
JFK	B77W	Boeing 777-300ER/GE90-115B-EIS	Boeing 777-300 ER	259
JFK	SR20	1985 1-ENG COMP	Cirrus SR20	241
JFK	A342	A340-211\CFM56-5C2	Airbus A340-200 Series	239
JFK	LJ55	LEAR 36/TFE731-2	Bombardier Learjet 55	235
JFK	PA27	BARON 58P/TS10-520-L	Piper PA-27 Aztec	223
JFK	B763	BOEING 767-300/PW4060	Boeing 767-300 Series	217
JFK	E145	EMBRAER 145 LR / ALLISON AE3007A1	Embraer ERJ145-LR	210
JFK	F2TH	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000	201
JFK	PAY1	CONQUEST II/TPE331-8	Piper PA-31T Cheyenne	200
JFK	LJ45	LEAR 36/TFE731-2	Bombardier Learjet 45	183
JFK	LJ40	LEAR 36/TFE731-2	Bombardier Learjet 40	176
JFK	CVLT	CV580/ALL 501-D15	Convair CV-640	174

Airport	ICAO Code	Description	Model	Operations
JFK	H25B	FALCON 20/CF700-2D-2	Hawker HS-125 Series 700	157
JFK	AC95	CONQUEST II/TPE331-8	COMMANDER980/1000	156
JFK	A333	A330-301\GE CF6-80 E1A2	Airbus A330-300 Series	131
JFK	BE58	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	120
JFK	D328	Dornier 328-100 / PW119C	Dornier 328-100 Series	92
JFK	PAY3	Piper PA-42 / PT6A-41	Piper PA-42 Cheyenne Series	90
JFK	BE10	DASH 6/PT6A-27	Raytheon King Air 100	88
JFK	FA50	1985 BUSINESS JET	Dassault Falcon 50	81
JFK	B744	BOEING 747-400/PW4056	Boeing 747-400 Series	78
JFK	BLCF	BOEING 747-400/PW4056	Boeing 747-400 Series Freighter	73
JFK	H25C	LEAR 36/TFE731-2	Raytheon Hawker 1000	73
JFK	B722	BOEING 727-200/JT8D-7	Boeing 727-200 Series	63
JFK	C208	Piper PA-42 / PT6A-41	Cessna 208 Caravan	63
JFK	C650	CIT 3/TFE731-3-100S	Cessna 650 Citation III	61
JFK	C501	CIT 2/JT15D-4	Cessna 501 Citation ISP	57
JFK	E170	ERJ170-100	Embraer ERJ170	50
JFK	PA31	BARON 58P/TS10-520-L	Piper PA-31 Navajo	49
JFK	GLEX	GULFSTREAM GV/BR 710	Bombardier Global Express	48
JFK	GLF5	GULFSTREAM GV/BR 710	Gulfstream G500	46
JFK	LJ31	LEAR 36/TFE731-2	Bombardier Learjet 31	43
JFK	CL60	CL600/ALF502L	Bombardier Challenger 600	40
JFK	C525	CIT 2/JT15D-4	Cessna 525 CitationJet	33
JFK	CRJ7	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	31
JFK	PRM1	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	30
JFK	IL76	AIRBUS A300B4-200/CF6-50C2	Ilyushin 76 Candid	28
JFK	CRJ1	CL600/ALF502L	Bombardier CRJ-100	28
JFK	C510	510 CITATION MUSTANG	CESSNA CITATION 510	26
JFK	B36T	Cessna 208 / PT6A-114	Raytheon Beech Bonanza 36	25
JFK	C310	BARON 58P/TS10-520-L	Cessna 310	24
JFK	SF34	SF340B/CT7-9B	Saab 340-A	24
JFK	E110	DASH 6/PT6A-27	Embraer EMB110 Bandeirante	24
JFK	F4	F-4C/J79-GE-15	McDonnell Douglas F-4 Phantom II	23
JFK	GLF6	GULFSTREAM GV/BR 710	GULFSTREAM AEROSPACE G650	21
JFK	J328	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dornier 328 Jet	20
JFK	DH8B	DASH 8-100/PW121	DeHavilland DHC-8-100	20
JFK	E190	ERJ190-100	Embraer ERJ190	19
JFK	C206	1985 1-ENG VP PROP	Cessna 206	18
JFK	NAVI	1985 1-ENG VP PROP	Ryan Navion B	18
JFK	A321	A321-232\V2530-A5	Airbus A321-100 Series	17
JFK	C750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	17
JFK	P46T	1985 1-ENG FP PROP	Piper PA46-TP Meridian	17
JFK	B788	Boeing 787-8/T1000-C/01 Family Plan Cert	B787-8R	16
JFK	C421	BARON 58P/TS10-520-L	Cessna 421 Golden Eagle	15
JFK	B735	BOEING 737-500/CFM56-3C-1	Boeing 737-500 Series	13
JFK	GLF4	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	12
JFK	B773	BOEING 777-300/TRENT892	Boeing 777-300 Series	11
JFK	GL5T	GULFSTREAM GV/BR 710	Bombardier Global Express Business	11
JFK	E135	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	11
JFK	MD82	MD-82/JT8D-217A	Boeing MD-82	11
JFK	FA20	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	11
JFK	HA4T	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	10
JFK	E55P	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	10
JFK	B06	Bell 206L Long Ranger	Bell 206 JetRanger	10
JFK	B753	BOEING 757-300/RB211-535E4B	Boeing 757-300 Series	10
JFK	B762	BOEING 767-300/PW4060	Boeing 767-200 ER	10
JFK	LJ35	LEAR 36/TFE731-2	Bombardier Learjet 35	9
JFK	MD90	MD-90/V2525-D5	Boeing MD-90	9
JFK	A343	A340-211\CFM56-5C2	Airbus A340-300 Series	9
JFK	AT43	DASH 8-100/PW121	ATR 42-400	9
JFK	B736	BOEING 737-700/CFM56-7B24	Boeing 737-600 Series	9
JFK	C182	Cessna 182H / Continental O-470-R	Cessna 182	7
JFK	C172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	6
JFK	C25C	CIT 2/JT15D-4	Cessna 525C CitationJet	6
JFK	MD11	MD-11/CF6-80C2D1F	Boeing MD-11	6
JFK	WW24	HS748/DART MK532-2	Gulfstream I	6
JFK	B772	BOEING 777-300/TRENT892	Boeing 777-200-LR	6
JFK	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	5

Airport	ICAO Code	Description	Model	Operations
JFK	R44	Robinson R44 Raven / Lycoming O-540-F1B5	Robinson R44 Raven / Lycoming O-540-F1B5	5
JFK	SR22	1985 1-ENG COMP	Cirrus SR22	5
JFK	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA-30 Twin Comanche	5
JFK	E120	EMBRAER 120 ER/ PRATT & WHITNEY PW118	Embraer EMB120 Brasilia	4
JFK	E145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	4
JFK	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	4
JFK	B739	BOEING 737-700/CFM56-7B24	Boeing 737-900 Series	4
JFK	A109	Agusta A-109	Agusta A-109	4
JFK	BE55	BARON 58P/TS10-520-L	Raytheon Beech 55 Baron	4
JFK	C14T	BARON 58P/TS10-520-L	Cessna 414	3
JFK	T38	NORTHRUP TALON T-38A NM	T-38 Talon	3
JFK	GLF3	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	3
JFK	C402	BARON 58P/TS10-520-L	Cessna 402	3
JFK	GLF2	GULFSTREAM GII/SPEY 511-8	Gulfstream II	2
JFK	B764	BOEING 767-400ER/CF6-80C2B(F)	Boeing 767-400	2
JFK	B772	BOEING 777-200ER/GE90-90B	Boeing 777-200 Series	2
JFK	GALX	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	2
JFK	PA34	BARON 58P/TS10-520-L	Piper PA-34 Seneca	2
JFK	DC10	DC10-30/CF6-50C2	Boeing DC-10-30 Series	2
JFK	C680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	2
JFK	DH8A	DASH 8-100/PW121	Bombardier de Havilland Dash 8 Q100	2
JFK	EA50	Eclipse 500 / PW610F	Eclipse 500 / PW610F	2
JFK	A310	A310-304\GE CF6-80 C2A2	Airbus A310-200 Series	2
JFK	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	1
JFK	C17	F117-PW-100 NM	Boeing C-17A	1
JFK	G150	ASTRA 1125/TFE731-3A	Gulfstream G150	1
JFK	A346	A340-642\Trent 556	Airbus A340-600 Series	1
JFK	A306	A300-622R\PW4168	Airbus A300F4-600 Series	1
JFK	BE40	LEAR 25/CJ610-8	Raytheon Beechjet 400	1
JFK	A30B	AIRBUS A300B4-200/CF6-50C2	Airbus A300B2-100 Series	1
EWR				
EWR	C550	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	43,358
EWR	BE55	BARON 58P/TS10-520-L	Raytheon Beech 55 Baron	41,342
EWR	R44	Robinson R44 Raven / Lycoming O-540-F1B5	Robinson R44 Raven / Lycoming O-540-F1B5	37,013
EWR	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	35,552
EWR	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	33,734
EWR	TBM7	1985 1-ENG VP PROP	EADS Socata TBM-700	32,858
EWR	BE9L	DASH 6/PT6A-27	Raytheon King Air 90	32,659
EWR	MD83	MD-83/JT8D-219	Boeing MD-83	28,636
EWR	A345	A340-642\Trent 556	Airbus A340-500 Series	22,087
EWR	GLF5	GULFSTREAM GV/BR 710	Gulfstream G500	11,256
EWR	C208	Piper PA-42 / PT6A-41	Cessna 208 Caravan	10,429
EWR	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	10,274
EWR	B732	BOEING 737/JT8D-9	Boeing 737-200 Series	6,158
EWR	FA7X	CITATION X / ROLLS ROYCE ALLISON AE3007C	Falcon 7X	5,865
EWR	GLEX	GULFSTREAM GV/BR 710	Bombardier Global Express	5,290
EWR	A30B	AIRBUS A300B4-200/CF6-50C2	Airbus A300B2-100 Series	4,723
EWR	EA50	Eclipse 500 / PW610F	Eclipse 500 / PW610F	4,599
EWR	C206	1985 1-ENG VP PROP	Cessna 206	4,520
EWR	B748	Boeing 747-8F/GEnx-2B67	7478	3,690
EWR	A318	A319-131\IAE V2522-A5	Airbus A318-100 Series	3,520
EWR	B739	BOEING 737-700/CFM56-7B24	Boeing 737-900 Series	3,393
EWR	B06	Bell 206L Long Ranger	Bell 206 JetRanger	2,926
EWR	JS41	SF340B/CT7-9B	BAE Jetstream 41	2,422
EWR	P46T	1985 1-ENG FP PROP	Piper PA46-TP Meridian	2,288
EWR	B77W	Boeing 777-300ER/GE90-115B-EIS	Boeing 777-300 ER	2,207
EWR	B752	BOEING 757-200/PW2037	Boeing 757-200 Series	2,067
EWR	E145	EMBRAER 145 LR / ALLISON AE3007A1	Embraer ERJ145-LR	2,038
EWR	GALX	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	1,529
EWR	C421	BARON 58P/TS10-520-L	Cessna 421 Golden Eagle	1,473
EWR	PA23	BARON 58P/TS10-520-L	Piper PA-23 Apache/Aztec	1,316
EWR	G150	ASTRA 1125/TFE731-3A	Gulfstream G150	1,059
EWR	LJ35	LEAR 36/TFE731-2	Bombardier Learjet 35	969
EWR	LJ55	LEAR 36/TFE731-2	Bombardier Learjet 55	943
EWR	C650	CIT 3/TFE731-3-100S	Cessna 650 Citation III	842
EWR	H25A	LEAR 36/TFE731-2	Hawker HS-125 Series 1	754
EWR	E50P	510 CITATION MUSTANG	Embraer 500	586

Airport	ICAO Code	Description	Model	Operations
EWR	LJ40	LEAR 36/TFE731-2	Bombardier Learjet 40	565
EWR	AEST	BARON 58P/TS10-520-L	Aerostar PA-60	561
EWR	CRJ7	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	554
EWR	MU2	DASH 6/PT6A-27	Mitsubishi MU-2	549
EWR	B753	BOEING 757-300/RB211-535E4B	Boeing 757-300 Series	456
EWR	GLF3	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	441
EWR	C510	510 CITATION MUSTANG	CESSNA CITATION 510	406
EWR	B762	BOEING 767-300/PW4060	Boeing 767-200 ER	370
EWR	MU30	MU300-10/JT15D-5	Mitsubishi MU-300 Diamond	363
EWR	A333	A330-301\GE CF6-80 E1A2	Airbus A330-300 Series	362
EWR	E135	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	351
EWR	B736	BOEING 737-700/CFM56-7B24	Boeing 737-600 Series	348
EWR	B772	BOEING 777-300/TRENT892	Boeing 777-200-LR	334
EWR	MD88	MD-83/JT8D-219	Boeing MD-88	325
EWR	B350	DASH 6/PT6A-27	Raytheon Super King Air 300	324
EWR	CRJ9	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-900	315
EWR	HA4T	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	311
EWR	C14T	BARON 58P/TS10-520-L	Cessna 414	304
EWR	B712	BOEING 717-200/BR 715	Boeing 717-200 Series	289
EWR	DH8C	DASH 8-300/PW123	Bombardier de Havilland Dash 8 Q300	284
EWR	FA20	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	265
EWR	A306	A300-622R\PW4168	Airbus A300F4-600 Series	237
EWR	LJ60	LEAR 36/TFE731-2	Bombardier Learjet 60	236
EWR	B722	BOEING 727-200/JT8D-7	Boeing 727-200 Series	232
EWR	A310	A310-304\GE CF6-80 C2A2	Airbus A310-200 Series	229
EWR	DC10	DC10-30/CF6-50C2	Boeing DC-10-30 Series	181
EWR	MD87	MD-83/JT8D-219	Boeing MD-87	179
EWR	SR22	1985 1-ENG COMP	Cirrus SR22	176
EWR	B721	BOEING 727-100/JT8D-7	Boeing 727-100 Series	176
EWR	AT72	HS748/DART MK532-2	ATR 72-500	160
EWR	C441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	160
EWR	PAY3	Piper PA-42 / PT6A-41	Piper PA-42 Cheyenne Series	150
EWR	C25C	CIT 2/JT15D-4	Cessna 525C CitationJet	137
EWR	B788	Boeing 787-8/T1000-C/01 Family Plan Cert	B787-8R	128
EWR	B407	Bell 407	Bell 407 / Rolls-Royce 250-C47B	126
EWR	B772	BOEING 777-200ER/GE90-90B	Boeing 777-200 Series	125
EWR	C182	Cessna 182H / Continental O-470-R	Cessna 182	121
EWR	CL30	CL600/ALF502L	Bombardier Challenger 300	119
EWR	PRM1	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	104
EWR	C680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	102
EWR	DH8B	DASH 8-100/PW121	DeHavilland DHC-8-100	96
EWR	ASTR	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	96
EWR	A346	A340-642\Trent 556	Airbus A340-600 Series	86
EWR	CL60	CL600/ALF502L	Bombardier Challenger 600	77
EWR	BE10	DASH 6/PT6A-27	Raytheon King Air 100	76
EWR	FA50	1985 BUSINESS JET	Dassault Falcon 50	73
EWR	T38	NORTHRUP TALON T-38A NM	T-38 Talon	65
EWR	A332	A330-301\GE CF6-80 E1A2	Airbus A330-200 Series	60
EWR	B763	BOEING 767-300/PW4060	Boeing 767-300 Series	54
EWR	C750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	50
EWR	B742	BOEING 747-200/JT9D-7	Boeing 747-200 Series	47
EWR	PA27	BARON 58P/TS10-520-L	Piper PA-27 Aztec	46
EWR	C25A	CIT 2/JT15D-4	Cessna 525 CitationJet	24
EWR	DC93	DC9-30/JT8D-9	Boeing DC-9-30 Series	23
EWR	P32R	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	23
EWR	D328	Dornier 328-100 / PW119C	Dornier 328-100 Series	23
EWR	PA31	BARON 58P/TS10-520-L	Piper PA-31 Navajo	22
EWR	M20T	1985 1-ENG VP PROP	Mooney M20-K	21
EWR	LJ31	LEAR 36/TFE731-2	Bombardier Learjet 31	21
EWR	GLF4	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	19
EWR	H25C	LEAR 36/TFE731-2	Raytheon Hawker 1000	19
EWR	A124	BOEING 707-320B/JT3D-7	Antonov 124 Ruslan	18
EWR	E190	ERJ190-100	Embraer ERJ190	18
EWR	B744	BOEING 747-400/PW4056	Boeing 747-400 Series	17
EWR	GL5T	GULFSTREAM GV/BR 710	Bombardier Global Express Business	16
EWR	P28A	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	16
EWR	SBR1	LEAR 36/TFE731-2	Rockwell Sabreliner 65	14

Airport	ICAO Code	Description	Model	Operations
EWR	B190	BEECH 1900D / PT6A67	Raytheon Beech 1900-C	13
EWR	E145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	13
EWR	P180	DASH 6/PT6A-27	Piaggio P.180 Avanti	13
EWR	GLF6	GULFSTREAM GV/BR 710	GULFSTREAM AEROSPACE Gulfstream G650	12
EWR	DH8A	DASH 8-100/PW121	Bombardier de Havilland Dash 8 Q100	12
EWR	B733	BOEING 737-300/CFM56-3B-1	Boeing 737-300 Series	12
EWR	MD90	MD-90/V2525-D5	Boeing MD-90	11
EWR	MD81	MD-81/JT8D-217	Boeing MD-81	11
EWR	A320	A320-211\CFM56-5A1	Airbus A320-200 Series	11
EWR	B36T	Cessna 208 / PT6A-114	Raytheon Beech Bonanza 36	10
EWR	A343	A340-211\CFM56-5C2	Airbus A340-300 Series	9
EWR	E55P	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	9
EWR	E120	EMBRAER 120 ER/ PRATT & WHITNEY PW118	Embraer EMB120 Brasilia	9
EWR	A319	A319-131\IAE V2522-A5	Airbus A319-100 Series	8
EWR	E170	ERJ170-100	Embraer ERJ170	8
EWR	A321	A321-232\V2530-A5	Airbus A321-100 Series	7
EWR	B735	BOEING 737-500/CFM56-3C-1	Boeing 737-500 Series	7
EWR	B738	BOEING 737-800/CFM56-7B26	Boeing 737-800 Series	7
EWR	FA10	FEDX 727-200/JT8D-15	Dassault Mercure 100	7
EWR	GLF2	GULFSTREAM GII/SPEY 511-8	Gulfstream II	7
EWR	TBM8	CONQUEST II/TPE331-8	SOCATA TBM 850	6
EWR	B773	BOEING 777-300/TRENT892	Boeing 777-300 Series	6
EWR	PAY1	CONQUEST II/TPE331-8	Piper PA-31T Cheyenne	6
EWR	A109	Agusta A-109	Agusta A-109	6
EWR	PA34	BARON 58P/TS10-520-L	Piper PA-34 Seneca	5
EWR	B764	BOEING 767-400ER/CF6-80C2B(F)	Boeing 767-400	5
EWR	SR20	1985 1-ENG COMP	Cirrus SR20	5
EWR	C172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	5
EWR	CRJ2	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	5
EWR	BE40	LEAR 25/CJ610-8	Raytheon Beechjet 400	4
EWR	C310	BARON 58P/TS10-520-L	Cessna 310	4
EWR	BE20	DASH 6/PT6A-27	Raytheon C-12 Huron	4
EWR	H25B	FALCON 20/CF700-2D-2	Hawker HS-125 Series 700	3
EWR	LJ45	LEAR 36/TFE731-2	Bombardier Learjet 45	3
EWR	BE9T	DASH 6/PT6A-27	Raytheon Beech 99	3
EWR	B734	BOEING 737-400/CFM56-3C-1	Boeing 737-400 Series	3
EWR	B737	BOEING 737-700/CFM56-7B24	Boeing 737-700 Series	3
EWR	B789	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-900 Dreamliner	3
EWR	C340	BARON 58P/TS10-520-L	Cessna 340	3
EWR	SF34	SF340B/CT7-9B	Saab 340-A	2
EWR	MD11	MD-11/CF6-80C2D1F	Boeing MD-11	2
EWR	AT43	DASH 8-100/PW121	ATR 42-400	2
EWR	C500	CIT 2/JT15D-4	Cessna 500 Citation I	2
EWR	WW24	HS748/DART MK532-2	Gulfstream I	2
EWR	F900	1985 BUSINESS JET	Dassault Falcon 900	2
EWR	PC12	Cessna 208 / PT6A-114	Pilatus PC-12	2
EWR	F2TH	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000	2
EWR	MD82	MD-82/JT8D-217A	Boeing MD-82	1
EWR	BE58	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	1
EWR	A388	A380-841\RR trent970	Airbus A380-800 Series/Trent 970	1
LGA				
LGA	CRJ7	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	56,586
LGA	E170	ERJ170-100	Embraer ERJ170	46,489
LGA	A320	A320-211\CFM56-5A1	Airbus A320-200 Series	34,753
LGA	B738	BOEING 737-800/CFM56-7B26	Boeing 737-800 Series	34,463
LGA	E190	ERJ190-100	Embraer ERJ190	24,978
LGA	B737	BOEING 737-700/CFM56-7B24	Boeing 737-700 Series	23,431
LGA	CRJ9	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-900	22,414
LGA	E145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	22,063
LGA	MD88	MD-83/JT8D-219	Boeing MD-88	19,684
LGA	B712	BOEING 717-200/BR 715	Boeing 717-200 Series	14,466
LGA	A319	A319-131\IAE V2522-A5	Airbus A319-100 Series	14,090
LGA	CL60	CL600/ALF502L	Bombardier Challenger 600	13,778
LGA	E135	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	8,344
LGA	A321	A321-232\V2530-A5	Airbus A321-100 Series	6,276
LGA	MD90	MD-90/V2525-D5	Boeing MD-90	5,586
LGA	CRJ2	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	3,665

Airport	ICAO Code	Description	Model	Operations
LGA	B736	BOEING 737-700/CFM56-7B24	Boeing 737-600 Series	2,995
LGA	B739	BOEING 737-700/CFM56-7B24	Boeing 737-900 Series	1,326
LGA	E145	EMBRAER 145 LR / ALLISON AE3007A1	Embraer ERJ145-LR	1,252
LGA	B752	BOEING 757-200/PW2037	Boeing 757-200 Series	1,091
LGA	DH8A	DASH 8-100/PW121	Bombardier de Havilland Dash 8 Q100	843
LGA	GLF4	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	814
LGA	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	563
LGA	C750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	562
LGA	GLF5	GULFSTREAM GV/BR 710	Gulfstream G500	544
LGA	H25B	FALCON 20/CF700-2D-2	Hawker HS-125 Series 700	531
LGA	B733	BOEING 737-300/CFM56-3B-1	Boeing 737-300 Series	480
LGA	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	421
LGA	CL30	CL600/ALF502L	Bombardier Challenger 300	377
LGA	PC12	Cessna 208 / PT6A-114	Pilatus PC-12	373
LGA	BE40	LEAR 25/CJ610-8	Raytheon Beechjet 400	355
LGA	F900	1985 BUSINESS JET	Dassault Falcon 900	325
LGA	F2TH	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000	323
LGA	E55P	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	308
LGA	GLEX	GULFSTREAM GV/BR 710	Bombardier Global Express	266
LGA	C680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	262
LGA	B407	Bell 407	Bell 407 / Rolls-Royce 250-C47B	244
LGA	C172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	169
LGA	B350	DASH 6/PT6A-27	Raytheon Super King Air 300	168
LGA	B763	BOEING 767-300/PW4060	Boeing 767-300 Series	147
LGA	GALX	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	146
LGA	GL5T	GULFSTREAM GV/BR 710	Bombardier Global Express Business	141
LGA	C208	Piper PA-42 / PT6A-41	Cessna 208 Caravan	135
LGA	HA4T	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	117
LGA	SR22	1985 1-ENG COMP	Cirrus SR22	111
LGA	DH8D	DASH 8-100/PW121	DeHavilland DHC-8-100	110
LGA	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	95
LGA	MD83	MD-83/JT8D-219	Boeing MD-83	93
LGA	C25A	CIT 2/JT15D-4	Cessna 525 CitationJet	87
LGA	LJ45	LEAR 36/TFE731-2	Bombardier Learjet 45	83
LGA	GLF3	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	75
LGA	LJ60	LEAR 36/TFE731-2	Bombardier Learjet 60	70
LGA	PA31	BARON 58P/TS10-520-L	Piper PA-31 Navajo	68
LGA	C421	BARON 58P/TS10-520-L	Cessna 421 Golden Eagle	65
LGA	BE20	DASH 6/PT6A-27	Raytheon C-12 Huron	64
LGA	MD82	MD-82/JT8D-217A	Boeing MD-82	63
LGA	C550	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	57
LGA	B36T	Cessna 208 / PT6A-114	Raytheon Beech Bonanza 36	56
LGA	FA50	1985 BUSINESS JET	Dassault Falcon 50	48
LGA	PA34	BARON 58P/TS10-520-L	Piper PA-34 Seneca	44
LGA	B06	Bell 206L Long Ranger	Bell 206 JetRanger	40
LGA	BE9L	DASH 6/PT6A-27	Raytheon King Air 90	39
LGA	FA7X	CITATION X / ROLLS ROYCE ALLISON AE3007C	Falcon 7X	39
LGA	DC10	DC10-30/CF6-50C2	Boeing DC-10-30 Series	39
LGA	C510	510 CITATION MUSTANG	CESSNA CITATION 510	38
LGA	A109	Agusta A-109	Agusta A-109	34
LGA	BE58	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	33
LGA	TBM8	CONQUEST II/TPE331-8	SOCATA TBM 850	30
LGA	G150	ASTRA 1125/TFE731-3A	Gulfstream G150	29
LGA	SR20	1985 1-ENG COMP	Cirrus SR20	27
LGA	R44	Robinson R44 Raven / Lycoming O-540-F1B5	Robinson R44 Raven / Lycoming O-540-F1B5	26
LGA	GLF6	GULFSTREAM GV/BR 710	GULFSTREAM AEROSPACE Gulfstream G650	23
LGA	P28A	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	21
LGA	P32R	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	19
LGA	LJ35	LEAR 36/TFE731-2	Bombardier Learjet 35	18
LGA	C182	Cessna 182H / Continental O-470-R	Cessna 182	18
LGA	ASTR	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	18
LGA	C650	CIT 3/TFE731-3-100S	Cessna 650 Citation III	17
LGA	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA-30 Twin Comanche	15
LGA	C310	BARON 58P/TS10-520-L	Cessna 310	15
LGA	B762	BOEING 767-300/PW4060	Boeing 767-200 ER	15
LGA	B734	BOEING 737-400/CFM56-3C-1	Boeing 737-400 Series	14
LGA	C14T	BARON 58P/TS10-520-L	Cessna 414	14

Airport	ICAO Code	Description	Model	Operations
LGA	LJ40	LEAR 36/TFE731-2	Bombardier Learjet 40	13
LGA	C402	BARON 58P/TS10-520-L	Cessna 402	13
LGA	C340	BARON 58P/TS10-520-L	Cessna 340	13
LGA	B772	BOEING 777-200ER/GE90-90B	Boeing 777-200 Series	10
LGA	PRM1	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	10
LGA	LJ55	LEAR 36/TFE731-2	Bombardier Learjet 55	10
LGA	B732	BOEING 737/JT8D-9	Boeing 737-200 Series	9
LGA	MD11	MD-11/CF6-80C2D1F	Boeing MD-11	8
LGA	EA50	Eclipse 500 / PW610F	Eclipse 500 / PW610F	8
LGA	A333	A330-301\GE CF6-80 E1A2	Airbus A330-300 Series	8
LGA	C25C	CIT 2/JT15D-4	Cessna 525C CitationJet	8
LGA	A332	A330-301\GE CF6-80 E1A2	Airbus A330-200 Series	7
LGA	B722	BOEING 727-200/JT8D-7	Boeing 727-200 Series	7
LGA	E50P	510 CITATION MUSTANG	Embraer 500	6
LGA	B77W	Boeing 777-300ER/GE90-115B-EIS	Boeing 777-300 ER	6
LGA	LJ31	LEAR 36/TFE731-2	Bombardier Learjet 31	6
LGA	PAY1	CONQUEST II/TPE331-8	Piper PA-31T Cheyenne	6
LGA	DH8C	DASH 8-300/PW123	Bombardier de Havilland Dash 8 Q300	6
LGA	FA10	FEDX 727-200/JT8D-15	Dassault Mercure 100	6
LGA	B788	Boeing 787-8/T1000-C/01 Family Plan Cert	B787-8R	6
LGA	B764	BOEING 767-400ER/CF6-80C2B(F)	Boeing 767-400	5
LGA	J328	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dornier 328 Jet	5
LGA	C441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	4
LGA	FA20	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	4
LGA	D328	Dornier 328-100 / PW119C	Dornier 328-100 Series	4
LGA	P180	DASH 6/PT6A-27	Piaggio P.180 Avanti	4
LGA	A346	A340-642\Trent 556	Airbus A340-600 Series	3
LGA	AC95	CONQUEST II/TPE331-8	COMMANDER980/1000	3
LGA	B753	BOEING 757-300/RB211-535E4B	Boeing 757-300 Series	3
LGA	B748	Boeing 747-8F/GEnx-2B67	7478	3
LGA	BE99	DASH 6/PT6A-27	Raytheon Beech 99	3
LGA	AEST	BARON 58P/TS10-520-L	Aerostar PA-60	3
LGA	E120	EMBRAER 120 ER/ PRATT & WHITNEY PW118	Embraer EMB120 Brasilia	3
LGA	A306	A300-622R\PW4168	Airbus A300F4-600 Series	2
LGA	M20T	1985 1-ENG VP PROP	Mooney M20-K	2
LGA	B773	BOEING 777-300/TRENT892	Boeing 777-300 Series	2
LGA	TBM7	1985 1-ENG VP PROP	EADS Socata TBM-700	2
LGA	MU30	MU300-10/JT15D-5	Mitsubishi MU-300 Diamond	2
LGA	B190	BEECH 1900D / PT6A67	Raytheon Beech 1900-C	2
LGA	BE10	DASH 6/PT6A-27	Raytheon King Air 100	2
LGA	A343	A340-211\CFM56-5C2	Airbus A340-300 Series	2
LGA	C500	CIT 2/JT15D-4	Cessna 500 Citation I	2
LGA	BE55	BARON 58P/TS10-520-L	Raytheon Beech 55 Baron	2
LGA	C206	1985 1-ENG VP PROP	Cessna 206	2
LGA	P46T	1985 1-ENG FP PROP	Piper PA46-TP Meridian	1
LGA	B744	BOEING 747-400/PW4056	Boeing 747-400 Series	1
LGA	PA24	1985 1-ENG VP PROP	Piper PA-24 Comanche	1
LGA	A388	A380-841\RR trent970	Airbus A380-800 Series/Trent 970	1
LGA	B789	Boeing 787-8/T1000-C/01 Family Plan Cert	Boeing 787-900 Dreamliner	1
LGA	H25C	LEAR 36/TFE731-2	Raytheon Hawker 1000	1
LGA	A310	A310-304\GE CF6-80 C2A2	Airbus A310-200 Series	1
LGA	A30B	AIRBUS A300B4-200/CF6-50C2	Airbus A300B2-100 Series	1
LGA	PA27	BARON 58P/TS10-520-L	Piper PA-27 Aztec	1
LGA	AC90	DASH 6/PT6A-27	Rockwell Commander 690	1
LGA	MU2	DASH 6/PT6A-27	Mitsubishi MU-2	1
LGA	T38	NORTHRUP TALON T-38A NM	T-38 Talon	1
LGA	C501	CIT 2/JT15D-4	Cessna 501 Citation ISP	1
TEB				
TEB	GLF4	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	13,079
TEB	H25B	FALCON 20/CF700-2D-2	Hawker HS-125 Series 700	12,499
TEB	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	9,980
TEB	CL30	CL600/ALF502L	Bombardier Challenger 300	9,964
TEB	CL60	CL600/ALF502L	Bombardier Challenger 600	9,102
TEB	C750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	8,534
TEB	GLF5	GULFSTREAM GV/BR 710	Gulfstream G500	8,322
TEB	F2TH	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000	7,868
TEB	PC12	Cessna 208 / PT6A-114	Pilatus PC-12	6,379

Airport	ICAO Code	Description	Model	Operations
TEB	BE40	LEAR 25/CJ610-8	Raytheon Beechjet 400	6,266
TEB	F900	1985 BUSINESS JET	Dassault Falcon 900	5,432
TEB	C680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	5,314
TEB	GLEX	GULFSTREAM GV/BR 710	Bombardier Global Express	5,135
TEB	C25A	CIT 2/JT15D-4	Cessna 525 CitationJet	5,020
TEB	LJ45	LEAR 36/TFE731-2	Bombardier Learjet 45	4,187
TEB	LJ60	LEAR 36/TFE731-2	Bombardier Learjet 60	4,007
TEB	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	3,886
TEB	E55P	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	3,671
TEB	B350	DASH 6/PT6A-27	Raytheon Super King Air 300	3,556
TEB	GALX	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	3,347
TEB	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	2,651
TEB	GL5T	GULFSTREAM GV/BR 710	Bombardier Global Express Business	2,174
TEB	LJ35	LEAR 36/TFE731-2	Bombardier Learjet 35	1,771
TEB	E135	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	1,699
TEB	FA50	1985 BUSINESS JET	Dassault Falcon 50	1,696
TEB	BE20	DASH 6/PT6A-27	Raytheon C-12 Huron	1,515
TEB	GLF6	GULFSTREAM GV/BR 710	GULFSTREAM AEROSPACE Gulfstream G650	1,452
TEB	SR22	1985 1-ENG COMP	Cirrus SR22	1,434
TEB	C550	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	1,365
TEB	E50P	510 CITATION MUSTANG	Embraer 500	1,159
TEB	FA7X	CITATION X / ROLLS ROYCE ALLISON AE3007C	Falcon 7X	1,140
TEB	BE9L	DASH 6/PT6A-27	Raytheon King Air 90	1,117
TEB	B407	Bell 407	Bell 407 / Rolls-Royce 250-C47B	1,036
TEB	C650	CIT 3/TFE731-3-100S	Cessna 650 Citation III	905
TEB	LJ55	LEAR 36/TFE731-2	Bombardier Learjet 55	877
TEB	G150	ASTRA 1125/TFE731-3A	Gulfstream G150	829
TEB	LJ31	LEAR 36/TFE731-2	Bombardier Learjet 31	757
TEB	H25C	LEAR 36/TFE731-2	Raytheon Hawker 1000	696
TEB	PRM1	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	637
TEB	FA20	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	566
TEB	HA4T	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	564
TEB	PA31	BARON 58P/TS10-520-L	Piper PA-31 Navajo	553
TEB	BE58	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	542
TEB	ASTR	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	509
TEB	EA50	Eclipse 500 / PW610F	Eclipse 500 / PW610F	446
TEB	C510	510 CITATION MUSTANG	CESSNA CITATION 510	443
TEB	LJ40	LEAR 36/TFE731-2	Bombardier Learjet 40	436
TEB	C172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	407
TEB	P180	DASH 6/PT6A-27	Piaggio P.180 Avanti	406
TEB	GLF3	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	404
TEB	PA34	BARON 58P/TS10-520-L	Piper PA-34 Seneca	395
TEB	FA10	FEDX 727-200/JT8D-15	Dassault Mercure 100	328
TEB	TBM8	CONQUEST II/TPE331-8	SOCATA TBM 850	310
TEB	P32R	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	295
TEB	T38	NORTHRUP TALON T-38A NM	T-38 Talon	288
TEB	P46T	1985 1-ENG FP PROP	Piper PA46-TP Meridian	257
TEB	B36T	Cessna 208 / PT6A-114	Raytheon Beech Bonanza 36	256
TEB	C421	BARON 58P/TS10-520-L	Cessna 421 Golden Eagle	255
TEB	C25C	CIT 2/JT15D-4	Cessna 525C CitationJet	210
TEB	A109	Agusta A-109	Agusta A-109	184
TEB	BE9T	DASH 6/PT6A-27	Raytheon Beech 99	177
TEB	C182	Cessna 182H / Continental O-470-R	Cessna 182	171
TEB	SBR1	LEAR 36/TFE731-2	Rockwell Sabreliner 65	159
TEB	C208	Piper PA-42 / PT6A-41	Cessna 208 Caravan	156
TEB	GLF2	GULFSTREAM GII/SPEY 511-8	Gulfstream II	154
TEB	BE10	DASH 6/PT6A-27	Raytheon King Air 100	151
TEB	C14T	BARON 58P/TS10-520-L	Cessna 414	145
TEB	PAY1	CONQUEST II/TPE331-8	Piper PA-31T Cheyenne	139
TEB	WW24	HS748/DART MK532-2	Gulfstream I	139
TEB	C310	BARON 58P/TS10-520-L	Cessna 310	129
TEB	M20T	1985 1-ENG VP PROP	Mooney M20-K	127
TEB	C441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	117
TEB	TBM7	1985 1-ENG VP PROP	EADS Socata TBM-700	109
TEB	AEST	BARON 58P/TS10-520-L	Aerostar PA-60	99
TEB	PA27	BARON 58P/TS10-520-L	Piper PA-27 Aztec	99
TEB	SR20	1985 1-ENG COMP	Cirrus SR20	98

Airport	ICAO Code	Description	Model	Operations
TEB	C340	BARON 58P/TS10-520-L	Cessna 340	96
TEB	BE55	BARON 58P/TS10-520-L	Raytheon Beech 55 Baron	95
TEB	P28A	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	95
TEB	AC90	DASH 6/PT6A-27	Rockwell Commander 690	90
TEB	H25A	LEAR 36/TFE731-2	Hawker HS-125 Series 1	77
TEB	B06	Bell 206L Long Ranger	Bell 206 JetRanger	74
TEB	MU2	DASH 6/PT6A-27	Mitsubishi MU-2	72
TEB	C10T	1985 1-ENG VP PROP	Cessna 210 Centurion	72
TEB	C206	1985 1-ENG VP PROP	Cessna 206	71
TEB	JS31	DASH 6/PT6A-27	BAE Jetstream 31	71
TEB	E145	EMBRAER 145 LR / ALLISON AE3007A1	Embraer ERJ145-LR	65
TEB	C501	CIT 2/JT15D-4	Cessna 501 Citation ISP	65
TEB	C500	CIT 2/JT15D-4	Cessna 500 Citation I	65
TEB	MU30	MU300-10/JT15D-5	Mitsubishi MU-300 Diamond	59
TEB	J328	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dornier 328 Jet	55
TEB	D328	Dornier 328-100 / PW119C	Dornier 328-100 Series	53
TEB	CRJ7	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	50
TEB	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA-30 Twin Comanche	49
TEB	LJ25	LEAR 25/CJ610-8	Bombardier Learjet 25	48
TEB	R44	Robinson R44 Raven / Lycoming O-540-F1B5	Robinson R44 Raven / Lycoming O-540-F1B5	48
TEB	L29B	LEAR 36/TFE731-2	Lockheed L-1329 Jetstar II	36
TEB	PA24	1985 1-ENG VP PROP	Piper PA-24 Comanche	28
TEB	AC95	CONQUEST II/TPE331-8	COMMANDER980/1000	27
TEB	C425	CONQUEST II/TPE331-8	Cessna 425 Conquest I	27
TEB	AC50	BARON 58P/TS10-520-L	Rockwell Commander 500	26
TEB	E120	EMBRAER 120 ER/ PRATT & WHITNEY PW118	Embraer EMB120 Brasilia	26
TEB	B190	BEECH 1900D / PT6A67	Raytheon Beech 1900-C	19
TEB	PAY3	Piper PA-42 / PT6A-41	Piper PA-42 Cheyenne Series	18
TEB	PA23	BARON 58P/TS10-520-L	Piper PA-23 Apache/Aztec	13
TEB	SBR2	NA SABRELINER 80	Rockwell Sabreliner 80	13
TEB	C402	BARON 58P/TS10-520-L	Cessna 402	12
TEB	SW3	DASH 6/PT6A-27	Fairchild SA-227-AC Metro III	12
TEB	CRJ1	CL600/ALF502L	Bombardier CRJ-100	12
TEB	COUR	1985 1-ENG VP PROP	Helio U-10 Super Courier	8
TEB	SW4	DASH 6/PT6A-27	Fairchild Metro IVC	7
TEB	DC91	DC9-10/JT8D-7	Boeing DC-9-10 Series	6
TEB	B764	BOEING 767-400ER/CF6-80C2B(F)	Boeing 767-400	5
TEB	BE60	BARON 58P/TS10-520-L	Raytheon Beech 60 Duke	4
TEB	ST75	1985 1-ENG VP PROP	Boeing Stearman PT-17 / A75N1	4
TEB	C551	CESSNA 550 CITATION BRAVO / PW530A	Cessna 551 Citation IISP	4
TEB	TRIN	1985 1-ENG VP PROP	EADS Socata TB-20 Trinidad	4
TEB	SF34	SF340B/CT7-9B	Saab 340-A	3
TEB	B733	BOEING 737-300/CFM56-3B-1	Boeing 737-300 Series	3
TEB	C337	BARON 58P/TS10-520-L	Cessna 337 Skymaster	2
TEB	S61	Sikorsky S-61 (CH-3A)	Sikorsky SH-3 Sea King	2
TEB	SB20	HS748/DART MK532-2	Saab 2000	2
TEB	E110	DASH 6/PT6A-27	Embraer EMB110 Bandeirante	2
TEB	B461	BAE146-200/ALF502R-5	BAE 146-100	2
TEB	LJ24	LEAR 25/CJ610-8	Bombardier Learjet 24	2
TEB	DC10	DC10-30/CF6-50C2	Boeing DC-10-30 Series	2
TEB	TOBA	1985 1-ENG VP PROP	EADS Socata TB-10 Tobago	2
TEB	CVLT	CV580/ALL 501-D15	Convair CV-640	1
TEB	B753	BOEING 757-300/RB211-535E4B	Boeing 757-300 Series	1
TEB	B772	BOEING 777-300/TRENT892	Boeing 777-200-LR	1
SWF				
SWF	C340	BARON 58P/TS10-520-L	Cessna 340	6,117
SWF	C206	1985 1-ENG VP PROP	Cessna 206	4,514
SWF	A319	A319-131\IAE V2522-A5	Airbus A319-100 Series	3,868
SWF	H25B	FALCON 20/CF700-2D-2	Hawker HS-125 Series 700	3,296
SWF	F2TH	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 2000	2,392
SWF	SF34	SF340B/CT7-9B	Saab 340-A	1,762
SWF	B744	BOEING 747-400/PW4056	Boeing 747-400 Series	1,624
SWF	M20T	1985 1-ENG VP PROP	Mooney M20-K	1,168
SWF	C17	F117-PW-100 NM	Boeing C-17A	1,162
SWF	WW24	HS748/DART MK532-2	Gulfstream I	1,126
SWF	T38	NORTHRUP TALON T-38A NM	T-38 Talon	1,018
SWF	GLF4	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G400	1,008

Airport	ICAO Code	Description	Model	Operations
SWF	CRJ7	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-700	912
SWF	B734	BOEING 737-400/CFM56-3C-1	Boeing 737-400 Series	658
SWF	C130	C-130H/T56-A-15	Lockheed C-130 Hercules	658
SWF	A30B	AIRBUS A300B4-200/CF6-50C2	Airbus A300B2-100 Series	586
SWF	L29B	LEAR 36/TFE731-2	Lockheed L-1329 Jetstar II	548
SWF	B762	BOEING 767-300/PW4060	Boeing 767-200 ER	520
SWF	A306	A300-622R\PW4168	Airbus A300F4-600 Series	502
SWF	B350	DASH 6/PT6A-27	Raytheon Super King Air 300	448
SWF	GL5T	GULFSTREAM GV/BR 710	Bombardier Global Express Business	440
SWF	TAMP	1985 1-ENG FP PROP	EADS Socata TB-9 Tampico	396
SWF	C310	BARON 58P/TS10-520-L	Cessna 310	352
SWF	FA7X	CITATION X / ROLLS ROYCE ALLISON AE3007C	Falcon 7X	342
SWF	SR20	1985 1-ENG COMP	Cirrus SR20	330
SWF	C650	CIT 3/TFE731-3-100S	Cessna 650 Citation III	312
SWF	MD88	MD-83/JT8D-219	Boeing MD-88	302
SWF	C150	1985 1-ENG FP PROP	Cessna 150 Series	290
SWF	LJ55	LEAR 36/TFE731-2	Bombardier Learjet 55	280
SWF	DH8D	DASH 8-100/PW121	DeHavilland DHC-8-100	268
SWF	E145	EMBRAER 145 LR / ALLISON AE3007A1	Embraer ERJ145-LR	264
SWF	B737	BOEING 737-700/CFM56-7B24	Boeing 737-700 Series	258
SWF	FA10	FEDX 727-200/JT8D-15	Dassault Mercure 100	252
SWF	B36T	Cessna 208 / PT6A-114	Raytheon Beech Bonanza 36	236
SWF	C172	CESSNA 172R / LYCOMING IO-360-L2A	Cessna 172 Skyhawk	234
SWF	C25A	CIT 2/JT15D-4	Cessna 525 CitationJet	228
SWF	P32R	1985 1-ENG VP PROP	Piper PA-32 Cherokee Six	192
SWF	MU2	DASH 6/PT6A-27	Mitsubishi MU-2	190
SWF	A345	A340-642\Trent 556	Airbus A340-500 Series	186
SWF	A320	A320-211\CFM56-5A1	Airbus A320-200 Series	180
SWF	B752	BOEING 757-200/PW2037	Boeing 757-200 Series	174
SWF	TRIN	1985 1-ENG VP PROP	EADS Socata TB-20 Trinidad	174
SWF	C402	BARON 58P/TS10-520-L	Cessna 402	170
SWF	C14T	BARON 58P/TS10-520-L	Cessna 414	148
SWF	B788	Boeing 787-8/T1000-C/01 Family Plan Cert	B787-8R	140
SWF	FA50	1985 BUSINESS JET	Dassault Falcon 50	112
SWF	B772	BOEING 777-200ER/GE90-90B	Boeing 777-200 Series	96
SWF	C421	BARON 58P/TS10-520-L	Cessna 421 Golden Eagle	90
SWF	BE60	BARON 58P/TS10-520-L	Raytheon Beech 60 Duke	90
SWF	PRM1	CESSNA 550 CITATION BRAVO / PW530A	Raytheon Premier I	90
SWF	GLF3	GULFSTREAM GIV-SP/TAY 611-8	Gulfstream G300	70
SWF	B712	BOEING 717-200/BR 715	Boeing 717-200 Series	70
SWF	E135	EMBRAER 145 ER/ALLISON AE3007	Embraer Legacy	68
SWF	E55P	CESSNA 550 CITATION BRAVO / PW530A	Embraer 505	68
SWF	C208	Piper PA-42 / PT6A-41	Cessna 208 Caravan	68
SWF	A321	A321-232\V2530-A5	Airbus A321-100 Series	68
SWF	P46T	1985 1-ENG FP PROP	Piper PA46-TP Meridian	64
SWF	CRJ2	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-200	62
SWF	C510	510 CITATION MUSTANG	CESSNA CITATION 510	58
SWF	BE40	LEAR 25/CJ610-8	Raytheon Beechjet 400	58
SWF	ASTR	ASTRA 1125/TFE731-3A	Israel IAI-1125 Astra	56
SWF	A124	BOEING 707-320B/JT3D-7	Antonov 124 Ruslan	56
SWF	C441	CONQUEST II/TPE331-8	Cessna 441 Conquest II	56
SWF	GALX	CITATION X / ROLLS ROYCE ALLISON AE3007C	Gulfstream G200	56
SWF	GLEX	GULFSTREAM GV/BR 710	Bombardier Global Express	56
SWF	BE9L	DASH 6/PT6A-27	Raytheon King Air 90	52
SWF	BE58	BARON 58P/TS10-520-L	Raytheon Beech Baron 58	52
SWF	FA20	CITATION X / ROLLS ROYCE ALLISON AE3007C	Dassault Falcon 200	52
SWF	LJ60	LEAR 36/TFE731-2	Bombardier Learjet 60	52
SWF	CL60	CL600/ALF502L	Bombardier Challenger 600	52
SWF	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation V	46
SWF	PA24	1985 1-ENG VP PROP	Piper PA-24 Comanche	42
SWF	P28A	1985 1-ENG FP PROP	Piper PA-28 Cherokee Series	42
SWF	C750	CITATION X / ROLLS ROYCE ALLISON AE3007C	Cessna 750 Citation X	40
SWF	F900	1985 BUSINESS JET	Dassault Falcon 900	40
SWF	TBM8	CONQUEST II/TPE331-8	SOCATA TBM 850	40
SWF	PA31	BARON 58P/TS10-520-L	Piper PA-31 Navajo	36
SWF	AC90	DASH 6/PT6A-27	Rockwell Commander 690	36
SWF	PA27	BARON 58P/TS10-520-L	Piper PA-27 Aztec	36

Airport	ICAO Code	Description	Model	Operations
SWF	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A	Piper PA-30 Twin Comanche	34
SWF	TBM7	1985 1-ENG VP PROP	EADS Socata TBM-700	30
SWF	BE20	DASH 6/PT6A-27	Raytheon C-12 Huron	30
SWF	SR22	1985 1-ENG COMP	Cirrus SR22	30
SWF	C25C	CIT 2/JT15D-4	Cessna 525C CitationJet	30
SWF	C501	CIT 2/JT15D-4	Cessna 501 Citation ISP	30
SWF	LJ35	LEAR 36/TFE731-2	Bombardier Learjet 35	28
SWF	B722	BOEING 727-200/JT8D-7	Boeing 727-200 Series	28
SWF	E50P	510 CITATION MUSTANG	Embraer 500	28
SWF	PAY3	Piper PA-42 / PT6A-41	Piper PA-42 Cheyenne Series	28
SWF	LJ31	LEAR 36/TFE731-2	Bombardier Learjet 31	24
SWF	C550	CESSNA 550 CITATION BRAVO / PW530A	Cessna 550 Citation II	24
SWF	A388	A380-841\RR trent970	Airbus A380-800 Series/Trent 970	24
SWF	R44	Robinson R44 Raven / Lycoming O-540-F1B5	Robinson R44 Raven / Lycoming O-540-F1B5	24
SWF	GLF5	GULFSTREAM GV/BR 710	Gulfstream G500	20
SWF	AEST	BARON 58P/TS10-520-L	Aerostar PA-60	20
SWF	C425	CONQUEST II/TPE331-8	Cessna 425 Conquest I	20
SWF	PA34	BARON 58P/TS10-520-L	Piper PA-34 Seneca	20
SWF	GLF6	GULFSTREAM GV/BR 710	GULFSTREAM AEROSPACE Gulfstream G650	20
SWF	BE55	BARON 58P/TS10-520-L	Raytheon Beech 55 Baron	20
SWF	S76	Sikorsky S-76 Spirit	Sikorsky S-76 Spirit	20
SWF	LJ40	LEAR 36/TFE731-2	Bombardier Learjet 40	20
SWF	H25C	LEAR 36/TFE731-2	Raytheon Hawker 1000	18
SWF	A333	A330-301\GE CF6-80 E1A2	Airbus A330-300 Series	18
SWF	HA4T	CITATION X / ROLLS ROYCE ALLISON AE3007C	Raytheon Hawker 4000 Horizon	18
SWF	AT43	DASH 8-100/PW121	ATR 42-400	14
SWF	C10T	1985 1-ENG VP PROP	Cessna 210 Centurion	12
SWF	B738	BOEING 737-800/CFM56-7B26	Boeing 737-800 Series	12
SWF	LJ45	LEAR 36/TFE731-2	Bombardier Learjet 45	12
SWF	G150	ASTRA 1125/TFE731-3A	Gulfstream G150	12
SWF	B763	BOEING 767-300/PW4060	Boeing 767-300 Series	8
SWF	NAVI	1985 1-ENG VP PROP	Ryan Navion B	8
SWF	A318	A319-131\IAE V2522-A5	Airbus A318-100 Series	8
SWF	B772	BOEING 777-300/TRENT892	Boeing 777-200-LR	8
SWF	BE99	DASH 6/PT6A-27	Raytheon Beech 99	8
SWF	C560	Cessna Citation Ultra 560 / JT15D-5D	Cessna 560 Citation Excel	8
SWF	B764	BOEING 767-400ER/CF6-80C2B(F)	Boeing 767-400	6
SWF	DH8A	DASH 8-100/PW121	Bombardier de Havilland Dash 8 Q100	6
SWF	B407	Bell 407	Bell 407 / Rolls-Royce 250-C47B	6
SWF	E190	ERJ190-100	Embraer ERJ190	6
SWF	PC12	Cessna 208 / PT6A-114	Pilatus PC-12	6
SWF	P180	DASH 6/PT6A-27	Piaggio P.180 Avanti	6
SWF	B773	BOEING 777-300/TRENT892	Boeing 777-300 Series	6
SWF	BE10	DASH 6/PT6A-27	Raytheon King Air 100	6
SWF	AC95	CONQUEST II/TPE331-8	COMMANDER980/1000	6
SWF	A310	A310-304\GE CF6-80 C2A2	Airbus A310-200 Series	6
SWF	PA23	BARON 58P/TS10-520-L	Piper PA-23 Apache/Aztec	6
SWF	B748	Boeing 747-8F/GEnx-2B67	7478	6
SWF	SW3	DASH 6/PT6A-27	Fairchild SA-227-AC Metro III	6
SWF	C182	Cessna 182H / Continental O-470-R	Cessna 182	2
SWF	B733	BOEING 737-300/CFM56-3B-1	Boeing 737-300 Series	2
SWF	DC91	DC9-10/JT8D-7	Boeing DC-9-10 Series	2
SWF	E145	EMBRAER 145 ER/ALLISON AE3007	Embraer ERJ145	2
SWF	B06	Bell 206L Long Ranger	Bell 206 JetRanger	2
SWF	E170	ERJ170-100	Embraer ERJ170	2
SWF	C680	Cessna Model 680 Sovereign / PW306C	Cessna 680 Citation Sovereign	2
SWF	MD83	MD-83/JT8D-219	Boeing MD-83	2
SWF	PAY1	CONQUEST II/TPE331-8	Piper PA-31T Cheyenne	2
SWF	C500	CIT 2/JT15D-4	Cessna 500 Citation I	2
SWF	CRJ9	CL-600-2D15/CL-600-2D24/CF34-8C5	Bombardier CRJ-900	2
SWF	B739	BOEING 737-700/CFM56-7B24	Boeing 737-900 Series	2
SWF	LNC2	CESSNA 172R / LYCOMING IO-360-L2A	Lancair 360	2
SWF	DHC6	DASH 6/PT6A-27	DeHavilland DHC-6-300 Twin Otter	2
SWF	EA50	Eclipse 500 / PW610F	Eclipse 500 / PW610F	2
SWF	CL30	CL600/ALF502L	Bombardier Challenger 300	2

APPENDIX C: 2015 GROUND SUPPORT EQUIPMENT PROFILES

	Annual Utilization (hours)				
Fuel Type/Equipment Name	**JFK**	**EWR**	**LGA**	**SWF**	**TEB**
Diesel	**1,556,883**	**829,313**	**579,711**	**8,312**	**4,858**
(None specified. EPA default data used.) - Generator	3,260			440	255
(None specified. EPA default data used.) - Lift	11,935	10,571	4,774	37	21
(None specified. EPA default data used.) - Other	304,510	49,380	9,876		
ACE 180 - Air Start	9,990	8,991	6,993	180	30
ACE 300/400 - Air Start				6	
ACE 802 - Air Conditioner	67,872	72,720	62,216		
Deicer - Use Diesel Stewart Stevenson Tug GT-35 MC in Separate Run	63,500	12,000	19,000		
Eagle Bobtail / F350 - Bobtail	18,670	1,867			
F250 / F350 - Hydrant Truck	16,797	13,743	6,108	470	85
F250 / F350 - Service Truck	146,160	42,000	33,600	778	451
F750 Dukes Transportation Services DART 3000 to 6000 gallon - Fuel Truck		2,256	16,920	1,605	1,848
FMC Commander 15 - Cargo Loader	4,400	48,400	1,100	991	
Hi-Way / TUG 660 chasis - Cabin Service Truck				275	255
Hi-Way / TUG 660 chasis - Catering Truck		121,600			
Hi-Way F650 - Cabin Service Truck				1,167	133
Stewart & Stevenson TUG 660 - Belt Loader	267,800	62,400	107,900	129	115
Stewart & Stevenson TUG GT-35 MC - Aircraft Tractor	234,400	120,000	149,600	88	42
Stewart & Stevenson TUG GT-50H - Aircraft Tractor				51	8
Stewart & Stevenson TUG MA 50 - Baggage Tractor	135,000	88,500	72,000		
Stewart & Stevenson TUG MC - Aircraft Tractor				294	319
Stewart & Stevenson TUG MT - Cargo Tractor	66,101	1,349			
Stewart & Stevenson TUG T-750 - Aircraft Tractor				95	
Tennant - Sweeper			24		
TLD 1410 - Lavatory Truck				344	207
TLD 28 VDC - Ground Power Unit	185,600	161,600	89,600	881	850
Wollard TLS-770 / F350 - Lavatory Truck	20,888	11,936		298	27
TLD, 400 Hz AC - Ground Power Unit				183	212
Gasoline	**667,784**	**822,557**	**200,584**	**6,628**	**3,998**
(None specified. EPA default data used.) - Lift	18,048	30,832	4,512		
(None specified. EPA default data used.) - Other	8,680	10,416	5,208		
Eagle Bobtail / F350 - Bobtail	7,468				
F250 / F350 - Hydrant Truck	16,797	13,743	10,689		
F250 / F350 - Service Truck	108,117	87,084	45,387		
F750 Dukes Transportation Services DART 3000 to 6000 gallon - Fuel Truck	1,128	564	564		
FMC Tempest II Single engine - Deicer	500	5,500	16,000		
Hi-Way / TUG 660 chasis - Catering Truck		43,200			
Stewart & Stevenson TUG 660 - Belt Loader	130,000	179,400	14,300	1,731	854
Stewart & Stevenson TUG GT-35 MC - Aircraft Tractor	106,400	330,400	44,000		
Stewart & Stevenson TUG MA 50 - Baggage Tractor	229,500	100,500	27,000	3,521	1,402
Stewart & Stevenson TUG MT - Cargo Tractor	16,188	2,698			
Taylor Dunn - Cart		100	100	37	21
Tennant - Sweeper	1,086				
TLD - Ground Power Unit				1,284	1,657
TLD 1410 - Lavatory Truck				55	64
TLD 28 VDC - Ground Power Unit		3,200			
Wollard TLS-770 / F350 - Lavatory Truck	23,872	14,920	32,824		

	Annual Utilization (hours)				
Fuel Type/Equipment Name	**JFK**	**EWR**	**LGA**	**SWF**	**TEB**
LPG	**77,786**	**43,285**	**23,765**		
(None specified. EPA default data used.) - Lift	682	341	341		
Toyota 5000 lb - Fork Lift	77,104	42,944	23,424		
CNG	**369**		**369**		
F250 / F350 - Service Truck	369		369		
Electric	**152,048**	**115,506**	**93,837**	**1,130**	**134**
(None specified. EPA default data used.) - Lift	2,387	6,479	2,387		
(None specified. EPA default data used.) - Other	15,255	7,119	53,901		
ACE 180 - Air Start	333		666		
ACE 802 - Air Conditioner	7,272		808		
Dukes Transportation Services THS-400 - Hydrant Cart		1,527			
F250 / F350 - Hydrant Truck		1,528			
F250 / F350 - Service Truck	1,476	13,653	2,583		
Gate Service - Water Service				330	38
None - Air Conditioner				800	96
Stewart & Stevenson TUG 660 - Belt Loader	28,800	26,400	4,800		
Stewart & Stevenson TUG GT-35 MC - Aircraft Tractor	76,800	48,000	9,600		
Stewart & Stevenson TUG MA 50 - Baggage Tractor	3,000	6,000			
Stewart & Stevenson TUG MT - Cargo Tractor	12,141				
TLD 28 VDC - Ground Power Unit	1,600	4,800	17,600		
Wollard TLS-770 / F350 - Lavatory Truck	2,984		1,492		
TOTAL	**2,454,870**	**1,810,661**	**898,266**	**16,070**	**8,990**