



September 23, 2021

Zorik Pirveysian, Planning and Rules Manager
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765-4178

Dear Mr. Pirveysian,

John Wayne Airport, Orange County (“SNA”, “JWA”, or “Airport”) has prepared the annual progress report as requested by the South Coast Air Quality Management District (“South Coast AQMD”). On December 6, 2019, a Memorandum of Understanding (“MOU”) was entered into by the South Coast AQMD and the Airport, acting by and through the County of Orange, California (“County”) in its capacity as the proprietor and certificated operator of JWA. The purpose of this annual progress report is to provide information concerning the progress on the MOU measures. There are three measures in the JWA MOU, as related to non-aircraft commercial passenger airport mobile sources. Information requested by South Coast AQMD on each of these measures and their associated equipment and emissions are provided in the following sections. This progress report is an updated submittal that incorporates emission factors to more accurately represent the emission inventory for the ground support equipment.¹

The Airport has been working to develop and implement these measures, however, in February 2020, the novel coronavirus (COVID-19) emerged and significantly disrupted virtually all aspects of life and commerce throughout the world. In response to COVID-19, demand for domestic and international air travel has drastically decreased to unprecedented levels and the outlook for recovery remains uncertain. This has forced airports, airlines, ground support equipment (“GSE”) operators, and many related third parties to evaluate capital plans and allocation of resources. The total airline passenger traffic at JWA was down 97% in April 2020 compared to April 2019, and the total commercial aircraft operations was down approximately 50% in 2020 compared to a pre-COVID-19 year. JWA is predicting that commercial operations will be down approximately 50% in 2021 compared to a pre-COVID-19 year. Based on discussions with airlines, the flight activity levels are not expected to return for years, and the long-term growth trend may not return for the foreseeable future. Many airlines, GSE operators, and third parties have suspended capital expenditures, such as GSE purchases, for the foreseeable future, while focusing available resources on the response to COVID-19. Nevertheless, the airport will continue planning activities with

¹ Note that this update in methodology does not constitute a change to the MOU, nor any requirements or obligations agreed to in the MOU.

airlines and third parties as the aviation industry continues to recover from the virus pandemic and associated impacts on air travel.

MOU Schedule No. 1 – Ground Support Equipment

MOU Schedule No. 1 is a measure for GSE.² This measure requires that all GSE associated with commercial operations achieve a fleet-average emission factor for Oxides of Nitrogen (NO_x) of 1.7 and 0.9 grams per brake horsepower hour (g/bhp-hr) in 2023 and 2031, respectively. To achieve this measure, the Airport has been working with Airport tenants and GSE operators to achieve the performance targets by specified dates through accelerated turnover to cleaner equipment.

As required by this measure, a list of GSE subject to this measure with the required information specified in MOU Schedule No. 1, Section III.B.1 is provided in **Table 1**. Information on the sale or retirement of non-zero emission GSE subject to this measure including information submitted to the California Air Resources Board DOORS database and any relocation details (as applicable) as required by MOU Schedule No. 1, Section III.B.2 is also presented in **Table 1**.

A fleet-average emission factor has been developed and may be found in **Table 2**. Additional supporting information for the development of the GSE fleet-average emission factor shown in **Table 2** can be found in **Attachment A**.

Calculation Methodology for Fleet Average Emission Factor

The inventory of GSE equipment was provided by airlines and GSE operators at JWA. Model year-specific emission factors were derived from the OFFROAD2017 database for each equipment type, horsepower bin, and fuel type operating in Orange County in 2020. Where an exact model year and/or horsepower bin match did not exist, an alternate model year/horsepower bin combination was selected to look up emission factors. The alternate model year and horsepower bin were selected based on the combination that would most accurately represent the specific equipment. Default load factors from OFFROAD2017 were used where operator-specified load factors were not available.

There are few pieces of GSE that are used to support commercial aircraft activity at JWA for only a portion of the time (and otherwise used for other non-commercial activity). While there are multiple pieces of equipment that may be used to support this carrier's commercial operations, we have listed a representative GSE in **Table 1 and Table 2** for disclosure purposes. An average emission factor based on individual equipment attributes are used for emission calculations.

² Ground Support Equipment or "GSE" is any vehicle or equipment used to support aircraft operations that is subject to, or included in compliance plans to meet, the requirements of the California Air Resources Board (CARB) In-Use Off-Road Diesel (ORD) Vehicle Regulation Program, CARB Off-Road Large Spark-Ignition (LSI) Engine Fleet Requirements Regulation Program, or CARB Portable Equipment Registration Program and associated Portable Diesel Engine Airborne Toxic Control Measure. Furthermore, GSE as defined here only includes equipment that is not subject to compliance with SCAQMD Rule XX – RECLAIM, or included in a mobile source emission reduction credit program under SCAQMD Rule XVI.

An emission factor of zero was used for electric vehicles. Additionally, equipment that did not meet the criteria for GSE as specified in the MOU were not included in the fleet average emission factor calculation. Some examples of equipment that do not meet MOU GSE criteria include gasoline vehicles licensed by the DMV for on-road usage³, gasoline equipment with a rating less than 25 brake horsepower⁴, and diesel equipment used for fewer than 200 hours per year which are exempt as part of a low-usage exemption.⁵

Progress Update

The fleet averaged NOx emission factor for commercial GSE at JWA in 2020 is 3.2 g/bhp-hr, which is lower than the 2017 Baseline fleet averaged NOx emission factor of 4.0 g/bhp-hr. The GSE fleet-average emission factors remain shy of the 2023 target, and thus JWA is continuing to work with airlines and GSE operators to make progress toward that target.

Based on current assessments, JWA infrastructure is currently able to support existing GSE electrical demands for the airlines and third parties. The airport will remain in communication with airlines and third party GSE operators to encourage the continued conversion of GSE, and to support any future electrical infrastructure changes that may be necessary.

Emissions Inventory Calculation Methodology

Further, as required by MOU Schedule No. 1, Section III.B.3, an emissions inventory for GSE has been developed for 2020. Note that at the request of AQMD, the GSE emission inventory was calculated using the revised calculation methodology detailed below. As part of this revision, the GSE emission inventory for 2017 was also updated using the revised methodology. GSE emission inventories for 2017 and 2020 can be found in **Table 3** and **Table 4**.

GSE emissions are based on an inventory of GSE equipment, provided by Airlines for America (A4A) in 2017 and by individual airlines and GSE operators at JWA for 2020. In the 2020 inventory, GSE identified as licensed for on-road use were not included; all

³ The CARB LSI regulation's definition for airport GSE does not include those categories of GSE equipment that are designated and licensed for on-road use. These pieces of equipment are not subject to the requirements of the LSI regulation. Available at: <https://ww2.arb.ca.gov/sites/default/files/classic/msprog/offroad/orspark/faqs/lsifaqagse.pdf>. Accessed: May 2021.

⁴ The CARB LSI regulation's definition for airport GSE does not include those categories of GSE equipment that are less than 25 horsepower, per CCR § 2775 (a)(1). Available at: <https://ww2.arb.ca.gov/sites/default/files/classic/msprog/offroad/orspark/largesparkappa-clean.pdf>. Accessed: May 2021.

⁵ The CARB Offroad Diesel (ORD) regulation exempts permanent and year-by-year low-use vehicles as defined in CCR § 2449 (e)(7). Available at: <https://ww2.arb.ca.gov/sites/default/files/2019-03/finalregorder-dec2011.pdf>. Accessed: May 2021.

other GSE (including small and low-use equipment) were included at the request of AQMD. A summary of all GSE included in the revised inventory can be found in **Table 5**.

Emission Factor Calculation

Model-year specific emission factors were calculated based on the new engine standards for spark-ignited engines for gasoline-fueled equipment, and CARB's 2017 Off-road Diesel Emission Factors for diesel-fueled equipment. NO_x and ROG emission factors for combustion equipment were calculated by summing the zero-hour pollutant emission factor with the product of the deterioration rate and cumulative hours, and multiplying by the pollutant-specific fuel correction factor. Model-year specific gasoline-fueled emission factor constants were provided by AQMD. Model-year specific diesel-fueled emission factor constants were referenced from CARB's 2017 Off-road Diesel Emission Factors for diesel-fueled equipment⁶.

The cumulative hours of operation for each unit were calculated by multiplying the equipment age (taken as the difference between the inventory year and engine model year) by the annual equipment usage. Annual equipment usage hours were calculated for 2017 and 2020 using activity data from the OFFROAD2017 database due to the absence of operator-specific activity information.

Cumulative hours of operation were capped according to guidance transmitted by the South Coast AQMD on August 13, 2021, as summarized below. Engine displacement information for GSE was not provided by the GSE owner/operator, therefore deterioration caps for gasoline-fueled GSE were determined solely based on model year.

Diesel GSE

25-50 HP, use DR cap of 5,000 hours
>50 HP, use DR cap of 12,000 hours

Gasoline and LPG GSE

25-50 HP and <1L, use DR cap of 2,000 hours
>1L, for MY2007+, use 10,000 hours
>1L, for MY2007 and earlier, use 7,000 hours

The revised emission factor methodology provides emission factors for hydrocarbon (HC) emissions. HC emission factors were converted to ROG emission factors by multiplying by a ROG to HC ratio of 1.21 for gasoline-fueled units and 0.9198 for diesel-fueled units, both derived from OFFROAD2017 for the airport ground support equipment sector. Additional supporting information for the development of the GSE emissions inventory shown in **Table 3** and **Table 4** can be found in **Attachment A**.

Additional Calculation Assumptions

⁶ 2017 Off-road Diesel Emission Factors. CARB. Available at: https://ww3.arb.ca.gov/msei/ordiesel/ordas_ef_fcf_2017_v7.xlsx. Accessed: September 2021.

The calculation methodology required additional assumptions as summarized in the following bullet points.

- Emission factors and deterioration rates for gasoline-fueled equipment were provided up to a maximum HP bin of 300 HP. Emissions calculated for gasoline-fueled equipment operating at greater than 300 HP were calculated using the 300 HP bin values.
- Zero-hour emission factors and deterioration rates for the 50 HP bin were provided for three different engine displacements for 50 HP engines. Since engine displacement information was not provided for GSE at JWA, the maximum emission factor and deterioration rate was assumed between the three 50 HP constants.
- Multiple fuel correction factors were provided for gasoline-fueled equipment. In the situation where multiple fuel correction factors applied, the maximum was selected.

MOU Schedule No. 2 – Jet Fuel Delivery Trucks

MOU Schedule No. 2 is a measure for commercial passenger airline jet fuel delivery trucks. The measure requires that the Airport install a jet fuel pipeline by the end of 2019 and eliminate routine commercial aviation jet fuel delivery trucks by January 1, 2023. The Airport has coordinated with third parties to complete the jet fuel pipeline installation and continues to work with tenants to eliminate routine commercial passenger jet fuel truck deliveries.

A summary of required data per the MOU is provided in **Table 6**. As required in MOU Schedule No. 2, Section III.B, information on jet fuel delivery is summarized in **Table 7** and **Table 8**. **Table 7** contains information on monthly jet fuel receipts via truck delivery and pipeline. **Table 8** shows the total number of routine and non-routine truck trips delivering jet fuel for commercial passenger aviation and vehicle model years (as available), an estimate of total vehicle miles traveled and an emission inventory for the jet fuel delivery trucks.

Calculation Methodology

The jet fuel delivery truck exhaust emissions for 2020 are calculated based on the number of delivery trips that occurred in 2020, the trip distance traveled by the delivery trucks, and emission factors from EMFAC2017. The number of annual truck trips in 2020 were provided by the two commercial jet fuel suppliers at JWA: the Commercial Fuel Farm and a Fixed Base Operator (FBO) servicing one commercial service airline. The total number of truck trips provided by the FBO were apportioned to reflect the truck trips attributable to the commercial operations based on the fraction of monthly fuel volume received by the FBO that was sold on to the commercial operator. A supplier-specific trip distance for fuel truck trips was used for each supplier's deliveries: 27.1 miles/trip for the Commercial Fuel Farm and 30 miles/trip for the FBO. Fleet-averaged exhaust emission factors for Reactive Organic Gases (ROG) and NO_x were obtained from EMFAC2017 for Heavy-Heavy Duty Trucks ("HHDT") in Orange County in 2020. If the fuel provider provided details on the model year (e.g., 2016-2019), the fleet-averaged emission factors were obtained from EMFAC2017 by

aggregating emission factors for the specified model years in the calendar year 2020. Otherwise, a fleet-average was used for all HHDT vehicles in 2020. Average daily emissions were calculated assuming operation for 365 days in a year.

Progress Update

The jet fuel pipeline has been installed and began operating in October 2019. The Airport has been working with the third parties to switch to fuel delivery via the pipeline. The majority of routine jet fuel truck deliveries have been replaced with pipeline fuel delivery as of August 1, 2020. An existing contract with at the FBO currently dictates fuel delivery to JWA via tanker truck.

JWA has worked with third parties to develop a fuel delivery tracking system for delivery of fuel by pipeline as well as by tanker truck. The third parties have agreed to a tracking system which will consist of recordkeeping forms that will be completed and submitted to JWA. These records form the basis of the data and inventory supplied as part of the 2021 MOU progress update. JWA continues to perform a quality assurance review of the information received.

MOU Schedule No. 3 – Parking Shuttle Bus Electrification

MOU Schedule No. 3 is a measure for shuttle bus (off airport employee and passenger parking lots) electrification. The measure requires that the Airport replace a minimum of 50% and 80% of Airport employee and passenger remote parking compressed natural gas shuttle buses with battery-electric shuttle buses by January 1, 2023 and 2031, respectively. The Airport may continue to reserve non-battery-electric shuttle buses for standby and emergency use.

As required by MOU Schedule No. 3, Section III.B.1 and III.B.3, an inventory of shuttle buses operating at JWA and shuttle buses operating at JWA that were replaced during the reported year are provided in **Table 9**. Additionally, an annual emissions inventory for shuttle buses including methodology and calculations, as required by MOU Schedule No. 3, Section III.B.2, is provided in **Table 10**.

Calculation Methodology

On-road emission factors for exhaust, idling, and starting ROG and NOx, as well as evaporative ROG from hot soak, running losses, resting losses, and diurnal losses were obtained from EMFAC2017 based on vehicle model year, vehicle category and fuel type in Orange County for each scenario's calendar year. The vehicle model year for all shuttles operating in 2020 was confirmed by JWA to be 2017. Exhaust emission factors were calculated to be the average of the emission factors at the 25 miles per hour (mph) speed bins in EMFAC, as an average speed representation for the predominant travel route. Average daily emissions were calculated assuming operation for 365 days in a year.

Progress Update

At this time, JWA has no regular shuttle service, and even as air travel increases JWA anticipates decreased demand due to changes in passenger travel habits. JWA will

continue moving forward with shuttle fleet changeover to electric buses while evaluating future shuttle demand.

JWA maintains ten (10) shuttle buses for routine transport and two in reserve (standby/emergency). JWA was approved in 2019 for Federal Aviation Administration (FAA) Zero Emission Vehicle (ZEV) grant funding support for the purchase of three electric shuttle buses and anticipates additional 2021 FAA ZEV funding for the purchase of two additional shuttle buses. JWA subsequently contracted for the purchase of three electric shuttle buses (which are due for delivery in 2021) and anticipates contracting for the two additional shuttle buses. JWA has identified the areas for infrastructure improvements to support the buses and new charging stations. Correspondence with the local utility has occurred to determine and coordinate the means and timeframes for the infrastructure changes (i.e., space allocations, electric drops, cable runs, etc.).

Conclusion

Please feel free to call Melinda McCoy at (949) 252-5267, with questions or concerns regarding this report.

Sincerely,



Melinda McCoy, PG
Environmental Resources Manager

Attachments



JOHN WAYNE
AIRPORT
ORANGE COUNTY

TABLES

Melinda McCoy, PG
Environmental Resources Manager

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Table 1. 2020 Ground Support Equipment (GSE) Reporting Data

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

MOU Schedule No. 1. Obligations													
Unit #	III.B.1								III.B.2				
	III.B.1.a	III.B.1.b	III.B.1.c	III.B.1.d	III.B.1.e		III.B.1.f	III.B.1.g	--	--	III.B.2.a	III.B.2.b	III.B.2.c
	Equipment ID ¹	Airline GSE Type ¹	Fuel Type ¹ (Electric, Diesel, Propane, Gasoline)	Engine Model Year ¹	Engine Power Rating ¹ (HP or kW)	Engine Power Rating Units ¹	Engine Tier Level ¹ (for diesel engines)	Activity Level - hrs/yr of engine operation or annual mileage ^{2,3}	Equipment Sold or Relocated? ¹	Date of Status Change ¹	Airport to which Equipment is Relocated ¹	Date of Relocation ¹	Estimated Projected Usage Hours ¹
1	21892	Bag Tug	Electric	2015	40	HP	--	--	No	--	No GSE units were relocated in 2020.		
2	26521	Bag Tug	Electric	2018	40	HP	--	--	No	--			
3	26522	Bag Tug	Electric	2018	40	HP	--	--	No	--			
4	26523	Bag Tug	Electric	2018	40	HP	--	--	No	--			
5	26524	Bag Tug	Electric	2018	40	HP	--	--	No	--			
6	26528	Bag Tug	Electric	2018	40	HP	--	--	No	--			
7	26529	Bag Tug	Electric	2018	40	HP	--	--	No	--			
8	26530	Bag Tug	Electric	2018	40	HP	--	--	No	--			
9	26531	Bag Tug	Electric	2018	40	HP	--	--	No	--			
10	26532	Bag Tug	Electric	2018	40	HP	--	--	No	--			
11	26533	Bag Tug	Electric	2018	40	HP	--	--	No	--			
12	26535	Bag Tug	Electric	2018	40	HP	--	--	No	--			
13	26536	Bag Tug	Electric	2018	40	HP	--	--	No	--			
14	26537	Bag Tug	Electric	2018	40	HP	--	--	No	--			
15	26538	Bag Tug	Electric	2018	40	HP	--	--	No	--			
16	26539	Bag Tug	Electric	2018	40	HP	--	--	No	--			
17	9513	High Speed Tug	Gasoline	2004	85	HP	--	913	No	--			
18	22047	High Speed Tug	Diesel	2015	85	HP	Tier 4	730	No	--			
19	3809	Belt Loader	Electric	2001	60	HP	--	--	No	--			
20	3810	Belt Loader	Electric	2001	60	HP	--	--	No	--			
21	3811	Belt Loader	Electric	2001	60	HP	--	--	No	--			
22	3812	Belt Loader	Electric	2001	60	HP	--	--	No	--			
23	10743	Belt Loader	Electric	2004	60	HP	--	--	No	--			
24	10744	Belt Loader	Electric	2004	60	HP	--	--	No	--			
25	10760	Belt Loader	Electric	2005	60	HP	--	--	No	--			
26	21778	Belt Loader	Electric	2015	60	HP	--	--	No	--			
27	21885	Belt Loader	Electric	2015	60	HP	--	--	No	--			
28	21886	Belt Loader	Electric	2015	60	HP	--	--	No	--			
29	897	Push Back	Diesel	2009	110	HP	Tier 3	328	No	--			
30	2308	Push Back	Electric	2001	110	HP	--	--	No	--			
31	2309	Push Back	Electric	2001	110	HP	--	--	No	--			
32	2310	Push Back	Electric	2001	110	HP	--	--	No	--			
33	21888	Push Back	Diesel	2015	74	HP	Tier 4	328	No	--			
34	21889	Push Back	Diesel	2015	74	HP	Tier 4	328	No	--			
35	26868	Push Back	Diesel	2018	74	HP	Tier 4	328	No	--			
36	21985	Golf Cart	Electric	2012	10	HP	--	--	No	--			
37	21986	Golf Cart	Electric	2012	10	HP	--	--	No	--			
38	21987	Golf Cart	Electric	2012	10	HP	--	--	No	--			
39	22495	Air Start	Diesel	2015	333	HP	Tier 4	--	No	--			
40	21896	Ground Power	Diesel	2015	155	HP	Tier 4	483	No	--			
41	22101	Ground Power	Diesel	2015	155	HP	Tier 4	483	No	--			
42	15707	Lav Truck	Gasoline	2011	260	HP	--	1232	No	--			
43	28286	Lav Truck	Gasoline	2018	200	HP	--	1227	No	--			
44	10039	Passenger Stairs	Electric	2004	19	HP	--	--	No	--			
45	22020	Provision truck	Gasoline	2016	320	HP	--	844	No	--			
46	24565	Provision truck	Gasoline	2017	362	HP	--	845	No	--			
47	18552	Van	Gasoline	2012	200	HP	--	--	No	--			
48	FE0151	Forklift	Electric	2013	80	HP	--	--	No	--			
49	UL1043	Lift	Diesel	2012	67	HP	Tier 4 Interim	414	No	--			

Table 1. 2020 Ground Support Equipment (GSE) Reporting Data

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

MOU Schedule No. 1. Obligations													
Unit #	III.B.1								III.B.2				
	III.B.1.a	III.B.1.b	III.B.1.c	III.B.1.d	III.B.1.e		III.B.1.f	III.B.1.g	--	--	III.B.2.a	III.B.2.b	III.B.2.c
	Equipment ID ¹	Airline GSE Type ¹	Fuel Type ¹ (Electric, Diesel, Propane, Gasoline)	Engine Model Year ¹	Engine Power Rating ¹ (HP or kW)	Engine Power Rating Units ¹	Engine Tier Level ¹ (for diesel engines)	Activity Level - hrs/yr of engine operation or annual mileage ^{2,3}	Equipment Sold or Relocated? ¹	Date of Status Change ¹	Airport to which Equipment is Relocated ¹	Date of Relocation ¹	Estimated Projected Usage Hours ¹
50	PT0726	A/C Tug Narrow Body	Electric	2018	74	HP	--	--	No	--	No GSE units were relocated in 2020.		
51	PT0727	A/C Tug Narrow Body	Electric	2018	74	HP	--	--	No	--			
52	PT0730	A/C Tug Narrow Body	Electric	2018	74	HP	--	--	No	--			
53	113597	Cart	Electric	2007	14	HP	--	--	No	--			
54	113598	Cart	Electric	2007	14	HP	--	--	No	--			
55	GC1696	Cart	Electric	2006	14	HP	--	--	No	--			
56	GC2373	Cart	Electric	2015	14	HP	--	--	No	--			
57	PT1828	A/C Tug Narrow Body	Electric	2006	0	HP	--	--	No	--			
58	BL1849	Belt Loader	Electric	2007	59	HP	--	--	No	--			
59	BL1851	Belt Loader	Electric	2007	59	HP	--	--	No	--			
60	BL1854	Belt Loader	Electric	2007	59	HP	--	--	No	--			
61	BL1855	Belt Loader	Electric	2007	59	HP	--	--	No	--			
62	CT1467	Cargo Tractor	Electric	2008	93	HP	--	--	No	--			
63	CT3251	Cargo Tractor	Electric	2008	93	HP	--	--	No	--			
64	CT3252	Cargo Tractor	Electric	2008	93	HP	--	--	No	--			
65	CT5846	Cargo Tractor	Electric	2008	55	HP	--	--	No	--			
66	CT5847	Cargo Tractor	Electric	2008	55	HP	--	--	No	--			
67	CT5848	Cargo Tractor	Electric	2008	55	HP	--	--	No	--			
68	CT5856	Cargo Tractor	Electric	2008	55	HP	--	--	No	--			
69	AL0426	Lift	Diesel	2016	67	HP	Tier 4	414	No	--			
70	AS0999	Air Start	Diesel	2018	450	HP	Tier 4	1314	No	--			
71	PT0645	A/C Tug Narrow Body	Diesel	2001	88	HP	Tier 1	328	No	--			
72	PT0768	A/C Tug Narrow Body	Diesel	2000	210	HP	Tier 1	328	No	--			
73	PT7648	A/C Tug Narrow Body	Diesel	1998	88	HP	Tier 1	273	No	--			
74	GP1907	Ground Power Unit	Gasoline	2018	229	HP	--	798	No	--			
75	GP1908	Ground Power Unit	Gasoline	2018	229	HP	--	798	No	--			
76	GP1911	Ground Power Unit	Gasoline	2018	229	HP	--	798	No	--			
77	GP1912	Ground Power Unit	Gasoline	2018	229	HP	--	798	No	--			
78	GP2004	Ground Power Unit	Gasoline	2019	229	HP	--	793	No	--			
79	113368	Lift	Electric	2009	114	HP	--	--	No	--			
80	GP7084	Ground Power Unit	Diesel	1997	181	HP	Tier 1	11	Yes	1/8/2020			
81	GPU.E0017.SNA	Ground Power Unit	Electric	2019	150	HP	--	--	No	--			
82	26051	A/C Tug Wide Body	Diesel	2011	175	HP	Tier 4 Interim	398	No	--			
83	33385	Cargo Loader	Diesel	2007	99	HP	Tier 2	475	No	--			
84	41009	Cargo Loader	Diesel	2009	110	HP	Tier 3	475	No	--			
85	99123	Cargo Loader	Diesel	2016	110	HP	Tier 4	475	No	--			
86	501565	Cargo Tractor	Diesel	2012	65	HP	Tier 4 Interim	687	No	--			
87	18246	Bdt Loader	Gasoline	1994	150	HP	--	730	No	--			
88	23262	Cargo Tractor	Gasoline	2010	80	HP	--	1352	No	--			
89	23263	Cargo Tractor	Gasoline	2010	80	HP	--	1352	No	--			
90	512143	Cargo Tractor	Gasoline	2017	86	HP	--	1353	No	--			
91	512144	Cargo Tractor	Gasoline	2017	86	HP	--	1353	No	--			
92	515410	Cargo Tractor	Gasoline	2018	86	HP	--	1350	No	--			
93	515411	Cargo Tractor	Gasoline	2018	86	HP	--	1350	No	--			
94	22851	AIRSTART	Diesel	2009	700	HP	--	--	No	--			
95	62198	GPU	Diesel	2006	173	HP	--	483	No	--			
96	62201	GPU	Diesel	2006	173	HP	--	483	No	--			
97	GT174	GPU	Diesel	2000	152	HP	Tier 1	483	No	--			
98	PJ123	PUSHOUT TRACTOR	Diesel	1990	110	HP	--	328	No	--			

Table 1. 2020 Ground Support Equipment (GSE) Reporting Data

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

MOU Schedule No. 1. Obligations													
Unit #	III.B.1								III.B.2				
	III.B.1.a	III.B.1.b	III.B.1.c	III.B.1.d	III.B.1.e		III.B.1.f	III.B.1.g	--	--	III.B.2.a	III.B.2.b	III.B.2.c
	Equipment ID ¹	Airline GSE Type ¹	Fuel Type ¹ (Electric, Diesel, Propane, Gasoline)	Engine Model Year ¹	Engine Power Rating ¹ (HP or kW)	Engine Power Rating Units ¹	Engine Tier Level ¹ (for diesel engines)	Activity Level - hrs/yr of engine operation or annual mileage ^{2,3}	Equipment Sold or Relocated? ¹	Date of Status Change ¹	Airport to which Equipment is Relocated ¹	Date of Relocation ¹	Estimated Projected Usage Hours ¹
99	TV0994	PUSHOUT TRACTOR	Diesel	2000	87	HP	Tier 1	328	No	--	No GSE units were relocated in 2020.		
100	TV20561	PUSHOUT TRACTOR	Diesel	2000	87	HP	Tier 1	328	No	--			
101	AS0118	AIRSTART UNIT	Diesel	2008	665	HP	Tier 3	1314	No	--			
102	AS20353	AIRSTART UNIT	Diesel	2000	330	HP	Tier 1	1314	No	--			
103	BL0342	BELTLOADER	Electric	2004	84	HP	--	--	No	--			
104	BL18927	BELTLOADER	Electric	1999	84	HP	--	--	No	--			
105	BL18928	BELTLOADER	Electric	1999	84	HP	--	--	No	--			
106	BL18929	BELTLOADER	Electric	1999	84	HP	--	--	No	--			
107	BL18930	BELTLOADER	Electric	1999	84	HP	--	--	No	--			
108	BL18943	BELTLOADER	Electric	1999	84	HP	--	--	No	--			
109	BL20011	BELTLOADER	Electric	1999	84	HP	--	--	No	--			
110	BL0344	BELTLOADER	Electric	2004	84	HP	--	--	No	--			
111	TV1168	PUSHOUT TRACTOR	Electric	2016	83	HP	--	--	No	--			
112	TV1169	PUSHOUT TRACTOR	Electric	2016	83	HP	--	--	No	--			
113	TV0995	BAG TRACTOR	Electric	2004	93	HP	--	--	No	--			
114	TV0997	BAG TRACTOR	Electric	2000	93	HP	--	--	No	--			
115	TV0998	BAG TRACTOR	Electric	1999	93	HP	--	--	No	--			
116	TV19845	BAG TRACTOR	Electric	2000	93	HP	--	--	No	--			
117	TV19846	BAG TRACTOR	Electric	2000	93	HP	--	--	No	--			
118	TV19847	BAG TRACTOR	Electric	2000	93	HP	--	--	No	--			
119	TV19848	BAG TRACTOR	Electric	2000	93	HP	--	--	No	--			
120	TV19850	BAG TRACTOR	Electric	2000	93	HP	--	--	No	--			
121	TV19849	BAG TRACTOR	Electric	2000	93	HP	--	--	No	--			
122	RV20027	PICKUP TRUCK	Gasoline	1999	260	HP	--	834	No	--			
123	LV19806	LAV TRUCK	Gasoline	2000	65	HP	--	1460	No	--			
124	SQ180	STAIR UNIT-MTR	Gasoline	2017	61	HP	--	190	No	--			
125	TV0999	CARGO TRACTOR	Gasoline	1992	107	HP	--	1278	No	--			
126	14242	Air Start	Diesel	2007	511	HP	Tier 3	1314	No	--			
127	22015	Aircraft Tow Tractor	Diesel	1998	165	HP	Tier 1	328	No	--			
128	270318	Aircraft Tow Tractor	Diesel	1998	200	HP	Tier 1	328	No	--			
129	170544	Baggage Tractor	Diesel	2001	60	HP	Tier 1	730	No	--			
130	170545	Baggage Tractor	Diesel	2001	60	HP	Tier 1	730	No	--			
131	170562	Baggage Tractor	Diesel	2001	60	HP	Tier 1	730	No	--			
132	170563	Baggage Tractor	Diesel	2001	60	HP	Tier 1	730	No	--			
133	171293	Baggage Tractor	Diesel	2011	49	HP	Tier 4 Interim	730	No	--			
134	521569	Belt Loader	Diesel	2000	60	HP	Tier 1	510	No	--			
135	521651	Belt Loader	Diesel	2000	60	HP	Tier 1	510	No	--			
136	521679	Belt Loader	Diesel	2000	52	HP	Tier 1	510	No	--			
137	521853	Belt Loader	Diesel	2006	65	HP	Tier 2	510	No	--			
138	9258	Ground Power Unit	Diesel	1997	165	HP	Tier 1	218	No	--			
139	900051	Ground Power Unit	Diesel	2007	220	HP	Tier 3	483	No	--			
140	78172	Passenger Steps	Diesel	2000	49	HP	Tier 1	218	No	--			
141	270963	Aircraft Tow Tractor	Electric	2016	45	HP	--	--	No	--			
142	770223	Baggage Tractor	Electric	2001	40	HP	--	--	No	--			
143	770224	Baggage Tractor	Electric	2001	40	HP	--	--	No	--			
144	770225	Baggage Tractor	Electric	2001	40	HP	--	--	No	--			
145	523229	Belt Loader	Electric	2001	60	HP	--	--	No	--			
146	18637	Aircraft Tow Tractor	Gasoline	1997	200	HP	--	730	No	--			
147	173897	Baggage Tractor	Gasoline	2019	69	HP	--	878	No	--			

Table 1. 2020 Ground Support Equipment (GSE) Reporting Data

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

MOU Schedule No. 1. Obligations													
Unit #	III.B.1								III.B.2				
	III.B.1.a	III.B.1.b	III.B.1.c	III.B.1.d	III.B.1.e		III.B.1.f	III.B.1.g	--	--	III.B.2.a	III.B.2.b	III.B.2.c
	Equipment ID ¹	Airline GSE Type ¹	Fuel Type ¹ (Electric, Diesel, Propane, Gasoline)	Engine Model Year ¹	Engine Power Rating ¹ (HP or kW)	Engine Power Rating Units ¹	Engine Tier Level ¹ (for diesel engines)	Activity Level - hrs/yr of engine operation or annual mileage ^{2,3}	Equipment Sold or Relocated? ¹	Date of Status Change ¹	Airport to which Equipment is Relocated ¹	Date of Relocation ¹	Estimated Projected Usage Hours ¹
148	522401	Belt Loader	Gasoline	2016	86	HP	--	811	No	--	No GSE units were relocated in 2020.		
149	522402	Belt Loader	Gasoline	2016	86	HP	--	811	No	--			
150	48245	Lavatory Service Truck	Gasoline	1995	200	HP	--	1460	No	--			
151	480045	Lavatory Service Truck	Gasoline	1997	350	HP	--	1460	No	--			
152	3301	LIFT MTX	Electric	2005	59	HP	--	--	No	--			
153	4469 ⁴	UTILITY TRANSPORT VEHICLE	Electric	2007	--	--	--	--	No	--			
154	4561	FORKLIFT	Electric	2008	53	HP	--	--	No	--			
155	8308 ⁴	UTILITY TRANSPORT VEHICLE	Electric	2018	--	--	--	--	No	--			
156	300503	Beltloader	Gasoline	1994	21	HP	--	--	No	--			
157	394376	Pushback Tractor	Diesel	1993	210	HP	--	328	No	--			
158	411986	Airstart	Diesel	2016	675	HP	Tier 4	1314	No	--			
159	412127	Pickup Truck	Gasoline	2017	300	HP	--	845	No	--			
160	419058	Beltloader	Gasoline	2019	84	HP	--	813	No	--			
161	4191695	Ground Power Unit	Diesel	2019	173	HP	Tier 4	483	No	--			
162	496400	Cargo Loader	Diesel	1997	152	HP	Tier 1	475	No	--			
163	770627	Cargo Loader	Gasoline	2015	21	HP	--	--	No	--			
164	770873	Cargo Tractor	Gasoline	2015	21	HP	--	--	No	--			
165	770874	Cargo Tractor	Gasoline	2015	21	HP	--	--	No	--			
166	770875	Cargo Tractor	Gasoline	2015	21	HP	--	--	No	--			
167	AS5615	Air Start	Diesel	2016	380	HP	Tier 4	1314	No	--			
168	BL1875	Beltloader	Gasoline	2015	84	HP	--	810	No	--			
169	BL3112	Beltloader	Gasoline	2015	84	HP	--	810	No	--			
170	BL3130	Beltloader	Gasoline	2009	27	HP	--	811	No	--			
171	BL3692	Beltloader	Gasoline	2009	18	HP	--	--	No	--			
172	BL3693	Beltloader	Gasoline	2009	18	HP	--	--	No	--			
173	BL5397	Beltloader	Electric	2016	40	HP	--	--	No	--			
174	BL5433	Beltloader	Electric	2016	40	HP	--	--	No	--			
175	BL5434	Beltloader	Electric	2016	40	HP	--	--	No	--			
176	BL6455	Beltloader	Electric	2018	40	HP	--	--	No	--			
177	BT3917	Bag Tug	Electric	2012	40	HP	--	--	No	--			
178	BT3918	Bag Tug	Electric	2012	40	HP	--	--	No	--			
179	BT5431	Bag Tug	Electric	2016	40	HP	--	--	No	--			
180	BT5432	Bag Tug	Electric	2016	40	HP	--	--	No	--			
181	BT5612	Bag Tug	Electric	2016	40	HP	--	--	No	--			
182	BT5613	Bag Tug	Electric	2016	40	HP	--	--	No	--			
183	BT5904	Bag Tug	Electric	2017	40	HP	--	--	No	--			
184	BT5907	Bag Tug	Electric	2017	40	HP	--	--	No	--			
185	HS6826	Cargo Tug	Diesel	2019	74	HP	Tier 4	687	No	--			
186	GP5372	Ground Power	Diesel	2016	116	HP	Tier 4	483	No	--			
187	LT3457	Lav Truck	Gasoline	2005	285	HP	--	1278	No	--			
188	PB5000	Pushback	Diesel	2019	74	HP	Tier 4	328	No	--			
189	PB6507	Pushback	Diesel	2019	74	HP	Tier 4	328	No	--			
190	PB6729	Pushback	Diesel	2019	74	HP	Tier 4	328	No	--			

Table 1. 2020 Ground Support Equipment (GSE) Reporting Data

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

MOU Schedule No. 1. Obligations													
Unit #	III.B.1							III.B.2					
	III.B.1.a	III.B.1.b	III.B.1.c	III.B.1.d	III.B.1.e		III.B.1.f	III.B.1.g	--	--	III.B.2.a	III.B.2.b	III.B.2.c
	Equipment ID ¹	Airline GSE Type ¹	Fuel Type ¹ (Electric, Diesel, Propane, Gasoline)	Engine Model Year ¹	Engine Power Rating ¹ (HP or kW)	Engine Power Rating Units ¹	Engine Tier Level ¹ (for diesel engines)	Activity Level - hrs/yr of engine operation or annual mileage ^{2,3}	Equipment Sold or Relocated? ¹	Date of Status Change ¹	Airport to which Equipment is Relocated ¹	Date of Relocation ¹	Estimated Projected Usage Hours ¹
191	PB6832	Pushback	Diesel	2019	74	HP	Tier 4	328	No	--	No GSE units were relocated in 2020.		
192	JT0007-JT0013 ⁵	Jet-A Refueler	Diesel	2004-2015	299	HP	Tier 2 - Tier 4	483	No	--			
193	BL0003 ⁵	Beltloader	Diesel	1989	74	HP	Tier 0	510	No	--			
194	TG0007-TG0015 ^{4,5}	Tug	Electric	--	--	--	--	--	No	--			
195	GP0005-GP0013 ⁵	GPU	Diesel	2017-2020	42-155	HP	Tier 4 Interim - Tier 4	483	No	--			
196	LV0004-LV0006 ^{4,5}	Lavatory Cart	Electric	--	--	--	--	--	No	--			
197	PW0002, PW0003, PW0006 ^{4,5}	Potable Cart	Electric	--	--	--	--	--	No	--			
198	UV0007-UV0011, UV0017-UV0020 ^{4,5}	Utility Cart	Electric	--	--	--	--	--	No	--			

Notes:

¹ Data provided by tenant airlines and GSE operators at JWA for CY 2020.

² Annual activity data was not provided for any GSE; therefore, average operating hours by equipment/fuel type was obtained from CARB's OFFROAD model.

³ Equipment shaded in blue were provided by tenant airlines and GSE operators but were deemed to be outside the scope of GSE as defined under this MOU. While these equipment are listed for disclosure purposes, they are omitted from the fleet-average emission factor calculations. Refer to Tables 2 and 4 for additional details.

⁴ These units do not have a power rating listed per the GSE operator.

⁵ These units only service commercial flight operations at JWA for a portion of time. For disclosure purposes, all equipment IDs that may be used to service commercial flights are listed.

Table 2. 2020 Ground Support Equipment (GSE) Fleet-Average Emission Factor

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)
1	21892	Bag Tug	Electric	2015	40	HP	--	--	--	--
2	26521	Bag Tug	Electric	2018	40	HP	--	--	--	--
3	26522	Bag Tug	Electric	2018	40	HP	--	--	--	--
4	26523	Bag Tug	Electric	2018	40	HP	--	--	--	--
5	26524	Bag Tug	Electric	2018	40	HP	--	--	--	--
6	26528	Bag Tug	Electric	2018	40	HP	--	--	--	--
7	26529	Bag Tug	Electric	2018	40	HP	--	--	--	--
8	26530	Bag Tug	Electric	2018	40	HP	--	--	--	--
9	26531	Bag Tug	Electric	2018	40	HP	--	--	--	--
10	26532	Bag Tug	Electric	2018	40	HP	--	--	--	--
11	26533	Bag Tug	Electric	2018	40	HP	--	--	--	--
12	26535	Bag Tug	Electric	2018	40	HP	--	--	--	--
13	26536	Bag Tug	Electric	2018	40	HP	--	--	--	--
14	26537	Bag Tug	Electric	2018	40	HP	--	--	--	--
15	26538	Bag Tug	Electric	2018	40	HP	--	--	--	--
16	26539	Bag Tug	Electric	2018	40	HP	--	--	--	--
17	9513	High Speed Tug	Gasoline	2004	85	HP	0.37	913	1.03	5.28
18	22047	High Speed Tug	Diesel	2015	85	HP	0.37	730	0.12	1.39
19	3809	Belt Loader	Electric	2001	60	HP	--	--	--	--
20	3810	Belt Loader	Electric	2001	60	HP	--	--	--	--
21	3811	Belt Loader	Electric	2001	60	HP	--	--	--	--
22	3812	Belt Loader	Electric	2001	60	HP	--	--	--	--
23	10743	Belt Loader	Electric	2004	60	HP	--	--	--	--
24	10744	Belt Loader	Electric	2004	60	HP	--	--	--	--
25	10760	Belt Loader	Electric	2005	60	HP	--	--	--	--
26	21778	Belt Loader	Electric	2015	60	HP	--	--	--	--
27	21885	Belt Loader	Electric	2015	60	HP	--	--	--	--
28	21886	Belt Loader	Electric	2015	60	HP	--	--	--	--
29	897	Push Back	Diesel	2009	110	HP	0.54	328	0.16	2.44
30	2308	Push Back	Electric	2001	110	HP	--	--	--	--
31	2309	Push Back	Electric	2001	110	HP	--	--	--	--
32	2310	Push Back	Electric	2001	110	HP	--	--	--	--
33	21888	Push Back	Diesel	2015	74	HP	0.54	328	0.09	1.35
34	21889	Push Back	Diesel	2015	74	HP	0.54	328	0.09	1.35
35	26868	Push Back	Diesel	2018	74	HP	0.54	328	0.07	1.33
36	21985	Golf Cart	Electric	2012	10	HP	--	--	--	--
37	21986	Golf Cart	Electric	2012	10	HP	--	--	--	--
38	21987	Golf Cart	Electric	2012	10	HP	--	--	--	--
39	22495	Air Start	Diesel	2015	333	HP	--	--	N/A - Exempt from ORD Rule (Low Use Exemption)	N/A - Exempt from ORD Rule (Low Use Exemption)
40	21896	Ground Power	Diesel	2015	155	HP	0.31	483	0.08	0.29
41	22101	Ground Power	Diesel	2015	155	HP	0.31	483	0.08	0.29
42	15707	Lav Truck	Gasoline	2011	260	HP	0.34	1,232	0.40	2.12
43	28286	Lav Truck	Gasoline	2018	200	HP	0.34	1,227	0.20	1.73
44	10039	Passenger Stairs	Electric	2004	19	HP	--	--	--	--
45	22020	Provision truck	Gasoline	2016	320	HP	0.34	844	0.17	1.40
46	24565	Provision truck	Gasoline	2017	362	HP	0.34	845	0.15	1.38

Table 2. 2020 Ground Support Equipment (GSE) Fleet-Average Emission Factor

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)
47	18552	Van	Gasoline	2012	200	HP	--	--	N/A - Exempt from LSI Rule (Onroad licensed vehicle)	N/A - Exempt from LSI Rule (Onroad licensed vehicle)
48	FE0151	Forklift	Electric	2013	80	HP	--	--	--	--
49	UL1043	Lift	Diesel	2012	67	HP	0.34	414	0.21	4.88
50	PT0726	A/C Tug Narrow Body	Electric	2018	74	HP	--	--	--	--
51	PT0727	A/C Tug Narrow Body	Electric	2018	74	HP	--	--	--	--
52	PT0730	A/C Tug Narrow Body	Electric	2018	74	HP	--	--	--	--
53	113597	Cart	Electric	2007	14	HP	--	--	--	--
54	113598	Cart	Electric	2007	14	HP	--	--	--	--
55	GC1696	Cart	Electric	2006	14	HP	--	--	--	--
56	GC2373	Cart	Electric	2015	14	HP	--	--	--	--
57	PT1828	A/C Tug Narrow Body	Electric	2006	0	HP	--	--	--	--
58	BL1849	Belt Loader	Electric	2007	59	HP	--	--	--	--
59	BL1851	Belt Loader	Electric	2007	59	HP	--	--	--	--
60	BL1854	Belt Loader	Electric	2007	59	HP	--	--	--	--
61	BL1855	Belt Loader	Electric	2007	59	HP	--	--	--	--
62	CT1467	Cargo Tractor	Electric	2008	93	HP	--	--	--	--
63	CT3251	Cargo Tractor	Electric	2008	93	HP	--	--	--	--
64	CT3252	Cargo Tractor	Electric	2008	93	HP	--	--	--	--
65	CT5846	Cargo Tractor	Electric	2008	55	HP	--	--	--	--
66	CT5847	Cargo Tractor	Electric	2008	55	HP	--	--	--	--
67	CT5848	Cargo Tractor	Electric	2008	55	HP	--	--	--	--
68	CT5856	Cargo Tractor	Electric	2008	55	HP	--	--	--	--
69	AL0426	Lift	Diesel	2016	67	HP	0.34	414	0.09	1.36
70	AS0999	Air Start	Diesel	2018	450	HP	0.34	1,314	0.09	0.12
71	PT0645	A/C Tug Narrow Body	Diesel	2001	88	HP	0.54	328	1.11	7.49
72	PT0768	A/C Tug Narrow Body	Diesel	2000	210	HP	0.54	328	0.36	6.74
73	PT7648	A/C Tug Narrow Body	Diesel	1998	88	HP	0.54	273	1.18	9.74
74	GP1907	Ground Power Unit	Gasoline	2018	229	HP	0.34	798	0.50	5.04
75	GP1908	Ground Power Unit	Gasoline	2018	229	HP	0.34	798	0.50	5.04
76	GP1911	Ground Power Unit	Gasoline	2018	229	HP	0.34	798	0.50	5.04
77	GP1912	Ground Power Unit	Gasoline	2018	229	HP	0.34	798	0.50	5.04
78	GP2004	Ground Power Unit	Gasoline	2019	229	HP	0.34	793	0.44	4.91
79	113368	Lift	Electric	2009	114	HP	--	--	--	--
80	GP7084	Ground Power Unit	Diesel	1997	181	HP	0.34	11	0.42	7.40
81	GPU.E0017.SNA	Ground Power Unit	Electric	2019	150	HP	--	--	--	--
82	26051	A/C Tug Wide Body	Diesel	2011	175	HP	0.54	398	0.12	1.35
83	33385	Cargo Loader	Diesel	2007	99	HP	0.34	475	0.31	5.18
84	41009	Cargo Loader	Diesel	2009	110	HP	0.34	475	0.20	2.93
85	99123	Cargo Loader	Diesel	2016	110	HP	0.34	475	0.07	0.26
86	501565	Cargo Tractor	Diesel	2012	65	HP	0.36	687	0.22	2.96
87	18246	Bdt Loader	Gasoline	1994	150	HP	0.34	730	1.15	5.79
88	23262	Cargo Tractor	Gasoline	2010	80	HP	0.36	1,352	1.33	6.38
89	23263	Cargo Tractor	Gasoline	2010	80	HP	0.36	1,352	1.33	6.38
90	512143	Cargo Tractor	Gasoline	2017	86	HP	0.36	1,353	0.71	4.16
91	512144	Cargo Tractor	Gasoline	2017	86	HP	0.36	1,353	0.71	4.16
92	515410	Cargo Tractor	Gasoline	2018	86	HP	0.36	1,350	0.63	3.84

Table 2. 2020 Ground Support Equipment (GSE) Fleet-Average Emission Factor

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)
93	515411	Cargo Tractor	Gasoline	2018	86	HP	0.36	1,350	0.63	3.84
94	22851	AIRSTART	Diesel	2009	700	HP	--	--	N/A - Exempt from ORD Rule (Low Use Exemption)	N/A - Exempt from ORD Rule (Low Use Exemption)
95	62198	GPU	Diesel	2006	173	HP	0.34	483	0.30	4.65
96	62201	GPU	Diesel	2006	173	HP	0.34	483	0.30	4.65
97	GT174	GPU	Diesel	2000	152	HP	0.34	483	0.85	7.96
98	PJ123	PUSHOUT TRACTOR	Diesel	1990	110	HP	0.54	328	0.86	9.33
99	TV0994	PUSHOUT TRACTOR	Diesel	2000	87	HP	0.54	328	1.11	7.49
100	TV20561	PUSHOUT TRACTOR	Diesel	2000	87	HP	0.54	328	1.11	7.49
101	AS0118	AIRSTART UNIT	Diesel	2008	665	HP	0.34	1,314	0.30	2.63
102	AS20353	AIRSTART UNIT	Diesel	2000	330	HP	0.34	1,314	0.35	5.71
103	BL0342	BELTLOADER	Electric	2004	84	HP	--	--	--	--
104	BL18927	BELTLOADER	Electric	1999	84	HP	--	--	--	--
105	BL18928	BELTLOADER	Electric	1999	84	HP	--	--	--	--
106	BL18929	BELTLOADER	Electric	1999	84	HP	--	--	--	--
107	BL18930	BELTLOADER	Electric	1999	84	HP	--	--	--	--
108	BL18943	BELTLOADER	Electric	1999	84	HP	--	--	--	--
109	BL20011	BELTLOADER	Electric	1999	84	HP	--	--	--	--
110	BL0344	BELTLOADER	Electric	2004	84	HP	--	--	--	--
111	TV1168	PUSHOUT TRACTOR	Electric	2016	83	HP	--	--	--	--
112	TV1169	PUSHOUT TRACTOR	Electric	2016	83	HP	--	--	--	--
113	TV0995	BAG TRACTOR	Electric	2004	93	HP	--	--	--	--
114	TV0997	BAG TRACTOR	Electric	2000	93	HP	--	--	--	--
115	TV0998	BAG TRACTOR	Electric	1999	93	HP	--	--	--	--
116	TV19845	BAG TRACTOR	Electric	2000	93	HP	--	--	--	--
117	TV19846	BAG TRACTOR	Electric	2000	93	HP	--	--	--	--
118	TV19847	BAG TRACTOR	Electric	2000	93	HP	--	--	--	--
119	TV19848	BAG TRACTOR	Electric	2000	93	HP	--	--	--	--
120	TV19850	BAG TRACTOR	Electric	2000	93	HP	--	--	--	--
121	TV19849	BAG TRACTOR	Electric	2000	93	HP	--	--	--	--
122	RV20027	PICKUP TRUCK	Gasoline	1999	260	HP	0.34	834	1.31	9.87
123	LV19806	LAV TRUCK	Gasoline	2000	65	HP	0.34	1,460	1.72	6.84
124	SQ180	STAIR UNIT-MTR	Gasoline	2017	61	HP	0.40	190	0.25	3.11
125	TV0999	CARGO TRACTOR	Gasoline	1992	107	HP	0.36	1,278	14.48	20.73
126	14242	Air Start	Diesel	2007	511	HP	0.34	1,314	0.30	2.69
127	22015	Aircraft Tow Tractor	Diesel	1998	165	HP	0.54	328	0.99	7.58
128	270318	Aircraft Tow Tractor	Diesel	1998	200	HP	0.54	328	0.37	6.87
129	170544	Baggage Tractor	Diesel	2001	60	HP	0.37	730	1.34	8.37
130	170545	Baggage Tractor	Diesel	2001	60	HP	0.37	730	1.34	8.37
131	170562	Baggage Tractor	Diesel	2001	60	HP	0.37	730	1.34	8.37
132	170563	Baggage Tractor	Diesel	2001	60	HP	0.37	730	1.34	8.37
133	171293	Baggage Tractor	Diesel	2011	49	HP	0.37	730	0.28	3.06
134	521569	Belt Loader	Diesel	2000	60	HP	0.34	510	1.26	8.04
135	521651	Belt Loader	Diesel	2000	60	HP	0.34	510	1.26	8.04
136	521679	Belt Loader	Diesel	2000	52	HP	0.34	510	1.26	8.04
137	521853	Belt Loader	Diesel	2006	65	HP	0.34	510	0.33	5.25
138	9258	Ground Power Unit	Diesel	1997	165	HP	0.34	218	0.91	9.62
139	900051	Ground Power Unit	Diesel	2007	220	HP	0.34	483	0.22	2.51

Table 2. 2020 Ground Support Equipment (GSE) Fleet-Average Emission Factor

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)
140	78172	Passenger Steps	Diesel	2000	49	HP	0.40	218	1.38	5.33
141	270963	Aircraft Tow Tractor	Electric	2016	45	HP	--	--	--	--
142	770223	Baggage Tractor	Electric	2001	40	HP	--	--	--	--
143	770224	Baggage Tractor	Electric	2001	40	HP	--	--	--	--
144	770225	Baggage Tractor	Electric	2001	40	HP	--	--	--	--
145	523229	Belt Loader	Electric	2001	60	HP	--	--	--	--
146	18637	Aircraft Tow Tractor	Gasoline	1997	200	HP	0.54	730	2.62	20.84
147	173897	Baggage Tractor	Gasoline	2019	69	HP	0.37	878	0.47	3.29
148	522401	Belt Loader	Gasoline	2016	86	HP	0.34	811	0.62	3.82
149	522402	Belt Loader	Gasoline	2016	86	HP	0.34	811	0.62	3.82
150	48245	Lavatory Service Truck	Gasoline	1995	200	HP	0.34	1,460	1.72	6.84
151	480045	Lavatory Service Truck	Gasoline	1997	350	HP	0.34	1,460	1.72	6.84
152	3301	LIFT MTX	Electric	2005	59	HP	--	--	--	--
153	4469 ⁴	UTILITY TRANSPORT VEHICLE	Electric	2007	--	HP	--	--	--	--
154	4561	FORKLIFT	Electric	2008	53	HP	--	--	--	--
155	8308 ⁴	UTILITY TRANSPORT VEHICLE	Electric	2018	--	HP	--	--	--	--
156	300503	Beltloader	Gasoline	1994	21	HP	--	--	N/A - Exempt from LSI Rule (< 25 horsepower)	N/A - Exempt from LSI Rule (< 25 horsepower)
157	394376	Pushback Tractor	Diesel	1993	210	HP	0.54	328	1.20	9.71
158	411986	Airstart	Diesel	2016	675	HP	0.34	1,314	0.08	0.96
159	412127	Pickup Truck	Gasoline	2017	300	HP	0.34	845	0.15	1.38
160	419058	Beltloader	Gasoline	2019	84	HP	0.34	813	0.46	3.25
161	4191695	Ground Power Unit	Diesel	2019	173	HP	0.34	483	0.05	0.26
162	496400	Cargo Loader	Diesel	1997	152	HP	0.34	475	0.92	9.70
163	770627	Cargo Loader	Gasoline	2015	21	HP	--	--	N/A - Exempt from LSI Rule (< 25 horsepower)	N/A - Exempt from LSI Rule (< 25 horsepower)
164	770873	Cargo Tractor	Gasoline	2015	21	HP	--	--	N/A - Exempt from LSI Rule (< 25 horsepower)	N/A - Exempt from LSI Rule (< 25 horsepower)
165	770874	Cargo Tractor	Gasoline	2015	21	HP	--	--	N/A - Exempt from LSI Rule (< 25 horsepower)	N/A - Exempt from LSI Rule (< 25 horsepower)
166	770875	Cargo Tractor	Gasoline	2015	21	HP	--	--	N/A - Exempt from LSI Rule (< 25 horsepower)	N/A - Exempt from LSI Rule (< 25 horsepower)
167	AS5615	Air Start	Diesel	2016	380	HP	0.34	1,314	0.05	0.76
168	BL1875	Beltloader	Gasoline	2015	84	HP	0.34	810	0.67	4.02
169	BL3112	Beltloader	Gasoline	2015	84	HP	0.34	810	0.67	4.02
170	BL3130	Beltloader	Gasoline	2009	27	HP	0.34	811	1.00	5.19
171	BL3692	Beltloader	Gasoline	2009	18	HP	--	--	N/A - Exempt from LSI Rule (< 25 horsepower)	N/A - Exempt from LSI Rule (< 25 horsepower)
172	BL3693	Beltloader	Gasoline	2009	18	HP	--	--	N/A - Exempt from LSI Rule (< 25 horsepower)	N/A - Exempt from LSI Rule (< 25 horsepower)
173	BL5397	Beltloader	Electric	2016	40	HP	--	--	--	--
174	BL5433	Beltloader	Electric	2016	40	HP	--	--	--	--

Table 2. 2020 Ground Support Equipment (GSE) Fleet-Average Emission Factor

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)
175	BL5434	Beltloader	Electric	2016	40	HP	--	--	--	--
176	BL6455	Beltloader	Electric	2018	40	HP	--	--	--	--
177	BT3917	Bag Tug	Electric	2012	40	HP	--	--	--	--
178	BT3918	Bag Tug	Electric	2012	40	HP	--	--	--	--
179	BT5431	Bag Tug	Electric	2016	40	HP	--	--	--	--
180	BT5432	Bag Tug	Electric	2016	40	HP	--	--	--	--
181	BT5612	Bag Tug	Electric	2016	40	HP	--	--	--	--
182	BT5613	Bag Tug	Electric	2016	40	HP	--	--	--	--
183	BT5904	Bag Tug	Electric	2017	40	HP	--	--	--	--
184	BT5907	Bag Tug	Electric	2017	40	HP	--	--	--	--
185	HS6826	Cargo Tug	Diesel	2019	74	HP	0.36	687	0.09	1.36
186	GP5372	Ground Power	Diesel	2016	116	HP	0.34	483	0.07	0.26
187	LT3457	Lav Truck	Gasoline	2005	285	HP	0.34	1,278	1.57	6.32
188	PB5000	Pushback	Diesel	2019	74	HP	0.54	328	0.07	1.34
189	PB6507	Pushback	Diesel	2019	74	HP	0.54	328	0.07	1.34
190	PB6729	Pushback	Diesel	2019	74	HP	0.54	328	0.07	1.34
191	PB6832	Pushback	Diesel	2019	74	HP	0.54	328	0.07	1.34
192	JT0007-JT0013 ⁵	Jet-A Refueler	Diesel	2004-2015	299	HP	0.34	483	0.21	3.48
193	BL0003 ⁵	Beltloader	Diesel	1989	74	HP	0.34	510	1.34	10.40
194	TG0007-TG0015 ^{4,5}	Tug	Electric	--	--	--	--	--	--	--
195	GP0005-GP0013 ⁵	GPU	Diesel	2017-2020	65	HP	0.34	483	0.09	1.60
196	LV0004-LV0006 ^{4,5}	Lavatory Cart	Electric	--	--	--	--	--	--	--
197	PW0002, PW0003, PW0006 ^{4,5}	Potable Cart	Electric	--	--	--	--	--	--	--
198	UV0007-UV0011, UV0017-UV0020 ^{4,5}	Utility Cart	Electric	--	--	--	--	--	--	--
Fleet-Averaged Emission Factor (g/bhp-hr)										3.2

Notes:

¹ GSE annual usage hours were calculated using activity from the OFFROAD2017 database for CY 2020 absent equipment-specific usage information. Annual equipment usage calculated using OFFROAD2017 for 2020 may not be representative of actual usage as a result of reduced airport activities due to COVID-19 impacts. Additionally, GSE load factors were taken from OFFROAD2017 absent equipment-specific load factor information.

² Model year-specific emission factors from OFFROAD2017 were derived by dividing total emissions by the total annual horsepower-hours and load factor for each equipment type based on equipment model year and horsepower bin. Where an exact model year and/or horsepower bin match did not exist, an alternate model year/horsepower bin combination was selected to look up emission factors. Electric vehicles are assigned an EF of 0. Emissions are calculated by multiplying the respective EFs by the equipment horsepower, load factor and hours of usage in 2020 and converted to an average daily emission rate assuming 365 days of operation.

³ Equipment that do not meet criteria for GSE as specified in the MOU were not included in the emissions calculations. These pieces of equipment are shown in this table, however do not have emissions calculations as shown by "N/A". Examples of equipment that do not meet MOU GSE criteria include vehicle licensed by the DMV for on-road usage (designated as "N/A - Onroad"), equipment with a rating less than 25 horsepower (designated as "N/A - < 25 horsepower"), and equipment exempt as part of a low-usage exemption (designated as "N/A - Low Use Exemption"). Regulatory guidance for these examples are cited below.

^a The CARB LSI regulation's definition for airport GSE does not include those categories of GSE equipment that are designated and licensed for on-road use. These pieces of equipment are not subject to the requirements of the LSI regulation. Available at: <https://ww2.arb.ca.gov/sites/default/files/classic/msprog/offroad/orspark/faqs/lsifaqagse.pdf>. Accessed: May 2021.

^b The CARB Offroad Diesel (ORD) regulation exempts permanent and year-by-year low-use vehicles as defined in CCR § 2449 (e)(7). Available at: <https://ww2.arb.ca.gov/sites/default/files/2019-03/finalregorder-dec2011.pdf>. Accessed: May 2021.

^c The CARB LSI regulation's definition for airport GSE does not include those categories of GSE equipment that are less than 25 horsepower, per CCR § 2775 (a)(1). Available at: <https://ww2.arb.ca.gov/sites/default/files/classic/msprog/offroad/orspark/largesparkappa-clean.pdf>. Accessed: May 2021.

⁴ These units do not have a power rating listed per the GSE operator.

⁵ These units only service commercial flight operations at JWA for a portion of time. For disclosure purposes, all equipment IDs that may be used to service commercial flights are listed. The ROG and NOx emission factors are calculated as a horsepower-weighted average of emission factors from the OFFROAD2017 database. The engine power rating used in the emission calculations represent the average horsepower across all units.

Table 3. JWA GSE List and Emissions for 2017 BaselineJohn Wayne Airport MOU
Santa Ana, CaliforniaJOHN WAYNE AIRPORT
ORANGE COUNTY

Row Number	Equipment ID ¹	GSE Type ¹	Fuel Type ¹	Engine Model Year ¹	Engine Rated HP ¹	Annual Hours 2017 ²	Load Factor ³	ROG EF (g/bhp-hr) ³	NOx EF (g/bhp-hr) ³	ROG (lb/day)	NOx (lb/day)
1	AJV261	Belt Loader	Electric	1999	84	499	0.34	--	--	--	--
2	AOS669	Aircraft Tractor	Diesel	1998	88	320	0.54	1.40	8.9	0.128	0.810
3	AQZ997	Belt Loader	Electric	1969	84	499	0.34	--	--	--	--
4	ASU698	Aircraft Tractor	Diesel	1980	101	320	0.54	1.59	13.1	0.167	1.369
5	BLL494	Belt Loader	Electric	2002	59	499	0.34	--	--	--	--
6	BSH411	Cargo Loader	Diesel	2016	110	459	0.34	0.07	0.86	0.007	0.088
7	CRU474	Aircraft Tractor	Diesel	2012	65	320	0.54	0.16	2.8	0.011	0.191
8	EID699	Aircraft Tractor	Diesel	1990	110	320	0.54	1.05	10.8	0.120	1.231
9	FPH282	Belt Loader	Electric	2001	84	499	0.34	--	--	--	--
10	GLW528	Aircraft Tractor	Diesel	2001	88	320	0.54	1.35	5.9	0.123	0.535
11	GRU635	Belt Loader	Electric	2002	84	499	0.34	--	--	--	--
12	IJA559	Belt Loader	Electric	2002	59	499	0.34	--	--	--	--
13	IVH845	Belt Loader	Electric	2000	84	499	0.34	--	--	--	--
14	IWT551	Baggage Tractor	Electric	1969	93	714	0.37	--	--	--	--
15	JFJ515	Cargo Loader	Diesel	1997	152	459	0.34	1.07	6.7	0.151	0.947
16	JMR629	Belt Loader	Electric	1999	84	499	0.34	--	--	--	--
17	JMU941	Aircraft Tractor	Electric	2001	110	320	0.54	--	--	--	--
18	KGC471	Aircraft Tractor	Diesel	2011	175	320	0.54	0.12	1.5	0.022	0.269
19	MUF942	Belt Loader	Electric	2001	84	499	0.34	--	--	--	--
20	NOK911	Baggage Tractor	Electric	2001	93	714	0.37	--	--	--	--
21	NPC715	Aircraft Tractor	Electric	2001	110	320	0.54	--	--	--	--
22	OOV713	Aircraft Tractor	Diesel	2001	87	320	0.54	1.35	5.9	0.122	0.529
23	OXY812	Aircraft Tractor	Diesel	2014	74	320	0.54	0.14	2.6	0.011	0.199
24	PYQ126	Belt Loader	Diesel	1991	55	499	0.34	1.68	9.9	0.093	0.548
25	QKW269	Aircraft Tractor	Diesel	2000	100	320	0.54	0.94	6.1	0.097	0.631
26	RDK866	Aircraft Tractor	Diesel	2009	110	320	0.54	0.19	2.6	0.021	0.299
27	RMH612	Aircraft Tractor	Diesel	2014	74	320	0.54	0.14	2.6	0.011	0.199
28	RWF453	Aircraft Tractor	Electric	1988	140	320	0.54	--	--	--	--
29	SIE184	Baggage Tractor	Electric	1969	93	714	0.37	--	--	--	--
30	SJB626	Belt Loader	Electric	1969	84	499	0.34	--	--	--	--
31	SXH922	Cargo Loader	Diesel	2007	99	459	0.34	0.36	3.8	0.033	0.351
32	TIL598	Aircraft Tractor	Diesel	2000	210	320	0.54	0.44	6.2	0.096	1.357

Table 3. JWA GSE List and Emissions for 2017 BaselineJohn Wayne Airport MOU
Santa Ana, CaliforniaJOHN WAYNE AIRPORT
ORANGE COUNTY

Row Number	Equipment ID ¹	GSE Type ¹	Fuel Type ¹	Engine Model Year ¹	Engine Rated HP ¹	Annual Hours 2017 ²	Load Factor ³	ROG EF (g/bhp-hr) ³	NOx EF (g/bhp-hr) ³	ROG (lb/day)	NOx (lb/day)
33	TVH639	Aircraft Tractor	Electric	2001	110	320	0.54	--	--	--	--
34	UCK839	Belt Loader	Electric	2002	84	499	0.34	--	--	--	--
35	UEY751	Baggage Tractor	Electric	1969	93	714	0.37	--	--	--	--
36	UGX578	Aircraft Tractor	Diesel	1993	210	320	0.54	1.02	8.1	0.221	1.763
37	UQR626	Belt Loader	Electric	1969	84	499	0.34	--	--	--	--
38	VLA757	Lift	Diesel	2012	67	404	0.34	0.17	2.85	0.010	0.155
39	VMD662	Baggage Tractor	Diesel	2015	85	714	0.37	0.08	2.7	0.011	0.359
40	VZS937	Cargo Loader	Diesel	2009	110	459	0.34	0.22	2.66	0.023	0.272
41	WJO795	Aircraft Tractor	Diesel	2000	87	320	0.54	1.37	5.9	0.123	0.532
42	WNN723	Baggage Tractor	Electric	2000	93	714	0.37	--	--	--	--
43	XCJ892	Aircraft Tractor	Diesel	2018	74	320	0.54	0.11	2.62	0.008	0.201
44	YAI573	Baggage Tractor	Electric	1969	93	714	0.37	--	--	--	--
45	ZCM526	Lift	Diesel	2016	67	404	0.34	0.13	2.65	0.007	0.145
46	ZDJ657	Baggage Tractor	Electric	2001	93	714	0.37	--	--	--	--
47	ZNP786	Baggage Tractor	Electric	2000	93	714	0.37	--	--	--	--
48	ABI825	Belt Loader	Electric	2004	84.4	499	0.34	--	--	--	--
49	API285	Belt Loader	Electric	2005	19	499	0.34	--	--	--	--
50	AP0159	Cargo Tractor	Gasoline	2017	86	1235	0.54	0.05	0.1	0.018	0.044
51	BAF751	Baggage Tractor	Gasoline	1992	107	870	0.55	1.70	13.8	0.526	4.261
52	BLI749	Belt Loader	Electric	2001	19	499	0.34	--	--	--	--
53	BSN419	Cargo Tractor	Gasoline	2010	80	1235	0.54	0.31	0.8	0.101	0.247
54	CIO565	Belt Loader	Electric	2005	19	499	0.34	--	--	--	--
55	CQH934	Baggage Tractor	Electric	2007	40	714	0.37	--	--	--	--
56	CUM541	Belt Loader	Electric	2015	19	499	0.34	--	--	--	--
57	DHV337	Aircraft Tractor	Electric	2016	200.4	320	0.54	--	--	--	--
58	DNE634	Fork Lift	Electric	2008	53	368	0.20	--	--	--	--
59	DQJ897	Belt Loader	Electric	2007	19	499	0.34	--	--	--	--
60	DZO429	Passenger Stand	Gasoline	2017	61	177	0.59	0.02	0.0	0.001	0.001
61	EJU243	Belt Loader	Electric	2015	19	499	0.34	--	--	--	--
62	EKZ482	Baggage Tractor	Electric	1999	92.5	714	0.37	--	--	--	--
63	FIT829	Cargo Tractor	Gasoline	2015	100.8	1235	0.54	0.15	0.3	0.062	0.138
64	FSF743	Baggage Tractor	Electric	2015	40	714	0.37	--	--	--	--

Table 3. JWA GSE List and Emissions for 2017 BaselineJohn Wayne Airport MOU
Santa Ana, CaliforniaJOHN WAYNE AIRPORT
ORANGE COUNTY

Row Number	Equipment ID ¹	GSE Type ¹	Fuel Type ¹	Engine Model Year ¹	Engine Rated HP ¹	Annual Hours 2017 ²	Load Factor ³	ROG EF (g/bhp-hr) ³	NOx EF (g/bhp-hr) ³	ROG (lb/day)	NOx (lb/day)
65	FYV818	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
66	GBA173	Baggage Tractor	Electric	2004	40	714	0.37	--	--	--	--
67	GKP522	Belt Loader	Electric	2004	19	499	0.34	--	--	--	--
68	HIW471	Baggage Tractor	Gasoline	2008	100	870	0.55	1.45	1.7	0.418	0.482
69	HPJ684	Cart	Electric	2007	6.6	1272	0.34	--	--	--	--
70	HQO191	Belt Loader	Electric	2004	19	499	0.34	--	--	--	--
71	HRX181	Belt Loader	Electric	2001	19	499	0.34	--	--	--	--
72	IAB926	Baggage Tractor	Electric	2015	40	714	0.37	--	--	--	--
73	JGD481	Baggage Tractor	Electric	2008	92.5	714	0.37	--	--	--	--
74	JMS471	Baggage Tractor	Electric	2004	40	714	0.37	--	--	--	--
75	JPB954	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
76	JRI671	Baggage Tractor	Electric	2018	49	714	0.37	--	--	--	--
77	KBA851	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
78	KMZ324	Passenger Stand	Electric	2004	19	47	0.40	--	--	--	--
79	LNC262	Baggage Tractor	Electric	2018	40	714	0.37	--	--	--	--
80	LRQ549	Baggage Tractor	Electric	2018	40	714	0.37	--	--	--	--
81	LRZ722	Baggage Tractor	Electric	2018	49	714	0.37	--	--	--	--
82	MDR266	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
83	MGP256	Belt Loader	Electric	2015	19	499	0.34	--	--	--	--
84	MIP827	Other	Gasoline	1998	260	182	0.50	1.6	13.4	0.232	1.918
85	MXL475	Baggage Tractor	Electric	2018	40	714	0.37	--	--	--	--
86	NUD378	Baggage Tractor	Electric	2018	49	714	0.37	--	--	--	--
87	OEQ194	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
88	OMP595	Other	Gasoline	1990	137.8	182	0.50	1.7	13.6	0.127	1.031
89	OOH792	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
90	PGM515	Cart	Electric	2006	55	1272	0.34	--	--	--	--
91	PYI219	Cargo Tractor	Gasoline	2002	124	1235	0.54	1.2	8.3	0.610	4.137
92	PZL425	Baggage Tractor	Electric	2008	92.5	714	0.37	--	--	--	--
93	QDM823	Catering Truck	Gasoline	2016	200	0,883	0.20	0.14	0.23	0.029	0.049
94	QGR424	Belt Loader	Electric	2007	19	499	0.34	--	--	--	--
95	QGZ262	Cargo Loader	Gasoline	2015	101.7	764	0.50	0.14	0.3	0.033	0.061
96	QKB754	Service Truck	Gasoline	2017	132.5	0,883	0.20	0.13	0.18	0.018	0.026

Table 3. JWA GSE List and Emissions for 2017 BaselineJohn Wayne Airport MOU
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Row Number	Equipment ID ¹	GSE Type ¹	Fuel Type ¹	Engine Model Year ¹	Engine Rated HP ¹	Annual Hours 2017 ²	Load Factor ³	ROG EF (g/bhp-hr) ³	NOx EF (g/bhp-hr) ³	ROG (lb/day)	NOx (lb/day)
97	QNZ773	Baggage Tractor	Electric	2002	40	714	0.37	--	--	--	--
98	QYO535	Cargo Tractor	Gasoline	1994	100.8	1235	0.54	1.7	13.8	0.691	5.598
99	REQ465	Baggage Tractor	Electric	2015	40	714	0.37	--	--	--	--
100	RIO497	Baggage Tractor	Electric	2018	49	714	0.37	--	--	--	--
101	RNS944	Baggage Tractor	Electric	2004	40	714	0.37	--	--	--	--
102	SAX899	Lift	Electric	2009	113.6	404	0.34	--	--	--	--
103	SSK522	Cargo Tractor	Gasoline	2018	86	1235	0.54	0.02	0.0	0.005	0.013
104	SVH737	Lavatory Truck	Gasoline	1993	250	1,163	0.25	1.70	13.8	0.747	6.052
105	SYX512	Lift	Electric	2005	59	404	0.34	--	--	--	--
106	TCS165	Baggage Tractor	Electric	2018	40	714	0.37	--	--	--	--
107	TFL596	Baggage Tractor	Electric	2000	92.5	714	0.37	--	--	--	--
108	TFW282	Cargo Tractor	Gasoline	2015	100.8	1235	0.54	0.15	0.3	0.062	0.138
109	TKE511	Belt Loader	Electric	2004	84.4	499	0.34	--	--	--	--
110	TOK383	Belt Loader	Electric	2015	19	499	0.34	--	--	--	--
111	UKK661	Cargo Tractor	Gasoline	2015	100.8	1235	0.54	0.15	0.3	0.062	0.138
112	UOP557	Lavatory Truck	Gasoline	2000	65	1,163	0.25	4.27	12.3	0.487	1.399
113	UYG876	Baggage Tractor	Gasoline	2004	202	870	0.55	2.53	2.9	1.477	1.701
114	VHR783	Lavatory Truck	Gasoline	2011	260	1,163	0.25	0.20	0.58	0.089	0.267
115	VLO747	Catering Truck	Gasoline	2017	362	0,883	0.20	0.13	0.18	0.049	0.071
116	VSJ454	Aircraft Tractor	Electric	2016	200.4	320	0.54	--	--	--	--
117	VUL841	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
118	VWT125	Cargo Tractor	Gasoline	2017	86	1235	0.54	0.05	0.1	0.018	0.044
119	VXO257	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
120	XIQ772	Baggage Tractor	Electric	2018	40	714	0.37	--	--	--	--
121	XLL875	Cargo Tractor	Gasoline	2010	80	1235	0.54	0.31	0.8	0.101	0.247
122	XNB822	Baggage Tractor	Electric	2004	40	714	0.37	--	--	--	--
123	XRJ221	Baggage Tractor	Electric	2018	40	714	0.37	--	--	--	--
124	XSY644	Baggage Tractor	Electric	2008	92.5	714	0.37	--	--	--	--
125	YOA937	Baggage Tractor	Electric	2018	40	714	0.37	--	--	--	--
126	YQN629	Cargo Tractor	Gasoline	2010	80	1235	0.54	0.31	0.8	0.101	0.247

Table 3. JWA GSE List and Emissions for 2017 BaselineJohn Wayne Airport MOU
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Row Number	Equipment ID ¹	GSE Type ¹	Fuel Type ¹	Engine Model Year ¹	Engine Rated HP ¹	Annual Hours 2017 ²	Load Factor ³	ROG EF (g/bhp-hr) ³	NOx EF (g/bhp-hr) ³	ROG (lb/day)	NOx (lb/day)
127	YZM374	Baggage Tractor	Electric	2015	40	714	0.37	--	--	--	--
128	ZDU587	Service Truck	Electric	2018	7	0,464	0.34	--	--	--	--
129	ZFL337	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
130	ZKE149	Belt Loader	Gasoline	1994	84.4	786	0.50	4.15	12.2	0.832	2.448
131	ZOG656	Belt Loader	Electric	2001	19	499	0.34	--	--	--	--
132	ZOX586	Baggage Tractor	Electric	2005	40	714	0.37	--	--	--	--
133	ZPL129	Baggage Tractor	Electric	2004	92.5	714	0.37	--	--	--	--
134	ZQF241	Baggage Tractor	Electric	2001	92.5	714	0.37	--	--	--	--
135	ZSN955	Belt Loader	Electric	2001	19	499	0.34	--	--	--	--
136	BT16125	BAG TUG	Electric	2005	40	714	0.37	--	--	--	--
137	BT16158	BAG TUG	Electric	2005	40	714	0.37	--	--	--	--
138	BL6093	BELT LOADER	Electric	2006	19	499	0.34	--	--	--	--
139	BL6094	BELT LOADER	Electric	2006	19	499	0.34	--	--	--	--
140	PB14095	PUSH BACK	Diesel	2008	100	320	0.54	0.20	2.7	0.020	0.283
141	22015	AC TOW TRACTOR	Diesel	1980	101	320	0.54	1.59	13.1	0.167	1.369
142	78172	PAX STAIRS	Diesel	2017	61	47	0.40	0.11	2.62	0.001	0.018
143	48245	LAV TRUCK	Gasoline	1993	250	1,163	0.25	1.70	13.8	0.747	6.052
144	170544	BAG TRACTOR	Diesel	2015	85	714	0.37	0.08	2.7	0.011	0.359
145	170545	BAG TRACTOR	Diesel	2015	85	714	0.37	0.08	2.7	0.011	0.359
146	170562	BAG TRACTOR	Diesel	2015	85	714	0.37	0.08	2.7	0.011	0.359
147	170563	BAG TRACTOR	Diesel	2015	85	714	0.37	0.08	2.7	0.011	0.359
148	521569	BELT LOADER	Diesel	1991	55	499	0.34	1.68	9.9	0.093	0.548
149	521651	BELT LOADER	Diesel	1991	55	499	0.34	1.68	9.9	0.093	0.548
150	521853	BELT LOADER	Diesel	1991	55	499	0.34	1.68	9.9	0.093	0.548
151	270318	AC TOW TRACTOR	Diesel	1980	101	320	0.54	1.59	13.1	0.167	1.369
152	18637	AC TOW TRACTOR	Gasoline	1980	101	729	0.80	1.75	13.8	0.622	4.918
153	48463	LAV CART	Gasoline	1993	250	0,122	0.50	1.6	13.3	0.143	1.220
154	270448	AC TOW TRACTOR	Diesel	1980	101	320	0.54	1.59	13.1	0.167	1.369
155	171293	BAG TRACTOR	Diesel	2015	85	714	0.37	0.08	2.7	0.011	0.359
156	750091	MANUAL PAX STAIRS	Gasoline	2017	61	177	0.59	0.02	0.0	0.001	0.001
157	522401	BELT LOADER	Gasoline	1994	84.4	786	0.50	4.15	12.2	0.832	2.448
158	522402	BELT LOADER	Gasoline	1994	84.4	786	0.50	4.15	12.2	0.832	2.448

Table 3. JWA GSE List and Emissions for 2017 BaselineJohn Wayne Airport MOU
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Row Number	Equipment ID ¹	GSE Type ¹	Fuel Type ¹	Engine Model Year ¹	Engine Rated HP ¹	Annual Hours 2017 ²	Load Factor ³	ROG EF (g/bhp-hr) ³	NOx EF (g/bhp-hr) ³	ROG (lb/day)	NOx (lb/day)
159	270963	AC TOW TRACTOR	Electric	2001	110	320	0.54	--	--	--	--
160	523229	BELT LOADER	Electric	2005	19	499	0.34	--	--	--	--
161	770223	BAG TRACTOR	Electric	2005	40	714	0.37	--	--	--	--
162	770224	BAG TRACTOR	Electric	2005	40	714	0.37	--	--	--	--
163	770225	BAG TRACTOR	Electric	2005	40	714	0.37	--	--	--	--
164	DAF969	Ground Power Unit	Diesel	2015	155	464	0.34	0.07	1.09	0.011	0.159
165	FAZ395	Air Start	Diesel	2017	600	1272	0.34	0.07	0.68	0.109	1.053
166	FDY453	Ground Power Unit	Diesel	1997	181	464	0.34	0.51	6.5	0.086	1.113
167	IPO495	Ground Power Unit	Diesel	2007	220	464	0.34	0.25	2.73	0.051	0.565
168	JDT355	Ground Power Unit	Diesel	1997	500	464	0.34	0.47	6.4	0.220	3.000
169	JUN844	Ground Power Unit	Diesel	2007	220	464	0.34	0.25	2.73	0.051	0.565
170	KYV169	Ground Power Unit	Diesel	2006	173	464	0.34	0.33	4.0	0.054	0.648
171	PWS242	Ground Power Unit	Diesel	2015	155	464	0.34	0.07	1.09	0.011	0.159
172	PZN983	Ground Power Unit	Diesel	2001	194	464	0.34	0.48	6.3	0.087	1.143
173	QYF444	Air Start	Diesel	2015	333	1272	0.34	0.10	0.81	0.088	0.695
174	REK374	Ground Power Unit	Diesel	2000	152	464	0.34	1.03	6.4	0.147	0.915
175	RTK928	Ground Power Unit	Diesel	1998	152	464	0.34	1.06	6.7	0.151	0.951
176	VGX912	Ground Power Unit	Diesel	2005	219	464	0.34	0.29	4.1	0.059	0.848
177	WZE196	Air Start	Diesel	2007	665	1272	0.34	0.44	2.85	0.745	4.880
178	YON237	Air Start	Diesel	1999	330	1272	0.34	0.49	6.4	0.420	5.441
179	YQY337	Ground Power Unit	Diesel	1998	152	464	0.34	1.06	6.7	0.151	0.951
180	YXU974	Ground Power Unit	Diesel	1999	185	464	0.34	0.49	6.7	0.085	1.160

Table 3. JWA GSE List and Emissions for 2017 Baseline

John Wayne Airport MOU
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JOHN WAYNE AIRPORT
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Row Number	Equipment ID ¹	GSE Type ¹	Fuel Type ¹	Engine Model Year ¹	Engine Rated HP ¹	Annual Hours 2017 ²	Load Factor ³	ROG EF (g/bhp-hr) ³	NOx EF (g/bhp-hr) ³	ROG (lb/day)	NOx (lb/day)
181	ZEJ832	Air Start	Diesel	2007	630	1272	0.34	0.44	2.85	0.706	4.623
182	9258	GROUND POWER	Diesel	1997	181	464	0.34	0.51	6.5	0.086	1.113
183	14242	AIR START	Diesel	1999	665	1272	0.34	0.49	6.9	0.847	11.834
184	900051	GROUND POWER	Diesel	1997	181	464	0.34	0.51	6.5	0.086	1.113
Total Annual Emissions (lbs)										6,130	40,734
Total Emissions (lb/day)										17	112

Notes:

¹ List of GSEs including fuel type, engine model year and engine horsepower are provided by GSE operators at JWA. Nonmotorized equipment and on-road vehicles (e.g., pickup truck, van) were excluded from the provided inventory. Where engine model year or horsepower were not provided, data was back-filled based on typical parameters of similar equipment operating at JWA.

² GSE annual usage hours were calculated using activity from the OFFROAD2017 database for CY 2017.

³ Model year-specific emission factors for diesel-fueled equipment were derived from CARB's 2017 Off-Road Diesel Emission Factors. For gasoline-fueled equipment, model year-specific HC and NOx emission factors were calculated based on new engine standards for spark-ignited engines. Gasoline-fueled and diesel-fueled emission factors were calculated by summing the zero-hour pollutant emission factor with the product of the deterioration rate and cumulative hours and multiplying by the fuel correction factor, following the methodology presented in Attachment A of <https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/facility-based-mobile-source-measures/airports-final-appendix-b.pdf?sfvrsn=6>. Engine accumulated hours were capped depending on fuel type and model-year (gasoline) or HP (diesel). Model year-specific gasoline-fueled emission factor constants and engine load factors were provided by AQMD. Gasoline-fueled emission factor constants were provided up to a HP bin of 300; therefore, units with a HP greater than 300 HP were quantified using the 300 HP bin constants. Gasoline-fueled emission factor constants for the 50 HP bin were provided based on engine displacement; however since engine displacement information was not available, the maximum emission factor constants were selected. HC emission factors were converted to ROG emission factors by multiplying by a gasoline ROG to HC ratio, derived from OFFROAD 2017. Electric vehicles are assigned an EF of 0. Emissions are calculated by multiplying the respective EFs by the equipment horsepower, load factor and hours of usage in 2020 and converted to an average daily emission rate assuming 365 days of operation.

Abbreviations:

bhp - brake horsepower	lb - pound
EF - emission factor	NO _x - oxides of Nitrogen
g - grams	ROG - reactive organic gases

Table 4. JWA GSE List and Emissions for 2020

John Wayne Airport MOU
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Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)	Annual ROG Emissions (lbs)	Annual NOx Emissions (lbs)
1	21892	Bag Tug	Electric	2015	40	HP			--	--	--	--
2	26521	Bag Tug	Electric	2018	40	HP			--	--	--	--
3	26522	Bag Tug	Electric	2018	40	HP			--	--	--	--
4	26523	Bag Tug	Electric	2018	40	HP			--	--	--	--
5	26524	Bag Tug	Electric	2018	40	HP			--	--	--	--
6	26528	Bag Tug	Electric	2018	40	HP			--	--	--	--
7	26529	Bag Tug	Electric	2018	40	HP			--	--	--	--
8	26530	Bag Tug	Electric	2018	40	HP			--	--	--	--
9	26531	Bag Tug	Electric	2018	40	HP			--	--	--	--
10	26532	Bag Tug	Electric	2018	40	HP			--	--	--	--
11	26533	Bag Tug	Electric	2018	40	HP			--	--	--	--
12	26535	Bag Tug	Electric	2018	40	HP			--	--	--	--
13	26536	Bag Tug	Electric	2018	40	HP			--	--	--	--
14	26537	Bag Tug	Electric	2018	40	HP			--	--	--	--
15	26538	Bag Tug	Electric	2018	40	HP			--	--	--	--
16	26539	Bag Tug	Electric	2018	40	HP			--	--	--	--
17	9513	High Speed Tug	Gasoline	2004	85	HP	0.55	913	4.88	0.43	458.82	40.61
18	22047	High Speed Tug	Diesel	2015	85	HP	0.37	730	0.11	2.74	5.58	138.35
19	3809	Belt Loader	Electric	2001	60	HP			--	--	--	--
20	3810	Belt Loader	Electric	2001	60	HP			--	--	--	--
21	3811	Belt Loader	Electric	2001	60	HP			--	--	--	--
22	3812	Belt Loader	Electric	2001	60	HP			--	--	--	--
23	10743	Belt Loader	Electric	2004	60	HP			--	--	--	--
24	10744	Belt Loader	Electric	2004	60	HP			--	--	--	--
25	10760	Belt Loader	Electric	2005	60	HP			--	--	--	--
26	21778	Belt Loader	Electric	2015	60	HP			--	--	--	--
27	21885	Belt Loader	Electric	2015	60	HP			--	--	--	--
28	21886	Belt Loader	Electric	2015	60	HP			--	--	--	--
29	897	Push Back	Diesel	2009	110	HP	0.54	328	0.22	2.66	9.29	114.18
30	2308	Push Back	Electric	2001	110	HP			--	--	--	--
31	2309	Push Back	Electric	2001	110	HP			--	--	--	--
32	2310	Push Back	Electric	2001	110	HP			--	--	--	--
33	21888	Push Back	Diesel	2015	74	HP	0.54	328	0.16	2.63	4.70	75.97
34	21889	Push Back	Diesel	2015	74	HP	0.54	328	0.16	2.63	4.70	75.97
35	26868	Push Back	Diesel	2018	74	HP	0.54	328	0.14	2.65	3.92	76.73
36	21985	Golf Cart	Electric	2012	10	HP			--	--	--	--
37	21986	Golf Cart	Electric	2012	10	HP			--	--	--	--
38	21987	Golf Cart	Electric	2012	10	HP			--	--	--	--
39	22495	Air Start	Diesel	2015	333	HP	0.31	1,314	0.15	0.85	46.30	254.74
40	21896	Ground Power	Diesel	2015	155	HP	0.31	483	0.09	1.11	4.68	56.83
41	22101	Ground Power	Diesel	2015	155	HP	0.31	483	0.09	1.11	4.68	56.83
42	15707	Lav Truck	Gasoline	2011	260	HP	0.25	1,232	0.21	0.69	37.51	121.25
43	28286	Lav Truck	Gasoline	2018	200	HP	0.25	1,227	0.15	0.34	20.72	45.64
44	10039	Passenger Stairs	Electric	2004	19	HP			--	--	--	--
45	22020	Provision truck	Gasoline	2016	320	HP	0.20	844	0.16	0.37	18.84	43.71
46	24565	Provision truck	Gasoline	2017	362	HP	0.20	845	0.15	0.32	20.29	43.28
47	18552 ⁷	Van	Gasoline	2012	200	HP	0.20	837	0.19	0.55	--	--
48	FE0151	Forklift	Electric	2013	80	HP			--	--	--	--
49	UL1043	Lift	Diesel	2012	67	HP	0.34	414	0.21	2.89	4.30	59.15

Table 4. JWA GSE List and Emissions for 2020

John Wayne Airport MOU
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JOHN WAYNE AIRPORT
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Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)	Annual ROG Emissions (lbs)	Annual NOx Emissions (lbs)
50	PT0726	A/C Tug Narrow Body	Electric	2018	74	HP			--	--	--	--
51	PT0727	A/C Tug Narrow Body	Electric	2018	74	HP			--	--	--	--
52	PT0730	A/C Tug Narrow Body	Electric	2018	74	HP			--	--	--	--
53	113597	Cart	Electric	2007	14	HP			--	--	--	--
54	113598	Cart	Electric	2007	14	HP			--	--	--	--
55	GC1696	Cart	Electric	2006	14	HP			--	--	--	--
56	GC2373	Cart	Electric	2015	14	HP			--	--	--	--
57	PT1828	A/C Tug Narrow Body	Electric	2006	0	HP			--	--	--	--
58	BL1849	Belt Loader	Electric	2007	59	HP			--	--	--	--
59	BL1851	Belt Loader	Electric	2007	59	HP			--	--	--	--
60	BL1854	Belt Loader	Electric	2007	59	HP			--	--	--	--
61	BL1855	Belt Loader	Electric	2007	59	HP			--	--	--	--
62	CT1467	Cargo Tractor	Electric	2008	93	HP			--	--	--	--
63	CT3251	Cargo Tractor	Electric	2008	93	HP			--	--	--	--
64	CT3252	Cargo Tractor	Electric	2008	93	HP			--	--	--	--
65	CT5846	Cargo Tractor	Electric	2008	55	HP			--	--	--	--
66	CT5847	Cargo Tractor	Electric	2008	55	HP			--	--	--	--
67	CT5848	Cargo Tractor	Electric	2008	55	HP			--	--	--	--
68	CT5856	Cargo Tractor	Electric	2008	55	HP			--	--	--	--
69	AL0426	Lift	Diesel	2016	67	HP	0.34	414	0.17	2.69	3.39	55.18
70	AS0999	Air Start	Diesel	2018	450	HP	0.34	1,314	0.10	0.13	45.69	57.87
71	PT0645	A/C Tug Narrow Body	Diesel	2001	88	HP	0.54	328	1.41	5.99	47.98	204.48
72	PT0768	A/C Tug Narrow Body	Diesel	2000	210	HP	0.54	328	0.46	6.37	37.44	519.03
73	PT7648	A/C Tug Narrow Body	Diesel	1998	88	HP	0.54	273	1.39	8.85	39.53	251.28
74	GP1907	Ground Power Unit	Gasoline	2018	229	HP	0.75	798	0.14	0.27	42.67	80.51
75	GP1908	Ground Power Unit	Gasoline	2018	229	HP	0.75	798	0.14	0.27	42.67	80.51
76	GP1911	Ground Power Unit	Gasoline	2018	229	HP	0.75	798	0.14	0.27	42.67	80.51
77	GP1912	Ground Power Unit	Gasoline	2018	229	HP	0.75	798	0.14	0.27	42.67	80.51
78	GP2004	Ground Power Unit	Gasoline	2019	229	HP	0.75	793	0.13	0.22	40.10	66.55
79	113368	Lift	Electric	2009	114	HP			--	--	--	--
80	GP7084	Ground Power Unit	Diesel	1997	181	HP	0.34	11	0.53	6.71	0.75	9.50
81	GPU.E0017.SNA	Ground Power Unit	Electric	2019	150	HP			--	--	--	--
82	26051	A/C Tug Wide Body	Diesel	2011	175	HP	0.54	398	0.16	1.51	12.80	124.63
83	33385	Cargo Loader	Diesel	2007	99	HP	0.34	475	0.40	3.90	14.02	135.68
84	41009	Cargo Loader	Diesel	2009	110	HP	0.34	475	0.26	2.71	10.21	104.85
85	99123	Cargo Loader	Diesel	2016	110	HP	0.34	475	0.08	0.88	3.27	33.90
86	501565	Cargo Tractor	Diesel	2012	65	HP	0.36	687	0.28	2.98	9.88	106.23
87	18246	Bdt Loader	Gasoline	1994	150	HP	0.50	730	1.70	13.79	205.39	1664.20
88	23262	Cargo Tractor	Gasoline	2010	80	HP	0.54	1,352	0.32	0.78	40.68	99.85
89	23263	Cargo Tractor	Gasoline	2010	80	HP	0.54	1,352	0.32	0.78	40.68	99.85
90	512143	Cargo Tractor	Gasoline	2017	86	HP	0.54	1,353	0.18	0.44	24.68	60.49
91	512144	Cargo Tractor	Gasoline	2017	86	HP	0.54	1,353	0.18	0.44	24.68	60.49
92	515410	Cargo Tractor	Gasoline	2018	86	HP	0.54	1,350	0.14	0.34	18.97	46.47
93	515411	Cargo Tractor	Gasoline	2018	86	HP	0.54	1,350	0.14	0.34	18.97	46.47
94	22851	AIRSTART	Diesel	2009	700	HP	0.34	1,314	0.44	2.96	295.82	2006.93
95	62198	GPU	Diesel	2006	173	HP	0.34	483	0.38	4.08	23.27	251.67
96	62201	GPU	Diesel	2006	173	HP	0.34	483	0.38	4.08	23.27	251.67
97	GT174	GPU	Diesel	2000	152	HP	0.34	483	1.09	6.63	59.03	359.63
98	PJ123	PUSHOUT TRACTOR	Diesel	1990	110	HP	0.54	328	1.09	11.04	46.49	470.93

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99	TV0994	PUSHOUT TRACTOR	Diesel	2000	87	HP	0.54	328	1.42	6.03	47.98	203.60
100	TV20561	PUSHOUT TRACTOR	Diesel	2000	87	HP	0.54	328	1.42	6.03	47.98	203.60
101	AS0118	AIRSTART UNIT	Diesel	2008	665	HP	0.34	1,314	0.44	3.02	281.03	1945.98
102	AS20353	AIRSTART UNIT	Diesel	2000	330	HP	0.34	1,314	0.49	6.32	158.42	2024.41
103	BL0342	BELTLOADER	Electric	2004	84	HP			--	--	--	--
104	BL18927	BELTLOADER	Electric	1999	84	HP			--	--	--	--
105	BL18928	BELTLOADER	Electric	1999	84	HP			--	--	--	--
106	BL18929	BELTLOADER	Electric	1999	84	HP			--	--	--	--
107	BL18930	BELTLOADER	Electric	1999	84	HP			--	--	--	--
108	BL18943	BELTLOADER	Electric	1999	84	HP			--	--	--	--
109	BL20011	BELTLOADER	Electric	1999	84	HP			--	--	--	--
110	BL0344	BELTLOADER	Electric	2004	84	HP			--	--	--	--
111	TV1168	PUSHOUT TRACTOR	Electric	2016	83	HP			--	--	--	--
112	TV1169	PUSHOUT TRACTOR	Electric	2016	83	HP			--	--	--	--
113	TV0995	BAG TRACTOR	Electric	2004	93	HP			--	--	--	--
114	TV0997	BAG TRACTOR	Electric	2000	93	HP			--	--	--	--
115	TV0998	BAG TRACTOR	Electric	1999	93	HP			--	--	--	--
116	TV19845	BAG TRACTOR	Electric	2000	93	HP			--	--	--	--
117	TV19846	BAG TRACTOR	Electric	2000	93	HP			--	--	--	--
118	TV19847	BAG TRACTOR	Electric	2000	93	HP			--	--	--	--
119	TV19848	BAG TRACTOR	Electric	2000	93	HP			--	--	--	--
120	TV19850	BAG TRACTOR	Electric	2000	93	HP			--	--	--	--
121	TV19849	BAG TRACTOR	Electric	2000	93	HP			--	--	--	--
122	RV20027	PICKUP TRUCK	Gasoline	1999	260	HP	0.20	834	1.75	13.83	167.19	1322.64
123	LV19806	LAV TRUCK	Gasoline	2000	65	HP	0.25	1,460	4.27	12.26	223.18	641.29
124	SQ180	STAIR UNIT-MTR	Gasoline	2017	61	HP	0.59	190	0.06	0.05	0.89	0.68
125	TV0999	CARGO TRACTOR	Gasoline	1992	107	HP	0.54	1,278	1.70	13.79	276.91	2243.67
126	14242	Air Start	Diesel	2007	511	HP	0.34	1,314	0.44	3.08	215.95	1527.83
127	22015	Aircraft Tow Tractor	Diesel	1998	165	HP	0.54	328	1.00	6.44	63.97	412.11
128	270318	Aircraft Tow Tractor	Diesel	1998	200	HP	0.54	328	0.47	6.27	36.47	486.59
129	170544	Baggage Tractor	Diesel	2001	60	HP	0.37	730	1.68	6.38	59.62	226.93
130	170545	Baggage Tractor	Diesel	2001	60	HP	0.37	730	1.68	6.38	59.62	226.93
131	170562	Baggage Tractor	Diesel	2001	60	HP	0.37	730	1.68	6.38	59.62	226.93
132	170563	Baggage Tractor	Diesel	2001	60	HP	0.37	730	1.68	6.38	59.62	226.93
133	171293	Baggage Tractor	Diesel	2011	49	HP	0.37	730	0.33	4.76	9.49	138.13
134	521569	Belt Loader	Diesel	2000	60	HP	0.34	510	1.61	6.27	36.47	141.77
135	521651	Belt Loader	Diesel	2000	60	HP	0.34	510	1.61	6.27	36.47	141.77
136	521679	Belt Loader	Diesel	2000	52	HP	0.34	510	1.61	6.27	31.61	122.86
137	521853	Belt Loader	Diesel	2006	65	HP	0.34	510	0.43	4.72	10.60	115.52
138	9258	Ground Power Unit	Diesel	1997	165	HP	0.34	218	0.92	6.14	24.45	163.32
139	900051	Ground Power Unit	Diesel	2007	220	HP	0.34	483	0.29	2.79	23.00	218.79
140	78172	Passenger Steps	Diesel	2000	49	HP	0.40	218	2.50	5.33	23.30	49.65
141	270963	Aircraft Tow Tractor	Electric	2016	45	HP			--	--	--	--
142	770223	Baggage Tractor	Electric	2001	40	HP			--	--	--	--
143	770224	Baggage Tractor	Electric	2001	40	HP			--	--	--	--
144	770225	Baggage Tractor	Electric	2001	40	HP			--	--	--	--
145	523229	Belt Loader	Electric	2001	60	HP			--	--	--	--
146	18637	Aircraft Tow Tractor	Gasoline	1997	200	HP	0.80	730	1.75	13.83	450.13	3560.97
147	173897	Baggage Tractor	Gasoline	2019	69	HP	0.55	878	0.12	0.09	8.81	6.73

Table 4. JWA GSE List and Emissions for 2020

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)	Annual ROG Emissions (lbs)	Annual NOx Emissions (lbs)
148	522401	Belt Loader	Gasoline	2016	86	HP	0.50	811	0.14	0.34	10.56	25.86
149	522402	Belt Loader	Gasoline	2016	86	HP	0.50	811	0.14	0.34	10.56	25.86
150	48245	Lavatory Service Truck	Gasoline	1995	200	HP	0.25	1,460	1.70	13.79	273.85	2218.93
151	480045	Lavatory Service Truck	Gasoline	1997	350	HP	0.25	1,460	1.75	13.83	492.33	3894.81
152	3301	LIFT MTX	Electric	2005	59	HP			--	--	--	--
153	4469 ⁴	UTILITY TRANSPORT VEHICLE	Electric	2007	--	HP			--	--	--	--
154	4561	FORKLIFT	Electric	2008	53	HP			--	--	--	--
155	8308 ⁴	UTILITY TRANSPORT VEHICLE	Electric	2018	--	HP			--	--	--	--
156	300503	Beltloader	Gasoline	1994	21	HP	0.50	730	118.24	12.75	2041.49	220.17
157	394376	Pushback Tractor	Diesel	1993	210	HP	0.54	328	1.06	8.28	86.00	674.12
158	411986	Airstart	Diesel	2016	675	HP	0.34	1,314	0.14	1.54	90.46	1011.26
159	412127	Pickup Truck	Gasoline	2017	300	HP	0.20	845	0.15	0.32	16.81	35.87
160	419058	Beltloader	Gasoline	2019	84	HP	0.50	813	0.06	0.16	4.88	11.90
161	4191695	Ground Power Unit	Diesel	2019	173	HP	0.34	483	0.07	0.73	4.12	44.96
162	496400	Cargo Loader	Diesel	1997	152	HP	0.34	475	1.13	6.93	60.42	369.88
163	770627	Cargo Loader	Gasoline	2015	21	HP	0.50	715	8.78	5.70	148.54	96.41
164	770873	Cargo Tractor	Gasoline	2015	21	HP	0.54	1,349	13.71	8.90	472.54	306.70
165	770874	Cargo Tractor	Gasoline	2015	21	HP	0.54	1,349	13.71	8.90	472.54	306.70
166	770875	Cargo Tractor	Gasoline	2015	21	HP	0.54	1,349	13.71	8.90	472.54	306.70
167	AS5615	Air Start	Diesel	2016	380	HP	0.34	1,314	0.14	0.93	50.92	344.02
168	BL1875	Beltloader	Gasoline	2015	84	HP	0.50	810	0.16	0.40	12.18	29.84
169	BL3112	Beltloader	Gasoline	2015	84	HP	0.50	810	0.16	0.40	12.12	29.70
170	BL3130	Beltloader	Gasoline	2009	27	HP	0.50	811	25.18	15.48	603.87	371.14
171	BL3692	Beltloader	Gasoline	2009	18	HP	0.50	811	15.83	10.27	254.76	165.36
172	BL3693	Beltloader	Gasoline	2009	18	HP	0.50	811	15.83	10.27	254.76	165.36
173	BL5397	Beltloader	Electric	2016	40	HP			--	--	--	--
174	BL5433	Beltloader	Electric	2016	40	HP			--	--	--	--
175	BL5434	Beltloader	Electric	2016	40	HP			--	--	--	--
176	BL6455	Beltloader	Electric	2018	40	HP			--	--	--	--
177	BT3917	Bag Tug	Electric	2012	40	HP			--	--	--	--
178	BT3918	Bag Tug	Electric	2012	40	HP			--	--	--	--
179	BT5431	Bag Tug	Electric	2016	40	HP			--	--	--	--
180	BT5432	Bag Tug	Electric	2016	40	HP			--	--	--	--
181	BT5612	Bag Tug	Electric	2016	40	HP			--	--	--	--
182	BT5613	Bag Tug	Electric	2016	40	HP			--	--	--	--
183	BT5904	Bag Tug	Electric	2017	40	HP			--	--	--	--
184	BT5907	Bag Tug	Electric	2017	40	HP			--	--	--	--
185	HS6826	Cargo Tug	Diesel	2019	74	HP	0.36	687	0.15	2.67	5.93	108.15
186	GP5372	Ground Power	Diesel	2016	116	HP	0.34	483	0.09	0.88	3.53	36.34
187	LT3457	Lav Truck	Gasoline	2005	285	HP	0.25	1,278	2.53	2.91	507.80	584.87
188	PB5000	Pushback	Diesel	2019	74	HP	0.54	328	0.13	2.64	3.64	75.84
189	PB6507	Pushback	Diesel	2019	74	HP	0.54	328	0.13	2.64	3.64	75.84
190	PB6729	Pushback	Diesel	2019	74	HP	0.54	328	0.13	2.64	3.64	75.84
191	PB6832	Pushback	Diesel	2019	74	HP	0.54	328	0.13	2.64	3.64	75.84
192	JT0007-JT0013 ⁴	Jet-A Refueler	Diesel	2004-2015	299	HP	0.34	483	0.28	3.37	29.42	359.47
193	BL0003 ⁵	Beltloader	Diesel	1989	74	HP	0.34	510	1.68	9.86	46.77	275.02
194	TG0007-TG0015 ^{3,4}	Tug	Electric	--	--	--			--	--	--	--
195	GP0005-GP0013 ⁴	GPU	Diesel	2017-2020	65	HP	0.34	483	0.13	2.10	3.05	48.94
196	LV0004-LV0006 ^{3,4}	Lavatory Cart	Electric	--	--	--			--	--	--	--

Table 4. JWA GSE List and Emissions for 2020

John Wayne Airport MOU
Santa Ana, California

JOHN WAYNE AIRPORT
ORANGE COUNTY

Unit #	Equipment ID	Airline GSE Type	Fuel Type (Electric, Diesel, Propane, Gasoline)	Engine Model Year	Engine Power Rating	Engine Power Rating Units	Load Factors ¹	Annual Usage ¹ (hrs)	ROG EF ² (g/bhp-hr)	NOx EF ² (g/bhp-hr)	Annual ROG Emissions (lbs)	Annual NOx Emissions (lbs)
197	PW0002, PW0003, PW0006 ^{3,4}	Potable Cart	Electric	--	--	--			--	--	--	--
198	UV0007-UV0011, UV0017-UV0020 ^{3,4}	Utility Cart	Electric	--	--	--			--	--	--	--
Annual Emissions (lbs)											10,772	37,564
Daily Emissions (lb/day) ⁵											30	103
COVID-19 Adjustment Factor ⁶											-48.5%	-48.5%
Adjusted Annual Emissions (lbs) ⁶											5,548	19,346
Adjusted Daily Emissions (lb/day) ⁶											15.2	53

Constants:

- 365 days/year
- 0.9198 Gasoline ROG/HC Ratio derived from OFFROAD2017
- 1.21 Diesel ROG/HC Ratio derived from OFFROAD2017

Notes:

¹ GSE annual usage hours were calculated using activity from the OFFROAD2017 database for CY 2020 absent equipment-specific usage information. Annual equipment usage calculated using OFFROAD2017 for 2020 may not be representative of actual usage as a result of reduced airport activities due to COVID-19 impacts. Additionally, GSE load factors were taken from OFFROAD2017 absent equipment-specific load factor information.

² Model year-specific emission factors for diesel-fueled equipment were derived from CARB's 2017 Off-Road Diesel Emission Factors. For gasoline-fueled equipment, model year-specific HC and NOx emission factors were calculated based on new engine standards for spark-ignited engines. Gasoline-fueled and diesel-fueled emission factors were calculated by summing the zero-hour pollutant emission factor with the product of the deterioration rate and cumulative hours and multiplying by the fuel correction factor, following the methodology presented in Attachment A of <https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/facility-based-mobile-source-measures/airports-final-appendix-b.pdf?sfvrsn=6>. Engine accumulated hours were capped depending on fuel type and model-year (gasoline) or HP (diesel). Model year-specific gasoline-fueled emission factor constants and engine load factors were provided by AQMD. Gasoline-fueled emission factor constants were provided up to a HP bin of 300; therefore, units with a HP greater than 300 HP were quantified using the 300 HP bin constants. Gasoline-fueled emission factor constants for the 50 HP bin were provided based on engine displacement; however since engine displacement information was not available, the maximum emission factor constants were selected. HC emission factors were converted to ROG emission factors by multiplying by a gasoline ROG to HC ratio, derived from OFFROAD 2017. Electric vehicles are assigned an EF of 0. Emissions are calculated by multiplying the respective EFs by the equipment horsepower, load factor and hours of usage in 2020 and converted to an average daily emission rate assuming 365 days of operation.

³ These units do not have a power rating listed per the GSE operator.

⁴ These units only service commercial flight operations at JWA for a portion of time. For disclosure purposes, all equipment IDs that may be used to service commercial flights are listed. The ROG and NOx emission factors are calculated as a horsepower-weighted average of emission factors from the OFFROAD2017 database. The engine power rating used in the emission calculations represent the average horsepower across all units.

⁵ Daily emissions are calculated assuming operation 365 days of the year.

⁶ An adjustment factor was applied to the total daily and annual emissions to account for reduced airport activities due to COVID-19 impacts, since annual activity levels for all GSE were obtained from the default values in OFFROAD2017. The adjustment factor is calculated based on the ratio of commercial airport operations at John Wayne Airport in 2020 to commercial airport operations in 2019 (pre-COVID year). Available at: <https://www.ocair.com/about/news-info/statistics/>. Accessed: May 2021.

⁷ Unit ID 18552 is designated and licensed for on-road use. Therefore emissions from this unit were not included in the inventory.

Table 5. JWA 2017 and 2020 GSE InventoryJohn Wayne Airport MOU
Santa Ana, CaliforniaJOHN WAYNE AIRPORT
ORANGE COUNTY

Fuel Type	Breakdown	2017	2020 AQMP Inventory ³
Diesel ¹	Tier 0	11	3
	Tier 1	21	20
	Tier 2	4	5
	Tier 3	7	6
	Tier 4 Interim	3	5
	Tier 4 Final	11	19
	Total Count	57	58
Electric	Total Count	96	99
Gasoline ²	MY <2001	12	8
	MY 2001 - 2006	2	2
	MY 2007 - 2009	1	3
	MY >=2010	16	27
	Total Count	31	40
Total Equipment		184	197

Notes:

¹ If diesel engine tier information was not provided by the owner/operator, tier was assumed to be in line with CARB's Non-road Diesel Engine Certification Tier Chart based on MY and HP. Available at: <https://ww2.arb.ca.gov/resources/documents/non-road-diesel-engine-certification-tier-chart>

² Gasoline-fueled equipment are broken down according to model years specified in the Off-Road Large Spark-Ignition (LSI) Engine regulations. Available at: <https://ww2.arb.ca.gov/large-spark-ignition-engine-regulatory-and-certification-documents>.

³ Equipment 18552 was excluded from the count of gasoline equipment as it was excluded due to being licensed for on-road use.

Table 6. Commercial Jet Fuel Delivery Truck Reporting DataJohn Wayne Airport MOU
Santa Ana, California

MOU Obligation ^{1,2}	Description	Quantity	Units
B.1	Total Number of Routine and Non-routine Truck Trips in 2020	241	trips
B.2	Total Amount of Jet Fuel Delivered by Truck in 2020	1,270,484	gallons
	Total Amount of Jet Fuel Delivered by Pipeline in 2020	30,938,418	gallons
B.3	Total Fuel Delivery Truck VMT in 2020	13,578	vehicle-miles
B.4	Annual NOx Running Exhaust Emissions	120.5	lb/yr
	Annual VOC Running Exhaust Emissions	3.5	lb/yr
	Daily NOx Running Exhaust Emissions ³	0.3	lb/day
	Daily VOC Running Exhaust Emissions ³	0.01	lb/day

Notes:¹ Additional calculation details for MOU obligations B.1, B.3, and B.4 are included in Table 5.² Additional calculation details for MOU obligations B.2 are included in Table 4.³ Average daily emissions were calculated assuming operation for 365 days in a year. Note that deliveries by truck for the Commercial Fuel Farm did not occur during all months in 2020 as the facility fully transitioned to delivery by pipeline starting in September 2020.

Table 7. Commercial Jet Fuel Delivery Truck Fuel Delivery InventoryJohn Wayne Airport MOU
Santa Ana, CaliforniaJOHN WAYNE AIRPORT
ORANGE COUNTY

Month	Commercial Fuel Farm Fuel		Fixed Base Operator Fuel ¹	
	Total Fuel Delivered by Pipeline (gallons)	Total Fuel Delivered by Truck (gallons)	Total Fuel Delivered by Pipeline (gallons)	Total Fuel Delivered by Truck (gallons)
January	5,196,618	79,925	0	97,766
February	5,608,722	56,015	0	84,681
March	4,942,266	141,896	0	71,608
April	0	63,750	0	15,009
May	209,958	63,697	0	12,519
June	1,037,988	31,827	0	40,775
July	1,915,620	141,431	0	66,865
August	2,725,884	15,847	0	44,970
September	1,937,838	0	0	47,174
October	2,464,728	0	0	55,682
November	2,599,968	0	0	74,713
December	2,298,828	0	0	64,334
Total	30,938,418	594,388	0	676,096

Notes:

¹ The volume of fuel for Fixed Base Operator Fuel reflects the volume of fuel actually sold to the commercial airline for use in commercial passenger aviation operations.

Table 8. Commercial Jet Fuel Delivery Truck Emissions Inventory

John Wayne Airport MOU
 Santa Ana, California

JOHN WAYNE AIRPORT
 ORANGE COUNTY

Commercial Fuel Farm Fuel Delivery Truck Information ¹						Total Round Trips	One-Way Trip Length (mi/trip) ⁴	Total Annual VMT ⁴ (mi)	Running Exhaust Emissions ⁵ (lbs/year)	
Month	Make/Model	Year	Fuel Type	NOx Emission Factor ² (g/mile)	ROG Emission Factor ² (g/mile)				NOx	ROG
January	Peterbilt/379	Not available	Diesel	4.42	0.14	20	27.1	1,084	10.6	0.3
February	Peterbilt/379	not available	Diesel	4.42	0.14	14	27.1	759	7.4	0.2
March	Peterbilt/379	not available	Diesel	4.42	0.14	38	27.1	2,060	20.1	0.6
April	Peterbilt/379	not available	Diesel	4.42	0.14	16	27.1	867	8.5	0.3
May	Peterbilt/379	not available	Diesel	4.42	0.14	16	27.1	867	8.5	0.3
June	Peterbilt/379	not available	Diesel	4.42	0.14	8	27.1	434	4.2	0.1
July	Peterbilt/379	2016-2019	Diesel	1.66	0.01	36	27.1	1,951	7.1	0.1
August	Peterbilt/379	not available	Diesel	4.42	0.14	4	27.1	217	2.1	0.1
September	NO TRUCKS	N/A	N/A	-	-	-	-	-	-	-
October	NO TRUCKS	N/A	N/A	-	-	-	-	-	-	-
November	NO TRUCKS	N/A	N/A	-	-	-	-	-	-	-
December	NO TRUCKS	N/A	N/A	-	-	-	-	-	-	-
Total						152	-	8,238	68.5	1.9

Table 8. Commercial Jet Fuel Delivery Truck Emissions Inventory

John Wayne Airport MOU
 Santa Ana, California

Fixed Base Operator (FBO) Fuel Delivery Truck Information ¹						Total Round Trips for Commercial Operation Fuel Delivery ³	One-Way Trip Length (mi/trip) ⁴	Total Annual VMT ⁴ (mi)	Running Exhaust Emissions ⁵ (lbs/year)	
Month	Make/Model	Year	Fuel Type	NOx Emission Factor ² (g/mile)	ROG Emission Factor ² (g/mile)				NOx	ROG
January	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	13	30	780	7.6	0.2
February	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	11	30	660	6.4	0.2
March	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	10	30	600	5.9	0.2
April	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	2	30	120	1.2	0.0
May	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	2	30	120	1.2	0.0
June	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	6	30	360	3.5	0.1
July	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	9	30	540	5.3	0.2
August	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	6	30	360	3.5	0.1
September	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	6	30	360	3.5	0.1
October	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	7	30	420	4.1	0.1
November	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	9	30	540	5.3	0.2
December	PETERBILT DS TRACTOR	Varies (2018, 2016, 2013, etc.)	Diesel	4.42	0.14	8	30	480	4.7	0.1
Total						89	-	5,340	52.1	1.6

Notes:

¹ Data is based on information provided by fuel providers.

² Fleet-averaged emission factors for Calendar Year 2020 were obtained from EMFAC2017 for HHDT trucks in Orange County for truck deliveries that did not have a model year specified. If the fuel provider provided details on the model year (e.g. 2016-2019), the fleet-averaged emission factors were obtained from EMFAC2017 for those specified model years in the calendar year 2020.

³ The number of round trips associated with fuel truck delivery for commercial airline operations supported by the FBO is calculated as the number of monthly fuel deliveries received by the FBO multiplied by the monthly percentage of fuel volume sold by the FBO to the commercial airline (rounded up for conservativeness).

⁴ VMT was calculated based on the total number of round trips that occurred in 2020 and the supplier-specific trip length. One-way trip distances to/from JWA are provided by the fuel providers. The VMT was calculated assuming two one-way trips for every single round trip to account for travel to/from the airport.

⁵ Emissions were calculated using annual VMT and EMFAC2017 emission factors in g/VMT for HHDT.

Constants:

27.1 Commercial Fuel Farm One-Way Delivery Trip Length (mi)

30 Fixed Base Operator One-Way Delivery Trip Length (mi)

Abbreviations:

FBO - Fixed Base Operator

NO_x - oxides of Nitrogen

HHDT - heavy heavy duty truck

ROG - reactive organic gases

lb - pound

VMT - vehicle miles travelled

Table 9. Parking Shuttle Bus Electrification Reporting Data

John Wayne Airport MOU
 Santa Ana, California

Shuttle Bus Inventory (B.1)								
B.1.a	B.1.b	B.1.c	B.1.d	B.1.e	B.1.f	B.1.g	B.1.g	B.1.h
Vehicle Identification Number	Vehicle Model Year ¹	Vehicle GVWR	Bus Engine Model Year ¹	Power Rating (hp or kW)	Fuel Type	Odometer Reading Start	Odometer Reading Finish	Vehicle Miles Travelled
1	2017	19,500 lbs.	2017	306 HP	CNG	109,885	120,243	10,358
2	2017	19,500 lbs.	2017	306 HP	CNG	108,734	119,101	10,367
3	2017	19,500 lbs.	2017	306 HP	CNG	121,468	133,398	11,930
4	2017	19,500 lbs.	2017	306 HP	CNG	101,144	112,845	11,701
5	2017	19,500 lbs.	2017	306 HP	CNG	122,576	132,082	9,506
6	2017	19,500 lbs.	2017	306 HP	CNG	111,838	119,185	7,347
7	2017	14,500 lbs.	2017	306 HP	CNG	81,133	88,764	7,631
8	2017	14,500 lbs.	2017	306 HP	CNG	89,784	91,915	2,131
10	2017	14,500 lbs.	2017	306 HP	CNG	89,469	95,474	6,005
12	2017	14,500 lbs.	2017	306 HP	CNG	82,616	91,915	9,299
5074	2017	14,500 lbs.	2017	362 HP	CNG	98,000	98,087	87
5075	2017	14,500 lbs.	2017	306 HP	CNG	91,700	91,780	80
Total VMT (miles/year)								86,442

Shuttle Bus Emissions Inventory (B.2) ²	
NOx Running Exhaust Emissions (lbs/year)	87.8
ROG Running Exhaust Emissions (lbs/year)	16.6
NOx Running Exhaust Emissions (lbs/day)	0.2
ROG Running Exhaust Emissions (lbs/day)	0.0

Shuttle Bus Replacement (B.3)								
Replacement Category (Replaced Bus or Replacement Bus)	Vehicle Identification Number	Vehicle Model Year	Vehicle GVWR	Bus Engine Model Year	Power Rating (hp or kW)	Fuel Type	Odometer Reading	Vehicle Miles Travelled
There were no shuttle bus replacements in 2020.								

Notes:

¹ All shuttles are manufactured by Ford with a 6.8 Liter F-550 Green Alternative engine.

² Additional calculation details for the shuttle bus emissions inventory can be referenced in Table 7.

Table 10. Parking Shuttle Bus Electrification Emissions Inventory Summary

John Wayne Airport MOU
Santa Ana, California

	Quantity
Total Shuttle Bus VMT in 2020 ¹	86,442
NOx Emission factor (g/mile) ²	0.461
ROG Emission factor (g/mile) ²	0.087
NOx Running Exhaust Emissions (lbs/year)	87.8
ROG Running Exhaust Emissions (lbs/year)	16.6
NOx Running Exhaust Emissions (lbs/day) ³	0.24
ROG Running Exhaust Emissions (lbs/day) ³	0.045

Notes:

¹ Annual Shuttle Bus VMT in 2020 is provided by JWA.

² Exhaust Emission Factors are obtained from EMFAC2017 assuming a vehicle category of Urban Bus with CNG fuel and an average travel speed of 25 mph. Shuttle buses are model year 2017 based on information provided by JWA. Idling, starting, hotsoak, running, resting and diurnal loss emission factors were zero in EMFAC2017 for Urban Bus.

³ Average daily emissions were calculated assuming operation for 365 days in a year.

Abbreviations:

CNG - compressed natural gas

EMFAC - California Air Resources Board Emissions Factor Model

g - gram

lb - pound

mph - miles per hour

NOX - oxides of nitrogen

ROG - Reactive organic gas

VMT - vehicle miles traveled



JOHN WAYNE
AIRPORT
ORANGE COUNTY

ATTACHMENT A SUPPORTING GSE EMISSIONS INVENTORY TABLE

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Table A-1. GSE Mapping to OFFROAD2017 Equipment TypesJohn Wayne Airport MOU
Santa Ana, CaliforniaJOHN WAYNE AIRPORT
ORANGE COUNTY

GSE Operator-defined Category¹	OFFROAD Category (Diesel)	OFFROAD Category (Gasoline & Natural Gas)	Load Factor
Air Start, Air Start Unit	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Air Start Unit	0.34
Aircraft Tow Tractor, A/C Tug Narrow Body	AirGrSupp - A/C Tug Narrow Body	OFF - AirGrSupp - A/C Tug Narrow Body	0.54
A/C Wide Body	AirGrSupp - A/C Tug Wide Body	OFF - AirGrSupp - A/C Tug Wide Body	0.54
High Speed Tug, Baggage Tractor	AirGrSupp - Baggage Tug	OFF - AirGrSupp - Baggage Tug	0.37
Bdt Loader, Belt Loader	AirGrSupp - Belt Loader	OFF - AirGrSupp - Belt Loader	0.34
Cargo Loader	AirGrSupp - Cargo Loader	OFF - AirGrSupp - Cargo Loader	0.34
Cargo Tractor, Cargo Tug	AirGrSupp - Cargo Tractor	OFF - AirGrSupp - Cargo Tractor	0.36
Jet-A Refueler	AirGrSupp - Other GSE	OFF - AirGrSupp - Fuel Truck	0.34
Ground Power, Ground Power Unit, GPU	AirGrSupp - Other GSE	OFF - AirGrSupp - Ground Power Unit	0.34
Lav Truck, Lavatory Service Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Lav Truck	0.34
Lift	AirGrSupp - Lift	OFF - AirGrSupp - Lift	0.34
Stair Unit-Mtr, Passenger Steps	AirGrSupp - Passenger Stand	OFF - AirGrSupp - Passenger Stand	0.40
Push Back, Pushout Tractor, Pushback Tractor	AirGrSupp - A/C Tug Narrow Body	OFF - AirGrSupp - A/C Tug Narrow Body	0.54
Provision Truck, Van, Pickup Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Service Truck	0.34

Notes:

¹ The GSE Operator-defined Category represents the GSE types specified by the GSE operators at JWA. Operator-specified GSE types were mapped to a corresponding OFFROAD category depending on vehicle and fuel type.