

MOU SCHEDULE NO. 1 – GROUND SUPPORT EQUIPMENT

This MOU Schedule No. 1 is based on the City's AQIP measure for ground support equipment¹.

- I. PROGRAM DESCRIPTION – Require that all ground support equipment associated with commercial operations achieve a fleet average NOx emission factors of 0.93 and 0.44 g/bhp-hr by January 1, 2023 and January 1, 2031, respectively.
- II. PROGRAM TIMEFRAME – Upon execution through 2032.
- III. AIRPORT OBLIGATIONS – The City agrees to:
 - A. Implement the measure by working with airport tenants to achieve the above performance targets by specified dates through accelerated turnover to cleaner equipment. Airport shall have complete discretion as to mechanisms used to implement this measure. Such mechanisms may include leases, licenses, operational requirements, or other agreements.
 - B. Beginning in 2021, and every year thereafter through 2032, provide the following information to South Coast AQMD on an annual basis by June 1 for each preceding calendar year:
 1. List of ground support equipment subject to this GSE measure with the following information:
 - a. Equipment ID
 - b. Equipment type
 - c. Fuel type
 - d. Engine model year
 - e. Power rating (hp or kW)
 - f. Engine tier level (for diesel engines)
 - g. Annual activity data for non-zero emission equipment that is sufficient to determine emission reductions at a reasonable level of accuracy (i.e., actual operating hours from hour meter readings/maintenance records, average operating hours representative of equipment type and airport, or average operating hours by equipment/fuel type from CARB's OFFROAD model, if applicable)

¹ 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.

2. For non-zero emission ground support equipment subject to this GSE measure, information regarding the sale or retirement of equipment available through CARB's DOORS system and, for pre-Tier 4 diesel, pre-2010 gasoline, or pre-2010 LPG ground support equipment relocated from LGB to another airport within the South Coast Air Basin, identify: a) the airport to which equipment is relocated, b) date of relocation, and c) estimated projected usage hours.
3. An annual emission inventory for all ground support equipment associated with commercial operations at LGB, including methodology and calculations.

III SOUTH COAST AQMD OBLIGATIONS – South Coast AQMD agrees to:

- A. Verify emission reductions from the implementation of this AQIP measure in order to determine actual emission reductions.
- B. Ensure that any emission reduction data related to this AQIP measure and other pertinent information and accessible to the public and the USEPA.

MOU SCHEDULE NO. 1 – III.B.1. List of Ground Support Equipment

List of ground support equipment subject to this GSE measure with the following information: a) Equipment ID, b) Equipment type, c) Fuel type, d) Engine model year, e) Power rating (hp or kW), f) Engine tier level (for diesel engines), g) Annual activity data based on average operating hours from CARB's OFFROAD model

Airport GSE ID	Reported Type	Emissions Designation	Fuel Type	Engine Model Year	Power Rating (hp)	Engine Tier Level	Activity (hours/year)	Vehicle Description	Vehicle Manufacture	Designated Low Use	On-Road Equivalent Engine
LGB-OP09-001	electric cart	cart	electric			--	152	golf cart		in-use	off-road
LGB-OP14-001	cart	cart	gasoline			--	152	golf cart truck	suzuki	in-use	off-road
LGB-OP14-002	fork lift	forklift	lpg		55	--	104	fork lift	nissan	low-use	off-road
LGB-OP14-003	fork lift	forklift	lpg	1992	131	--	104	fork lift	caterpillar	low-use	off-road
LGB-OP14-004	golf cart	cart	electric			--	152	golf cart	e-z-go	in-use	off-road
LGB-OP20-002	bag tug	baggage tug	gasoline	2016	76	--	846	bag tug	tug	in-use	off-road
LGB-OP20-003	bag tug	baggage tug	gasoline	2016	76	--	846	bag tug	tug	in-use	off-road
LGB-OP20-004	belt loader	belt loader	gasoline	2016	76	--	706	belt loader	tug	in-use	off-road
LGB-OP20-005	belt loader	belt loader	gasoline	2018	76	--	706	belt loader	tug	in-use	off-road
LGB-OP20-006	belt loader	belt loader	gasoline	2018	76	--	706	belt loader	tug	in-use	off-road
LGB-OP20-008	pushback	a/c tug narrow body	diesel	2016	94	tier 4	385	pushback	tld	in-use	off-road
LGB-OP20-010	bag tug	baggage tug	electric	2020		--	846	bag tug	ev gse	in-use	off-road
LGB-OP20-011	gpu	ground power unit	electric	2021		--	798	ground power	itw	in-use	off-road
LGB-OP20-012	gpu	ground power unit	electric	2021		--	798	ground power	itw	in-use	off-road
LGB-OP20-001	air conditioning	air conditioner	diesel	2016	82	tier 4	200	air conditioning cart	tug	low-use	off-road

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LGB-OP20-007	gpu	ground power unit	diesel	2018	94	tier 4	798	gpu	tld	in-use	off-road
LGB-OP20-009	ground power unit	ground power unit	diesel	2014	86	tier 4	798	perp-atcm	168615	in-use	off-road
LGB-OP20-013	ground power unit	ground power unit	diesel	2016	94	tier 4	798	gpu	tug	in-use	off-road
LGB-OP19-001	belt loader	belt loader	gasoline	1972	120	--	200	cochran-western	701	low-use	off-road
LGB-OP19-002	belt loader	belt loader	gasoline	1980	120	--	200	cochran-western	702	low-use	off-road
LGB-OP19-003	belt loader	belt loader	gasoline	2015	140	--	200	tug inc	777	low-use	off-road
LGB-OP19-004	stair truck	passenger stand	gasoline	2001	140	--	137	wollard	810	low-use	off-road
LGB-OP19-005	stair truck	passenger stand	gasoline	2008	140	--	137	wollard	811	low-use	off-road
LGB-OP19-006	stair truck	passenger stand	gasoline	2010	140	--	137	stinar	812	low-use	off-road
LGB-OP19-007	tug	baggage tug	gasoline	1998	140	--	200	jet line	935	low-use	off-road
LGB-OP19-008	passenger stand	passenger stand	gasoline	1972	16	--	137	skyramp	897	low-use	off-road
LGB-OP04-001	golf cart	cart	electric	2005		--	152			in-use	off-road
LGB-OP07-002	fuel truck	fuel truck	diesel	1981	275	tier 0	83	jet fuel truck - dart		low-use	off-road
								10,000 gallon			
LGB-OP07-003	aircraft tow tractor	a/c tug narrow body	diesel	1998	215	tier 1	200	large tug	stewart & stevenson	low-use	off-road
LGB-OP07-004	aircraft tow tractor	a/c tug narrow body	diesel	1990	90	tier 0	385	large toyota tug	toyota industrial equipment	in-use	off-road
LGB-OP07-005	aircraft tow tractor	a/c tug narrow body	diesel	2011	53	tier 4i	200	small toyota tug	toyota industrial equipment	low-use	off-road
LGB-OP07-006	lift	lift	electric			--	391	scissor lift	upright	in-use	off-road
LGB-OP07-007	fork lift	forklift	electric	2012	53	--	591	toyota forklift	toyota	in-use	off-road

Airport GSE ID	Reported Type	Emissions Designation	Fuel Type	Engine Model Year	Power Rating (hp)	Engine Tier Level	Activity (hours/year)	Vehicle Description	Vehicle Manufacture	Designated Low Use	On-Road Equivalent Engine
LGB-OP07-008	golf cart	cart	electric	2002	3	--	152	people mover	club cart	in-use	off-road
LGB-OP07-009	towbarless tow tractor	a/c tug narrow body	electric	2006	33	--	385	stand up lektro	lektro-8750	in-use	off-road
LGB-OP07-010	towbarless tow tractor	a/c tug narrow body	electric	2000	45	--	385	sit down lektro	lektro-8850	in-use	off-road
LGB-OP07-011	scrubber/sweeper	sweeper	electric		3	--	339	scrubber	factory cat clark	in-use	off-road
LGB-OP07-012	sweeper	sweeper	gasoline	1998	32	--	339	sweeper	american lincoln	in-use	off-road
LGB-OP07-013	scrubber/sweeper	sweeper	electric			--	339	sweeper/scrubber	factory cat	in-use	off-road
LGB-OP07-014	electric cart	cart	electric	2004	4	--	152	electric flat bed	club car	in-use	off-road
LGB-OP07-015	electric cart	cart	electric			--	152	golf cart	club cart	in-use	off-road
LGB-OP07-016	lavatory cart	lav cart	electric	2009		--	150	lav cart	aero specialties	in-use	off-road
LGB-OP07-017	potable water cart	cart	electric			--	152	water cart	aero specialties	in-use	off-road
LGB-OP07-018	fuel truck	fuel truck	diesel	2020	200	tier 4	83	jet fuel truck - 3,000 gallons	international	in-use	off-road
LGB-OP07-019	fuel truck	fuel truck	diesel	2011	220	tier 4i	83	jet fuel truck - 7,000 gallons	international	in-use	off-road
LGB-OP07-020	fuel truck	fuel truck	diesel	2011	220	tier 4i	83	jet fuel truck - 7,000 gallons	international	in-use	off-road
LGB-OP07-023	fluid cart	lav cart	electric			--	150	diesel cart - 300 gallons		in-use	off-road
LGB-OP07-026	fuel truck	fuel truck	gasoline	2020	297	--	83	avgas fuel truck - 1,000 gallons	isuzu	in-use	off-road
LGB-OP07-027	fuel truck	fuel truck	gasoline	2020	297	--	83	avgas fuel truck - 1,000 gallons	isuzu	in-use	off-road

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LGB-OP07-028	towbarless tow tractor	a/c tug narrow body	electric	2019	58	--	385	sit down lektro	lektro-8900	in-use	off-road
LGB-OP07-024	ground power unit	ground power unit	diesel	2018	155	tier 4	798	185317	tld-gpu-406-t-cup	in-use	off-road
LGB-OP07-025	ground power unit	ground power unit	diesel	2019	74	tier 4	798	185842	jetgo 900 gpu	in-use	off-road
LGB-OP03-001	fork lift	forklift	lpg	1993	93	--	520		toyota	in-use	off-road
LGB-OP03-002	fork lift	forklift	lpg	1996	94	--	520		toyota	in-use	off-road
LGB-OP11-001	aircraft tow tractor	a/c tug narrow body	lpg	1999	230	--	385		eagle	in-use	off-road
LGB-OP11-003	aircraft tow tractor	a/c tug narrow body	electric	1999		--	385		lektro	in-use	off-road
LGB-OP11-005	aircraft tow tractor	a/c tug narrow body	electric	2004		--	64		lektro	in-use	off-road
LGB-OP11-006	aircraft tow tractor	a/c tug narrow body	diesel	2011	110	tier 3	385		wollard	in-use	off-road
LGB-OP11-007	fuel truck	fuel truck	gasoline	1976	147	--	83		gmc	low-use	off-road
LGB-OP11-008	fork lift	forklift	lpg	1999	46	--	591	1 g/bhp-hr nett bluecat 300-catalytic muf installed 11/20/2019 https://www.nettinc.com/wp-content/uploads/2016/07/executive-order-g-09-012-bluecat-300.pdf	clark	in-use	off-road

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LGB-OP11-009	fork lift	forklift	lpg	1999	74	--	591	1 g/bhp-hr nett bluecat 300-catalytic muf installed 11/20/2019 https://www.nettinc.com/wp-content/uploads/2016/07/executive-order-g-09-012-bluecat-300.pdf	yale	in-use	off-road
LGB-OP11-010	fork lift	forklift	lpg	2001	93	--	591	1 g/bhp-hr nett bluecat 300-catalytic muf installed 11/20/2019 https://www.nettinc.com/wp-content/uploads/2016/07/executive-order-g-09-012-bluecat-300.pdf	clark	in-use	off-road
LGB-OP11-012	fork lift	forklift	lpg	2008	98	--	591		hyster	in-use	off-road
LGB-OP11-013	fork lift	forklift	lpg	2017	62	--	591		hyster	in-use	off-road
LGB-OP11-018	fuel truck	fuel truck	diesel	2014	215	tier 4	83		garsite	in-use	off-road
LGB-OP11-019	fuel truck	fuel truck	diesel	2005	130	tier 2	83		garsite	low-use	off-road
LGB-OP11-015	ground power unit	ground power unit	diesel	2011	155	tier 3	798		168966	in-use	off-road

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LGB-OP11-017	ground power unit	ground power unit	diesel	2019	155	tier 4	133		188514	in-use	off-road
LGB-OP10-001	fuel truck	fuel truck	gasoline	1991	300	--	83	gmc		low-use	on-road
LGB-OP10-002	golf cart	cart	electric			--	152	yamaha		in-use	off-road
LGB-OP06-001	refueler	fuel truck	diesel	1990	285	tier 0	83	r-11	oshkosh	in-use	off-road
LGB-OP06-002	refueler	fuel truck	diesel	1990	285	tier 0	83	r-11	oshkosh	in-use	off-road
LGB-OP06-003	refueler	fuel truck	diesel	2007	250	tier 3	83	c7500	gmc	in-use	off-road
LGB-OP06-004	refueler	fuel truck	gasoline	1991	217	--	83	f600	ford	in-use	off-road
LGB-OP06-005	golf cart	cart	electric	1998	6	--	152	r6-80	taylor dunn	in-use	off-road
LGB-OP06-006	golf cart	cart	gasoline	2005	22	--	152	mule	kawasaski	in-use	off-road
LGB-OP06-007	golf cart	cart	gasoline	2000	22	--	152	mule	kawasaski	in-use	off-road
LGB-OP06-008	fork lift	forklift	electric	2010	80	--	591	tmg15s	clark	in-use	off-road
LGB-OP06-009	fork lift	forklift	electric	2009	51	--	591	7fbcu15	toyota	in-use	off-road
LGB-OP06-010	fork lift	forklift	diesel	2006	154	tier 2	591	fork lift	caterpillar	in-use	off-road
LGB-OP06-011	supertug	a/c tug narrow body	gasoline	1998	95	--	385	tc30	taylor dunn	in-use	off-road
LGB-OP06-012	supertug	a/c tug narrow body	gasoline	1998	95	--	385	tc30	taylor dunn	in-use	off-road
LGB-OP06-013	supertug	a/c tug narrow body	diesel	1994	105	tier 0	385	tug	harlan	in-use	off-road
LGB-OP06-014	generator	generator	diesel	2002	75	tier 1	913	400-60-28	davco	in-use	off-road
LGB-OP01-001	towbarless tow tractor	a/c tug narrow body	electric			--	385	ap8600	lektro, inc.	in-use	off-road
LGB-OP01-002	towbarless tow tractor	a/c tug narrow body	electric			--	385	ap8600	lektro, inc.	in-use	off-road
LGB-OP01-003	towbarless tow tractor	a/c tug narrow body	electric			--	385	ap8360	lektro, inc.	in-use	off-road
LGB-OP23-001	tug	baggage tug	electric	2000	35	--	200			low-use	off-road
LGB-OP21-002	pushback tractor	a/c tug narrow body	diesel	1994	94	tier 0	385	b300	jetway	in-use	off-road
LGB-OP21-003	bag tug	baggage tug	electric	2005		--	846	m3a	s/s-tug	in-use	off-road
LGB-OP21-004	bag tug	baggage tug	electric	1999		--	846	m3a	s/s-tug	in-use	off-road

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LGB-OP21-005	bag tug	baggage tug	electric	1999		--	846	m3a	s/s-tug	in-use	off-road
LGB-OP21-006	bag tug	baggage tug	electric	1999		--	846	m3a	s/s-tug	in-use	off-road
LGB-OP21-008	belt loader	belt loader	electric	1987		--	706	wollard	tc886 electric	in-use	off-road
LGB-OP21-009	belt loader	belt loader	electric	1987		--	706	wollard	tc886 electric	in-use	off-road
LGB-OP21-010	belt loader	belt loader	electric	1990		--	706	wollard	tc886 electric	in-use	off-road
LGB-OP21-011	ground power unit	ground power unit	electric	1990		--	798	j060-115-a1-009	jetway	in-use	off-road
LGB-OP21-012	ground power unit	ground power unit	electric	2001		--	798	davco	20ehr	in-use	off-road
LGB-OP21-014	air start	air start unit	diesel	2008	665	tier 3	79	asu-600-180-ddp	tld	in-use	off-road
LGB-OP05-001	tug	baggage tug	electric	2016		--	846	towbot model 432-618-7223		in-use	off-road
LGB-OP05-002	tug	baggage tug	electric	2019		--	846	mototok model m 528		in-use	off-road
LGB-OP05-003	gpu	ground power unit	electric	2018		--	798	foxcart gse model fdc-420m		in-use	off-road
LGB-OP08-002	aircraft tractor	a/c tug narrow body	diesel	2011	84	tier 3	200	tug	eagle	low-use	off-road
LGB-OP08-003	aircraft tractor	a/c tug narrow body	diesel	2014	49	tier 4	385	tug	tug	in-use	off-road
LGB-OP08-004	refueler	fuel truck	diesel	2017	250	tier 4	83	refueler	eam	in-use	off-road
LGB-OP08-005	refueler	fuel truck	diesel	2017	250	tier 4	83	refueler	eam	in-use	off-road
LGB-OP08-006	refueler	fuel truck	gasoline	1995	300	--	83	refueler	gm	in-use	off-road
LGB-OP08-007	tug	baggage tug	electric	2005		--	846	tug	lektro, inc.	in-use	off-road
LGB-OP08-008	tug	baggage tug	electric	1999		--	846	tug	lektro, inc.	in-use	off-road
LGB-OP08-010	service truck	service truck	gasoline	2000	119	--	883	service truck	ford	in-use	on-road
LGB-OP08-011	refueler	fuel truck	diesel	2018	200	--	83	refueler - hv607 sba	international	in-use	on-road
LGB-OP08-012	refueler	fuel truck	diesel	2008	285	--	80	refueler - m2	freightliner	in-use	on-road

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LGB-OP08-013	refueler	fuel truck	diesel	2019	260	--	83	refueler - hv607 sba	international	in-use	on-road
LGB-OP08-019	refueler	fuel truck	diesel	2021	210	--	83	avgas truck - npr7sn	isuzu	in-use	on-road
LGB-OP08-020	refueler	fuel truck	diesel	2015	250	--	83	refueler - 7300 sba	international	in-use	on-road
LGB-OP08-021	refueler	fuel truck	diesel	2014	215	--	83	refueler - 7300 sfa	international	in-use	on-road
LGB-OP08-022	refueler	fuel truck	diesel	2022	260	--	35	refueler jet - mdl-7ma-300a-mrercndas	garsite	in-use	on-road
LGB-OP08-015	gpu	ground power unit	diesel	2013	130	tier 4i	798	gpu-4060-t-cup-28	tld	in-use	off-road
LGB-OP08-017	gpu	ground power unit	diesel	2004	107	tier 2	133	gpu magnum 28v	stewart & stevenson tug	in-use	off-road
LGB-OP08-018	gpu	ground power unit	diesel	2022	74	tier 4	798	gpu 28v gpi	aero specialties	in-use	off-road
LGB-OP13-001	bag tug	baggage tug	electric	2001	40	--	846		tug	in-use	off-road
LGB-OP13-002	bag tug	baggage tug	electric	2001	40	--	846		tug	in-use	off-road
LGB-OP13-003	bag tug	baggage tug	electric	2002	40	--	846		tug	in-use	off-road
LGB-OP13-004	bag tug	baggage tug	electric	2002	40	--	846		tug	in-use	off-road
LGB-OP13-005	bag tug	baggage tug	electric	2002	40	--	846		tug	in-use	off-road
LGB-OP13-006	bag tug	baggage tug	electric	2005	40	--	846		tug	in-use	off-road
LGB-OP13-007	bag tug	baggage tug	gasoline	2016	40	--	846		tug	in-use	off-road
LGB-OP13-008	belt loader	belt loader	electric	2013	60	--	706		tug	in-use	off-road
LGB-OP13-009	belt loader	belt loader	electric	2013	60	--	706		tug	in-use	off-road
LGB-OP13-010	belt loader	belt loader	electric	2017	60	--	706		tug	in-use	off-road
LGB-OP13-011	belt loader	belt loader	electric	2017	60	--	706		tug	in-use	off-road
LGB-OP13-012	belt loader	belt loader	electric	2018	60	--	706		tug	in-use	off-road
LGB-OP13-013	belt loader	belt loader	electric	2018	60	--	706		tug	in-use	off-road
LGB-OP13-014	belt loader	belt loader	electric	2019	60	--	706		tug	in-use	off-road
LGB-OP13-015	belt loader	belt loader	electric	2019	60	--	706		tug	in-use	off-road
LGB-OP13-016	fork lift	forklift	lpg	2007	52	--	591		toyota	in-use	off-road

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LGB-OP13-017	lav truck	lav truck	gasoline	2018	297	--	1,158		phoenix metals	in-use	on-road
LGB-OP13-018	passenger stairs	passenger stand	gasoline	2018	49	--	137		phoenix metals	in-use	off-road
LGB-OP13-019	passenger stairs	passenger stand	gasoline	2018	49	--	137		wollard	in-use	off-road
LGB-OP13-020	air conditioning	air conditioner	electric	2001	131	--	391		tld	in-use	off-road
LGB-OP13-021	provision truck	catering truck	gasoline	2019	200	--	928		mallaghan	in-use	on-road
LGB-OP13-022	aircraft tow tractor	a/c tug narrow body	diesel	2011	110	tier 3	385		stewart stevenson	in-use	off-road
LGB-OP13-032	bag tug	baggage tug	electric	2002	40	--	846		tug	in-use	off-road
LGB-OP13-033	bag tug	baggage tug	electric	2005	40	--	846		tug	in-use	off-road
LGB-OP13-034	bag tug	baggage tug	electric	2001	40	--	846		tug	in-use	off-road
LGB-OP13-035	bag tug	baggage tug	electric	2001	40	--	846		tug	in-use	off-road
LGB-OP13-036	bag tug	baggage tug	electric	2001	40	--	846		tug	in-use	off-road
LGB-OP13-037	bag tug	baggage tug	electric	2002	40	--	846		tug	in-use	off-road
LGB-OP13-038	belt loader	belt loader	electric	2017	60	--	706		tug	in-use	off-road
LGB-OP13-039	aircraft tow tractor	a/c tug narrow body	electric	1983	74	--	385		gt24	in-use	off-road
LGB-OP13-040	aircraft tow tractor	a/c tug narrow body	electric	1983	74	--	385		gt24	in-use	off-road
LGB-OP13-041	aircraft tow tractor	a/c tug narrow body	electric	1983	74	--	385		gt24	in-use	off-road
LGB-OP13-042	aircraft tow tractor	a/c tug narrow body	electric	1984	74	--	385		gt24	in-use	off-road
LGB-OP13-043	aircraft tow tractor	a/c tug narrow body	electric	2002	74	--	385	gt32	stewart stevenson	in-use	off-road
LGB-OP13-044	belt loader	belt loader	electric	2011	60	--	706	660e	tug	in-use	off-road
LGB-OP13-045	belt loader	belt loader	electric	2017	60	--	706	660e	tug	in-use	off-road
LGB-OP13-046	passenger stairs	passenger stand	gasoline	2017	40	--	137	cmpps87/137	phoenix metals	in-use	off-road
LGB-OP13-047	passenger stairs	passenger stand	gasoline	2018	40	--	137	cmpps87/137	phoenix metals	in-use	off-road

Airport GSE ID	Reported Type	Emissions Designation	Fuel Type	Engine Model Year	Power Rating (hp)	Engine Tier Level	Activity (hours/year)	Vehicle Description	Vehicle Manufacture	Designated Low Use	On-Road Equivalent Engine
LGB-OP13-048	passenger stairs	passenger stand	gasoline	2018	40	--	137	cmpps87/137	phoenix metals	in-use	off-road
LGB-OP13-024	air start	air start unit	diesel	2018	333	tier 4	79		182491	low-use	off-road
LGB-OP13-025	ground power unit	ground power unit	electric	2021	155	--	798			in-use	off-road
LGB-OP13-026	ground power unit	ground power unit	electric	2021	155	--	798			in-use	off-road
LGB-OP13-027	ground power unit	ground power unit	electric	2016	155	--	798			in-use	off-road
LGB-OP13-028	ground power unit	ground power unit	electric	2018	155	--	798			in-use	off-road
LGB-OP13-029	air conditioner	air conditioner	electric	2018	131	--	391			in-use	off-road
LGB-OP13-030	air conditioner	air conditioner	electric	2011	131	--	391			in-use	off-road
LGB-OP13-031	air conditioner	air conditioner	electric	2011	131	--	391			in-use	off-road
LGB-OP13-049	ground power unit	ground power unit	electric	2019	155	--	200	2400 mobile	itw gse	in-use	off-road
LGB-OP13-050	ground power unit	ground power unit	electric	2022	155	--	200	2400 mobile	itw gse	in-use	off-road
LGB-OP13-051	ground power unit	ground power unit	electric	2022	155	--	200	2400 mobile	itw gse	in-use	off-road
LGB-OP13-052	air conditioner	air conditioner	electric	2001	131	--	261	ace-h-302-emp	tld	in-use	off-road
LGB-OP13-053	air conditioner	air conditioner	electric	2011	131	--	261	ace-h-302-emp	tld	in-use	off-road
LGB-OP13-054	air conditioner	air conditioner	electric	2011	131	--	261	ace-h-302-emp	tld	in-use	off-road
LGB-OP13-055	air conditioner	air conditioner	electric	2011	131	--	261	ace-h-302-emp	tld	in-use	off-road
LGB-OP18-010	aircraft tractor	a/c tug narrow body	diesel	2019	83.5	tier 4	385	eagle ttr-12	other	in-use	off-road
LGB-OP18-009	aircraft tractor	a/c tug narrow body	diesel	2019	75	tier 4	385	gt35	tug technologies, inc.	in-use	off-road

Airport GSE ID	Reported Type	Emissions Designation	Fuel Type	Engine Model Year	Power Rating (hp)	Engine Tier Level	Activity (hours/year)	Vehicle Description	Vehicle Manufacture	Designated Low Use	On-Road Equivalent Engine
LGB-OP18-011	belt loader	belt loader	diesel	2014	49	tier 4	706	tc-88	other	in-use	off-road
LGB-OP18-001	baggage tractor	baggage tug	gasoline	2019	61	--	846	av50pk25	other	in-use	off-road
LGB-OP18-002	baggage tractor	baggage tug	gasoline	2019	61	--	846	av50pk25	other	in-use	off-road
LGB-OP18-003	baggage tractor	baggage tug	gasoline	2019	61	--	846	av50pk25	other	in-use	off-road
LGB-OP18-006	belt loader	belt loader	gasoline	2019	64.3	--	706	663-28	tug technologies, inc.	in-use	off-road
LGB-OP18-007	belt loader	belt loader	gasoline	2019	64.3	--	706	663-28	tug technologies, inc.	in-use	off-road
LGB-OP18-004	baggage tractor	baggage tug	gasoline	2019	61	--	846	av50pk25	other	in-use	off-road
LGB-OP18-005	air start	air start unit	diesel	2014	435	tier 4	79	tmd-180	tug tech	in-use	off-road
LGB-OP18-012	air conditioning	air conditioner	diesel	2015	130	tier 4	391	acu 302-h-cup	tld	in-use	off-road
LGB-OP18-008	ground power	ground power unit	diesel	2007	220	tier 3	798	gpu 4090-t-cup-28	tld	in-use	off-road
LGB-OP18-013	ground power	ground power unit	diesel	2019	173	tier 4	--	ga90v13c1100	guinault	in-use	off-road
LGB-OP16-001	fork lift	forklift	lpg	2015	155	--	591	afl05	hyster h50ft	in-use	off-road
LGB-OP16-002	container loader	cargo loader	diesel	1998	152	tier 1	510	al18d	lantis	in-use	off-road
LGB-OP16-003	container loader	cargo loader	diesel	2000	152	tier 1	510	al22d	lantis	in-use	off-road
LGB-OP16-004	light tower	generator	diesel	2017	24	tier 4	913	apld	generac	in-use	off-road
LGB-OP16-005	light tower	generator	diesel	2017	24	tier 4	913	apld	generac	in-use	off-road
LGB-OP16-006	light tower	generator	diesel	2018	24	tier 4	913	apld	generac	in-use	off-road
LGB-OP16-007	light tower	generator	diesel	2018	24	tier 4	913	apld	generac	in-use	off-road
LGB-OP16-008	pushback tractor	a/c tug narrow body	diesel	1998	210	tier 1	385	ata27	stewart-stevenson	in-use	off-road
LGB-OP16-009	belt loader	belt loader	electric	2000	85	--	706	acme	tug 660e	in-use	off-road
LGB-OP16-010	belt loader	belt loader	electric	1999	85	--	706	acme	tug 660e	in-use	off-road
LGB-OP16-011	belt loader	belt loader	electric	2000	85	--	706	acme	tug 660e	in-use	off-road

Airport GSE ID	Reported Type	Emissions Designation	Fuel Type	Engine Model Year	Power Rating (hp)	Engine Tier Level	Activity (hours/year)	Vehicle Description	Vehicle Manufacture	Designated Low Use	On-Road Equivalent Engine
LGB-OP16-012	baggage tractor	cargo tractor	electric	1999	85	--	1,114	atgoe	tug m3a	in-use	off-road
LGB-OP16-013	baggage tractor	cargo tractor	electric	1999	85	--	1,114	atgoe	tug m3a	in-use	off-road
LGB-OP16-014	baggage tractor	cargo tractor	electric	1999	85	--	1,114	atgoe	tug m3a	in-use	off-road
LGB-OP16-015	baggage tractor	cargo tractor	electric	2000	85	--	1,114	atgoe	tug m3a	in-use	off-road
LGB-OP16-016	baggage tractor	cargo tractor	electric	2000	85	--	1,114	atgoe	tug m3a	in-use	off-road
LGB-OP16-017	baggage tractor	cargo tractor	electric	2000	85	--	1,114	atgoe	tug m3a	in-use	off-road
LGB-OP16-018	baggage tractor	cargo tractor	electric	2000	85	--	1,114	atgoe	tug m3a	in-use	off-road
LGB-OP16-019	cargo loader	cargo loader	gasoline	2015	154	--	556	al220	tld	in-use	off-road
LGB-OP16-020	ramp pickup truck	service truck	gasoline	2017	285	--	883	apk22	ford f250	in-use	on-road
LGB-OP16-021	ground power unit	ground power unit	diesel	2007	155	tier 3	420	agpu	horbart	in-use	off-road
LGB-OP16-022	ground power unit	ground power unit	diesel	2010	155	tier 3	420	agpu	tld gpu 4090-t-cup	in-use	off-road
LGB-OP16-024	cargo loader	cargo loader	diesel	2021	154	tier 4	556	al22d	tld 929	in-use	off-road
LGB-OP16-023	air start	air start unit	diesel	2019	513	tier 4	79	as270	asu-600-270-cup	in-use	off-road
LGB-OP12-001	aircraft tow tractor	a/c tug narrow body	gasoline	1982	95	--	10		harlan	low-use	off-road
LGB-OP12-002	fork lift	forklift	lpg	1998	50	--	591	gc30k	cat	in-use	off-road
LGB-OP12-003	tug	baggage tug	electric	2008		--	846	ap8600	lektro	in-use	off-road
LGB-OP24-001	air start	air start unit	diesel	1997	630	tier 1	79	tmac-250	stewart & stevenson	low-use	off-road
LGB-OP24-002	ground power unit	ground power unit	diesel	2018	150	tier 4	200	gpu-414	tld	low-use	off-road
LGB-OP24-003	aircraft tractor	a/c tug narrow body	diesel	2000	290	tier 1	200	b1200	fmc	low-use	off-road

Airport GSE ID	Reported Type	Emissions Designation	Fuel Type	Engine Model Year	Power Rating (hp)	Engine Tier Level	Activity (hours/year)	Vehicle Description	Vehicle Manufacture	Designated Low Use	On-Road Equivalent Engine
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Notes: Reported Type, Fuel Type, Engine Model Year, Power Rating, Vehicle Description, Vehicle Manufacture, Low Use Designation, and On-Road Equivalent Engine data are provided directly by airport GSE operators. A unit's Emissions Designation is the representative emissions unit's type from which its emission rates are derived. A unit's Airport GSE ID is a unique ID assigned by the airport for tracking and identification of the unit in subsequent years.

MOU SCHEDULE NO. 1 – III.B.2. List of Sold, Retired, or Relocated Equipment

For non-zero emission ground support equipment subject to this GSE measure, information regarding the sale or retirement of equipment available through CARB's DOORS system and, for pre-Tier 4 diesel, pre-2010 gasoline, or pre-2010 LPG ground support equipment relocated from LGB to another airport within the South Coast Air Basin, identify: a) the airport to which equipment is relocated, b) date of relocation, and c) estimated projected usage hours.

The annual activities for these units, presented in the *MOU Schedule No. 1 – III.B.1. List of Ground Support Equipment* table and in the table below are prorated to account for equipment in operation at the airport for fewer than 12 months of the reporting year.

The following pre-Tier 4 diesel, pre-2010 gasoline, or pre-2010 LPG ground support equipment at Long Beach Airport was identified as having been retired, scrapped, relocated, or sold in the reporting year.

Airport GSE ID	Reported Type	Emissions Designation	Fuel Type	Engine Model Year	Power Rating (hp)	Engine Tier Level	Activity at LGB (hours)	Designated Low Use	On-Road Equivalent Engine	Retired / Transferred?
LGB-OP20-009	ground power unit	ground power unit	diesel	2014	86	tier 4i	798	in-use	off-road	Transferred out of air basin (12/2022)
LGB-OP08-012	refueler	fuel truck	diesel	2008	285	--	80	in-use	on-road	Transferred out of state (12/2022) - SOLD
LGB-OP08-017	gpu	ground power unit	diesel	2004	107	tier 2	133	in-use	off-road	Transferred out of air basin (03/2022)
LGB-OP16-002	container loader	cargo loader	diesel	1998	152	tier 1	510	in-use	off-road	Scrapped (11/2022)
LGB-OP16-003	container loader	cargo loader	diesel	2000	152	tier 1	510	in-use	off-road	Scrapped (11/2022)
LGB-OP16-021	ground power unit	ground power unit	diesel	2007	155	tier 3	420	in-use	off-road	Transferred out of state (12/2022)

MOU SCHEDULE NO. 1 – III.B.3. Emission Inventory

An annual emission inventory for all ground support equipment associated with commercial operations at LGB, including methodology and calculations.

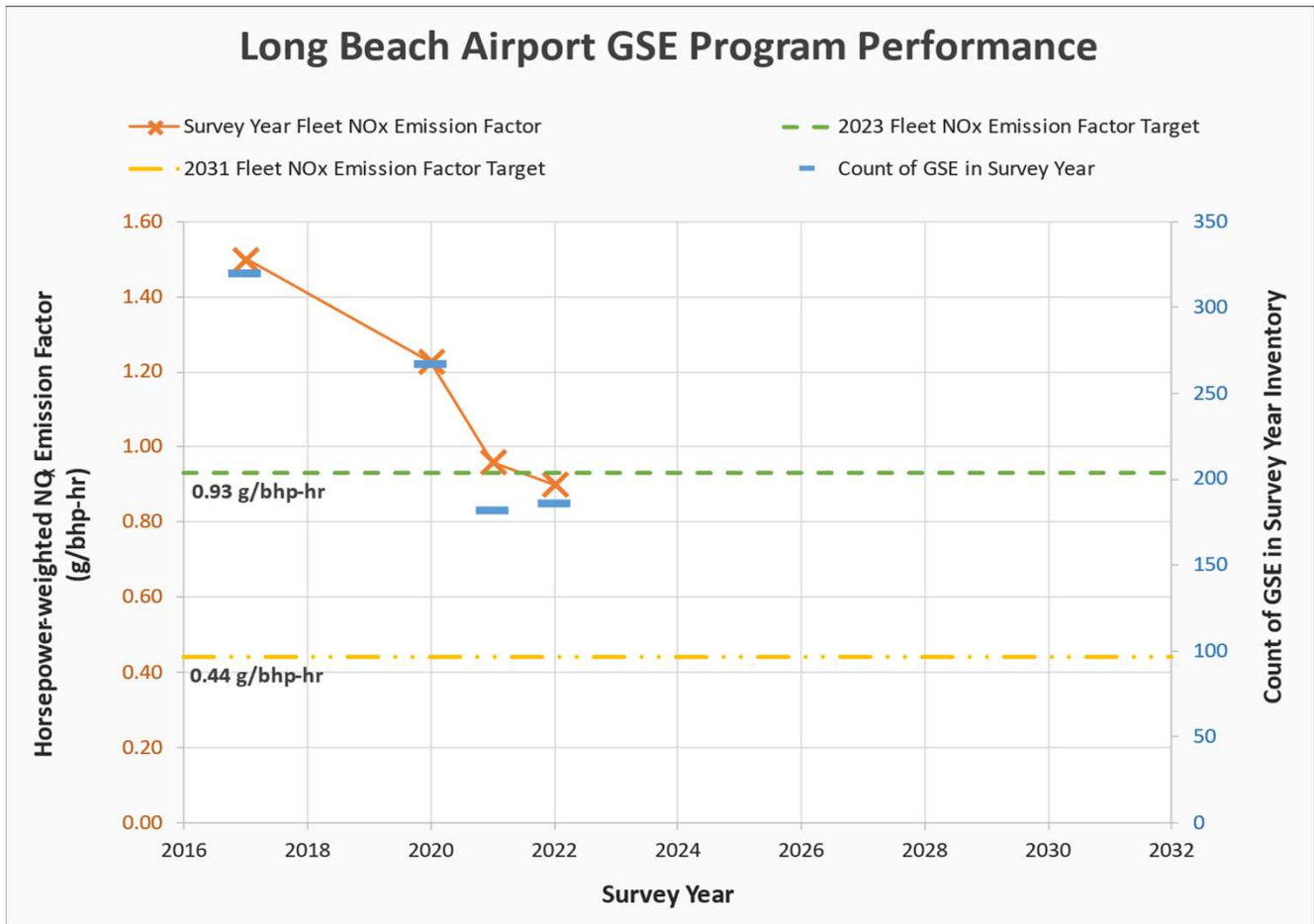
Fleet Mix					Emissions (tons per year; metric tons for CO ₂ e)							
Total	Electric	Diesel	Gas	Other	CO	ROG	NO _x	PM ₁₀	PM _{2.5}	SO _x	CO ₂ e	
186	96	50	29	11	19.4	1.6	7.5	0.24	0.22	0.00	1,302	

Notes:

1. Fleet counts include ≥25 horsepower in-use equipment used in the calculation of the NO_x performance factor.
2. Fleet emissions include the operation of all reported equipment, including <25 horsepower and low-use (<200 hours per year) equipment.

Fleet NO_x performance factor:

0.90 grams per brake horsepower-hour



Methodology - Collection of Data

In March 2023, reporting forms were distributed to all operators of GSE at the airport. Operators were supplied with the final versions of their fleet reporting forms from the previous MOU reporting year and were instructed to provide information on any equipment added to their fleet during the reporting year and to verify the data for the existing fleet, which include the model years, horsepower, equipment categories, fuel types, and other identifying characteristics of the GSE in operation at the airport. Operators were instructed to specify the status of all previously reported equipment and, if the status of that equipment had changed, to indicate the nature of the change (such as a unit of GSE having been scrapped, relegated to emergency use, or relocated to a different airport). Operators were also instructed to provide specific dates for the status change. For equipment relocated to a different airport, operators were instructed to further report to which airport the equipment was relocated.

All operators had completed and submitted the reporting forms by the end of April. Additional follow-up with operators was completed in May.

Each unit of reported GSE was reviewed for accuracy and program applicability based on previously submitted data, MOU requirements, and professional judgement. Non-electric GSE with power ratings less than or equal to 25 horsepower are exempt from the California Air Resource Board (CARB) in-use off-road diesel-fueled (ORD) fleets, and large spark-ignition (LSI) fleets regulations, upon which the MOU's GSE agreement is predicated and thus were removed from the inventory. Low-use equipment (defined as operating fewer than 200 hours per year), were retained in the inventory for the purposes of determining fleet-total emissions but were not included in the calculation of the fleet-wide grams of NOX per brake horsepower-hour performance factor. Emergency-use equipment were evaluated as low-use equipment to ensure any emergency equipment use was adequately captured. Quality review was performed for each reported unit and adjustments were made to irregular data. Such adjustments were most commonly: adjustments to engine model year, horsepower, or fuel type data based on discussions with operators and prior inventory reports; and the use of surrogate horsepower or model year data for equipment for which such data was not reported or otherwise attainable from manufacturer specifications or prior reports.

Methodology - Emission Calculations

The fleet performance factor was estimated using California regulatory standard emissions models, OFFROAD2017 and EMFAC2017, developed by CARB. For each unit of GSE, a representative equipment type was identified from either the OFFROAD2017 model (for off-road engine units) or EMFAC2017 model (for on-road engine units) based on Table 3 in the Long Beach AQIP Technical Support Document. Emission factors from the emissions models were queried for the Los Angeles (South Coast) region for calendar year 2022, assuming all adopted rules for exhaust controls. All fuel types, model years, and horsepower bins (OFFROAD2017 only) were selected, and an aggregated speed was assumed (EMFAC2017 only). Emission factors were assigned to each reported unit of GSE based on the GSE category, model year, horsepower, and fuel type of the equipment. For units which were reported without complete horsepower or model year data, the average horsepower or model year for similar equipment in-use at the airport were used.

Emission factors were obtained in units of grams per brake horsepower-hour from OFFROAD2017, and in units of grams per mile from EMFAC2017. For equipment paired to the EMFAC2017 model, an average on-airport speed of 15 miles per hour was multiplied against the model's emission factor and the resulting factor was divided by a reported equipment's respective horsepower to convert to the appropriate grams per brake horsepower-hour unit. The resultant factors, with units of grams per brake horsepower-hour, were weighted by reported equipment horsepower and averaged to determine the NOx fleet performance factor.

On July 12, 2021, it was determined that the publicly available version of CARB's OFFROAD2017 model did not incorporate the engine-standard requirements associated with CARB's 2006 LSI rulemaking and subsequent 2010 amendments. These standards required new LSI equipment certified for sale in the state of California to meet stringent emission standards for NO_x and hydrocarbons which far exceeded previous requirements. As a result, LSI engine emissions calculated using the OFFROAD2017 factors resulted in vastly overpredicted emissions, especially for newer equipment

SCAQMD was informed of this discrepancy and discussed the issue with CARB on July 14, 2021. Updated emission factors were developed by CARB based on actual historical engine certifications in the state of California since the 2006 rulemaking came into effect. These updated factors were provided initially on July 16, 2021 and were updated on July 23, 2021 with final load factors and deterioration caps provided on August 13, 2021. These finalized LSI factors were used alongside CARB's ORDAS factors for diesel equipment (which also incorporated the most recent engine standard requirements) to develop the emissions inventory.

Although the emission factors were updated, the fundamental calculation methodology was not changed from the methodology used in the 2017 AQIP and MOU. Equipment categories were paired to each reported unit and emission factors were looked up based on the model year, fuel type, horsepower rating, and equipment category of a given unit. In the calendar year 2017 MOU calculations, base emission factors were back calculated from the OFFROAD2017 model's tons per year per equipment population outputs. The CARB-provided updated base factors were calculated using zero-hour emissions, emission deterioration rates, fuel correction factors, and load factors. Activity factors were derived from the OFFROAD2017 default activity levels for diesel GSE pairings, except where gasoline & natural gas pairings provided a more specific factor (i.e., for air start GSE units, the activity for gasoline & natural gas "air start units" was used in lieu of the diesel "other GSE" activity). For low-use equipment, the activity level was assumed to be 200 hours per year regardless of the equipment type. Per unit emissions were calculated using the following formula and summed across all equipment listed at the airport to determine the fleet-total emissions:

Emissions (grams per year) = **Activity** (hours per year) × **Power Rating** (horsepower) × **Load Factor** (dimensionless) × { **Zero-hour Emission Factor** (grams per brake horsepower-hour) + [**Deterioration Rate** (grams per brake horsepower-hour per hour) × **Equipment Lifetime Cumulative Operational Hours** (hours)] } × **Fuel Correction Factor** (dimensionless)

COMMERCIAL
AIRPORTS MOU
SUPPORT

**MOU Schedule No. 1
Ground Support Equipment Survey**

**Reporting Year 2022
Emissions Inventory Report**



long beach
airport

October 2023

**CDM
Smith**

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Section 1

Project Information

Project Title: MOU Schedule No. 1 - Ground Support Equipment Survey Support
Airport Code: LGB
Airport Name: Long Beach Airport
Airport Owner: City of Long Beach

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1.1 MOU Background

In December 2019, the City of Long Beach, the owner and operator of Long Beach Airport (LGB or the Airport), entered into a voluntary Memorandum of Understanding (MOU) with the South Coast Air Quality Management District (South Coast AQMD) for the purpose of reducing emissions of criteria air pollutants at the airport. Schedule No. 1 of the MOU establishes Ground Support Equipment (GSE) fleet-average oxides of Nitrogen (NO_x) performance targets to be achieved at the airport by January 1, 2023 and January 1, 2031.

The purpose of the MOU is to reduce emissions of oxides of Nitrogen (NO_x) at the Airport by encouraging adoption of low- and zero-emission GSE as an alternative to conventional high-emission fossil fuel equipment. The MOU sets NO_x fleet-average performance targets of 0.93 grams NO_x per brake horsepower-hour by 2023 and 0.44 grams NO_x per brake horsepower-hour by 2031. The MOU allows discretion in the means by which the Airport is to achieve these targets, including but not limiting to enforcement through leases, licenses operational requirements, or other agreements.

Beginning on June 1, 2021 and continuing each year thereafter through 2032, LGB is required to collect and report information regarding GSE operating at the airport to the South Coast AQMD. The Airport is also required to collect and report information pertaining to the sale or retirement of non-zero equipment retired under the MOU. Additionally, annual emissions inventories are required to be developed and reported based on the collected GSE data. This report details the results of the reporting year 2022 LGB GSE survey and associated emissions inventory.

Section 2

GSE Inventory

2.1 Methodology

Data collected for the 2022 GSE survey were analyzed, and emissions related to their operation were estimated using industry standard models and assumptions following a methodology consistent with the Technical Support Documentation for the MOU, as detailed below.

2.1.1 Collection of Data

In March 2023, reporting forms were distributed to all operators of GSE at the airport. Operators were supplied with the final versions of their fleet reporting forms from the previous MOU reporting year and were instructed to provide information on any equipment added to their fleet during the reporting year as well as verify the data for the existing fleet, which include the model years, horsepower ratings, equipment categories, fuel types, and other identifying characteristics of the GSE in operation at the airport. Operators were instructed to specify the status of all previously reported equipment and, if the status of that equipment had changed, to indicate the nature of the change (such as a unit of GSE having been scrapped, relegated to emergency use, or relocated to a different airport). Operators were also instructed to provide specific dates for the status change. For equipment relocated to a different airport, operators were instructed to further report to which airport the equipment was relocated.

All operators had completed and submitted the reporting forms by the end of April. Additional follow-up with operators was completed in May.

Each unit of reported GSE was reviewed for accuracy and program applicability based on previously submitted data, MOU requirements, and professional judgement. Non-electric GSE with power ratings less than or equal to 25 horsepower are exempt from the California Air Resource Board (CARB) in-use off-road diesel-fueled (ORD) fleets and large spark-ignition (LSI) fleets regulations, upon which the MOU's GSE agreement is predicated and thus were removed from the inventory. Low-use equipment (defined as operating fewer than 200 hours per year) were retained in the inventory for the purposes of determining fleet-total emissions but were not included in the calculation of the fleet-wide grams of NO_x per brake horsepower-hour performance factor. Emergency-use equipment were evaluated as low-use equipment to ensure any emergency usage use was adequately captured. Quality review was performed for each reported unit and adjustments were made to irregular data. Such adjustments were most commonly: adjustments to engine model year, horsepower rating, or fuel type data based on discussions with operators and prior inventory reports; and the use of surrogate horsepower or model year data for equipment for which such data was not reported or otherwise attainable from manufacturer specifications or prior reports.

A detailed breakdown of all reported GSE is included in **Attachment A** to this report.

2.1.2 Emissions Calculations

The fleet performance factor was estimated using California regulatory standard emissions models, OFFROAD2017 and EMFAC2017, developed by CARB. For each unit of GSE, a representative equipment type was identified from either the OFFROAD2017 model (for off-road engine units) or EMFAC2017 model (for on-road engine units). **Table 1** presents the GSE type pairings for reported GSE categories. Emission factors from the emissions models were queried for the Los Angeles (South Coast) region for calendar year 2022, assuming all adopted rules for exhaust controls. All fuel types, model years, and horsepower bins (OFFROAD2017 only) were selected, and an aggregated speed was assumed (EMFAC2017 only). Emission factors were assigned to each reported unit of GSE based on the GSE category, model year, horsepower, and fuel type of the equipment. For units which were reported without complete horsepower or model year data, the average horsepower or model year for similar equipment in-use at the airport were used.

Emission factors were obtained in units of grams per brake horsepower-hour from OFFROAD2017, and in units of grams per mile from EMFAC2017. For equipment paired to the EMFAC2017 model, an average on-airport speed of 15 miles per hour was multiplied against the model's emission factor and the resulting factor was divided by a reported equipment's respective horsepower to convert to the appropriate grams per brake horsepower-hour unit. The resultant factors, with units of grams per brake horsepower-hour, were weighted by reported equipment horsepower and averaged to determine the NO_x fleet performance factor.

On July 12, 2021, it was determined that the publicly available version of CARB's OFFROAD2017 model did not incorporate the engine-standard requirements associated with CARB's 2006 LSI rulemaking and subsequent 2010 amendments. These standards required new LSI equipment certified for sale in the state of California to meet stringent emission standards for NO_x and hydrocarbons which far exceeded previous requirements. As a result, LSI engine emissions calculated using the OFFROAD2017 factors resulted in vastly overpredicted emissions, especially for newer equipment.

SCAQMD was informed of this discrepancy and discussed the issue with CARB on July 14, 2021. Updated emission factors were developed by CARB based on actual historical engine certifications in the state of California since the 2006 rulemaking came into effect. These updated factors were provided initially on July 16, 2021 and were updated on July 23, 2021 with final load factors and deterioration caps provided on August 13, 2021. These finalized LSI factors were used alongside CARB's ORDAS factors for diesel equipment (which also incorporated the most recent engine standard requirements) to develop the emissions inventory.

Although the emission factors were updated, the fundamental calculation methodology was not changed from the methodology used in the 2017 MOU Technical Support Document. Equipment categories were paired to each reported unit and emission factors were looked up based on the model year, fuel type, horsepower rating, and equipment category of a given unit. In the calendar year 2017 MOU calculations, base emission factors were back-calculated from the OFFROAD2017 model's tons per year per equipment population outputs. The CARB-provided updated base factors were calculated using zero-hour emissions, emission deterioration rates, fuel correction factors, and load factors. Activity factors were derived from the OFFROAD2017 default activity

levels for diesel GSE pairings, except where gasoline & natural gas pairings provided a more specific factor (i.e., for air start GSE units, the activity for gasoline & natural gas “air start units” was used in lieu of the diesel “other GSE” activity). For low-use equipment, the activity level was assumed to be 200 hours per year regardless of the equipment type. Per unit emissions were calculated using the following formula and summed across all equipment listed at the airport to determine the fleet-total emissions:

$$\text{Emissions (grams per year)} = \text{Activity (hours per year)} \times \text{Power Rating (horsepower)} \times \text{Load Factor (dimensionless)} \times \{ \text{Zero-hour Emission Factor (grams per brake horsepower-hour)} + [\text{Deterioration Rate (grams per brake horsepower-hour per hour)} \times \text{Equipment Lifetime Cumulative Operational Hours (hours)}] \} \times \text{Fuel Correction Factor (dimensionless)}$$

2.1.3 Revised Calculations

On August 17, 2023, South Coast AQMD completed a preliminary review of the 2022 reporting period GSE inventory, which the Airport submitted on June 1, 2023. Several of the provided comments were applicable to only the 2022 reporting period inventory, while other comments were also applicable to the 2021 reporting period inventory, which had been most recently revised and resubmitted on February 8, 2023. The Airport prepared responses to the comments which were provided to South Coast AQMD on September 15, 2023. This revised 2022 reporting period inventory report incorporates revisions per South Coast AQMD’s comments as applicable, including: adjustment of deterioration rate calculations to use default operating hours for low use GSE instead of the low use 200 hour per year low use criteria or actual operator-provided operating hours; revisions to the equipment specifications of several specific GSE units to ensure accuracy and consistency between the 2022 and 2021 reports; and updates to the offroad diesel tier assignment formula to disambiguate Tier 0 and Tier 1 equipment.

Table 1. GSE Category Pairing with OFFROAD2017 Equipment and Fuel Types

GSE Category ¹	OFFROAD Category (Diesel)	GSE Category ¹	OFFROAD Category (Gasoline & Nat Gas)
Air Conditioner	Portable Equipment - Non-Rental Generator	Air Conditioner	OFF - AirGrSupp - Air Conditioner
Aircraft Tug	AirGrSupp - A/C Tug Narrow Body	Aircraft Tug	OFF - AirGrSupp - A/C Tug Narrow Body
Air Start Unit	Portable Equipment - Non-Rental Generator	Air Start Unit	OFF - AirGrSupp - Air Start Unit
Baggage Tug	AirGrSupp - Baggage Tug	Baggage Tug	OFF - AirGrSupp - Baggage Tug
Belt Loader	AirGrSupp - Belt Loader	Belt Loader	OFF - AirGrSupp - Belt Loader
Cargo Loader	AirGrSupp - Cargo Loader	Cargo Loader	OFF - AirGrSupp - Cargo Loader
Cargo Tractor	AirGrSupp - Cargo Tractor	Cargo Tractor	OFF - AirGrSupp - Cargo Tractor
Cart	AirGrSupp - Cart	Cart	OFF - AirGrSupp - Cart
Catering Truck	AirGrSupp - Other GSE	Catering Truck	OFF - AirGrSupp - Catering Truck
Forklift	AirGrSupp - Forklift	Forklift	OFF - AirGrSupp - Forklift
Fuel Truck	AirGrSupp - Other GSE	Fuel Truck	OFF - AirGrSupp - Fuel Truck
Generator	Portable Equipment - Non-Rental Generator	Generator	OFF - AirGrSupp - Generator
Ground Power Unit	AirGrSupp - Other GSE	Ground Power Unit	OFF - AirGrSupp - Ground Power Unit
Lavatory Cart	AirGrSupp - Other GSE	Lavatory Cart	OFF - AirGrSupp - Lav Cart
Lavatory Truck	AirGrSupp - Other GSE	Lavatory Truck	OFF - AirGrSupp - Lav Truck
Lift	AirGrSupp - Lift	Lift	OFF - AirGrSupp - Lift
Maintenance Truck	AirGrSupp - Other GSE	Maintenance Truck	OFF - AirGrSupp - Maint. Truck
Other GSE	AirGrSupp - Other GSE	Other GSE	OFF - AirGrSupp - Other GSE
Passenger Stand	AirGrSupp - Passenger Stand	Passenger Stand	OFF - AirGrSupp - Passenger Stand
Service Truck	AirGrSupp - Other GSE	Service Truck	OFF - AirGrSupp - Service Truck
Sweeper	ConstMin - Sweepers/Scrubbers	Sweeper	OFF - AirGrSupp - Sweeper
Water Truck	AirGrSupp - Other GSE	Water Truck	OFF - AirGrSupp - Water Truck

Notes:

1. The OFFROAD2017 model does not include emission factors for every combination of vehicle category, fuel type, and engine model year. For units in which no appropriate vehicle category, fuel type, and model year pairing exists, the "Other GSE" vehicle category was used in the estimation of emission factors.

2.2 Reporting Year 2022 GSE Inventory

The reporting year 2022 GSE inventory for the Airport is presented below.

2.2.1 GSE Operators

Table 2 presents airport tenants identified as GSE operators in the reporting year.

Table 2. LGB GSE Operators

GSE Operator	GSE Operator	GSE Operator	GSE Operator
Aero City Maintenance	Atlantic Aviation	OCR Aviation	Southwest Airlines
Aeroplex	Catalina Flying Boats	Olen Properties	Unifi Aviation
Airport Terminal Services	Gulfstream Aerospace	Piedmont-Envoy	UPS
Airserv	Long Beach Flying Club & Flight Academy	Quinn Group	Virgin Orbit
Anthelion Helicopters	LA County Sheriff Dept. Aero Bureau	Signature Flight Support	West Coast Aircraft Maintenance

2.2.2 Equipment Breakdown

Table 3 presents a summary of GSE by category and fuel type for the reporting year.

Table 3. Count of Equipment by GSE Category and Fuel Type

GSE Category	Total Reported Equipment ¹	Electric	Diesel	Gasoline	LPG/Propane
Aircraft Tug	27	13	10	3	1
Air Conditioner	9	8	1	--	--
Air Start Unit	3	--	3	--	--
Baggage Tug	29	22	--	7	--
Belt Loader	23	17	1	5	--
Cargo Loader	4	--	3	1	--
Cargo Tractor	7	7	--	--	--
Cart	9	9	--	--	--
Catering Truck	1	--	--	1	--
Forklift	14	3	1	--	10
Fuel Truck	20	--	16	4	--
Generator	1	--	1	--	--
Ground Power Unit	26	12	14	--	--
Lavatory Cart	2	2	--	--	--
Lavatory Truck	1	--	--	1	--
Lift	1	1	--	--	--
Maintenance Truck	--	--	--	--	--
Other GSE	--	--	--	--	--
Passenger Stand	5	--	--	5	--
Service Truck	2	--	--	2	--
Sweeper	3	2	--	1	--
Water Truck	--	--	--	--	--
Total	187	96	50	30	11

Key: GSE = ground support equipment; LPG = liquefied petroleum gas

Note:

1. Equipment counts exclude non-electric equipment less than 25 horsepower and low-use equipment.

2.2.3 Emissions Inventory

Table 4 presents the summary of emissions by GSE category for the reporting year.

Table 4. Emissions by GSE Category

GSE Category	Emissions (tons per year; metric tons per year for CO _{2e})						
	CO	ROG	NO _x	PM ₁₀	PM _{2.5}	SO _x	CO _{2e}
Aircraft Tug	6.9	0.6	3.3	0.10	0.09	<0.01	281
Air Conditioner	0.1	<0.1	<0.1	<0.01	<0.01	<0.01	14
Air Start Unit	0.1	<0.1	0.2	0.01	<0.01	<0.01	40
Baggage Tug	2.5	0.2	0.1	0.01	0.01	<0.01	178
Belt Loader	1.7	0.1	0.1	0.01	0.01	<0.01	124
Cargo Loader	0.6	0.1	0.4	0.02	0.02	<0.01	84
Cargo Tractor	0	0	0	0	0	0	0
Cart	0.4	<0.1	<0.1	<0.01	<0.01	<0.01	4
Catering Truck	<0.1	<0.1	<0.1	<0.01	<0.01	<0.01	26
Forklift	3.0	0.3	0.7	0.01	0.01	<0.01	122
Fuel Truck	0.5	0.1	0.5	0.02	0.01	<0.01	77
Generator	0.2	0.1	0.3	0.01	0.01	<0.01	34
Ground Power Unit	1.1	0.1	0.9	0.04	0.04	<0.01	216
Lavatory Cart	0	0	0	0	0	0	0
Lavatory Truck	<0.1	<0.1	<0.1	<0.01	<0.01	<0.01	6
Lift	0	0	0	0	0	0	0
Passenger Stand	0.4	0.1	0.1	<0.01	<0.01	<0.01	23
Service Truck	0.1	<0.1	<0.1	<0.01	<0.01	<0.01	13
Sweeper	0.8	<0.1	<0.1	<0.01	<0.01	<0.01	5
Total	18.5	1.6	6.8	0.24	0.21	<0.01	1,247

Key: CO = carbon monoxide; CO_{2e} = carbon dioxide equivalents; GSE = ground support equipment; NO_x = oxides of nitrogen; PM₁₀ = particulate matter with an aerodynamic diameter less than or equal to 10 microns; PM_{2.5} = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns; ROG = reactive organic gases; SO_x = oxides of sulfur

2.2.4 Fleet-Wide Performance Factor

The Airport’s fleet-wide NO_x performance factor for the 2022 reporting year was 0.90 grams per brake-horsepower hour, below the 2023 target of 0.93 grams per brake horsepower-hour and above the 2031 target of 0.44 grams per brake-horsepower hour. The Airport’s fleet-wide NO_x performance factor for the 2021 reporting year was 0.96 grams per brake-horsepower hour.

Figure 1 presents the historical fleet-wide NO_x performance factor by survey year.

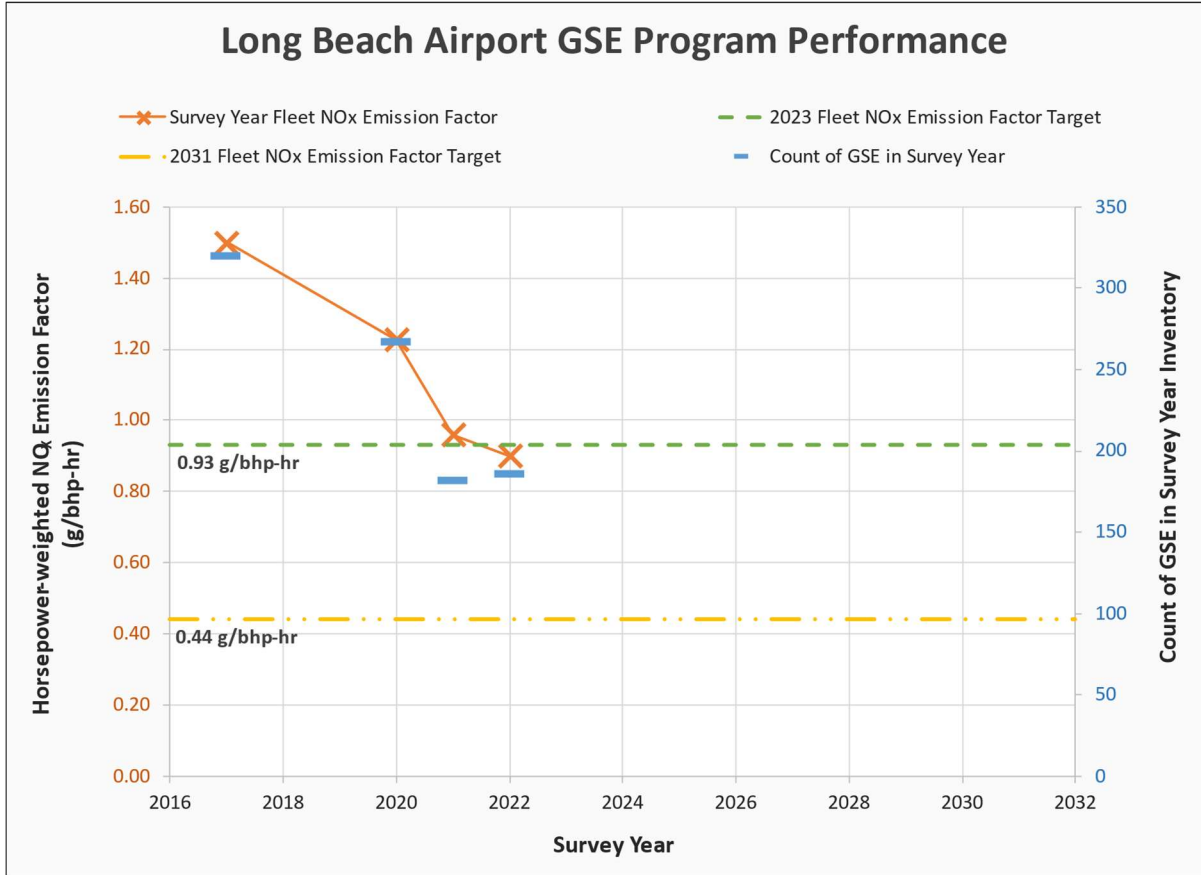


Figure 1. GSE Program Fleet-Wide NO_x Performance Factor by Survey Year

2.2.5 Fleet-Wide Performance Factor

The Airport’s fleet-wide NO_x emissions for the 2022 reporting year totaled to 7.48 tons of NO_x, reflecting a 66.0 percent reduction relative to the fleet-wide emissions at GSE program inception. The Airport’s fleet-wide NO_x emissions for the 2021 reporting year totaled to 7.70 tons of NO_x. **Figure 2** presents the historical fleet-wide NO_x emissions by survey year.

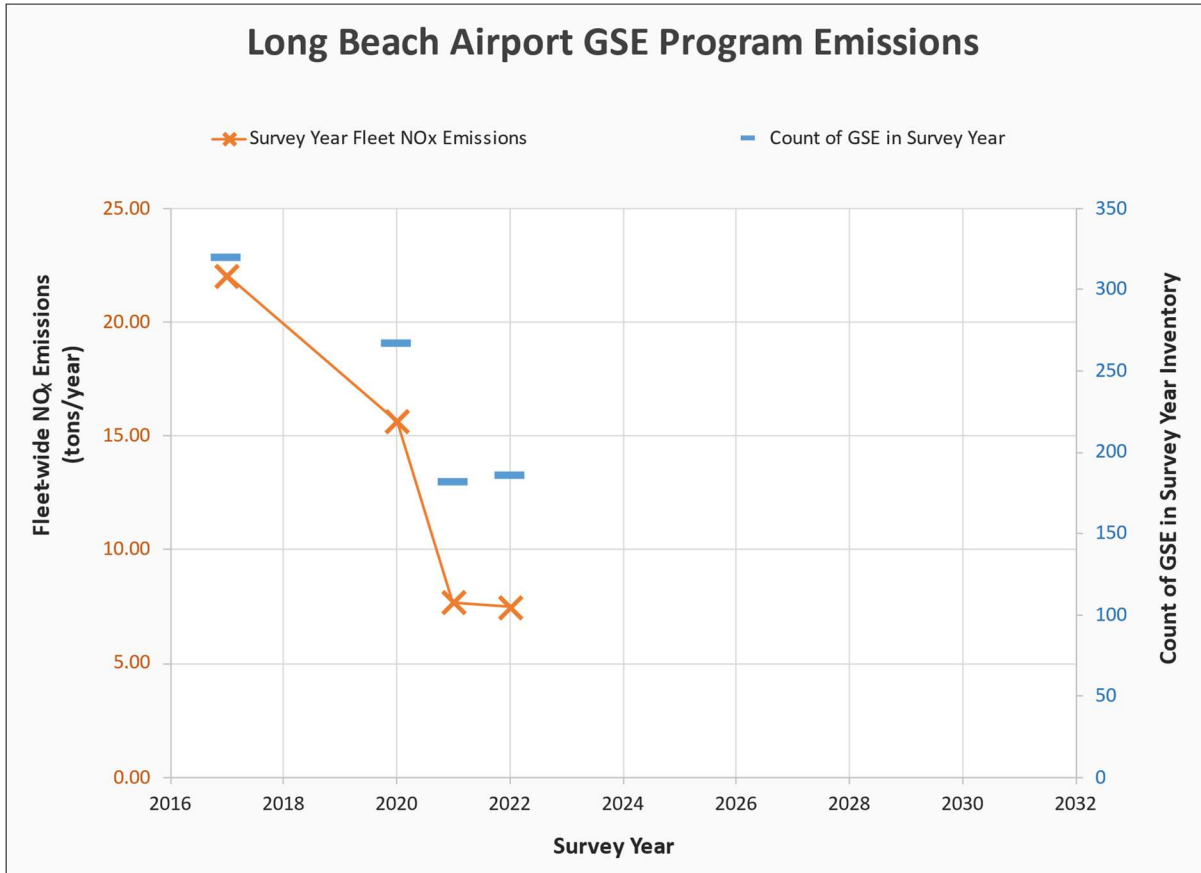


Figure 2. GSE Program Fleet-Wide NO_x Emissions by Survey Year

Attachment A

Detailed Reported GSE Data and Emissions

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2022 LGB GSE Program Progress

Survey Year	Count of Equipment ^[1]	Percent Electric ^[1]	OFFROAD Method NO _x ^{[2][3]} (short tons)	CARB Factors Method NO _x ^{[2][4]} (short tons)	MOU Fleet Performance NO _x ^{[1][3][5]} (g/bhp-hr)
2017	320	48.4%	16.78	22.05	1.50
2018					
2019					
2020	267	40.8%	16.02	15.64	1.23
2021	182	48.4%	--	7.70	0.96
2022	186	51.6%	--	7.48	0.90
2023					
2023				Performance Target: 0.93	
2024					
2025					
2026					
2027					
2028					
2029					
2030					
2031					
2031				Performance Target: 0.44	
2032					

Notes:

- [1] Low-use and <25 horsepower non-electric equipment **excluded**
- [2] All reported equipment, including low-use and <25 hp equipment **included**
- [3] Emission factors back-calculated from OFFROAD2017 annual emissions outputs.
- [4] Emission factors provided by CARB July 2021 based on certified engine standards (LSI) and 2017 ORDAS model (ORD).
- [5] Calculated as a fully-loaded horsepower-weighted factor consistent with the methodology employed throughout the development of the **SCAQMD and City of Long Beach 2019 MOU**.

2022 LGB GSE Inventory by Equipment Type

	Count of Equipment [excluding <25hp non-electric and low-use equipment]				
	Diesel	Gasoline	LPG	Electric	Total
Overall Fleet	50	29	11	96	186
Overall Fleet Percent	26.9%	15.6%	5.9%	51.6%	--
A/C Tug Narrow Body	10	2	1	13	26
Air Conditioner	1	--	--	8	9
Air Start Unit	3	--	--	--	3
Baggage Tug	--	7	--	22	29
Belt Loader	1	5	--	17	23
Cargo Loader	3	1	--	--	4
Cargo Tractor	--	--	--	7	7
Cart	--	--	--	9	9
Catering Truck	--	1	--	--	1
Forklift	1	--	10	3	14
Fuel Truck	16	4	--	--	20
Generator	1	--	--	--	1
Ground Power Unit	14	--	--	12	26
Lav Cart	--	--	--	2	2
Lav Truck	--	1	--	--	1
Lift	--	--	--	1	1
Passenger Stand	--	5	--	--	5
Service Truck	--	2	--	--	2
Sweeper	--	1	--	2	3

2022 LGB GSE Inventory by Equipment Type

	Fleet Inventory Equipment Count [including <25hp non-electric and low-use equipment]			
	In-Use (any fuel)	Low-Use (any fuel)	Total (any fuel)	Electric
Overall Fleet	193	24	217	97
Overall Fleet Percent	88.9%	11.1%	--	44.7%
A/C Tug Narrow Body	26	5	31	13
Air Conditioner	9	1	10	8
Air Start Unit	3	2	5	--
Baggage Tug	29	2	31	23
Belt Loader	23	3	26	17
Cargo Loader	4	--	4	--
Cargo Tractor	7	--	7	7
Cart	12	--	12	9
Catering Truck	1	--	1	--
Forklift	14	2	16	3
Fuel Truck	20	4	24	--
Generator	5	--	5	--
Ground Power Unit	26	1	27	12
Lav Cart	2	--	2	2
Lav Truck	1	--	1	--
Lift	1	--	1	1
Passenger Stand	5	4	9	--
Service Truck	2	--	2	--
Sweeper	3	--	3	2

2022 LGB GSE Inventory by Equipment Type

Fleet Inventory Annual Emissions [including <25hp non-electric and low-use equipment]							
	ROG (short tons)	CO (short tons)	NO _x (short tons)	PM ₁₀ (short tons)	PM _{2.5} (short tons)	CO ₂ e (metric tons)	SO _x (short tons)
Overall Fleet	1.6	19.4	7.5	0.24	0.22	1,302	<0.01
Overall Fleet Percent	--	--	--	--	--	--	--
A/C Tug Narrow Body	0.6	6.8	3.4	0.10	0.09	278	<0.01
Air Conditioner	<0.1	0.1	<0.1	<0.01	<0.01	14	<0.01
Air Start Unit	<0.1	0.1	0.2	0.01	<0.01	40	<0.01
Baggage Tug	0.2	3.0	0.4	0.01	0.01	189	<0.01
Belt Loader	0.1	1.9	0.4	0.01	0.01	149	<0.01
Cargo Loader	0.1	0.6	0.4	0.02	0.02	84	<0.01
Cargo Tractor	<0.1	<0.1	<0.1	<0.01	<0.01	<1	<0.01
Cart	<0.1	0.4	<0.1	<0.01	<0.01	4	<0.01
Catering Truck	<0.1	<0.1	<0.1	<0.01	<0.01	26	<0.01
Forklift	0.3	3.0	0.7	0.01	0.01	122	<0.01
Fuel Truck	0.1	0.5	0.5	0.02	0.01	77	<0.01
Generator	0.1	0.2	0.3	0.01	0.01	34	<0.01
Ground Power Unit	0.1	1.1	0.9	0.04	0.04	216	<0.01
Lav Cart	<0.1	<0.1	<0.1	<0.01	<0.01	<1	<0.01
Lav Truck	<0.1	<0.1	<0.1	<0.01	<0.01	6	<0.01
Lift	<0.1	<0.1	<0.1	<0.01	<0.01	<1	<0.01
Passenger Stand	0.1	0.8	0.2	<0.01	<0.01	45	<0.01
Service Truck	<0.1	0.1	<0.1	<0.01	<0.01	13	<0.01
Sweeper	<0.1	0.8	<0.1	<0.01	<0.01	5	<0.01

2022 LGB GSE Inventory by Fuel Type

	Fleet Inventory Equipment Count (including <25hp non-electric and low-use equipment)		
	In-Use (any fuel)	Low-Use (any fuel)	Total (any fuel)
Overall Fleet	193	24	217
Overall Fleet Percent	88.9%	11.1%	--
Diesel	54	10	64
<i>Tier 4</i>	25	3	28
<i>Tier 4i</i>	3	1	4
<i>Tier 3</i>	8	1	9
<i>Tier 2</i>	2	1	3
<i>Tier 1</i>	4	3	7
<i>Tier 0</i>	5	1	6
<i>On-Road</i>	7	0	7
Gasoline	32	11	43
<i>Pre-2010</i>	8	9	17
<i>2010 and Newer</i>	24	2	26
LPG	11	2	13
<i>Pre-2010</i>	9	1	10
<i>2010 and Newer</i>	2	1	3
Electric	96	1	97

2022 LGB GSE Inventory by Fuel Type

Fleet Inventory Annual Emissions (including <25hp non-electric and low-use equipment)							
	ROG (short tons)	CO (short tons)	NO _x (short tons)	PM ₁₀ (short tons)	PM _{2.5} (short tons)	CO _{2e} (metric tons)	SO _x (short tons)
Overall Fleet	1.6	19.4	7.5	0.245	0.220	1,302	0.0046
Overall Fleet Percent	--	--	--	--	--	--	--
Diesel	0.5	2.9	4.0	0.188	0.173	595	0.0029
<i>Tier 4</i>	0.1	1.2	0.7	0.027	0.025	242	0.0012
<i>Tier 4i</i>	0.0	0.2	0.1	0.003	0.003	31	0.0002
<i>Tier 3</i>	0.1	0.6	0.7	0.038	0.035	132	0.0006
<i>Tier 2</i>	0.0	0.1	0.1	0.006	0.005	16	0.0001
<i>Tier 1</i>	0.2	0.5	1.4	0.049	0.046	113	0.0005
<i>Tier 0</i>	0.1	0.4	0.9	0.063	0.058	52	0.0002
<i>On-Road</i>	0.0	0.0	0.0	0.001	0.001	10	0.0000
Gasoline	0.7	11.8	2.0	0.043	0.032	541	0.0017
<i>Pre-2010</i>	0.5	7.2	1.7	0.011	0.008	135	0.0004
<i>2010 and Newer</i>	0.3	4.6	0.3	0.032	0.024	406	0.0013
LPG	0.4	4.7	1.5	0.014	0.014	165	0.0000
<i>Pre-2010</i>	0.4	4.2	1.5	0.012	0.012	135	0.0000
<i>2010 and Newer</i>	0.0	0.5	0.0	0.003	0.003	31	0.0000
Electric	0.0	0.0	0.0	0.000	0.000	0	0.0000

2022 LGB GSE Inventory by Fuel Type - Comparison to Prior Reporting Years

2022 (change vs 2021)

Fleet Inventory Equipment Count

(including <25hp non-electric and low-use equipment)

2021

Fleet Inventory Equipment Count

(including <25hp non-electric and low-use equipment)

	In-Use (any fuel)	Low-Use (any fuel)	Total (any fuel)	In-Use (any fuel)	Low-Use (any fuel)	Total (any fuel)
Overall Fleet	193 (+4)	24 (+4)	217 (+8)	189	20	209
Diesel	54 (-3)	10 (+4)	64 (+1)	57	6	63
<i>Tier 4</i>	25 (+1)	3 (+1)	28 (+2)	24	2	26
<i>Tier 4i</i>	3 (-2)	1 (-)	4 (-2)	5	1	6
<i>Tier 3</i>	8 (-2)	1 (-)	9 (-2)	10	1	11
<i>Tier 2</i>	2 (-)	1 (+1)	3 (+1)	2	0	2
<i>Tier 1</i>	4 (-1)	3 (+2)	7 (+1)	5	1	6
<i>Tier 0</i>	5 (-)	1 (-)	6 (-)	5	1	6
<i>On-Road</i>	7 (+1)	0 (-)	7 (+1)	6	0	6
Gasoline	32 (+2)	11 (-)	43 (+2)	30	11	41
<i>Pre-2010</i>	8 (-)	9 (-)	17 (-)	8	9	17
<i>2010 and Newer</i>	24 (+2)	2 (-)	26 (+2)	22	2	24
LPG	11 (-3)	2 (-)	13 (-3)	14	2	16
<i>Pre-2010</i>	9 (-2)	1 (-)	10 (-2)	11	1	12
<i>2010 and Newer</i>	2 (-1)	1 (-)	3 (-1)	3	1	4
Electric	96 (+8)	1 (-)	97 (+8)	88	1	89

2022 LGB GSE Inventory by Fuel Type - Comparison to Prior Reporting Years

2022 (change vs 2019)

Fleet Inventory Equipment Count

(including <25hp non-electric and low-use equipment)

2019 (based on 2017 fleet survey)

Fleet Inventory Equipment Count

(including <25hp non-electric and low-use equipment)

	In-Use (any fuel)	Low-Use (any fuel)	Total (any fuel)	In-Use (any fuel)	Low-Use (any fuel)	Total (any fuel)
Overall Fleet	193	24	217 (-105)	--	--	322
Diesel	54	10	64 (-34)	--	--	98
<i>Tier 4</i>	25	3	28 (+19)	--	--	9
<i>Tier 4i</i>	3	1	4 (+2)	--	--	2
<i>Tier 3</i>	8	1	9 (+6)	--	--	3
<i>Tier 2</i>	2	1	3 (-10)	--	--	13
<i>Tier 1</i>	4	3	7 (-45)	--	--	52
<i>Tier 0</i>	5	1	6 (-13)	--	--	19
<i>On-Road</i>	7	0	7 (+7)	--	--	0
Gasoline	32	11	43 (-8)	--	--	51
<i>Pre-2010</i>	8	9	17 (-21)	--	--	38
<i>2010 and Newer</i>	24	2	26 (+13)	--	--	13
LPG	11	2	13 (-5)	--	--	18
<i>Pre-2010</i>	9	1	10 (-5)	--	--	15
<i>2010 and Newer</i>	2	1	3 (-)	--	--	3
Electric	96	1	97 (-58)	--	--	155

2022 LGB GSE Detailed Inventory - Comparison to Prior Reporting Years

Comparison of Enginer Tier & Horsepower by Reporting Year (Diesel-Fueled Equipment)

Low-use and on-road designated equipment **excluded** in equipment counts.

2022 Fleet (difference as compared to 2021)

Tier	Horsepower Bin									Total
	< 25	25 - 49	50 - 74	75 - 99	100 - 174	175 - 299	300 - 599	600 - 749	≥ 750	
Tier 0	0 (-)	0 (-)	0 (-)	2 (-)	1 (-)	2 (-)	0 (-)	0 (-)	0 (-)	5 (-)
Tier 1	0 (-)	0 (-)	0 (-)	1 (-)	2 (-1)	1 (-)	0 (-)	0 (-)	0 (-)	4 (-1)
Tier 2	0 (-)	0 (-)	0 (-)	0 (-)	2 (-)	0 (-)	0 (-)	0 (-)	0 (-)	2 (-)
Tier 3	0 (-)	0 (-)	0 (-)	0 (-)	5 (-2)	2 (-)	0 (-)	1 (-)	0 (-)	8 (-2)
Tier 4i	0 (-)	0 (-)	0 (-)	0 (-)	1 (-)	2 (-)	0 (-2)	0 (-)	0 (-)	3 (-2)
Tier 4	4 (-)	2 (-)	2 (-1)	6 (-)	5 (+1)	4 (+1)	2 (-)	0 (-)	0 (-)	25 (+1)
Total:										47 (-4)

2022 Fleet (difference as compared to 2019 reporting year [based on 2017 fleet])

Tier	Horsepower Bin									Total
	< 25	25 - 49	50 - 74	75 - 99	100 - 174	175 - 299	300 - 599	600 - 749	≥ 750	
Tier 0	0 (-)	0 (-2)	0 (-)	2 (+1)	1 (-14)	2 (+1)	0 (-)	0 (-)	0 (-)	5 (-14)
Tier 1	0 (-)	0 (-26)	0 (-1)	1 (-2)	2 (-17)	1 (-1)	0 (-)	0 (-1)	0 (-)	4 (-48)
Tier 2	0 (-)	0 (-)	0 (-3)	0 (-3)	2 (-4)	0 (-)	0 (-)	0 (-1)	0 (-)	2 (-11)
Tier 3	0 (-)	0 (-)	0 (-)	0 (-)	5 (+4)	2 (+2)	0 (-1)	1 (-)	0 (-)	8 (+5)
Tier 4i	0 (-)	0 (-)	0 (-1)	0 (-)	1 (-)	2 (+2)	0 (-)	0 (-)	0 (-)	3 (+1)
Tier 4	4 (+4)	2 (-1)	2 (+1)	6 (+5)	5 (+2)	4 (+3)	2 (+2)	0 (-)	0 (-)	25 (+16)
Total:										47 (-51)

2022 LGB GSE Detailed Inventory - Comparison to Prior Reporting Years

Comparison of Enginer Model Year & Fuel Type by Reporting Year

Low-use and <25 horsepower non-electric equipment **excluded** in equipment counts.

2022 Fleet (difference as compared to 2021)

Model Year	Fuel Type				Total
	Gasoline	LPG/Propane	Electric	Diesel	
≤ 2007	6 (-)	8 (-1)	51 (+1)	14 (-2)	79 (-2)
2008 - 2009	0 (-)	1 (-1)	6 (-)	2 (-)	9 (-1)
2010 - 2015	1 (-1)	1 (-)	16 (+3)	15 (-2)	33 (-)
2016 - 2020	22 (+3)	1 (-1)	17 (+2)	15 (-)	55 (+4)
≥ 2021	0 (-)	0 (-)	6 (+2)	4 (+1)	10 (+3)
Total:				186 (+4)	

2022 Fleet (difference as compared to 2019 reporting year [based on 2017 fleet])

Model Year	Fuel Type				Total
	Gasoline	LPG/Propane	Electric	Diesel	
≤ 2007	6 (-21)	8 (-5)	51 (-44)	14 (-71)	79 (-141)
2008 - 2009	0 (-9)	1 (-1)	6 (-1)	2 (-1)	9 (-12)
2010 - 2015	1 (-8)	1 (+1)	16 (-21)	15 (+11)	33 (-17)
2016 - 2020	22 (+18)	1 (-2)	17 (+1)	15 (+9)	55 (+26)
≥ 2021	0 (-)	0 (-)	6 (+6)	4 (+4)	10 (+10)
Total:				186 (-134)	

