

June 15, 2026

Ms. Melissa Gamoning
Program Supervisor
Planning, Rule Development & Implementation
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765-4178

CITY OF LONG BEACH SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT MEMORANDUM OF UNDERSTANDING – REVISED ANNUAL PROGRESS REPORT FOR CALENDAR YEAR 2024

Dear Ms. Gamoning,

Long Beach Airport (“LGB” or “the Airport”) is pleased to submit this revised 2024 annual progress report. On May 30, 2025, the Airport submitted an initial Memorandum of Understanding (MOU) progress report for calendar year (CY) 2024 for South Coast Air Quality Management District (South Coast AQMD) review and comment. On January 30, 2026, South Coast AQMD provided comments on the initial report. This revised report details the results of the CY 2024 MOU Report, incorporating revisions to address South Coast AQMD comments.

On December 6, 2019, an MOU was entered into between the South Coast AQMD and the Airport for the voluntary reduction of emissions from commercial non-aircraft airport mobile sources. This report details the progress achieved in CY 2024 and provides an overview of the Airport’s efforts to implement the MOU measures and quantify actual emission reductions. The LGB MOU includes one measure related to non-aircraft commercial passenger airport mobile sources – the Ground Support Equipment (GSE) Program. The following sections provide the required information for this measure and associated emissions, as described in the Airport’s MOU. This report does not apply to any source or operation of any source that is not specifically identified in the MOU measure.

PROGRESS ON MOU MEASURES

MOU SCHEDULE NO. 1 – GROUND SUPPORT EQUIPMENT

Schedule No. 1 of the MOU requires the Airport to reduce nitrogen oxides (“NOx”) emissions from GSE to achieve a GSE fleet average composite emissions factor (“performance level”) that is less than or equal to 0.93 grams of NOx per brake horsepower-hour (“g/hp-hr of NOx”) by January 1, 2023 and is less than or equal to 0.44 g/hp-hr NOx by January 1, 2031. To achieve these targets, the Airport has been working with airlines and third-party GSE operators to achieve the performance targets by specified dates through accelerated turnover of existing equipment to newer, lower-emission equipment.

A list of GSE subject to this measure with the required information specified in MOU Schedule No. 1 Section III.B.1., *List of Commercial Ground Support Equipment*, is provided in **Exhibit A, 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 relocation details (as

applicable) as required by MOU Schedule No. 1, Section III.B.2, *List of Sold, Retired, or Relocated Equipment*, is presented in **Exhibit A, Table 2**. Furthermore, as required by MOU Schedule No. 1, Section III.B.3, *Emission Inventory*, an inventory of GSE emissions associated with commercial operations at the Airport has been developed. Additional supporting information for the development of the GSE emissions inventory is provided in **Exhibit B**.

RESULTS OF THE 2024 GSE SURVEY

In CY 2024, there were 182 pieces of in-use, ≥ 25 horsepower (collectively, “reportable”) GSE operating at the Airport – a net increase of 9 pieces of equipment relative to CY 2023. The airport composite commercial fleet saw a net reduction in reportable GSE of 3 units of pre-Tier 4 final diesel and 0 units of pre-model year 2010 non-diesel (collectively, “legacy GSE”). There were also 108 reportable electric ground support equipment (eGSE) representing a net increase of 12 pieces of equipment, 35 diesel-powered GSE representing a net decrease of 5 pieces of equipment, 34 gasoline-powered GSE representing a net increase of 2 pieces of equipment, and 5 liquified petroleum gas- or propane-powered GSE representing no net change relative to CY 2023. One unit, designated as LGB-OP18-014, which had been reported in previous survey years, was identified through discussions with the equipment operators as a duplicate entry of another reported GSE, LGB-OP18-012. Consequently, it has been removed from the inventory in this annual progress report.

In CY 2024, the Airport achieved a performance level of 0.45 g/hp-hr of NO_x, demonstrating the Airport’s continued achievement of the MOU’s January 1, 2023 target. This performance level is within 3 percent of the MOU’s January 1, 2031 performance target and indicates that the 2031 target is likely to be achieved ahead of schedule. The CY 2024 factor decreased meaningfully relative to the CY 2023 factor of 0.55 g/hp-hr NO_x. The decrease was the result of the removal of legacy GSE from the combined Airport fleet and an increase in in-use electric GSE at LGB. The Airport anticipates the fleet composite performance factor will continue to decrease as the Airport continues its ongoing partnerships with third-party GSE operators to replace or relocate legacy GSE.

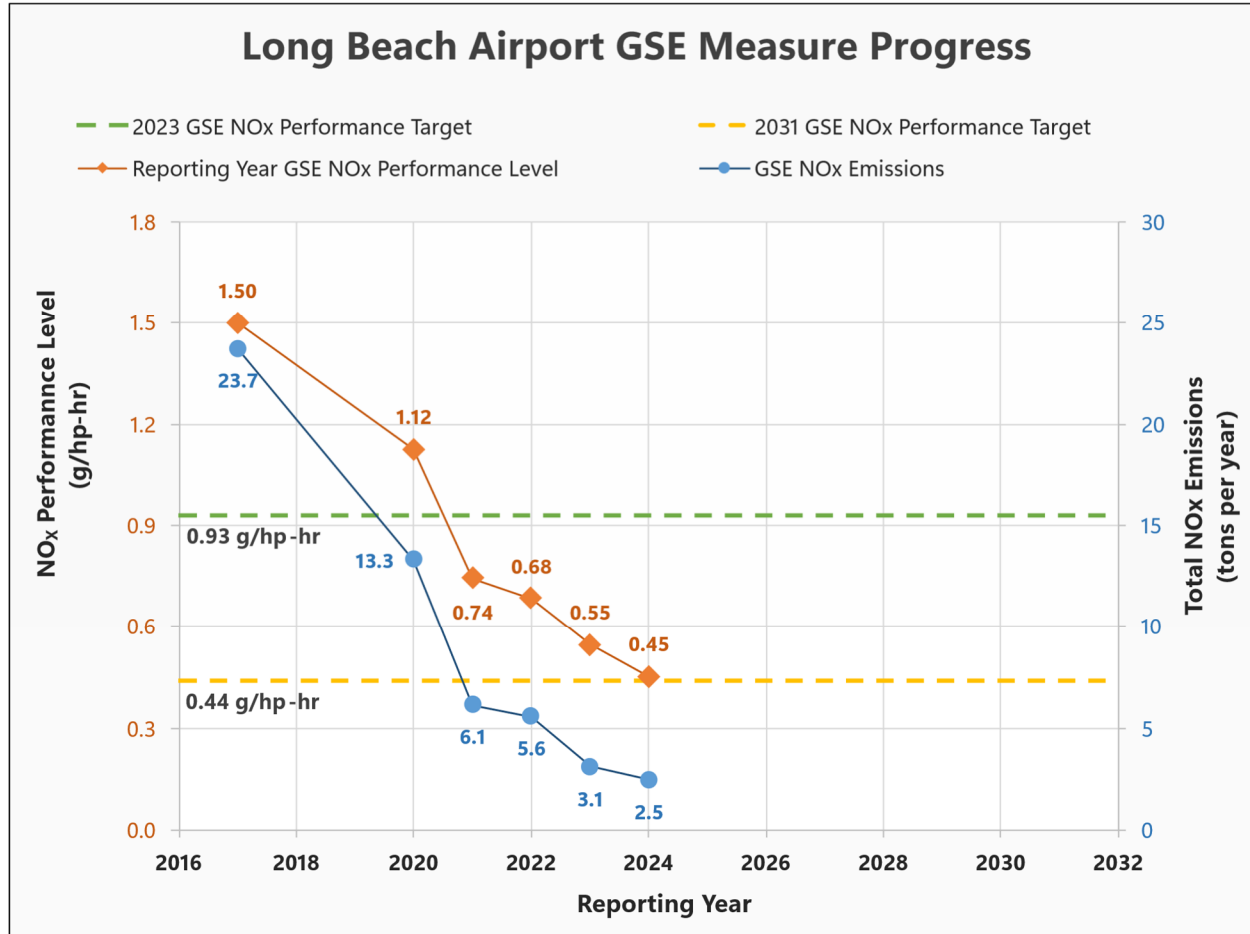
2024 Long Beach Airport MOU Commercial GSE Summary

Fleet Mix ¹					Fleet Emissions (tons per year; metric tons for CO ₂ e) ²						
Total	Electric	Diesel	Gas	Other	CO	ROG	NO _x	PM ₁₀	PM _{2.5}	SO _x	CO ₂ e
182	108	35	34	5	12.3	0.8	2.5	0.10	0.08	<0.01	1,253

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) or emergency-use equipment.

Long Beach Airport MOU Commercial GSE Performance and Emissions by Survey Year

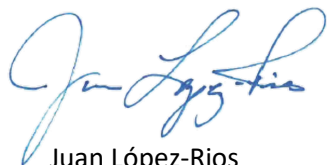


For CY 2024, annual NOx emissions from commercial GSE totaled 2.5 tons, which is lower than the 2023 annual NOx emissions from GSE of 3.1 tons. This decrease in total annual NOx emissions is directly attributable to the removal and retirement of legacy GSE from the GSE fleets in operation at the Airport. The Airport's GSE Emissions Reduction Program has achieved an annual reduction of 89.3% relative to the annual NOx emissions from GSE in 2017, the baseline year of the Program.

In June 2025, the Airport continued its targeted outreach approach, informing operators of their highest-emitting GSE and encouraging the elimination of remaining legacy GSE or highest-emission non-legacy GSE that remained in operation at the Airport in 2025.

Long Beach Airport appreciates the ongoing partnership and collaboration with South Coast AQMD. If there are any questions, please contact either myself at juan.lopez-rios@longbeach.gov (562) 570-2608 or Jeremy Gilbride at gilbridej@cdmsmith.com (949) 930-9809 at your convenience.

Sincerely,



Juan López-Rios
Deputy Director, Long Beach Airport

Enclosed are the following documents.

Exhibit A: MOU Schedule No. 1 – Ground Support Equipment MOU Report, Revised May 2026

Exhibit B: MOU Schedule No. 1 – Ground Support Equipment Survey, Emissions Inventory Report, Revised May 2026

Exhibit C: South Coast AQMD Comments on May 30, 2025, Calendar Year 2024 MOU Progress Report and Airport Responses

Exhibit A

*MOU Schedule No. 1 – Ground Support Equipment MOU Report,
Revised May 2026*

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 Airbourne 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 Commercial 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-OP20-001	air conditioning	air conditioner	diesel	2016	82	tier 4	200	air conditioning cart	tug	low-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-OP20-002	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-OP19-001	belt loader	belt loader	gasoline	1972	120	--	50	cochran-western	701	low-use	off-road
LGB-OP19-002	belt loader	belt loader	gasoline	1980	120	--	50	cochran-western	702	low-use	off-road
LGB-OP19-003	belt loader	belt loader	gasoline	2015	140	--	50	tug inc	777	low-use	off-road
LGB-OP19-004	stair truck	passenger stand	gasoline	2001	140	--	50	wollard	810	low-use	off-road
LGB-OP19-005	stair truck	passenger stand	gasoline	2008	140	--	50	wollard	811	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
LGB-OP19-006	stair truck	passenger stand	gasoline	2010	140	--	50	stinar	812	low-use	off-road
LGB-OP19-007	tug	baggage tug	gasoline	1998	140	--	50	jet line	935	low-use	off-road
LGB-OP19-008	passenger stand	passenger stand	gasoline	1972	16	--	50	skyramp	897	low-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-OP07-002	fuel truck	fuel truck	diesel	1981	275	tier 0	83	jet fuel truck - 10,000 gallon	dart	low-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	2000		--	391	scissor lift	upright	in-use	off-road
LGB-OP07-007	fork lift	forklift	gasoline	2012	53	--	591	toyota forklift	toyota	in-use	off-road
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	2004	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	2013		--	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

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-OP07-017	potable water cart	cart	electric	2002		--	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	2008		--	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
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-OP07-029	potable water cart	cart	electric	2023		--	152	water cart	areo specialties	in-use	off-road
LGB-OP07-030	lavatory service cart	lav cart	electric	2023		--	150	lav cart	areo specialties	in-use	off-road
LGB-OP03-001	fork lift	forklift	lpg	1993	93	--	730		toyota	in-use	off-road
LGB-OP03-002	fork lift	forklift	lpg	1996	94	--	730		toyota	in-use	off-road
LGB-OP08-002	aircraft tractor	a/c tug narrow body	diesel	2011	84	tier 3	63	tug	eagle	low-use	off-road
LGB-OP08-003	aircraft tractor	a/c tug narrow body	diesel	2014	49	tier 4	274	tug	tug	in-use	off-road
LGB-OP08-005	refueler	fuel truck	diesel	2017	250	tier 4	2,467	refueler	eam	in-use	off-road
LGB-OP08-006	refueler	fuel truck	gasoline	1995	300	--	172	refueler	gm	in-use	off-road
LGB-OP08-007	tug	baggage tug	electric	2005		--	3,353	tug	lektro, inc.	in-use	off-road
LGB-OP08-008	tug	baggage tug	electric	1999		--	143	tug	lektro, 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-OP08-010	service truck	service truck	gasoline	2000	119	--	262	service truck	ford	in-use	on-road
LGB-OP08-011	refueler	fuel truck	diesel	2018	200	--	13	refueler - hv607 sba	international	in-use	on-road
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-OP08-021	refueler	fuel truck	diesel	2014	215	--	83	refueler - 7300 sfa	international	in-use	on-road
LGB-OP08-022	refueler	fuel truck	diesel	2022	260	--	83	refueler jet - mdl-7ma-300a-mrer-cndas	garsite	in-use	on-road
LGB-OP08-023	refueler	fuel truck	diesel	2000	235	--	83	ford	f-350	in-use	on-road
LGB-OP08-024	golf cart	cart	electric	2010		--	152	e-z-go	rxv	in-use	off-road
LGB-OP08-025	refueler	fuel truck	diesel	2022	210	--	83	isuzu	npr-hd	in-use	on-road
LGB-OP08-026	refueler	fuel truck	diesel	2023	250	tier 4	3,025	skymark	rf10rd-2-2c-t4-xf	in-use	off-road
LGB-OP08-027	golf cart	cart	electric	2023		--	152	clubcar	villager 6	in-use	off-road
LGB-OP08-028	service truck	service truck	gasoline	2022	310	--	2,908	chevrolet	silverado 1500	in-use	on-road
LGB-OP08-029	floor scrubber	sweeper	electric	2012		--	339	tennant	t7	in-use	off-road
LGB-OP08-030	service truck	service truck	gasoline	1994	160	--	899	ford	ranger	in-use	on-road
LGB-OP08-031	service truck	service truck	gasoline	2020	300	--	883	ford	explorer	in-use	on-road
LGB-OP08-034	refueler	fuel truck	diesel	2014	215	--	5	7300 sba	international	in-use	on-road
LGB-OP08-035	aircraft tractor	a/c tug narrow body	electric	2007		--	58	lektro, inc.	ap-8850sd	in-use	off-road
LGB-OP08-036	refueler	fuel truck	gasoline	2022	350	--	2,592	ramp service	isuzu	in-use	on-road
LGB-OP08-015	ground power unit	ground power unit	diesel	2013	130	tier 4i	152	gpu-4060-t-cup-28	tld	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-OP08-032	ground power unit	ground power unit	electric	2023		--	347	itw	jetex mobile egpu-3gwb-28/40i	in-use	off-road
LGB-OP08-033	ground power unit	ground power unit	electric	2023		--	360	itw	jetex mobile egpu-3gwb-28/40i	in-use	off-road
LGB-OP18-010	aircraft tractor	a/c tug narrow body	diesel	2019	84	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
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	--	706	663-28	tug technologies, inc.	in-use	off-road
LGB-OP18-007	belt loader	belt loader	gasoline	2019	64	--	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-OP18-013	ground power unit	ground power unit	diesel	2019	173	tier 4	207	ga90v13c1100	guinault	in-use	off-road
LGB-OP18-015	ground power unit	ground power unit	diesel	2022	155	tier 4	576	gpu 409-e-cup	tld	in-use	off-road
LGB-OP16-001	fork lift	forklift	lpg	2015	155	--	591	af105	hyster h50ft	in-use	off-road
LGB-OP16-004	light tower	generator	diesel	2017	24	tier 4	913	aplđ	generac	in-use	off-road
LGB-OP16-005	light tower	generator	diesel	2017	24	tier 4	913	aplđ	generac	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-OP16-006	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-OP16-009	belt loader	belt loader	electric	2000	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
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-OP16-022	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-OP16-034	baggage tractor	baggage tug	electric	2023	85	--	846	atgoe	taylor dun l40	in-use	off-road
LGB-OP16-035	baggage tractor	baggage tug	electric	2023	85	--	846	atgoe	taylor dun l40	in-use	off-road
LGB-OP16-036	baggage tractor	baggage tug	electric	2023	85	--	846	atgoe	taylor dun l40	in-use	off-road
LGB-OP16-026	aircraft tractor	a/c tug narrow body	diesel	2022	175	tier 4	385	ata27	tld- tmx350	in-use	off-road
LGB-OP16-027	baggage tractor	baggage tug	electric	2023	85	--	846	atgoe	taylor dun l40	in-use	off-road
LGB-OP16-028	baggage tractor	baggage tug	electric	2023	85	--	846	atgoe	taylor dun l40	in-use	off-road
LGB-OP16-029	baggage tractor	baggage tug	electric	2023	85	--	846	atgoe	taylor dun l40	in-use	off-road
LGB-OP16-030	baggage tractor	baggage tug	electric	2023	85	--	846	atgoe	taylor dun l40	in-use	off-road
LGB-OP16-031	ground power unit	ground power unit	diesel	2018	154	tier 4	798	agpu	tld gpu 4090-t-cup	in-use	off-road
LGB-OP16-032	cargo loader	cargo loader	gasoline	2018	385	--	556	al220	tld 929	in-use	off-road
LGB-OP16-033	cargo loader	cargo loader	diesel	2019	154	tier 4	556	al22d	tld 929	in-use	off-road
LGB-OP16-008	pushback tractor	a/c tug narrow body	diesel	1998	210	tier 1	45	ata27	stewart-stevenson	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-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	5	--	846	ap8600	lektro	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	--	506		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
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-OP13-021	provision truck	catering truck	gasoline	2019	200	--	928		mallaghan	in-use	on-road
LGB-OP13-032	bag tug	baggage tug	electric	2002	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

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-OP13-039	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	--	150		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	--	272		gt24	in-use	off-road
LGB-OP13-043	aircraft tow tractor	a/c tug narrow body	electric	2002	74	--	150	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
LGB-OP13-048	passenger stairs	passenger stand	gasoline	2018	40	--	137	cmpps87/137	phoenix metals	in-use	off-road
LGB-OP13-056	aircraft tow tractor	a/c tug narrow body	diesel	2014	100	tier 4	385	gt35	tug	in-use	off-road
LGB-OP13-057	passenger stairs	passenger stand	gasoline	2018	84	--	137	cmpps170	wollard	in-use	off-road
LGB-OP13-058	passenger stairs	passenger stand	gasoline	2018	84	--	137	cmpps170	wollard	in-use	off-road
LGB-OP13-059	belt loader	belt loader	electric	2023	60	--	706	660e	tug	in-use	off-road
LGB-OP13-060	belt loader	belt loader	electric	2023	60	--	706	660e	tug	in-use	off-road
LGB-OP13-061	bag tug	baggage tug	electric	2023	40	--	846	t-137 v3	charlatte	in-use	off-road
LGB-OP13-062	bag tug	baggage tug	electric	2023	40	--	846	t-137 v3	charlatte	in-use	off-road
LGB-OP13-063	bag tug	baggage tug	electric	2023	40	--	846	t-137 v3	charlatte	in-use	off-road
LGB-OP13-064	bag tug	baggage tug	electric	2023	40	--	846	t-137 v3	charlatte	in-use	off-road
LGB-OP13-065	bag tug	baggage tug	electric	2023	40	--	846	t-137 v3	charlatte	in-use	off-road
LGB-OP13-066	aircraft tow tractor	a/c tug narrow body	electric	2023	75	--	385	tmx 150 12e	tld	in-use	off-road
LGB-OP13-067	aircraft tow tractor	a/c tug narrow body	electric	2023	75	--	385	tmx 150 12e	tld	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-OP13-068	aircraft tow tractor	a/c tug narrow body	electric	2023	75	--	385	tmx 150 12e	tld	in-use	off-road
LGB-OP13-069	aircraft tow tractor	a/c tug narrow body	electric	2023	75	--	385	tmx 150 12e	tld	in-use	off-road
LGB-OP13-070	aircraft tow tractor	a/c tug narrow body	electric	2023	75	--	385	tmx 150 12e	tld	in-use	off-road
LGB-OP13-071	aircraft tow tractor	a/c tug narrow body	electric	2023	75	--	385	tmx 150 12e	tld	in-use	off-road
LGB-OP13-072	passenger stairs	passenger stand	gasoline	2024	25	--	63	cmpps87/137	phoenix metals	in-use	off-road
LGB-OP13-073	bag tug	baggage tug	electric	2024	40	--	435	t137 pro	charlatte	in-use	off-road
LGB-OP13-074	bag tug	baggage tug	electric	2024	40	--	53	t137 pro	charlatte	in-use	off-road
LGB-OP13-075	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-076	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-077	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-078	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-079	bag tug	baggage tug	electric	2024	40	--	180	t137 pro	charlatte	in-use	off-road
LGB-OP13-080	bag tug	baggage tug	electric	2024	40	--	180	t137 pro	charlatte	in-use	off-road
LGB-OP13-081	bag tug	baggage tug	electric	2024	40	--	180	t137 pro	charlatte	in-use	off-road
LGB-OP13-082	bag tug	baggage tug	electric	2024	40	--	180	t137 pro	charlatte	in-use	off-road
LGB-OP13-083	bag tug	baggage tug	electric	2024	40	--	180	t137 pro	charlatte	in-use	off-road
LGB-OP13-084	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-085	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-086	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-087	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-088	bag tug	baggage tug	electric	2024	40	--	150	t137 pro	charlatte	in-use	off-road
LGB-OP13-089	bag tug	baggage tug	electric	2024	40	--	53	t137 pro	charlatte	in-use	off-road
LGB-OP13-090	bag tug	baggage tug	electric	2024	40	--	53	t137 pro	charlatte	in-use	off-road
LGB-OP13-091	bag tug	baggage tug	electric	2024	40	--	53	t137 pro	charlatte	in-use	off-road
LGB-OP13-024	air start	air start unit	diesel	2018	333	tier 4	79		182491	in-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

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-OP13-028	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	--	798	2400 mobile	itw gse	in-use	off-road
LGB-OP13-050	ground power unit	ground power unit	electric	2022	155	--	798	2400 mobile	itw gse	in-use	off-road
LGB-OP13-051	ground power unit	ground power unit	electric	2022	155	--	798	2400 mobile	itw gse	in-use	off-road
LGB-OP13-052	air conditioner	air conditioner	electric	2001	131	--	391	ace-h-302-emp	tld	in-use	off-road
LGB-OP13-053	air conditioner	air conditioner	electric	2011	131	--	391	ace-h-302-emp	tld	in-use	off-road
LGB-OP13-054	air conditioner	air conditioner	electric	2011	131	--	391	ace-h-302-emp	tld	in-use	off-road
LGB-OP13-055	air conditioner	air conditioner	electric	2011	131	--	391	ace-h-302-emp	tld	in-use	off-road

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-OP07-003	AIRCRAFT TOW TRACTOR	A/C Tug Narrow Body	Diesel	1998	215	Tier 1	0	Low-Use	Off-Road	Moved from LGB to other airport (out of State)
LGB-OP07-004	AIRCRAFT TOW TRACTOR	A/C Tug Narrow Body	Diesel	1990	90	Tier 0	0	In-Use	Off-Road	Moved from LGB to other airport (out of State)
LGB-OP08-002	Aircraft Tractor	A/C Tug Narrow Body	Diesel	2011	84	Tier 3	63	Low-Use	Off-Road	Moved from LGB to other airport (Transferred to LRD on 4/26/24)
LGB-OP08-011	REFUELER	Fuel Truck	Diesel	2018	200	--	13	In-Use	On-Road	Moved from LGB to other airport (Unit transferred to HWD on 2/27/24)
LGB-OP18-013	GROUND POWER	Ground Power Unit	Diesel	2019	173	Tier 4	207	In-Use	Off-Road	Moved from LGB to other airport (4/5/2024 SAN)
LGB-OP13-004	Bag Tug	Baggage Tug	Electric	2002	40	--	506	In-Use	Off-Road	Scrapped (8/7/2024)
LGB-OP13-040	AIRCRAFT TOW TRACTOR	A/C Tug Narrow Body	Electric	1983	74	--	150	In-Use	Off-Road	Scrapped (5/23/2024)
LGB-OP13-042	AIRCRAFT TOW TRACTOR	A/C Tug Narrow Body	Electric	1984	74	--	272	In-Use	Off-Road	Scrapped (9/16/2024)

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-OP13-043	AIRCRAFT TOW TRACTOR	A/C Tug Narrow Body	Electric	2002	74	--	150	In-Use	Off-Road	Scrapped (5/23/2024)

Note. In RY24 GSE survey, unit LGB-OP18-014 was identified to be a duplicate of unit LGB-OP18-12, inadvertently reported in prior years, and was eliminated.

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
182	108	35	34	5	12.3	0.8	2.5	0.10	0.08	<0.01	1,253

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:

0.45 grams per brake horsepower-hour

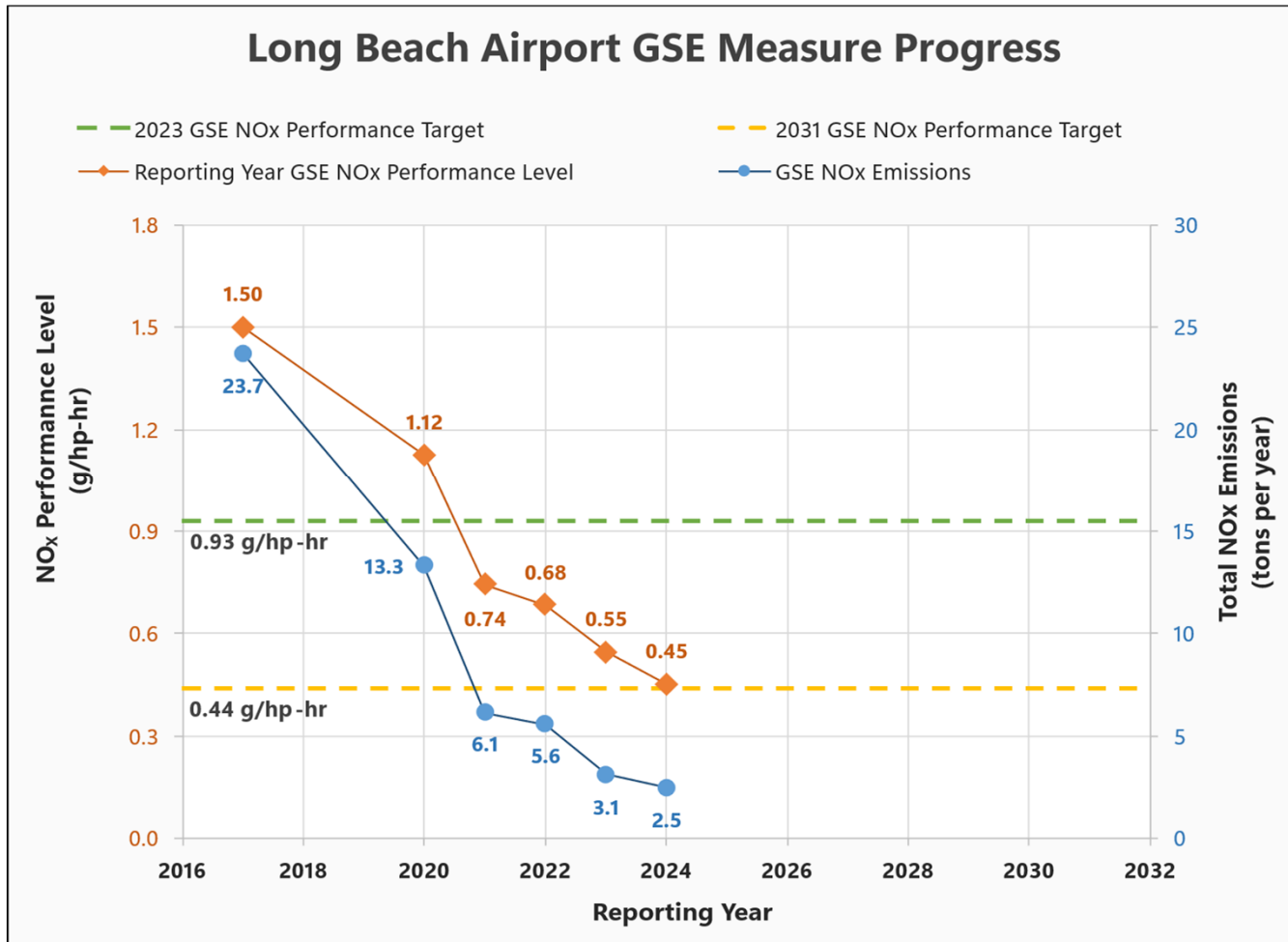


Exhibit B

*MOU Schedule No. 1 – Calendar Year 2024 Ground Support
Equipment Survey Emissions Inventory Report, Revised May
2026*

**COMMERCIAL
AIRPORTS MOU
SUPPORT**

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

**2024 Survey and Inventory Report
Revised May 2026**



long beach
airport

May 2026

**CDM
Smith**

This page intentionally left blank.

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

Key Contacts:

Juan López-Ríos
Deputy Director

Long Beach Airport
4100 E. Donald Douglass Dr., Floor 2
Long Beach, CA 90808
(562) 570-2608
juan.lopez-rios@longbeach.gov

Gilberto Contreras
Administrative Analyst

Long Beach Airport
4100 E. Donald Douglass Dr., Floor 2
Long Beach, CA 90808
(562) 570-2707
gilberto.contreras@longbeach.gov

Jeremy Gilbride, PE
Chemical Engineer

CDM Smith, Inc.
75 State Street, Suite 701
Boston, MA 02109
(949) 930-9809
gilbridej@cdmsmith.com

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 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 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 2024 LGB GSE survey and associated emissions inventory.

On May 30, 2025, LGB submitted an initial MOU progress report for reporting year 2024 for South Coast AQMD review and comment. On January 30, 2026, South Coast AQMD provided comments on the initial report. This revised report details the results of the reporting year 2024 LGB GSE survey and associated emissions inventory, incorporating revisions to address South Coast AQMD comments.

Section 2

Methodology

Data collected for the 2024 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 Collection of Data

In February 2025, 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 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 throughout May.

Each unit of reported GSE was reviewed for accuracy and program applicability based on previously submitted data, MOU requirements, and professional judgment. Non-electric GSE with power ratings less than or equal to 25 horsepower are exempt from the California Air Resources 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 excluded from the performance level calculations. Consistent with the MOU requirements, low-use equipment (defined as operating fewer than 200 hours per year) were also excluded from performance level calculations. Both non-electric GSE with power ratings less than or equal to 25 horsepower and low- and emergency-use equipment were retained in the inventory for the purposes of determining total annual NO_x emissions from GSE. 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 as needed. Such adjustments may include but are not limited to: adjustments to engine model year, horsepower, or fuel type data based on discussions with equipment operators or review of previously reported data; 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. 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 was used.

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

2.2 Performance 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 2-3 in the *Long Beach Airport AQIP Technical Support Document*. Emission factors from the emissions models were queried for the Los Angeles (South Coast) region for CY 2024, 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 rating, and fuel type of the equipment.

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.

2.3 Emission Calculations

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, particularly for new equipment. South Coast AQMD 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 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 CY 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.

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)

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.

Section 3

GSE Inventory

The reporting year 2024 GSE inventory for the Airport is presented below.

3.1 GSE Operators

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

Table 2. LGB GSE Operators

Commercial ¹	Noncommercial
AGI (Delta Air Lines)	Aero City Maintenance
Airserv	Aeroplex (FBO)
Atlantic Aviation (FBO)	Gulfstream
Catalina Flying Boats	LA County Sheriff's Dept. Aero Bureau
Signature Aviation	Long Beach Flying Club and Flight Academy
Southwest Airlines	OCR Aviation
Unifi Aviation (Hawaiian Airlines)	Olen Properties
UPS	Quinn Group
West Coast Aircraft Maintenance	

Notes:

1. Commercial operators are defined as those operators supporting commercial aviation, including passenger airlines, cargo operations, or charter operations. Consistent with the MOU requirements and with concurrence with South Coast AQMD staff, only GSE associated with commercial operations are included in the annual MOU GSE surveys.

2. In 2022, Gulfstream divested the last of its fulfillment center operations at the Airport. Gulfstream now only provides maintenance support to private jet owners visiting the Airport, and its remaining operations are considered noncommercial.

3.2 Equipment Breakdown

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

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

GSE Category	Total Reported Equipment ¹	Electric	Diesel	Gasoline	LPG/Propane
Aircraft Tug	22	15	7	--	--
Air Conditioner	8	7	1	--	--
Air Start Unit	3	--	3	--	--
Baggage Tug	52	46	--	6	--
Belt Loader	21	15	1	5	--
Cargo Loader	4	--	2	2	--
Cargo Tractor	--	--	--	--	--
Cart	7	7	--	--	--
Catering Truck	1	--	--	1	--
Forklift	6	--	--	1	5
Fuel Truck	17	--	13	4	--
Generator	--	--	--	--	--
Ground Power Unit	19	11	8	--	--
Lavatory Cart	3	3	--	--	--
Lavatory Truck	1	--	--	1	--
Lift	1	1	--	--	--
Maintenance Truck	--	--	--	--	--
Other GSE	--	--	--	--	--
Passenger Stand	8	--	--	8	--
Service Truck	5	--	--	5	--
Sweeper	4	3	--	1	--
Water Truck	--	--	--	--	--
Total	182	108	35	34	5

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.

3.3 Emissions Inventory

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

Table 4. Commercial Emissions by GSE Category

GSE Category	Emissions (tons per year; metric tons per year for CO ₂ e)						
	CO	ROG	NO _x	PM ₁₀	PM _{2.5}	SO _x	CO ₂ e
Aircraft Tug	0.4	<0.1	0.2	0.01	0.01	<0.01	82
Air Conditioner	0.1	<0.1	<0.1	<0.01	<0.01	<0.01	14
Air Start Unit	<0.1	<0.1	<0.1	<0.01	<0.01	<0.01	20
Baggage Tug	2.9	0.2	0.2	0.01	0.01	<0.01	149
Belt Loader	1.9	<0.1	0.2	0.01	0.01	<0.01	125
Cargo Loader	1.3	<0.1	0.1	0.01	0.01	<0.01	160
Cart	--	--	--	--	--	--	--
Catering Truck	<0.1	<0.1	<0.1	<0.01	<0.01	<0.01	26
Forklift	2.3	0.2	0.6	0.01	0.01	<0.01	74
Fuel Truck	0.9	0.1	0.4	0.02	0.02	<0.01	382
Generator	0.1	<0.1	0.1	<0.01	<0.01	<0.01	19
Ground Power Unit	0.7	<0.1	0.3	0.01	0.01	<0.01	120
Lavatory Cart	--	--	--	--	--	--	--
Lavatory Truck	<0.1	<0.1	<0.1	<0.01	<0.01	<0.01	6
Lift	--	--	--	--	--	--	--
Passenger Stand	0.6	0.1	0.1	<0.01	<0.01	<0.01	39
Service Truck	0.3	<0.1	<0.1	<0.01	<0.01	<0.01	33
Sweeper	0.8	<0.1	<0.1	<0.01	<0.01	<0.01	5
Total	12.3	0.8	2.5	0.10	0.08	0.00	1,253

Key: CO = carbon monoxide; CO₂e = 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

3.4 Fleet-Wide Performance Level and Emissions

The Airport's fleet-wide NO_x performance factor for commercial GSE in the 2024 reporting year was 0.45 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 emissions from commercial GSE in the 2024 reporting year totaled 2.5 tons of NO_x, reflecting an 89 percent reduction relative to the fleet-wide emissions at GSE program inception. **Figure 1** presents the historical fleet-wide NO_x performance factor by survey year.

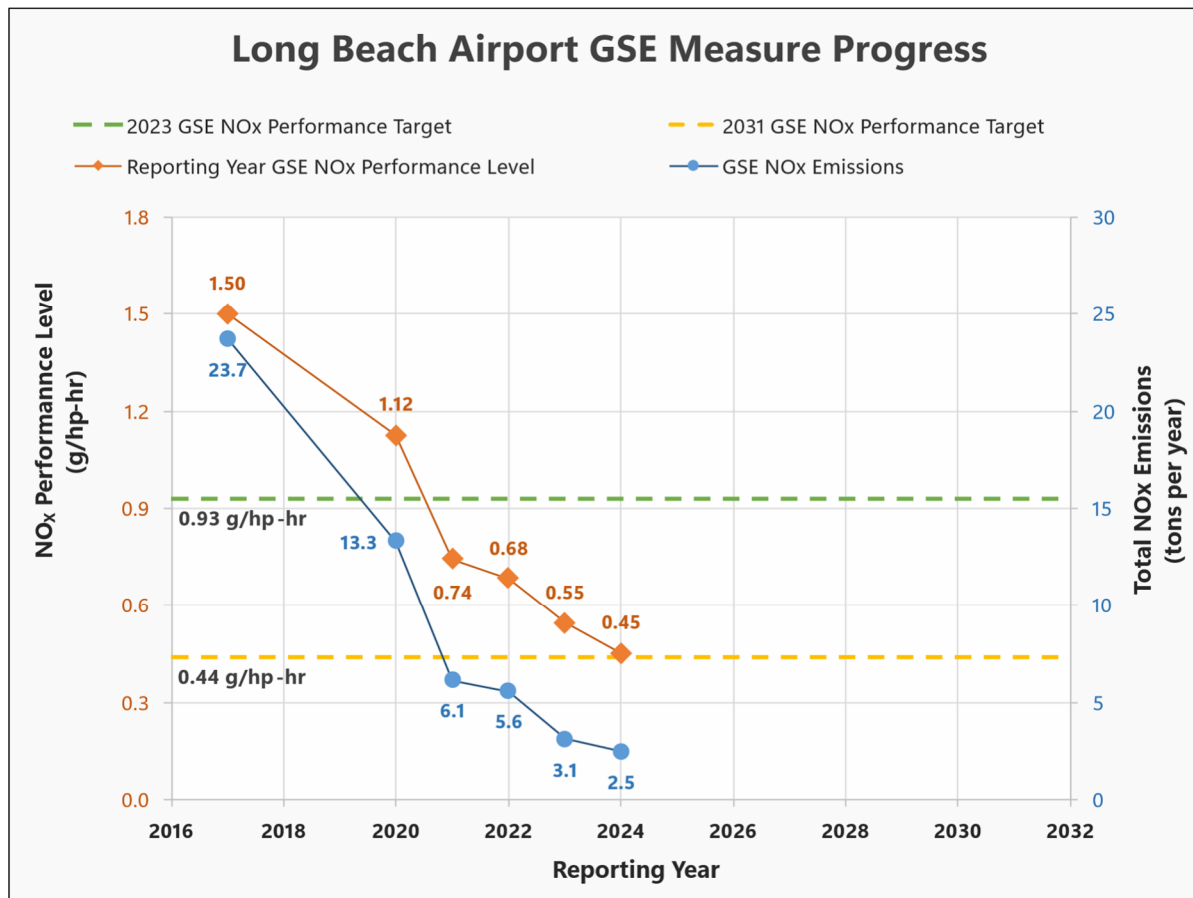


Figure 1. GSE Program Fleet-Wide Commercial NO_x Performance Level and Emissions by Survey Year

Attachment A

Detailed Commercial GSE Data and Emissions

2024 LGB Commercial GSE Survey — Progress To-Date

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][5][6]} (g/hp-hr)
2017	320	48.4%	16.8	23.7	1.50
2018					
2019					
2020	248	38.7%	16.0	13.3	1.12
2021	160	46.9%	--	6.1	0.74
2022	164	50.6%	--	5.6	0.68
2023	173	55.5%	--	3.1	0.55
2023				Performance Target:	0.93
2024	182	59.3%	--	2.5	0.45
2025					
2026					
2027					
2028					
2029					
2030					
2031					
2031				Performance Target:	0.44
2032					

Notes:

[1] Excludes <25hp non-electric, low-use, and emergency-use equipment; Includes both new and removed equipment that operated at any point in reporting period.

[2] Includes <25hp non-electric, low-use, emergency-use, and both new and removed equipment that operated at any point in reporting period.

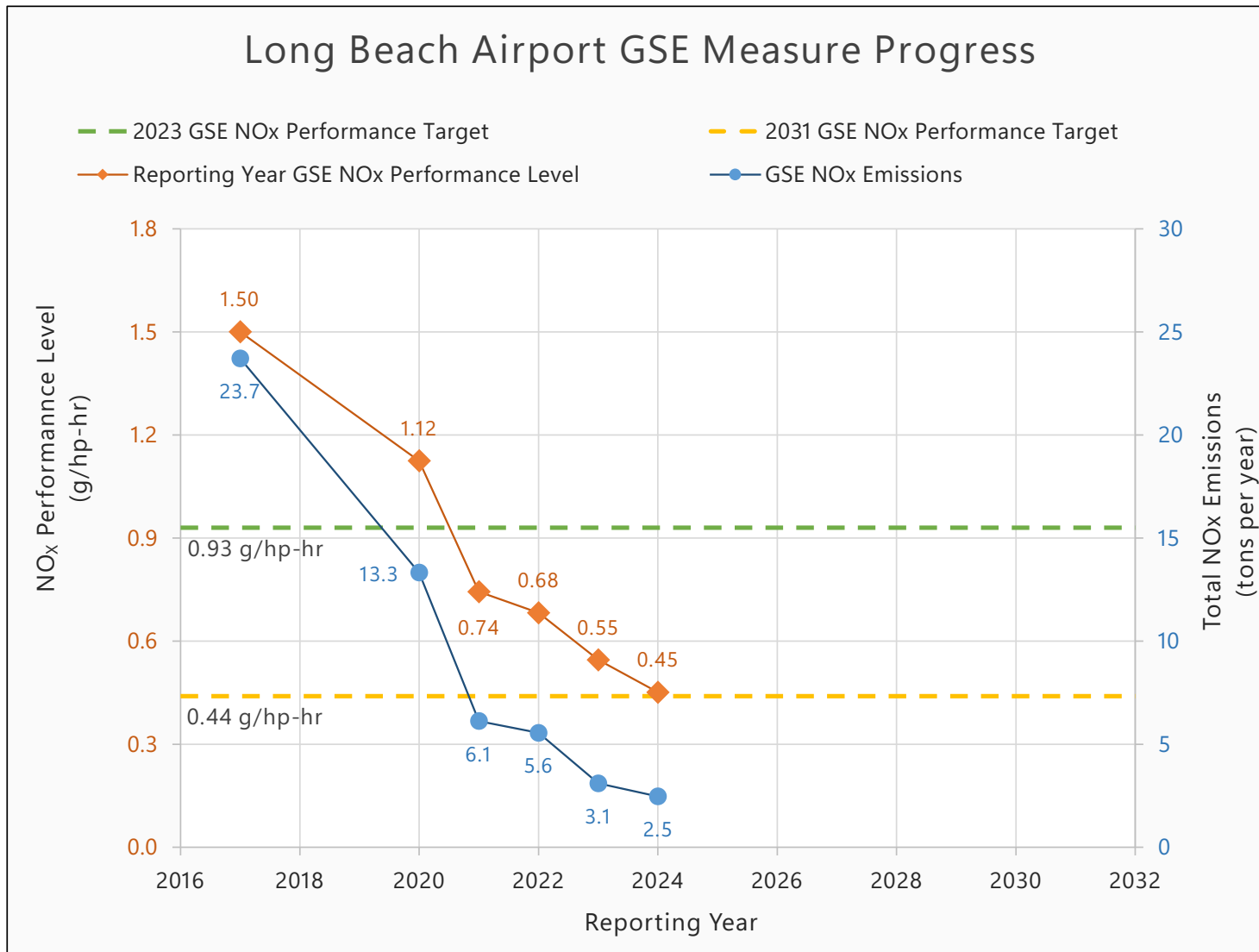
[3] Emission factors back-calculated from OFFROAD2017 outputs (outdated LSI emission factors).

[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**.

[6] Reporting year 2020 performance factor calculated using emission factors provided by CARB July 2021 based on certified engine standards (LSI) and 2017 ORDAS model (ORD). Reporting year 2017 factor and targets for years 2023 and 2031 based on back-calculated emission factors from the OFFROAD2017 model.

2024 LGB Commercial GSE Survey — Progress To-Date



2024 LGB Commercial GSE Survey — Progress To-Date

Airport-wide Reportable GSE Fleet Equipment Inventory <u>Excludes</u> <25hp non-electric, low-use, and emergency-use equipment; <u>Includes</u> both new and removed equipment that operated at any point in reporting period.					
	Diesel	Gasoline	LPG	Electric	Total
Overall Fleet	35	34	5	108	182
Overall Fleet Percent	19.2%	18.7%	2.7%	59.3%	--
A/C Tug Narrow Body	7	0	0	15	22
Air Conditioner	1	0	0	7	8
Air Start Unit	3	0	0	0	3
Baggage Tug	0	6	0	46	52
Belt Loader	1	5	0	15	21
Cargo Loader	2	2	0	0	4
Cart	0	0	0	7	7
Catering Truck	0	1	0	0	1
Forklift	0	1	5	0	6
Fuel Truck	13	4	0	0	17
Generator	0	0	0	0	0
Ground Power Unit	8	0	0	11	19
Lav Cart	0	0	0	3	3
Lav Truck	0	1	0	0	1
Lift	0	0	0	1	1
Passenger Stand	0	8	0	0	8
Service Truck	0	5	0	0	5
Sweeper	0	1	0	3	4

2024 LGB Commercial GSE Survey — Progress To-Date

Airport-wide Total GSE Fleet Equipment Inventory <i>Includes</i> <25hp non-electric, low-use, emergency-use, and both new and removed equipment that operated at any point in reporting period.						
	In-Use	Low- or Emergency-Use	New Equipment	Removed Equipment	Total (all reported)	Electric (all reported)
Overall Fleet	186	13	24	10	199	108
Overall Fleet Percent	93.5%	6.5%	--	--	--	--
A/C Tug Narrow Body	22	3	1	7	25	15
Air Conditioner	8	1	0	0	9	7
Air Start Unit	3	0	0	0	3	0
Baggage Tug	52	1	19	1	53	46
Belt Loader	21	3	0	0	24	15
Cargo Loader	4	0	0	0	4	0
Cart	7	0	0	0	7	7
Catering Truck	1	0	0	0	1	0
Forklift	6	0	0	0	6	0
Fuel Truck	17	1	2	1	18	0
Generator	4	0	0	0	4	0
Ground Power Unit	19	0	1	1	19	11
Lav Cart	3	0	0	0	3	3
Lav Truck	1	0	0	0	1	0
Lift	1	0	0	0	1	1
Passenger Stand	8	4	1	0	12	0
Service Truck	5	0	0	0	5	0
Sweeper	4	0	0	0	4	3

2024 LGB Commercial GSE Survey — Progress To-Date

Airport-wide Total GSE Fleet Emissions Inventory <i>Includes</i> <25hp non-electric, low-use, emergency-use, and both new and removed equipment that operated at any point in reporting period.							
	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	0.8	12.3	2.5	0.10	0.08	1,253	<0.01
Overall Fleet Percent	--	--	--	--	--	--	--
A/C Tug Narrow Body	<0.1	0.4	0.2	0.01	0.01	82	<0.01
Air Conditioner	<0.1	0.1	<0.1	<0.01	<0.01	14	<0.01
Air Start Unit	<0.1	<0.1	<0.1	<0.01	<0.01	20	<0.01
Baggage Tug	0.2	2.9	0.2	0.01	0.01	149	<0.01
Belt Loader	<0.1	1.9	0.2	0.01	0.01	125	<0.01
Cargo Loader	<0.1	1.3	0.1	0.01	0.01	160	<0.01
Cart	--	--	--	--	--	--	--
Catering Truck	<0.1	<0.1	<0.1	<0.01	<0.01	26	<0.01
Forklift	0.2	2.3	0.6	0.01	0.01	74	<0.01
Fuel Truck	0.1	0.9	0.4	0.02	0.02	382	<0.01
Generator	<0.1	0.1	0.1	<0.01	<0.01	19	<0.01
Ground Power Unit	<0.1	0.7	0.3	0.01	0.01	120	<0.01
Lav Cart	--	--	--	--	--	--	--
Lav Truck	<0.1	<0.1	<0.1	<0.01	<0.01	6	<0.01
Lift	--	--	--	--	--	--	--
Passenger Stand	0.1	0.6	0.1	<0.01	<0.01	39	<0.01
Service Truck	<0.1	0.3	<0.1	<0.01	<0.01	33	<0.01
Sweeper	<0.1	0.8	<0.1	<0.01	<0.01	5	<0.01

2024 LGB Commercial GSE Survey — Progress To-Date

Condensed Summary of GSE Fuel Type and Tier Rating Changes

2024 (change vs 2023)

Fleet Inventory Equipment Count

Excludes low-use equipment, <25 hp non-electric equipment.

Overall Fleet	182 (+9)
Diesel	35 (-5)
<i>Tier 4</i>	22 (-2)
<i>Tier 4i</i>	3 (-1)
<i>Tier 3</i>	1 (-1)
<i>Tier 2</i>	0 (-)
<i>Tier 1</i>	1 (-)
<i>Tier 0</i>	0 (-1)
<i>On-Road</i>	8 (-)
Gasoline	34 (+2)
<i>Pre-2010</i>	4 (-)
<i>2010 and Newer</i>	30 (+2)
LPG	5 (-)
<i>Pre-2010</i>	4 (-)
<i>2010 and Newer</i>	1 (-)
Electric	108 (+12)

2024 (change vs 2019)

Fleet Inventory Equipment Count

Excludes low-use equipment, <25 hp non-electric equipment.

Overall Fleet	182 (-138)
Diesel	35 (-63)
<i>Tier 4</i>	22 (+13)
<i>Tier 4i</i>	3 (+1)
<i>Tier 3</i>	1 (-2)
<i>Tier 2</i>	0 (-13)
<i>Tier 1</i>	1 (-51)
<i>Tier 0</i>	0 (-19)
<i>On-Road</i>	8 (+8)
Gasoline	34 (-15)
<i>Pre-2010</i>	4 (-32)
<i>2010 and Newer</i>	30 (+17)
LPG	5 (-13)
<i>Pre-2010</i>	4 (-11)
<i>2010 and Newer</i>	1 (-2)
Electric	108 (-47)

2024 LGB Commercial GSE Survey — Progress To-Date

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

Excludes low-use equipment and <25 hp non-electric equipment.

2024 Fleet (difference as compared to 2023)

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 (-)	0 (-1)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-1)
Tier 1	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	1 (-)	0 (-)	0 (-)	0 (-)	1 (-)
Tier 2	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)
Tier 3	0 (-)	0 (-)	0 (-)	0 (-)	1 (-1)	0 (-)	0 (-)	0 (-)	0 (-)	1 (-1)
Tier 4i	0 (-)	0 (-)	0 (-)	0 (-)	1 (-1)	2 (-)	0 (-)	0 (-)	0 (-)	3 (-1)
Tier 4	4 (-)	2 (-)	1 (-1)	4 (-)	8 (-)	4 (-1)	3 (-)	0 (-)	0 (-)	22 (-2)
Total										27 (-5)

Note. Totals exclude <25 hp equipment.

2024 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 (-)	0 (-1)	0 (-15)	0 (-1)	0 (-)	0 (-)	0 (-)	0 (-19)
Tier 1	0 (-)	0 (-26)	0 (-1)	0 (-3)	0 (-19)	1 (-1)	0 (-)	0 (-1)	0 (-)	1 (-51)
Tier 2	0 (-)	0 (-)	0 (-3)	0 (-3)	0 (-6)	0 (-)	0 (-)	0 (-1)	0 (-)	0 (-13)
Tier 3	0 (-)	0 (-)	0 (-)	0 (-)	1 (-)	0 (-)	0 (-1)	0 (-1)	0 (-)	1 (-2)
Tier 4i	0 (-)	0 (-)	0 (-1)	0 (-)	1 (-)	2 (+2)	0 (-)	0 (-)	0 (-)	3 (+1)
Tier 4	4 (+4)	2 (-1)	1 (-)	4 (+3)	8 (+5)	4 (+3)	3 (+3)	0 (-)	0 (-)	22 (+13)
Total										27 (-71)

Note. Totals exclude <25 hp equipment.

2024 LGB Commercial GSE Survey — Progress To-Date

Comparison of Engine Model Year & Fuel Type by Reporting Year

Excludes low-use equipment and <25 hp non-electric equipment.

2024 Fleet (difference as compared to 2023)

Fuel Type					
Model Year	Gasoline	LPG/Propane	Electric	Diesel	Total
≤ 2007	4 (-)	4 (-)	29 (-7)	2 (-1)	39 (-8)
2008 - 2009	0 (-)	0 (-)	3 (-)	0 (-)	3 (-)
2010 - 2015	2 (-)	1 (-)	12 (-)	11 (-3)	26 (-3)
2016 - 2020	25 (-)	0 (-)	14 (-)	15 (-1)	54 (-1)
≥ 2021	3 (+2)	0 (-)	50 (+19)	7 (-)	60 (+21)
Total:	34 (+2)	5 (-)	108 (+12)	35 (-5)	182 (+9)

2024 Fleet (difference as compared to 2019 reporting year [based on 2017 fleet])

Fuel Type					
Model Year	Gasoline	LPG/Propane	Electric	Diesel	Total
≤ 2007	4 (-23)	4 (-9)	29 (-66)	2 (-83)	39 (-181)
2008 - 2009	0 (-9)	0 (-2)	3 (-4)	0 (-3)	3 (-18)
2010 - 2015	2 (-7)	1 (+1)	12 (-25)	11 (+7)	26 (-24)
2016 - 2020	25 (+21)	0 (-3)	14 (-2)	15 (+9)	54 (+25)
≥ 2021	3 (+3)	0 (-)	50 (+50)	7 (+7)	60 (+60)
Total:	34 (-15)	5 (-13)	108 (-47)	35 (-63)	182 (-138)

This page intentionally left blank.

Exhibit C

*South Coast AQMD Comments on May 30, 2025, Calendar Year
2024 MOU Progress Report and Airport Responses*



Memorandum

To: *Melissa Gamoning
Program Supervisor
South Coast Air Quality Management District*

From: *CDM Smith and Long Beach Airport*

Date: *March 27, 2026*

Subject: *Responses to South Coast Air Quality Management District Comments on the Long Beach Airport Memorandum of Understanding Annual Progress Report, dated May 30, 2025*

Purpose

This memorandum documents responses to South Coast Air Quality Management District (“SCAQMD” or “the District”) comments on the Long Beach Airport (“LGB” or “the Airport”) Memorandum of Understanding (MOU) Progress Report for calendar year 2024, submitted May 30th, 2025. The Airport’s only measure in the MOU is for emission reductions to ground support equipment (GSE).

Responses have been prepared by CDM Smith on behalf of the Airport. **Bold** font weighting is used to identify specific revisions which will be applied, to address SCAQMD comment, under a final revised LGB MOU Progress Report.

Responses to AQMD Comments

Comment #1

About 6% of GSE emissions come from just the following units. Please validate the following entries and make corrections, if needed.

Eq ID	Type	Fuel	Tier	Hp	Year	Use	Hrs
LGB-OP07-002	Fuel Truck	Diesel	Tier 0	275	1981	Low-Use	83
LGB-OP03-001	Forklift	LPG	--	93	1993	In-Use	730
LGB-OP08-006	Fuel Truck	Gasoline	--	300	1995	In-Use	172
LGB-OP03-002	Forklift	LPG	--	94	1996	In-Use	730
LGB-OP19-007	Baggage Tug	Gasoline	--	140	1998	Low-Use	50
LGB-OP12-002	Forklift	LPG	--	50	1998	In-Use	591
LGB-OP16-022	Ground Power Unit	Diesel	Tier 3	155	2010	In-Use	798
LGB-OP20-013	Ground Power Unit	Diesel	Tier 4	94	2016	In-Use	798
LGB-OP13-007	Baggage Tug	Gasoline	--	40	2016	In-Use	846
LGB-OP08-005	Fuel Truck	Diesel	Tier 4	250	2017	In-Use	2467

LGB-OP07-025	Ground Power Unit	Diesel	Tier 4	74	2019	In-Use	798
--------------	-------------------	--------	--------	----	------	--------	-----

Response to Comment #1

It is understood that the District is requesting confirmation that a small number of vehicles are estimated to generate a disproportionate amount of the residual GSE emissions at the Airport. Although the comment states “6% of GSE emissions,” it is understood that the District likely meant to state that “6% of equipment by count represent 50% of emissions,” which is accurate to the equipment specified in the Comment #1 table.

The vehicles presented in the Comment #1 table were estimated to generate roughly 50% of the Airport-wide NOx emissions from GSE at LGB. This statement is accurate; based on information available to the Airport, the operating specifications, hours, and emissions from these units are accurate.

The Airport would like to highlight that the Airport's fleet is 59% electric GSE, and annual NOx emissions have been cut by 20.8 tons annually (an 88 percent reduction) since the program's inception. Most legacy GSE have been eliminated, and among the top 10 emitters, 3 meet the strictest Tier 4 diesel standards. Although a small number of units account for a large share of the residual GSE emissions, this reflects the program's success rather than any sort of failure. Nevertheless, the Airport continues each year to engage its operators and encourage the continuing turnover of these remaining high-emitting units to clean alternatives.

Comment #2

Please verify significant changes found in the operating hours of the following units. If the operator provided data for 2024 but not for 2023 (or for 2023 and not for 2024), use the same data for both years instead of using off-road model default operating hours.

Eq ID	Type	Tier/Fuel	Hp	Year	Use	2024 Hrs	2023 Hrs
LGB-OP07-004	A/C Tug Narrow Body	Tier 0	90	1990	In-Use	385	6
LGB-OP07-003	A/C Tug Narrow Body	Tier 1	215	1998	Low-Use	200	0
LGB-OP08-010	Service Truck	Gasoline	119	2000	In-Use	262	883
LGB-OP16-022	Ground Power Unit	Tier 3	155	2010	In-Use	798	420
LGB-OP08-015	Ground Power Unit	Tier 4i	130	2013	In-Use	152	798
LGB-OP08-005	Fuel Truck	Tier 4	250	2017	In-Use	2467	83
LGB-OP16-031	Ground Power Unit	Tier 4	154	2018	In-Use	798	50
LGB-OP16-032	Cargo Loader	Gasoline	385	2018	In-Use	556	61
LGB-OP16-033	Cargo Loader	Tier 4	154	2019	In-Use	556	24
LGB-OP18-013	Ground Power Unit	Tier 4	173	2019	In-Use	207	669
LGB-OP08-028	Service Truck	Gasoline	310	2022	In-Use	2908	303
LGB-OP08-026	Fuel Truck	Tier 4	250	2023	In-Use	3025	32

Response to Comment #2

The differences in operating hours identified by the District between the calendar year 2023 and 2024 reports for most of the equipment identified in the Comment #2 table are the reflection of actual

operational differences, supported by data provided to the Airport by the GSE owners. These real differences include various combinations of pro-rating operating hours due to equipment being relocated to or from of the Airport; or default operating hours being assumed in 2023 with actual operating hours provided in 2024.

CDM Smith identified two discrepancies for units LGB-OP07-003 and LGB-OP07-004, which were removed from service in 2023 and inactive throughout 2024. **LGB-OP07-003 and LGB-OP07-004 were mistakenly assigned default operating hours in the 2024 report; this will be corrected in the final revised MOU report.**

Regarding the use of 2024 Operating Hours in the 2023 Report

The District has recommended revising the calendar year 2023 emission estimates by applying the operating hours from calendar year 2024. While it is acknowledged that the operating hours provided for one year could sometimes serve as a reasonable proxy for prior years, there is no certainty that this will always be the case. Airports, including LGB, operate in highly dynamic environments where activity can fluctuate significantly year over year.

In 2024, LGB experienced its busiest year on record, with historic monthly enplanement numbers in both March and May, and a substantial 14% increase in enplanements during the summer months compared to the summer of 2023. These changes illustrate the variability inherent in airport operations. Additionally, factors such as operator mergers, shifts in airline priorities, and changes to the GSE fleet—potentially influenced by the MOU—can all contribute to considerable changes in airfield operational patterns, even if not immediately apparent.

Given these considerations, it is essential for the Airport to ensure that all reporting is based on actual operating data supplied by the GSE owners. Relying solely on the 2024 operating hours to update the 2023 report would introduce a level of speculation that is not acceptable for accurate reporting. Therefore, the Airport respectfully declines to reissue the 2023 report using 2024 operating data as the basis for these estimates.

Comment #3

Please confirm that unit LGB-OP16-008 did not operate in 2024 prior to its scrapping reported 2/13/2024. If the unit was operated, please make necessary corrections.

Response to Comment #3

Upon further review, no clear evidence has been made available to confirm that LGB-OP16-008 was inoperable prior to its removal in February of 2024. Given the significant time which has passed since February of 2024, additional records cannot be obtained regarding this removed unit. **Operating hours for LGB-OP16-008 will be updated to reflect default operating hours, prorated based on its time spent at LGB in 2024; this will be corrected in the final revised MOU report.**

Comment #4

Unit LGB-OP08-15 has less than 200 operating hours in 2024 but is marked as “in-use” please make necessary corrections and double check other units.

Response to Comment #4

Although the MOU does not specifically define “low-use” nor prescribe the definition established by California Air Resources Board (CARB), for all previous MOU reporting, CARB’s definition has been used. While CARB’s definition limits equipment usage to no greater than an average of 200 hours per year over a three-year period, the core applicable aspects to CARB’s definition are that a low-use designation is irrevocable and legally binding. A vehicle is thus not considered low-use if it operates for fewer than 200 hours in any given year; it is considered low-use only when registered and committed to never operating more than an average of 200 hours annually over a three-year period.

Each unit’s use is reported by GSE owners during the data survey period. GSE owners are instructed to provide the equipment status as reported in CARB’s Diesel Off-Road Online Reporting System (DOORS). LGB requests the actual annual operating hour data for all non-electric equipment.

Comment #5

Please double check NOx in-use emission factors used in performance level calculations. The following table shows some examples of possible abnormalities.

Eq ID	Type	Hp	Year	NOx In-Use EF
LGB-OP16-022	Ground Power Unit	155	2010	0.847
LGB-OP16-031	Ground Power Unit	154	2018	0.090
LGB-OP16-033	Cargo Loader	154	2019	0.089
LGB-OP16-024	Cargo Loader	154	2021	0.360
LGB-OP18-015	Ground Power Unit	155	2022	0.087
LGB-OP08-023	Fuel Truck (On-Road)	235	2000	0.350
LGB-OP08-021	Fuel Truck (On-Road)	215	2014	0.313
LGB-OP08-034	Fuel Truck (On-Road)	215	2014	0.313
LGB-OP08-013	Fuel Truck (On-Road)	260	2019	0.278
LGB-OP08-019	Fuel Truck (On-Road)	210	2021	0.267
LGB-OP08-022	Fuel Truck (On-Road)	260	2022	0.262
LGB-OP08-025	Fuel Truck (On-Road)	210	2022	0.262

CDM Smith Note — The above table was included below Comment #7 in the District’s comment letter but is understood to be applicable to Comment #5.

Response to Comment #5

The MOU and each airport’s aggregate performance targets were developed in 2019 using emission factors derived from CARB’s then-current OFFROAD emissions model, OFFROAD2017. To ensure a like-to-like comparison of airport performance progress against the MOU targets, LGB in concurrence with SCAQMD under prior reporting periods, has continued to use OFFROAD2017 factors for evaluating performance characteristics instead of updating to a more recent emissions model.

It is understood that due to gaps in the OFFROAD2017 model's coverage, for specific combinations of fuel types, horsepower ratings, equipment types, and the extremes of equipment ages, GSE performance factors may be inconsistently estimated from calendar year to calendar year. The November 26, 2024 [*Final Methodology for Calculating Ground Support Equipment Fleet Average Emission Factor*](#) guidance establishes a consistent approach to addressing gap equipment. The in-use performance factors for all LGB GSE in the MOU Annual Progress Report for calendar year 2024 were selected and are consistent with the guidance.

LGB-OP16-024

For unit LGB-OP16-024 identified in the Comment #5 table, the 0.360 factor presented is due to a gap in the OFFROAD2017 model. Despite having an exact match in the model, its model year (2021) has an abnormally high calculated performance factor of 0.36 relative to the expected value of 0.09. This issue is present for model year 2020 and 2018 equipment as well, shown in the table below.

Cargo Loader OFFROAD2017 Inconsistencies

Calendar Year	Vehicle Category	Model Year	Horsepower Bin	Fuel	NOx Emissions (tons per day)	Activity (horsepower-hours/year)	MOU Performance Factor
2024	Cargo Loader	2015	175	Diesel	3.4905E-05	127,175	0.09
2024	Cargo Loader	2016	175	Diesel	1.4759E-04	540,843	0.09
2024	Cargo Loader	2017	175	Diesel	7.2805E-05	268,325	0.09
2024	Cargo Loader	2018	175	Diesel	6.1604E-04	1,088,954	0.19
2024	Cargo Loader	2019	175	Diesel	1.3853E-04	516,526	0.09
2024	Cargo Loader	2020	175	Diesel	7.6537E-04	730,068	0.35
2024	Cargo Loader	2021	175	Diesel	1.0547E-03	969,605	0.36
2024	Cargo Loader	2022	175	Diesel	2.2242E-05	84,411	0.09
2024	Cargo Loader	2023	175	Diesel	2.2256E-05	84,970	0.09
2024	Cargo Loader	2024	175	Diesel	4.1190E-05	158,200	0.09
2024	Cargo Loader	2025	175	Diesel	1.8776E-05	72,112	0.09

Source: CDM Smith 2026; California Air Resources Board, OFFROAD2017 v1.0.1 Emission Inventory for Los Angeles (SC)

Under LGB's MOU, the performance factor is calculated as the tons per day, annualized to 365 days, converted to grams, divided by the activity in horsepower hours. This results in a performance factor which is slightly different in form from the Tier 4 final standard. To properly compare against the standard, a unitless load factor (approximately 0.30 for Cargo Loaders) would need to be divided out from the MOU performance factor.

When the MOU performance factor is adjusted for comparison to the Tier 4 final standard, the 0.09 performance factor prevalent for 2014+ diesel equipment of the 175 horsepower bin would equal 0.30, the exact value of the Tier 4 final standard which went into effect in 2014 for this horsepower bin. When the MOU performance factor assigned for LGB-OP16-024 is adjusted, it totals 1.20, four times the applicable standard.

Nonetheless, the November 26, 2024 [*Final Methodology for Calculating Ground Support Equipment Fleet Average Emission Factor*](#) guidance directs the Airport to use the exact match factor from the OFFROAD2017 model; thus, although the District has flagged the value as atypical and the Airport acknowledges that the factor is overconservative for this equipment, the initially reported performance factor will be retained.

LGB-OP08-023 and LGB-OP08-25

Units LGB-OP08-023 and LGB-OP08-25 each have on-road engines; thus, their performance factors are not calculated using OFFROAD2017, but factors derived predominantly from EMFAC2017. Total NO_x exhaust emissions (in tons per day) are converted to grams, divided by the vehicle miles traveled per day, and then multiplied by an assumed 15 miles per hour (for on-airfield activity). Then the average vehicle horsepower for the given equipment type and horsepower bin (derived from the OFFROAD2017 model's activity data) are divided out to produce the MOU performance factor. This approach has been consistently applied for on-road equipment throughout the MOU reporting period.

Upon reviewing the specific equipment identified in the Comment #5 table, LGB-OP08-023 and LGB-OP08-25 which are each refuelers, no abnormalities were identified.

Comment #6

Please confirm whether the determination of emissions factors conform to the latest methodology [[*methodology-for-calculating-ground-support-equipment-fleet-average-emission-factor.pdf*](#)]

Response to Comment #6

Emission factors in the LGB MOU Annual Report for calendar year 2024 were identified consistent with the methods detailed in the November 26, 2024 [*Final Methodology for Calculating Ground Support Equipment Fleet Average Emission Factor*](#) guidance.

Documentation is included in the Airport's MOU performance calculation spreadsheet for each unit of GSE as to which NO_x factor was ultimately applied and which step of the stepdown approach described in the final methodology was applicable.

Comment #7

For the seven on-road fuel trucks, please also provide the basis for using T6 public EMFAC category.

Response to Comment #7

Emission factors from CARB's EMFAC model have consistently been used for MOU reporting since the agreement began. EMFAC classifications serve as surrogates for GSE with on-road certified engines, commonly including captive fleet vehicles like catering trucks, service trucks, refuelers, and bobtails. Non-road vehicles or those using modified engines, such as aircraft tractors with modified Ford "Straight Six" engines, use off-road emission factors.

The “T6” classification covers medium-heavy-duty trucks (GVWR 14,001–33,000 lb), fitting for refuelers and smaller tankers. While the “public” classification typically applies to government fleets and most GSE are not government-owned, the difference in emission factors between “public” and broader categories like “instate” is minimal, given similar vehicle forms, horsepower ratings, fuel types, GVWRs, and model years.

Classification assignment has previously been discussed with SCAQMD staff by web conference but lacked formal documentation. For the assessment of MOU performance, SCAQMD and LGB have consistently agreed that using consistent methods and factors allows transparent, year-over-year comparison and progress tracking toward MOU targets. Thus, the Airport recommends continuing to use the T6 Public EMFAC classification to reflect these refuelers for performance calculations.

Comment #8

Please revise and resubmit the 2024 and 2023 progress reports for any corrections as a result of the above comments or other changes.

Response to Comment #8

As indicated in the preceding comments, several minor revisions are required for the LGB MOU Annual Progress Report for calendar year 2024. **Following receipt of the necessary responses and confirmation from the District that no further comments will be provided, the 2024 report will be updated and reissued accordingly.**

Additionally, as previously noted, no changes have been identified that would necessitate further revision of the calendar year 2023 report, and LGB does not anticipate making any additional modifications to that document.