SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

2022 and 2023 Airports MOU Implementation Progress Report

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Table of Contents

Introduction

This report covers the progress towards implementation of the airports MOU measures under the Facility-Based Mobile Source Measure (FBMSM) for Commercial Airports for the 2021 and 2022 reporting years. The 2021 Airports MOU Implementation Progress Report,[1] which covered the 2020 reporting year, was submitted to the U.S. EPA on November 1, 2021.

The FBMSM for Commercial Airports implements the 2016 Air Quality Management Plan (AQMP) Control Measure MOB-04, Emission Reductions at Commercial Airports. This measure has also been included in the 2022 AQMP as Control Measure MOB-04. Although there were no emission reductions specified for this AQMP control measure, any reductions achieved from implementation of this measure will apply toward both AQMP's overall emission reductions obligations. The FBMSM for Commercial Airports was adopted by South Coast AQMD on December 6, 2019. The measure consists of Memoranda of Understanding (MOUs) between South Coast AQMD and five commercial airports and South Coast AQMD's enforceable commitment to achieve an aggregate 0.52 and 0.37 tpd NOx reductions in 2023 and 2031, respectively. The MOUs were executed with Los Angeles International Airport (LAX), John Wayne Orange County Airport (SNA), Hollywood Burbank Airport (BUR), Ontario International Airport (ONT), and Long Beach Airport (LGB).

Each MOU includes specific measures which each airport has committed to implement. The South Coast AQMD's emission reduction commitment is based on the airports' implementation of their measures included in the MOUs. These measures seek to reduce emissions from non-aircraft airport sources – namely ground support equipment (GSE), airport shuttle buses, and heavy-duty trucks as specified in the MOUs. The MOU measures establish performance targets for 2023 and 2031 for these sources, as presented in Tables 1 to 3. All airport MOUs include a GSE measure, with three airports also including measures for shuttle buses or heavy-duty trucks.

Table 1. GSE performance targets representing fleet average emission factors (g/hp-hr)*

Airport	2023 Performance Target	2031 Performance Target
LAX	1.8	1.0
BUR	1.66	0.74
LGB	0.93	0.44
SNA	1.7	0.9
ONT	2.2	1.0

* LAX uses a HC + NOx combined emission factor; other airports use a NOx emission factor.

Table 2. Shuttle bus performance targets representing zero-emission percentage of fleet

Airport	2023 Performance Target	2031 Performance Target
LAX	20%	100%
BUR	50%	100%
SNA	50%	80%

[1] Facility-Based Mobile Source Control Measures - MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

Table 3. Heavy-duty vehicle performance targets

Airport	2023 Performance Target
LAX	Distribute up to $500,000 to incentivize adoption of zero or near-zero emission vehicles with a Gross Vehicle Weight Rating (GVWR) greater than 14,000 pounds
SNA	Eliminate routine commercial passenger jet fuel deliveries through the installation of a fuel pipeline

Under the MOUs, the airports have committed to meet these performance targets by the specified dates. The MOU measures for each airport are included in their respective Air Quality Improvement Plan/Measures (AQIP/AQIM) submitted to South Coast AQMD in September 2019.[2] Although the airports have also estimated the projected emission reductions for these measures, their commitments are for meeting the 2023 and 2031 MOU performance targets.

Beginning June 1, 2021, and every year thereafter through 2032, airports are required to submit detailed annual reports to document progress toward implementation of these MOU measures.

MOU Implementation

Implementation of MOU measures is monitored by South Coast AQMD based on the annual progress reports submitted by airports. As part of its enforceable commitment, South Coast AQMD is also required to submit progress reports to the U.S. EPA based the airports' annual progress reports. The airports' annual progress reports quantify the actual performance levels and associated emissions for each of the MOU measures for the previous reporting calendar year. Based on these annual progress reports, South Coast AQMD staff quantifies the corresponding State Implementation Plan (SIP) creditable NOx emissions reductions based on specified methodology.[3] The progress report for 2021 and 2022 reporting years presented herein addresses the following items:

a. Identify the portion of NOx emission reduction targets achieved and all emissions-related information necessary to independently quantify emission reductions;

b. Document actions by the airports on implementation of the airports SIP creditable Air Quality Improvement Plan/Measures (AQIP/AQIM) measures in the MOUs; and

c. Determine whether the implementation of SIP creditable AQIP/AQIM measures in the MOUs is projected to achieve the full 0.52 tpd of NOx emission reductions in 2023.

Progress Report for 2021 and 2022 Reporting Years

This report analyzes the progress made by airports in 2021 and 2022 reporting years based on the 2022 and 2023 progress reports submitted by the airports, respectively. These reports provide the actual performance levels and the "remaining" emissions associated with implementation of the MOU measures in 2021 and 2022 calendar years. Detailed calculations submitted by airports for determining the performance levels and emissions for MOU measures were audited by South Coast AQMD staff to ensure

[2] Facility-Based Mobile Source Control Measures – Commercial Airports MOUs, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous

[3] FBMSM Commercial Airport MOU Staff Report, Appendix B - SIP Credit Calculations, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous

accuracy and adherence to the specified methodologies. As a result of staff audit, all airports submitted revised annual reports making appropriate corrections to performance levels and emissions calculations. The final revised 2022 and 2023 airports progress reports are posted on South Coast AQMD's website.[4] A summary of progress for Airport GSE performance target and other MOU measures during reporting years 2021 and 2022 are outlined in Tables 4 and 5 below.

Table 4. Summary of Progress for Airport GSE Performance During Reporting Years 2021 and 2022

Airport	2023 Target (g/bhp-hr)	2021 Progress (g/bhp-hr)	2022 Progress (g/bhp-hr)
LAX	≤1.8	1.52	1.16
LGB	≤0.93	0.96	0.9
BUR	≤1.66	0.99	1.01
SNA	≤1.7	2.6	2.23
ONT	≤2.2	2.56	2.53

*Performance levels for each airport are not comparable with each other. For additional details on airport GSE performance levels, please see GSE Measure section for the airport.

Table 5. Summary of Progress for Other MOU Measures During Reporting Years 2021 and 2022

Airport	MOU Measure	AQIP/AQIM Target	Current Progress
LAX	Alternative Fuel Vehicle Incentive	Incentivize $500,000 towards Zero and Near Zero Heavy Duty Vehicle Incentive Program by 12/31/2021	$325,000 distributed as of 2020, remaining $175,000 is expected to be distributed in 2023
	Zero Emission Bus	20% of airport owned and operated buses to be ZE by 1/1/2023	~40% of fleet is ZE at the end of 2022
BUR	Shuttle Bus Electrification	Replace 50% BUR owned/operated/contracted buses with ZE by 1/1/2023	Awarded contract to bus operator requiring 50% ZE buses by April 2025
SNA	Parking Shuttle Bus Electrification	Replace 50 % of airport employee and passenger remote parking buses with battery electric by 1/1/ 2023	Five battery electric buses (~50% of active fleet) were purchased and delivered by the end of 2022 and operating pending completion of required charging infrastructure
	Jet Fuel Delivery Truck	Installation of jet fuel pipeline by 12/31/2019 and eliminate routine commercial aviation jet fuel delivery by 1/1/2023	Jet fuel pipeline became operational in October 2019 and supplied all routine fuel deliveries in 2022

The 2021 and 2022 actual emission reductions achieved for each MOU measure were calculated primarily based on the detailed methodology presented in Appendix B of the FBMSM for Commercial Airports Staff Report.[5] The methodology for calculating GSE emissions, while largely consistent with that presented in Appendix B of the staff report, was revised in 2021 to incorporate the latest emission standards for

[4] Facility-Based Mobile Source Control Measures – Airports MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

[5] FBMSM Commercial Airport MOU Staff Report, Appendix B - SIP Credit Calculations, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous

gasoline and liquefied petroleum gas (LPG) equipment based on existing adopted regulations for Large Spark Ignition (LSI) equipment.[6] For a more detailed discussion of this revision to the methodology, please refer to the 2021 Airports MOU Implementation Progress Report, dated October 2021.[7]

In contrast with the emissions inventory calculations, the performance targets contained in the MOUs are legally binding agreements between South Coast AQMD and the airports. Therefore, the original methodology used to develop the MOU targets was applied to calculate the fleet average emission factors for GSE measures in the airports 2022 and 2023 progress reports. Attachment A of Appendix B of the FBMSM for Commercial Airports Staff Report[8] provides the methodology to calculate emission reductions from MOU measures toward SIP creditable reductions for 2021 and 2022 reporting years. This ensures consistency when comparing the fleet average emission factors with the MOU performance targets. While each airport used a method consistent to its own MOU to calculate its baseline and future fleet average GSE emission factors, the method differed among airports. As such, the performance levels and targets are not comparable among airports. Key differences are summarized in Table 6.

Table 6. Methods for calculating the GSE fleet average emission factor

Airport	Source of emission factors*	Calculation method
LAX	Engine standards	Horsepower weighted average
LGB	In-use emission factor, including load factor	Horsepower weighted average
BUR	In-use emission factor, including load factor	Horsepower weighted average
SNA	In-use emission factor, excluding load factor	Horsepower weighted average
ONT	In-use emission factor, excluding load factor, with certain equipment using engine standards	Arithmetic average

* In-use emission factors were derived from OFFROAD2017[9] by dividing total emissions by the total annual horsepower-hours for each equipment type based on model year and horsepower bin. In-use emission factors for on-road vehicles were derived from EMFAC2017[10] by dividing total emissions by annual VMT for each vehicle type based on model year and fuel type.

The following sections present an overview of the 2021 and 2022 progress in implementing the MOU measures for each airport. The aggregated SIP creditable GSE emission reductions for 2021 and 2022 for all airports are discussed and presented later in this report (see Figure 6 and Table 13).

[6] Off-road Large Spark Ignition Engine Regulation, https://ww2.arb.ca.gov/sites/default/files/2020-03/Amended%20Section%202433%2C%20Title%2013%2C%20California%20Code%20of%20Regulations_2008_R.pdf

[7] Facility-Based Mobile Source Control Measures - MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

[8] FBMSM Commercial Airport MOU Staff Report, Appendix B - SIP Credit Calculations, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous

[9] OFFROAD2017 Database, https://www.arb.ca.gov/orion/ with 2017 updated emission factors, https://www.arb.ca.gov/msei/ordiesel/ordas_ef_fcf_2017.pdf

[10] EMFAC2017 User's Guide, https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-i-users-guide.pdf

Los Angeles International Airport

GSE Measure

The airport's GSE policy was originally developed in 2015 to ensure cleaner GSE operations. This policy was subsequently modified after MOU adoption to incorporate the performance targets specified in Table 1. For the 2021 and 2022 reporting years, LAX has continued to work with airlines and third party GSE operators for continued conversion of older GSE to cleaner equipment. The 2022 and 2023 MOU progress reports for LAX are provided on South Coast AQMD's website.[11]

Figure 1 presents LAX's GSE performance levels for 2017 (baseline), 2020, 2021 and 2022 as compared to the 2023 and 2031 performance targets. The corresponding GSE NOx emissions for 2017, 2020, 2021 and 2022 are also shown in Figure 1. As indicated, the LAX GSE performance level has continued to improve from 2.24 g/hp-hr in 2017 and 1.52 g/hp-hr in 2020 to 1.16 g/hp-hr in 2022, surpassing its 2023 GSE performance target of 1.80 g/hp-hr (which was met in 2020) and is approaching its 2031 target of 1.0 g/hp-hr. The 2021 performance level stayed the same as the 2020 level at 1.52 g/hp-hr. In terms of emission reductions, GSE NOx emissions have significantly been reduced from 181.9 tons per year (tpy) in 2017 and 150.3 tpy in 2020 to 130.2 in 2022 because of GSE measure implementation. However, the overall rate of reduction slowed and the airport-wide emissions slightly increased in 2021 (156.6 tpy) mainly because of COVID impacts on airline operations in 2020 and 2021. For reference, the 2023 projected GSE emissions in the AQIM were 94.3 tpy, which is substantially lower than the 2022 GSE emissions of 130.2 tpy. Although LAX is already achieving its 2023 performance target on an airport-wide basis, LAX has stated that they will continue to work with their tenants for accelerated conversion of older GSE to cleaner equipment while providing support for any future electrical infrastructure needs to ensure that all airport tenants meet the 2023 performance target. As a result of this effort, additional emission reductions are expected in 2023 and subsequent years.

[11] Facility-Based Mobile Source Control Measures – Airports MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

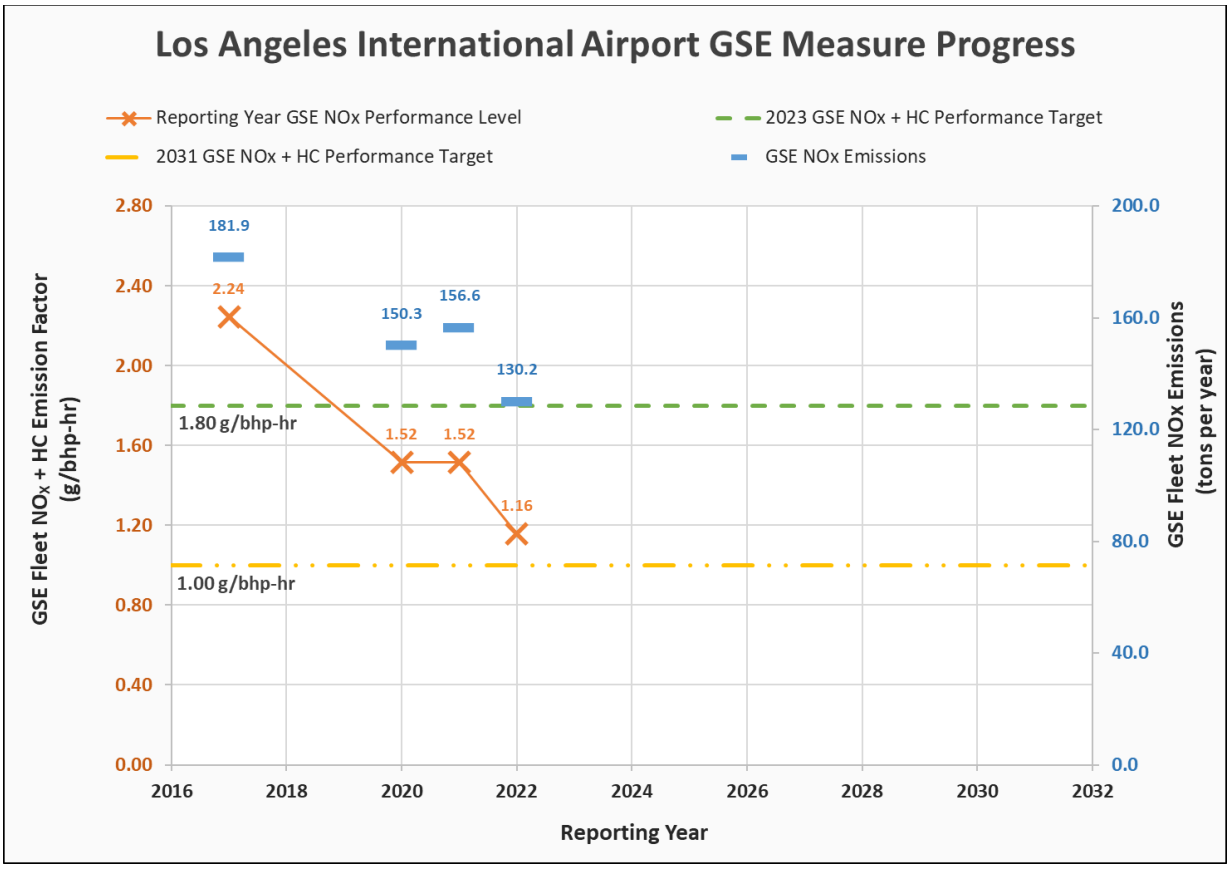

Figure 1. LAX GSE performance levels and targets and GSE Emissions

Table 7 presents the LAX GSE fleet by fuel type (diesel, electric, gasoline, LPG), Tier type (for off-road diesel engines) and model year for gasoline and LPG units in 2017, 2020, 2021 and 2022. The changes in the overall number of GSE fleet are reflective of the addition and departure of tenants, new equipment, retirement or low-use operation of older equipment, and better tracking of equipment by tenants and the airport. As indicated, there has been a significant transition in the GSE fleet from older, higher emitting equipment (e.g., Tier 0 and 1 off-road diesel engines, pre-2010 gasoline/LPG engines) towards newer and cleaner equipment. Although there are some increases in the number of electric-powered GSE over the last few years, the majority of this transition has been towards newer diesel (i.e., Tier 4) and newer gasoline and LPG equipment (i.e., 2020+). In order to accelerate the deployment of zero-emission electric GSE, LAX adopted a GSE incentive program[12] in 2023. This effort is expected to increase the number of electric GSE at LAX in the upcoming years and prioritize the removal of older GSE (e.g., Tier 0 and 1 off-road diesel and pre-2010 gasoline equipment), achieving further emission reductions. In addition, in order to consolidate GSE facilities and expand electric GSE use, LAX is also conducting a GSE infrastructure study to evaluate the feasibility of comprehensive GSE pooling and electrical charging infrastructure for its tenants.

[12] https://www.lawa.org/-/media/lawa-web/environment/files/gse-emissions-reduction-program/lax-egse-incentive-program.ashx

Table 7. LAX GSE fleet by fuel and tier/model year

Fuel	Sub-type	2017	2020	2021	2022
Diesel	Tier 0	40	25	17	10
	Tier 1	156	111	105	91
	Tier 2	72	48	54	45
	Tier 3	147	88	88	79
	Tier 4i	65	73	69	71
	Tier 4f	166	335	392	444
	On-road engine	36	132	137	131
Electric	All	1,052	1,053	992	1,117
Gasoline	Pre-2010	323	251	272	225
	2010-2022	268	618	720	745
LPG/Propane	Pre-2010	217	126	123	124
	2010-2022	175	401	406	480
Total	All	2,717	3261	3,429	3,562

Alternative Fuel Vehicle Incentive Measure

Under this measure, LAX has allocated up to $500,000 for its Zero and Near-Zero Heavy Duty Vehicle Incentive Program to be distributed to qualified applicants based on the incremental cost associated with purchasing near-zero or zero-emissions heavy-duty vehicles, with a GVWR[13] of 14,001 pound or greater by December 31, 2021. This program is fully subscribed and resulted in the acquisition of 15 near-zero heavy duty vehicles in 2020 for a total funding of $325,000. The replaced vehicles were either scrapped or moved out of state. There were no additional incentive-funded vehicles in 2021 and 2022 primarily due to truck delivery delays and supply chain shortages. The remaining $175,000 is expected to be distributed to existing grant recipients and new applicants from the airport's reserve list in 2023 and subsequent years resulting in further emission reductions.

[13] Gross Vehicle Weight Rating

The emission reductions associated with this program are calculated based on the difference in emissions between the diesel trucks and near-zero-emissions trucks (i.e., CNG and propane trucks). For the purpose of calculating SIP emission reductions, it is assumed that existing older diesel trucks would have been replaced with 2020 model year diesel trucks. The emission factors for the 2020 diesel trucks are derived from EMFAC2017 for applicable vehicle categories (T6 instate small, T6 instate heavy, T7 single) for Los Angeles County. The emission factors for the near-zero emissions trucks are from Tables D-1 and D-2 of CARB's Carl Moyer Guidelines.[14] The combined annual VMT for both replaced and replacement vehicles is assumed constant and derived from EMFAC2017 based on the average annual VMT for applicable vehicle categories. For detailed methodology, refer to Appendix B of the FBMSM for Commercial Airports Staff Report.[15]

Table 8 summarizes the NOx emission reductions calculations for this measure. The SIP creditable reductions for this measure are estimated to be 0.43 and 0.48 tpy in 2021 and 2022, respectively. Since the LAX program is fully subscribed, additional vehicle replacements are anticipated in 2023, which will further increase the SIP creditable reductions.

Table 8. NOx Emissions Benefits for LAX Alternative Fuel Vehicle Incentive Measure

	2021	2022
Number of Vehicles	15	15
Total annual VMTs for replaced vehicles (million)	0.54	0.55
Emissions of new diesel trucks (tpy)	0.51	0.56
Emissions of new near-zero trucks (tpy)	0.08	0.08
SIP creditable emission reductions (tpy)	0.43	0.48

Zero Emission Bus Measure

Under this measure, 20% and 100% of airport-owned and operated shuttle buses are required to be replaced with zero-emission buses by January 1, 2023 and January 1, 2031, respectively. In 2021, LAX operated 20 electric (out of 124) airport-owned shuttle buses, which represented 16% of its fleet. In 2022, LAX retired a significant portion of its fleet due to technical issues with its CNG-fueled buses by scrapping or removing non-operating buses from service. During 2022, LAX had 77 operating buses with actual VMT data. By the end of 2022, the LAX-owned fleet decreased to 50 shuttle buses including 20 electric-powered buses. The 20 electric buses represented 40% of LAX-owned shuttle buses, exceeding the 2023 performance target of 20% electrification. To address the airport's bus services needs due to the removal

[14] https://ww3.arb.ca.gov/msprog/moyer/guidelines/2017gl/2017_gl_appendix_d.pdf
[15] FBMSM Commercial Airport MOU Staff Report, Appendix B - SIP Credit Calculations, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous

of CNG buses, LAX is using a temporary contract for bus services until the completion of the LAX Automated People Mover, anticipated in 2024. Under this MOU measure, LAX is not required to report buses owned and operated by contractors.

Table 9 summarizes the emission reduction calculations using the actual reported VMT for zero emission (ZE) buses in 2021 and 2022 and the mileage and emissions for CNG urban buses in the EMFAC2017 for LA County.

Table 9. NOx Emissions Benefits for LAX Zero Emission Bus Program

	2021	2022
CNG Urban bus emissions for LA County (tons per day)	0.395	0.236
Daily CNG urban bus VMTs in LA County (miles/day)	439,987	442,636
LA County urban bus emission factor in 2016 AQMP (g/mile)	0.814	0.483
Airport's zero emission shuttle bus total annual VMT (million miles/year)	0.163	0.150
SIP creditable emission reductions (tpy)	0.13	0.09

John Wayne Orange County Airport

GSE Measure

For the 2021 and 2022 reporting years, SNA has continued to work with its tenants for continued conversion of GSE to cleaner equipment and achieving the GSE performance targets specified in Table 1. The 2022 and 2023 MOU progress reports for SNA are provided on South Coast AQMD's website.[16]

Figure 2 presents SNA's GSE performance levels for 2017 (baseline), 2020, 2021 and 2022 as compared to the 2023 and 2031 performance targets. The corresponding GSE NOx emissions for 2017, 2020, 2021 and 2022 are also shown in Figure 2. As indicated, the SNA GSE performance level has continued to improve from 4.0 g/hp-hr in 2017 and 3.2 g/hp-hr in 2020 to 2.6 g/hp-hr in 2021 and 2.23 g/hp-hr in 2022, falling short of its 2023 performance target of 1.7 g/hp-hr (required under the MOU as of January 1, 2023). In terms of emission reductions, GSE NOx emissions have continued to decrease from 20.4 tpy in 2017 and 18.8 tpy in 2020 to 18.6 and 18.2 tpy in 2021 and 2022, respectively, because of GSE measure implementation. However, the overall rate of reduction has slowed in the last two years mainly because of COVID impacts on airline operations in 2020 and 2021 and GSE emissions remain significantly higher than the 2023 projected GSE emissions of 10.27 tpy in the AQIP.

Although the 2023 performance target was not achieved as of January 1, 2023, SNA has committed to continue working with airlines and GSE operators in 2023 to make progress toward and achieve this target. Specifically, SNA is working with its tenants to prioritize and replace the oldest diesel and gasoline GSE

[16] Facility-Based Mobile Source Control Measures – Airports MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

(e.g., Tier 0 and 1 diesel and pre-2000 gasoline equipment) with cleaner equipment and electric replacements. SNA is currently in the process of updating and improving its electrical infrastructure to support future EV charging. Significant progress towards the 2023 performance target is expected from these efforts in 2023 which will be reflected in the airport's upcoming 2024 progress report. If the 2023 performance target is still not demonstrated in the 2024 progress report, South Coast AQMD will work with SNA to identify and implement additional measures to meet this target and remedy any shortfall in emission reductions in accordance with the MOU.

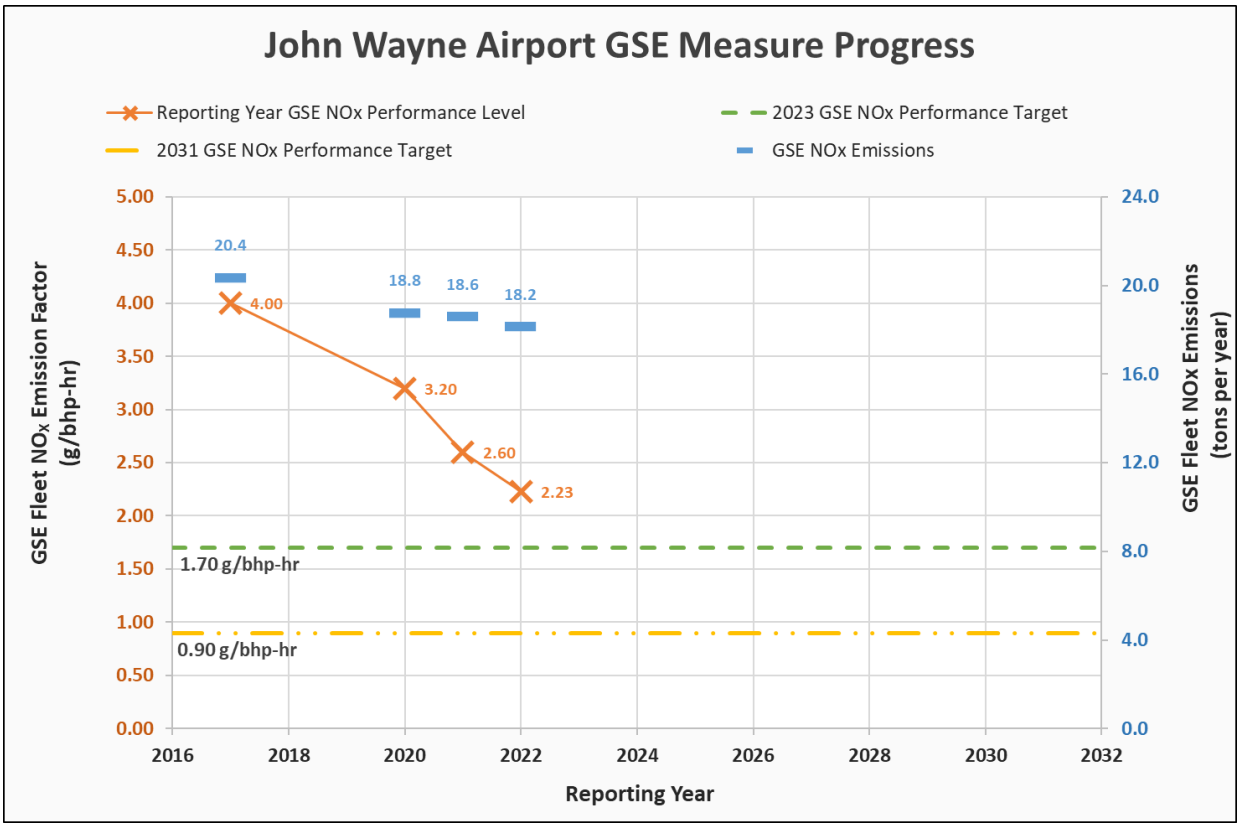

Figure 2. SNA GSE performance levels and targets and GSE emissions

Table 10 presents the SNA GSE fleet by fuel type (diesel, electric, gasoline), Tier type (for off-road diesel engines) and model year for gasoline units in 2017, 2020, 2021 and 2022. The changes in the overall number of GSE fleet reflect the addition and departure of tenants, new equipment, retirement or low-use operation of older equipment, and better tracking of equipment by tenants and the airport. As indicated, there has been a significant transition in the GSE fleet from older, higher emitting equipment (e.g., Tier 0 and 1 off-road diesel equipment, pre-2010 gasoline engines) towards newer and cleaner equipment (i.e., Tier 4 off-road diesel, 2020+ gasoline, and electric GSE). The number of electric-powered GSE have increased significantly by 37% and 48% in 2021 and 2022, respectively, compared to 2020 because of the existing airport infrastructure.

Table 104. SNA GSE fleet by fuel and tier/model year

Fuel	Sub-type	2017	2020	2021	2022
Diesel	Tier 0	11	3	9	4
	Tier 1	21	20	18	10
	Tier 2	4	5	5	4
	Tier 3	7	6	6	6
	Tier 4i	3	5	4	5
	Tier 4f	11	19	35	36
Electric	All	96	99	136	147
Gasoline	Pre-2010	15	13	16	12
	2010-2022	16	27	27	33
Total	All	184	197	256	257

Parking Shuttle Bus Electrification Measure

Under this measure, a minimum of 50% and 80% of the airport's employee and passenger remote parking compressed natural gas shuttle buses are required to be replaced with battery-electric shuttle buses by January 1, 2023 and 2031, respectively. In 2021 and 2022, SNA continued to pursue the acquisition and deployment of electric shuttle buses. By the end of 2022, five battery-electric shuttle buses have been purchased and delivered to the airport with funding support from FAA's Zero-Emission Vehicle grant funding program. The operation of the ZE shuttle buses is awaiting the completion of the installation of the required charging infrastructure which has been delayed because of the local utility's backlogs. As such, there were no operating ZE shuttle buses and associated emission reductions from this measure in 2021 and 2022.

Jet Fuel Delivery Truck Measure

This measure requires installation of a jet fuel pipeline by the end of 2019 to eliminate routine commercial aviation jet fuel delivery trucks by January 1, 2023. SNA's jet fuel pipeline became operational in October 2019 and the airport has continued to coordinate with tenants to facilitate the transition from fuel truck deliveries to the pipeline. The majority of routine commercial aviation jet fuel truck deliveries have been replaced with pipeline fuel delivery since 2020. However, due to contractual obligations, unexpected demands and fuel pipeline maintenance activities, there were some jet fuel deliveries by trucks in 2021 and 2022. In 2021, 55 million gallons of fuel were delivered via pipeline, representing 98% of total fuel deliveries. The 2021 total fuel delivery by trucks was 1,103,759 gallons corresponding to 14,386 truck VMT. In 2022, 72 million gallons of fuel was delivered via pipeline, representing 99% of total fuel deliveries. The 2022 total fuel delivery by trucks was 797,988 gallons corresponding to 10,184 truck VMT. As of the end of 2022, SNA has conducted all routine fuel deliveries via pipeline and has fulfilled their commitment to this MOU measure. Table 11 summarizes the emission reduction calculations for SNA's Jet Fuel Delivery Truck Measure.

Table 11. NOx Emissions Benefits for SNA Jet Fuel Delivery Truck Measure

	2021	2022
Fuel Delivery via Pipeline (million gallon)	55.5	72.6
Fuel Delivery by Trucks (million gallon)	1.1	0.8
Fuel truck total emissions (tpy)	0.06	0.02
Fuel trucks total VMT (miles)	14,386	10,184
Annual truck VMT eliminated by measure (million miles/year)	0.72	0.93
SIP creditable emission reductions (tpy)	2.88	2.22

Long Beach Airport

GSE Measure

For the 2021 and 2022 reporting years, LGB has continued to work with its tenants to achieve the GSE performance targets specified in Table 1 through accelerated turnover to cleaner equipment while developing electric vehicle infrastructure at the airport. The 2022 and 2023 MOU progress reports for LGB are provided on South Coast AQMD's website.[17]

Figure 3 presents LGB's GSE performance levels for 2017 (baseline), 2020, 2021 and 2022 compared to the 2023 and 2031 performance targets. The corresponding GSE NOx emissions for 2017, 2020, 2021 and

[17] Facility-Based Mobile Source Control Measures – Airports MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

2022 are also shown in Figure 3 as compared to 2023 projected emissions in their Air Quality Improvement Plan (AQIP). As indicated, LGB's GSE performance level has improved from 1.50 g/hp-hr in 2017 and 1.23 g/hp-hr in 2020 to 0.96 g/hp-hr in 2021 and 0.90 g/hp-hr in 2022 meeting its 2023 performance target of 0.93 g/hp-hr (required under the MOU as of January 1, 2023). Achieving the 2023 performance target is primarily attributed to the replacement of older diesel equipment with zero-emission electric and newer gasoline equipment. In terms of emission reductions, GSE NOx emissions have continued to decrease from 22.1 tpy in 2017 and 15.6 tpy in 2020 to 7.7 and 7.5 tpy in 2021 and 2022, respectively, because of GSE measure implementation. The 2021 and 2022 GSE emissions are lower than the 2023 projected GSE emissions of 12.3 tpy in the AQIP. In addition to the replacement of older GSE with cleaner equipment, the overall emissions reductions since 2017 are also attributed to FedEx's suspension of operations on April 10, 2020 and JetBlue's departure on October 7, 2020. Although LGB has already met its 2023 performance target, the GSE performance level and emissions are expected to continue their downward trend in future years as the airport continues to work with its tenants to replace their older equipment.

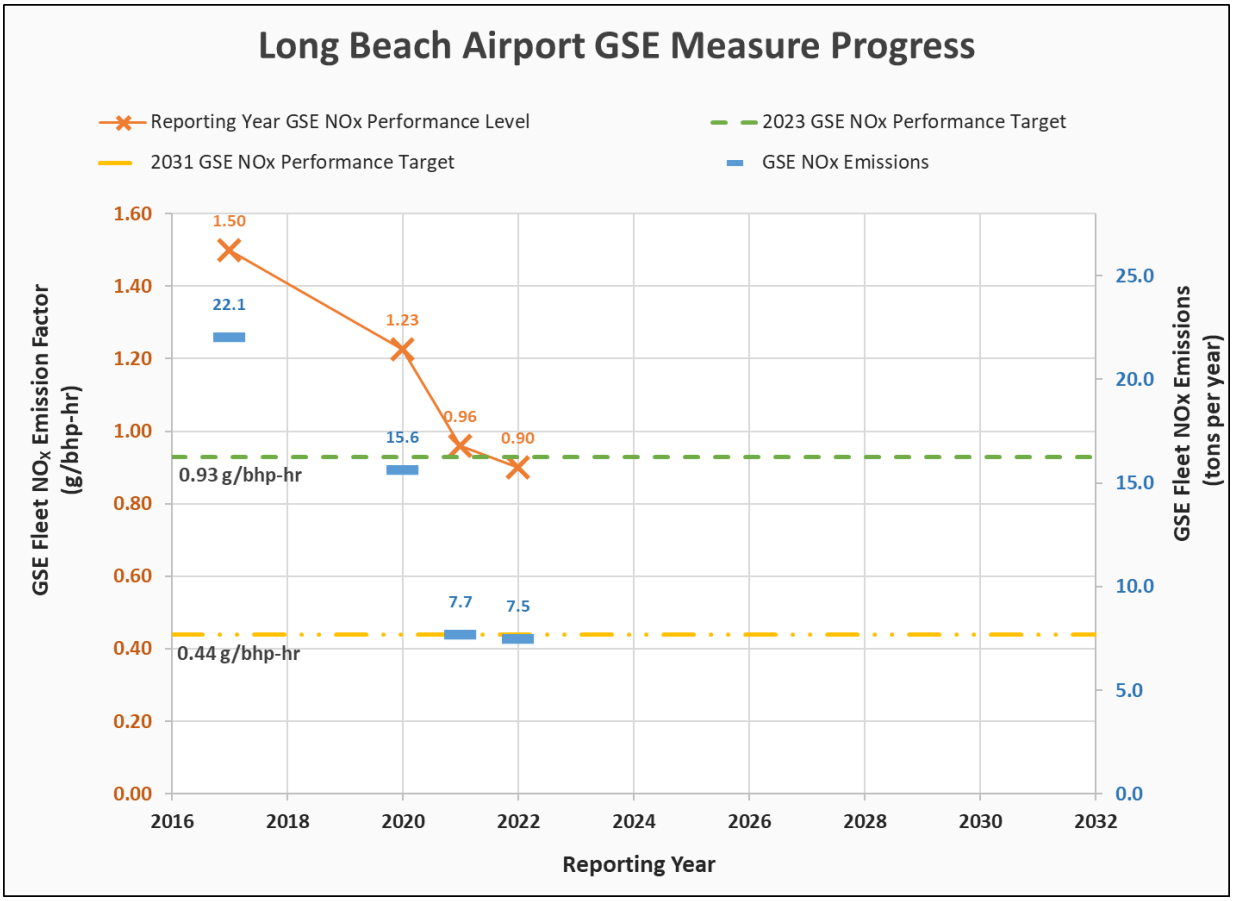

Figure 3. LGB GSE performance levels and targets and GSE emissions

Table 12 presents LGB's GSE fleet by fuel type (diesel, electric, gasoline, LPG/propane), Tier type (for off-road diesel engines) and model year for gasoline and LPG/propane units in 2017, 2020, 2021 and 2022. The changes in the overall number of GSE fleet reflect the addition and departure of tenants, new equipment, retirement or low-use operation of older equipment, and better tracking of equipment by tenants and the airport. As indicated, there has been a transition in the GSE fleet from older, higher

emitting equipment (e.g., Tier 0 and 1 off-road diesel equipment, pre-2010 gasoline/LPG engines) towards newer and cleaner equipment (i.e., Tier 4 off-road diesel, 2020+ gasoline/LPG, and electric GSE). The number of electric-powered GSE has also steadily increased in 2021 and 2022 after the departure of FedEx and JetBlue because of the airport's electric infrastructure.

Table 12. LGB GSE fleet by fuel and tier/model year

Fuel	Sub-type	2017	2020	2021	2022
Diesel	Tier 0	19	12	6	6
	Tier 1	52	15	6	7
	Tier 2	13	8	2	3
	Tier 3	3	16	11	9
	Tier 4i	2	10	6	4
	Tier 4f	9	24	26	28
	On-road	0	20	6	7
Electric	All	155	109	89	97
Gasoline	Pre-2010	38	44	17	17
	2010-2022	13	32	24	26
LPG/Propane	Pre-2010	15	12	12	10
	2010-2022	3	3	4	3
Total	All	322	305	209	217

Ontario International Airport

GSE Measure

For the 2021 and 2022 reporting years, ONT continued to work with airlines and third party GSE operators to remove and replace the older GSE with newer and cleaner equipment in meeting the performance targets specified in Table 1. In early 2022, ONT advised AQMD staff that a significant number of GSE associated with off-airport operations were inadvertently included in the 2017 baseline and 2020 reporting years. Accordingly, ONT submitted revised performance levels and emissions for 2017, 2020, 2021 and 2022 for on-airport GSE operations. This report references the revised figures only unless specified otherwise. These revisions also reflected the GSE operations for the off-airport operator which

operates during the peak holiday season (approximately two months of a year) on-airport property. The 2023 and 2031 performance targets specified under the MOU for ONT remained unchanged despite these revisions. The 2022 and 2023 MOU progress reports for ONT and the revised 2017 and 2020 GSE emissions as well as the performance level and emissions for off-airport operations are provided on South Coast AQMD's website.[18]

Figure 5 presents ONT's GSE performance levels for 2017 (baseline), 2020, 2021 and 2022 as compared to the 2023 and 2031 performance targets reflecting on-airport GSE operations. The corresponding GSE NOx emissions for 2017, 2020, 2021 and 2022 are also shown in Figure 5. As indicated, ONT's GSE performance level has continued to improve from 3.62 g/hp-hr in 2017 and 3.26 g/hp-hr in 2020 to 2.56 g/hp-hr in 2021 and 2.53 g/hp-hr in 2022, falling short of its 2023 performance target of 2.2 g/hp-hr (required under the MOU as of January 1, 2023). To meet the 2023 performance target, ONT is pursuing commitments from its tenants for removal and replacement of additional older equipment in 2023. Also, in order to improve its on-airport equipment tracking and facilitate further replacement of older GSE, ONT is planning to expand the use of its current ONT Motor Vehicle Operating Permit (MVOP) working with GSE stakeholders. Furthermore, the airport is conducting a comprehensive study to evaluate and support future GSE electric infrastructure requirements.

In terms of emission reductions, GSE NOx emissions have continued to decrease from 103 tpy in 2017 and 37.9 tpy in 2020 to 21.7 and 19.4 tpy in 2021 and 2022, respectively, because of GSE measure implementation. Fewer GSE units were reported in 2020 compared to 2017, shifting away from the use of aging diesel and gasoline equipment which resulted in a large decrease of emissions. If the 2023 performance target is still not demonstrated in the 2024 progress report, South Coast AQMD will work with ONT to identify and implement additional measures to meet this target and remedy any shortfall in emission reductions in accordance with the MOU. Although ONT's off-airport GSE operations are not covered under the MOU, for the purpose of tracking, ONT has also provided the 2021 and 2022 GSE performance levels and emissions for these operations. The GSE performance levels for off-airport operations were 1.77 g/hp-hr and 1.62 g/hp-hr in 2021 and 2022, respectively. The corresponding emissions were 13.0 tpy and 8.4 tpy in 2021 and 2022, respectively.

[18] Facility-Based Mobile Source Control Measures – Airports MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

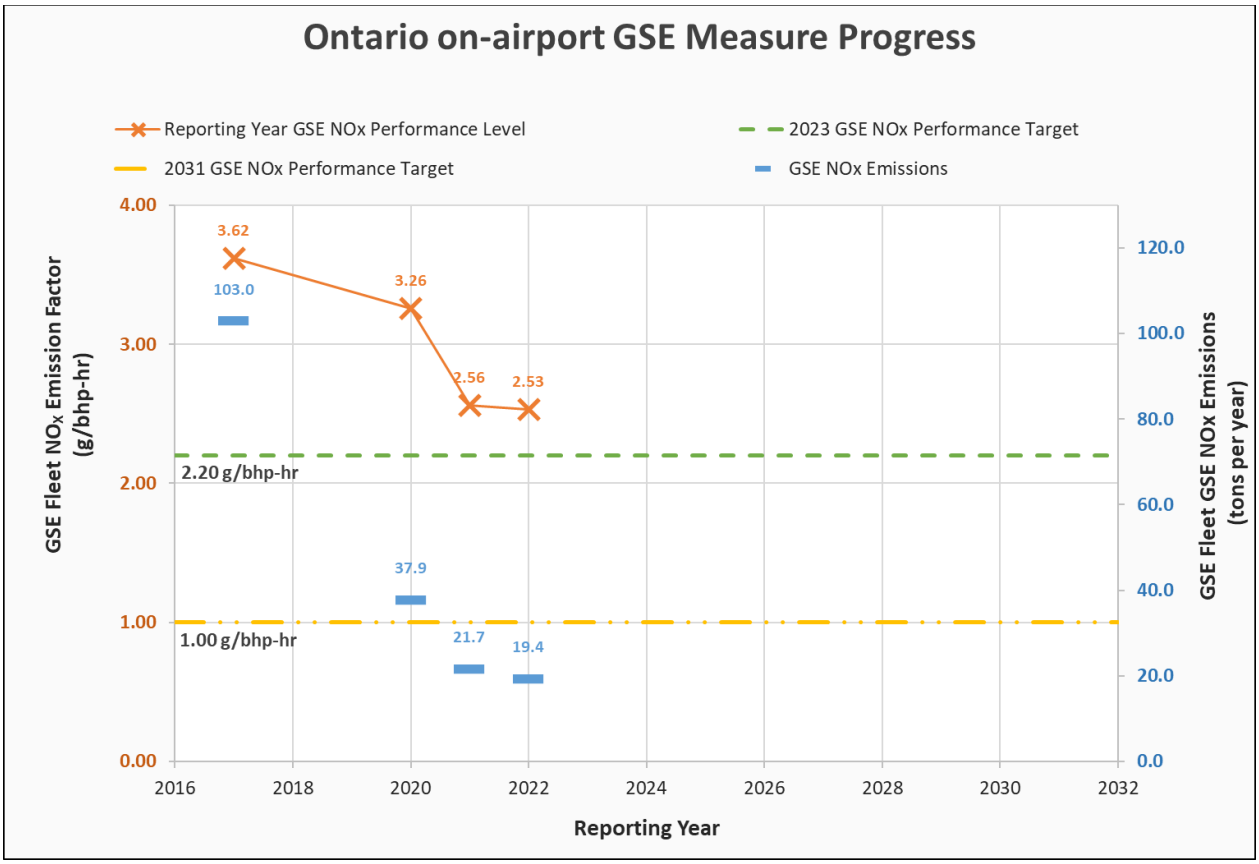

Figure 4. ONT GSE performance levels and targets and GSE emissions

Table 13 presents ONT's GSE fleet by fuel type (diesel, electric, gasoline), Tier type (for off-road diesel engines) and model year for gasoline units in 2017, 2020, 2021 and 2022. For 2017 and 2020, the originally-reported GSE fleet (including off-airport GSE operations) and the revised GSE fleet representing on-airport GSE operations are provided in Table 11. The 2021 and 2022 GSE fleet only include on-airport GSE operations. The changes in the overall number of ONT's on-airport GSE fleet also reflect the addition and departure of tenants, new equipment, retirement or low-use operation of older equipment, and better tracking of equipment by tenants and the airport. As indicated, there has been a significant transition in the GSE fleet from older, higher emitting equipment (e.g., Tier 0 and 1 off-road diesel equipment, pre-2010 gasoline engines) towards newer and cleaner equipment (i.e., Tier 4 off-road diesel, 2020+ gasoline, and electric GSE). The number of electric-powered GSE have increased significantly by 32% and 51% in 2021 and 2022, respectively, compared to 2020 supported by the existing airport infrastructure. ONT's 2022 and 2023 MOU progress reports are provided on South Coast AQMD's website.[19]

[19] Facility-Based Mobile Source Control Measures – Airports MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

Table 13. ONT GSE fleet by fuel and tier/model year

Fuel	Tier	2017		2020		2021	2022
		Original Submission	Revised	Original Submission	Revised		
Diesel	Tier 0	25	6	15	7	7	7
	Tier 1	23	32	9	12	15	15
	Tier 2	26	19	16	12	14	13
	Tier 3	52	28	28	20	24	17
	Tier 4i	13	30	8	23	27	25
	Tier 4f	63	57	102	78	81	73
Electric	All	157	128	110	76	100	115
Gasoline	Pre-2010	254	126	164	55	48	46
	2010-2022	185	185	275	124	123	135
LGP/Propane	Pre-2010	2	2	2	3	4	5
	2010-2022	2	2	2	2	3	3
Total	All	802	615	731	412	446	454

Burbank Airport

GSE Measure

For the 2021 and 2022 reporting years, BUR continued to work with their tenants to achieve the performance target specified in Table 1 through accelerated turnover to cleaner equipment. The 2022 and 2023 MOU progress reports for BUR are provided on South Coast AQMD's website.[20]

[20] Facility-Based Mobile Source Control Measures – Airports MOU Progress Reports, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous/mou-progress-reports

Figure 5 presents BUR's GSE performance levels for 2017 (baseline), 2020, 2021 and 2022 compared to the 2023 and 2031 performance targets. The corresponding GSE NOx emissions for 2017, 2020, 2021 and 2022 are also shown in Figure 5. As indicated, the BUR GSE performance level has improved from 1.74 g/hp-hr in 2017 and 1.09 g/hp-hr in 2020 to 0.99 g/hp-hr in 2021 and slightly increasing to 1.01 g/hp-hr in 2022, surpassing its 2023 GSE performance target of 1.66 g/hp-hr (which was met in 2020). The slight increase in 2022 was the net result of the arrival and departure of GSE operators at the airport with distinct GSE fleets. Although BUR has already achieved its 2023 performance target since 2020 on an airport-wide basis, BUR will work with airlines and third-party GSE operators to ensure compliance with the 2023 performance target for all tenants and resume its overall downward trend, achieving further reductions in future reporting years. In terms of emission reductions, GSE NOx emissions have decreased from 19.1 tpy in 2017 to 11.2 tpy in 2020 but slightly increased to 12.2 tpy in 2021 and 12.7 tpy in 2022. The net increases in 2021 and 2022 emissions compared to 2020 were primarily attributed to addition and departure of tenants with different equipment and operating levels at the airport. The 2021 and 2022 GSE emissions are still lower than the 2023 projected GSE emissions of 16.81 tpy in the AQIP.

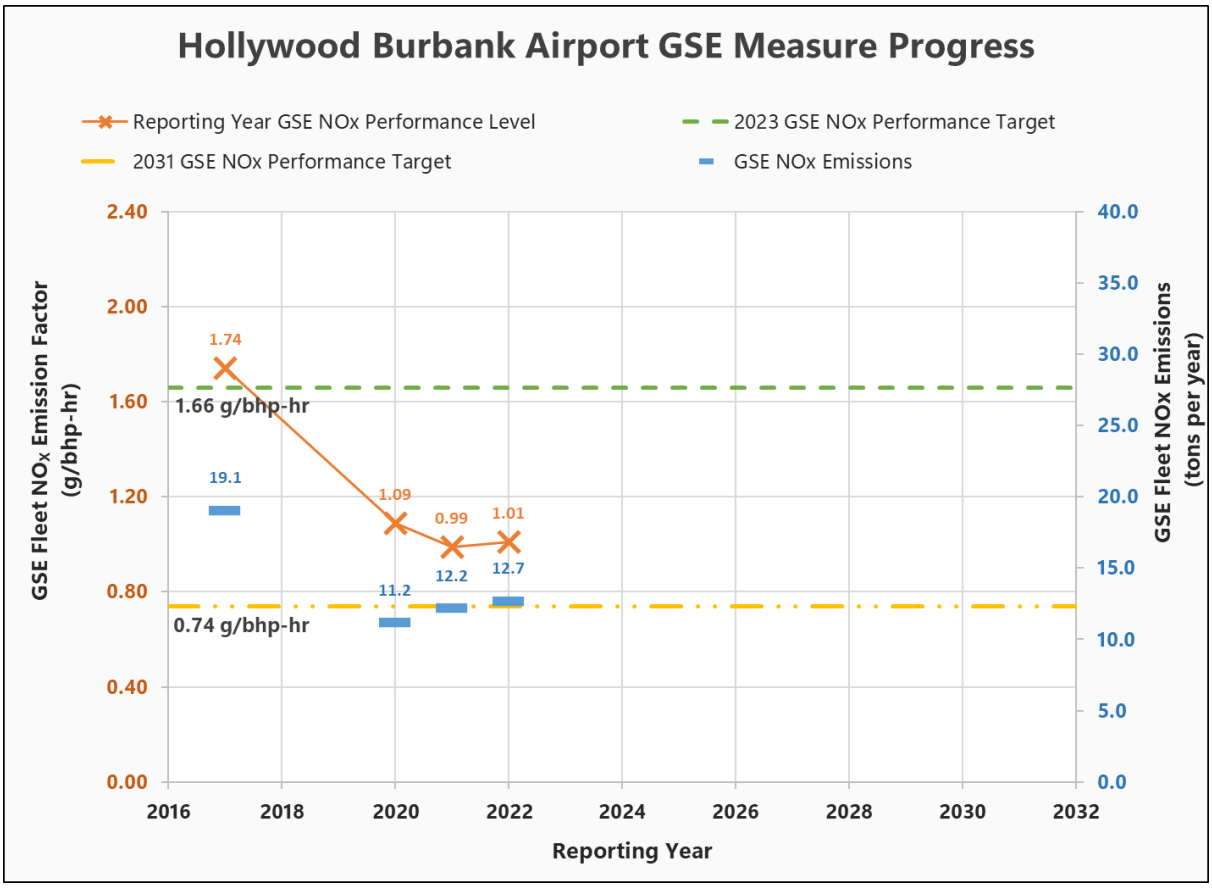

Figure 5. BUR GSE performance levels and targets and GSE emissions

Table 14 presents BUR's GSE fleet by fuel type (diesel, electric, gasoline, LPG/propane), Tier type (for off-road diesel engines) and model year for gasoline and LPG/propane units. The changes in the overall number of GSE fleet reflect the addition and departure of tenants, new equipment, retirement or low-use operation of older equipment, and better tracking of equipment by tenants and the airport. As indicated,

there has been a significant transition in the GSE fleet from older, higher emitting equipment (e.g., Tier 0 and 1 off-road diesel equipment, pre-2010 gasoline/LPG engines) towards newer and cleaner equipment (i.e., Tier 4 off-road diesel, 2020+ gasoline/LPG, and electric GSE). The number of electric-powered GSE has increased by 19% and 23% in 2021 and 2022, respectively, compared to 2020.

Table 14. BUR GSE fleets by fuel and tier/model year

Fuel	Sub-type	2017	2020	2021	2022
Diesel	Tier 0	3	7	2	2
	Tier 1	12	2	8	6
	Tier 2	13	13	13	15
	Tier 3	16	17	17	17
	Tier 4i	2	8	3	3
	Tier 4f	17	41	63	67
	On-road	0	2	1	0
Electric	All	107	120	143	147
Gasoline	Pre-2010	41	37	40	36
	2010-2022	12	27	44	52
LPG/Propane	Pre-2010	10	8	9	8
	2010-2022	3	5	5	6
Total	All	236	287	348	359

Shuttle Bus Electrification Measure

Under this measure, BUR is required to replace 50% and 100% of the airport-owned and operated or contracted buses by electric buses by January 1, 2023 and 2031, respectively. Shuttle services to all parking lots including staff parking lots were fully suspended on April 5, 2020 at the airport and resumed in June 2021. BUR has pursued the acquisition and deployment of electric buses by releasing a Request for Information (RFI) in April 2022 and subsequent Request for Proposals (RFP) in April 2023 for long-term third party courtesy shuttle bus operation. In July 2023, BUR awarded a five-year contract for shuttle services commencing October 2023. As part of this contract, the operator is required to procure and deploy a minimum of 50% electric buses with the required chargers by April 2025. As such, no emission reductions occurred in 2021 and 2022 for this measure.

Progress toward South Coast AQMD's SIP creditable emission reduction target

Despite some of the lingering effects of the COVID-19 pandemic which began in early 2020 causing significant air travel disruption and economic hardships for airports, airlines, and other airport operators impacting the effective implementation of MOU measures mainly in 2020 and 2021, the five commercial airports have continued to reiterate their commitments to the full implementation of the MOU measures.

Based on the airports 2022 and 2023 progress reports, all airports either met or made significant progress toward their 2023 performance targets. With respect to GSE measures, LAX, BUR and LGB met their 2023 performance targets early in 2022, while SNA and ONT fell short of their targets. However, South Coast AQMD works closely with both SNA and ONT to facilitate them meeting their targets as quickly as possible.

For ZE shuttle bus measures, LAX achieved its 2023 target for the airport-owned shuttle buses by retiring a significant portion of its CNG-fueled buses. Although BUR and SNA did not meet their 2023 targets, both airports are actively engaged in the deployment of ZE buses and the required infrastructure.

Regarding the two measures targeting heavy duty trucks, although the 2023 targets have not completely been met, significant progress has been made toward these targets as well. For the LAX Alternative Fuel Vehicle Incentive measure, LAX has already distributed $320,000 out the $500,000 allocated funding with the program's full subscription, the remainder of the incentive funding are expected to be distributed in 2023 or subsequent year for near-zero or zero-emission trucks. For the SNA Fuel Pipeline Measure, SNA committed to eliminate routine commercial passenger jet fuel delivery trucks. Progress reports demonstrated that 98% and 99% of the fuel deliveries were carried out via pipeline in 2021 and 2022, respectively. However, a Fixed Base Operator (FBO) serving a commercial airline receives fuel via tanker truck in addition to pipeline fuel delivery. SNA commits to work with the FBO to transition all routine deliveries to the fuel pipeline. In 2021 and 2022, small amounts of fuel were delivered by tanker truck due to unexpected events and/or maintenance of the fuel pipeline.

Table 15 and Figure 6 summarize progress towards South Coast AQMD's 2023 SIP creditable reduction target for all MOU measures based on the airports 2022 and 2023 progress reports. The SIP creditable emission reductions represent the difference between the airport-reported remaining emissions and the projected SIP baseline inventory for the same reporting year. The SIP inventory is developed using a "top-down" method, which involves statewide or countywide estimates of equipment population or fuel consumption to calculate county-total emissions. In contrast, this MOU employs a "bottom-up" method, relying on specific data such as equipment population, model year, fuel type, engine size, and operation hours. Although these approaches inevitably lead to discrepancies that are challenging to reconcile, the

bottom-up approach is more accurate, provided the reported GSE database is accurate. Consequently, the report estimates SIP creditable reductions as the difference between the projected SIP baseline inventory and the reported emissions.

Table 15 presents the reductions from MOU measures targeting GSE, heavy-duty trucks, and airport shuttle buses in 2021 and 2022 as compared to the 2023 SIP creditable reduction targets for these measures. Attachment A of Appendix B of the FBMSM for Commercial Airports Staff Report[21] provides calculation methodology for SIP creditable reductions from MOU measures. Approximately 95% of the NOx reductions in 2023 were projected to come from GSE measures. The 2021 GSE NOx emissions for all airports totaled 228.8 tpy compared to the 2021 SIP baseline inventory of 420.5 tpy, which is 191.7 tpy lower or 46% less than the projected 2021 SIP baseline. The 2022 total GSE NOx emissions for all airports was 196.3 tpy compared to the 2022 SIP baseline inventory of 374.9 tpy, which is 178.5 tpy lower or 48% less than the projected SIP baseline inventory for the same year. These reductions are comparable to the 2023 SIP creditable reduction target of 180 tpy beyond the 2023 SIP baseline inventory. While the 2021 and 2022 GSE NOx emissions reductions cannot be directly compared to the 2023 SIP inventory, these reductions which have occurred due to transition to cleaner GSE under MOUs are expected to continue in 2023. The airports 2024 progress report will provide the SIP creditable reductions achieved in 2023.

[21] FBMSM Commercial Airport MOU Staff Report, Appendix B - SIP Credit Calculations, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous

Table 15. Progress toward SIP creditable reduction target by MOU measure for all airports (NOx, tpy)

MOU Measure	2021 Reductions	2022 Reductions	2023 SIP Creditable Reduction Target
GSE	191.7	178.5	180.2
LAX Fuel Incentive Measure	0.4	0.5	0.39
LAX ZE Shuttle Bus	0.1	0.1	6.40
JWA Fuel Pipeline	2.9	2.2	1.52
JWA Parking Shuttle Bus Electrification	-	-	1.34
BUR Shuttle Bus Electrification	-	-	0.11
Total	195.1	181.3	189.9

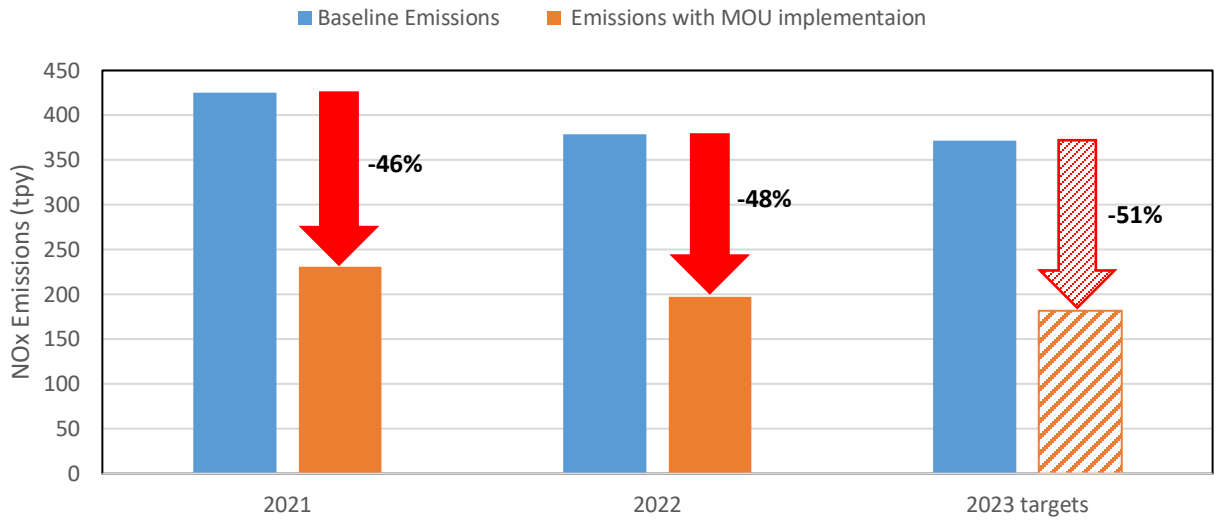

Figure 6. Comparison of total NOx emissions for all MOU measures with the SIP baseline. The orange bar in 2023 reflects the SIP creditable reduction target.

Figure 6 demonstrates positive progress in 2021 and 2022 toward the 2023 SIP creditable emission reduction target. The implementation of MOU measures resulted in a lower level of overall NOx emissions from the five airports, corresponding to 195.1 tpy and 181.3 tpy of SIP creditable reductions in 2021 and 2022, respectively. These reductions represent 46% and 48% reductions compared to the 2021 and 2022 SIP baseline, respectively. To achieve the 2023 target, the corresponding SIP creditable emissions reductions would be 189.9 tpy, or 51% lower compared to the projected 2023 SIP baseline. While the total reductions in 2021 and 2022 cannot be mapped directly to the 2023 inventory, significant progress has been made toward the reduction target in 2023 despite the continued impact of the pandemic on air travel activities particularly in 2021. The 2023 SIP creditable reductions for MOU measures will be reported in the airports 2024 progress reports.

The SIP creditable emissions reductions associated with implementation of the MOU measures satisfy the U.S. EPA's four integrity elements (i.e., surplus, permanent, quantifiable, and enforceable), with thorough supporting analysis presented in Chapter 4 of the FBMSM for Commercial Airports Staff Report.[22] All MOU measures provide surplus reductions because the accelerated pace of achieving the reductions exceeds the requirements under existing regulations. CARB's Zero-Emission Shuttle Bus Regulation and the In-Use Off-Road Diesel-Fueled Fleets Regulation are the only adopted regulations that may affect the 2031 surplus reductions from shuttle bus and GSE measures, respectively, due to the phase-in schedule of the regulations. All reductions achieved are quantifiable and permanent due to the stringent MOU reporting requirements, which require detailed emissions-related data and calculations. The detailed annual emissions inventories provided by the airports represent the remaining emissions for each measure and they provide the basis for tracking progress toward achieving the projected SIP credit in 2023, demonstrating permanency of emission reductions. The airports also provide data on the sale, retirement, and relocation of existing equipment to other airports within the South Coast Air Basin as specified in the MOUs. Finally, MOU reductions are enforceable due the airports' commitment to implement the measures and due to the public accessibility of the emissions calculations. Furthermore, the enforceable commitment by South Coast AQMD provides a safeguard against a potential shortfall.

Public Process

The airports' 2022 and 2023 MOU progress reports including emissions inventories and calculations are directly accessible at http://www.aqmd.gov/airportsmous. The airports' 2022 and 2023 progress reports for 2021 and 2022 reporting years were presented at the sixth Airport MOU Working Group Meeting on May 7, 2024 and are directly accessible at http://www.aqmd.gov/airportsmous. A summary of these reports and the preliminary SIP creditable NOx emission reductions were subsequently presented to South Coast AQMD's Mobile Source Committee on June 21, 2024.

Summary and Conclusion

This airports MOU progress report for 2021 and 2022 reporting years demonstrates that, despite the lingering impact of COVID-19 in 2021, significant progress in implementing the MOU measures were achieved in 2021 and 2022 and all airports either met or came close to their 2023 performance targets. South Coast AQMD's enforceable commitment is based on the airports' implementing their MOU measures and achieving their performance targets. In general, older GSEs are being phased out with newer units and good overall progress has been made in 2021 and 2022 toward meeting South Coast AQMD's 2023 SIP creditable emission reduction of 0.52 tpd of NOx emission reductions. All airports are fully committed to the implementation of MOU measures, and additional actions have been taken or proposed to be taken soon by those airports that have come close but have not met their 2023 performance targets.

[22] FBMSM for Commercial Airports Staff Report, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/commercial-airports-mous