

MOU MEASURE NO. 3 - ZERO-EMISSION BUS PROGRAM

This MOU Measure No. 3 is based on LAWA's Air Quality Improvement Measures plan for LAX (LAX AQIM), the LAWA Zero-Emission Bus Program to convert LAWA-owned buses at LAX to zero-emission buses and is attached to and a part of the MOU between LAWA and South Coast AQMD.

I. PROGRAM DESCRIPTION - Replace 20% and 100% of LAWA-owned and operated buses with zero-emission buses by January 1, 2023 and January 1, 2031, respectively.

II. PROGRAM TIMEFRAME - Upon execution through 2032.

III. LAWA OBLIGATIONS - LAWA shall:

A. Replace LAWA-owned buses to meet the specified targets.

B. Beginning in 2021, provide the following information to South Coast AQMD on an annual basis by June 1 for each preceding calendar year:

1. List of buses operating at LAWA with the following information:

- a. Vehicle Identification Number
- b. Vehicle model year
- c. Vehicle GVWR¹
- d. Bus engine model year
- e. Power rating (hp or kW)
- f. Odometer reading
- g. Vehicle miles traveled²

2. An emission inventory for the LAWA-owned bus fleet, following the methodology and calculations used to generate the 2017 baseline inventory report for the LAX AQIM.

3. List of buses replaced during the reported year and information specified in III.B.1. above on replaced and replacement buses (i.e., replaced buses scrapped or moved out of state).

¹ Gross Vehicle Weight Rating

² Vehicle miles traveled (VMT) will be based on actual annual mileage traveled by each bus in the LAWA-owned bus fleet.

**MOU MEASURE NO. 3
ZERO-EMISSION BUS PROGRAM**

Operating List

MOU Measure 3 III.B.1.

Reporting year: 2021

#	LAWA ID #	VIN	Vehicle Model Year	Vehicle GVWR	Engine Model Year	Fuel Type	Power Rating	Power Rating Unit	Odometer End	VMT
1	C-1308	1FDPF70J7SVA69431	1996	30000	1996	Gasoline	245	HP	14650	200
2	C-1608	1GDM7C1C21J505505	2001	17500	2001	Diesel	250	HP	8300	101
3	C-1643	1N9AMACG46C084063	2006	42760	2005	CNG	190	HP	39779	2643
4	C-1644	1N960B0286A140078	2006	68540	2006	CNG	320	HP	Not Available	3438 ^a
5	C-1645	1N960B02X6A140079	2006	68540	2006	CNG	320	HP	105157	4557
6	C-1646	1N960B0266A140080	2006	68540	2006	CNG	320	HP	95866	11366
7	C-1647	1N960B0286A140081	2006	68540	2006	CNG	320	HP	92000	1
8	C-1648	1N960B02X6A140082	2006	68540	2006	CNG	320	HP	105375	826
9	C-1649	1N960B0216A140083	2006	68540	2006	CNG	320	HP	88094	1594
10	C-1650	1N960B0206A140124	2006	68540	2006	CNG	320	HP	102500	10725
11	C-1651	1N960B0226A140125	2006	68540	2006	CNG	320	HP	96512	6959
12	C-1652	1N960B0246A140126	2006	68540	2006	CNG	320	HP	95756	2403
13	C-1653	1N960B0266A140127	2006	68540	2006	CNG	320	HP	78754	10454
14	C-1654	1N960B0286A140128	2006	68540	2006	CNG	320	HP	95228	4559
15	C-1655	1N960B02X6A140129	2006	68540	2006	CNG	320	HP	85656	801
16	C-1658	1N90350877A140058	2007	42540	2006	CNG	280	HP	270370	23679
17	C-1659	1N90350897A140059	2007	42540	2006	CNG	280	HP	238102	25569
18	C-1660	1N90350857A140060	2007	42540	2006	CNG	280	HP	Not Available	48246 ^b
19	C-1661	1N90350877A140061	2007	42540	2006	CNG	280	HP	Not Available	68239 ^b
20	C-1662	1N90350897A140062	2007	42540	2006	CNG	280	HP	249637	16058
21	C-1663	1N90350807A140063	2007	42540	2006	CNG	280	HP	255834	22654
22	C-1664	1N90350827A140064	2007	42540	2006	CNG	280	HP	123117	15099
23	C-1665	1N90350847A140065	2007	42540	2006	CNG	280	HP	104633	26203
24	C-1666	1N90350867A140066	2007	42540	2006	CNG	280	HP	Not Available	23705 ^b
25	C-1667	1N90350887A140067	2007	42540	2006	CNG	280	HP	207074	19679
26	C-1668	1N903508X7A140068	2007	42540	2006	CNG	280	HP	Not Available	4314 ^b
27	C-1670	1N90350887A140070	2007	42540	2006	CNG	280	HP	198503	28743
28	C-1671	1N90350887A140071	2007	42540	2006	CNG	280	HP	179970	12589
29	C-1672	1N90350817A140072	2007	42540	2006	CNG	280	HP	216701	20756
30	C-1673	1N90350887A140073	2007	42540	2006	CNG	280	HP	259051	26667
31	C-1674	1N90350857A140074	2007	42540	2006	CNG	280	HP	161698	14984
32	C-1675	1N90350877A140075	2007	42540	2006	CNG	280	HP	154888	29580
33	C-1676	1N90350897A140076	2007	42540	2006	CNG	280	HP	217417	22465
34	C-1677	1N90350807A140077	2007	42540	2006	CNG	280	HP	123458	0
35	C-1678	1N90350827A140078	2007	42540	2006	CNG	280	HP	214337	19387
36	C-1683	1N90350828A140499	2008	42540	2007	CNG	320	HP	Not Available	4103 ^b
37	C-1684	1N90350827A140500	2008	42540	2007	CNG	320	HP	142019	27290
38	C-1685	1N90350878A140501	2008	42540	2007	CNG	320	HP	243830	32704
39	C-1686	1N90350898A140502	2008	42540	2007	CNG	320	HP	Not Available	5550 ^b

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#	LAWA ID #	VIN	Vehicle Model Year	Vehicle GVWR	Engine Model Year	Fuel Type	Power Rating	Power Rating Unit	Odometer End	VMT
40	C-1687	1N90350808A140503	2008	42540	2007	CNG	320	HP	Not Available	26503 ^b
41	C-1688	1N90350828A140504	2008	42540	2007	CNG	320	HP	332920	46573
42	C-1689	1N90350848A140505	2008	42540	2007	CNG	320	HP	201567	0
43	C-1690	1N90350868A140506	2008	42540	2007	CNG	320	HP	Not Available	36812 ^b
44	C-1691	1N90350888A140507	2008	42540	2007	CNG	320	HP	Not Available	9783 ^b
45	C-1692	1N903508X8A140508	2008	42540	2007	CNG	320	HP	Not Available	39589 ^b
46	C-1693	1N90350818A140509	2008	42540	2007	CNG	320	HP	263987	51338
47	C-1694	1N90350888A140510	2008	42540	2007	CNG	320	HP	325812	33852
48	C-1695	1N903508X8A140511	2008	42540	2007	CNG	320	HP	199194	22244
49	C-1696	1N90350818A140512	2008	42540	2007	CNG	320	HP	Not Available	40988 ^b
50	C-1697	1N90350838A140513	2008	42540	2007	CNG	320	HP	265328	45854
51	C-1698	1N90350858A140514	2010	42540	2007	CNG	320	HP	222876	38065
52	C-1699	1N90350878A140515	2008	42540	2007	CNG	320	HP	225984	40304
53	C-1700	1N90350898A140516	2008	42540	2007	CNG	320	HP	Not Available	32874 ^b
54	C-1701	1N90350808A140517	2008	42540	2007	CNG	320	HP	Not Available	28963 ^b
55	C-1702	1N90350828A140518	2008	42540	2007	CNG	320	HP	Not Available	18266 ^b
56	C-1710	1N904220E8A140611	2008	42560	2008	CNG	280	HP	105473	3473
57	C-1711	1N90422058A140614	2008	42560	2008	CNG	280	HP	152699	7199
58	C-1712	1N9351819AA140433	2010	42540	2009	CNG	320	HP	Not Available	73789 ^b
59	C-1713	1N9351810AA140434	2010	42540	2009	CNG	320	HP	Not Available	58430 ^b
60	C-1714	1N9351812AA140435	2010	42540	2009	CNG	320	HP	Not Available	54282 ^b
61	C-1715	1N9351814AA140436	2010	42540	2009	CNG	320	HP	Not Available	62773 ^b
62	C-1716	1N9351816AA140437	2010	42540	2009	CNG	320	HP	273993	24881
63	C-1717	1N9351818AA140438	2010	42540	2009	CNG	320	HP	Not Available	74314 ^b
64	C-1718	1N935181XAA140439	2010	42540	2009	CNG	320	HP	441334	37780
65	C-1753	4UZAEJF6XKCKC3839	2019	25990	2019	CNG	220	HP	8281	0
66	C-1754	4UZAEJE72JJP8151	2019	25990	2019	CNG	220	HP	5087	0
67	C-1755	4UZAEJF65LCLU5935	2019	25990	2019	CNG	220	HP	10712	0
68	C-1756	4UZAEJF69LCLU5937	2019	25990	2019	CNG	220	HP	8100	0
69	C-1757	4UZAEJF67LCLU5936	2019	25990	2019	CNG	220	HP	8253	0
70	C-1758	4UZAEJF60LCLU5938	2019	25990	2019	CNG	220	HP	7279	0
71	C-1759	4UZAEJF66LCLU5944	2019	25990	2019	CNG	220	HP	8422	0
72	C-1760	4UZAEJF69LCLU5940	2019	25990	2019	CNG	220	HP	6826	0
73	C-1761	4UZAEJF62LCLU5939	2019	25990	2019	CNG	220	HP	10306	0
74	C-1762	4UZAEJF6XLCLU5946	2019	25990	2019	CNG	220	HP	6681	0
75	C-1763	4UZAEJF64LCLU5943	2019	25990	2019	CNG	220	HP	10571	0
76	C-1764	4UZAEJF68LCLU5945	2019	25990	2019	CNG	220	HP	9375	0
77	C-1765	4UZAEJF63LCLU5948	2019	25990	2019	CNG	220	HP	10113	0
78	C-1766	4UZAEJF65LCLU5949	2019	25990	2019	CNG	220	HP	5280	0

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ZERO-EMISSION BUS PROGRAM**

Operating List

MOU Measure 3 III.B.1.

Reporting year: 2021

#	LAWA ID #	VIN	Vehicle Model Year	Vehicle GVWR	Engine Model Year	Fuel Type	Power Rating	Power Rating Unit	Odometer End	VMT
79	C-1767	4UZAEJF62LCLU5942	2019	25990	2019	CNG	220	HP	9110	0
80	C-1768	4UZAEJF60LCLU5941	2019	25990	2019	CNG	220	HP	12355	0
81	C-1769	4UZAEJF63LCLU5951	2019	25990	2019	CNG	220	HP	11851	0
82	C-1770	4UZAEJF61LCLU5950	2019	25990	2019	CNG	220	HP	7213	0
83	C-1771	4UZAEJF65LCLU5952	2019	25990	2019	CNG	220	HP	11081	0
84	C-1772	4UZAEJF61LCLU5947	2019	25990	2019	CNG	220	HP	7934	0
85	C-1773	4UZAEJF67LCLU5953	2019	25990	2019	CNG	220	HP	6451	0
86	C-1774	4UZAEJF60LCLU5954	2019	25990	2019	CNG	220	HP	8508	0
87	C-1775	4UZAEJF69LCLU5954	2019	25990	2019	CNG	220	HP	8304	0
88	C-1776	4UZAEJF62LCLU5956	2019	25990	2019	CNG	220	HP	8181	0
89	C-1777	4UZAEJF66LCLU5958	2019	25990	2019	CNG	220	HP	8130	0
90	C-1778	4UZAEJF64LCLU5957	2019	25990	2019	CNG	220	HP	6660	0
91	C-1779	4UZAEJF68LCLU5959	2019	25990	2019	CNG	220	HP	10088	0
92	C-1780	4UZAEJF61LCLU5964	2019	25990	2019	CNG	220	HP	11172	0
93	C-1781	4UZAEJF68LCLU5962	2019	25990	2019	CNG	220	HP	10312	0
94	C-1782	4UZAEJF67LCLU9559	2019	25990	2019	CNG	220	HP	4186	0
95	C-1783	4UZAEJF66LCLU5961	2019	25990	2019	CNG	220	HP	9965	0
96	C-1784	4UZAEJF64LCLU5960	2019	25990	2019	CNG	220	HP	8857	0
97	C-1785	4UZAEJF65LCLV9561	2019	25990	2019	CNG	220	HP	1464	0
98	C-1786	4UZAEJF6XLCLU5963	2019	25990	2019	CNG	220	HP	5443	0
99	C-1787	4UZAEJF63LCLV9560	2019	25990	2019	CNG	220	HP	4855	0
100	C-1788	4UZAEJF65LCLV9558	2019	25990	2019	CNG	220	HP	8241	0
101	C-1900	4B9KCGA81K2038024	2019	66138	2019	Electric	180x2	kW	13733	9634
102	C-1901	4B9KCGA84K2038017	2019	66138	2019	Electric	180x2	kW	15885	11986
103	C-1902	4B9KCGA86K2038018	2019	66138	2019	Electric	180x2	kW	14000	11000
104	C-1903	4B9KCGA88K2038019	2019	66138	2019	Electric	180x2	kW	14972	8956
105	C-1904	4B9KCGA8XK2038023	2019	66138	2019	Electric	180x2	kW	12200	6146
106	C-1905	4B9KCGA81K2038010	2019	66138	2019	Electric	180x2	kW	12859	8944
107	C-1906	4B9KCGA83K2038011	2019	66138	2019	Electric	180x2	kW	14863	9060
108	C-1907	4B9KCGA85K2038012	2019	66138	2019	Electric	180x2	kW	17001	13087
109	C-1908	4B9KCGA88K2038005	2019	66138	2019	Electric	180x2	kW	14968	10125
110	C-1909	4B9KCGA8XK2038006	2019	66138	2019	Electric	180x2	kW	11728	8528
111	C-1910	4B9KCGA81K2038007	2019	66138	2019	Electric	180x2	kW	10504	8156
112	C-1911	4B9KCGA83K2038008	2019	66138	2019	Electric	180x2	kW	9798	7085
113	C-1912	4B9KCGA85K2038009	2019	66138	2019	Electric	180x2	kW	11074	9074
114	C-1913	4B9KCGA87K2038013	2019	66138	2019	Electric	180x2	kW	11385	8241
115	C-1914	4B9KCGA89K2038014	2019	66138	2019	Electric	180x2	kW	12500	8713
116	C-1915	4B9KCGA80K2038015	2019	66138	2019	Electric	180x2	kW	6000	4230
117	C-1916	4B9KCGA82K2038016	2019	66138	2019	Electric	180x2	kW	6451	5203
118	C-1917	4B9KCGA84K2038020	2019	66138	2019	Electric	180x2	kW	7150	5220

**MOU MEASURE NO. 3
ZERO-EMISSION BUS PROGRAM**

Operating List

MOU Measure 3 III.B.1.

Reporting year: 2021

#	LAWA ID #	VIN	Vehicle Model Year	Vehicle GVWR	Engine Model Year	Fuel Type	Power Rating	Power Rating Unit	Odometer End	VMT
119	C-1918	4B9KCGA86K2038021	2019	66138	2019	Electric	180x2	kW	4285	3086
120	C-1919	4B9KCGA88K2038022	2019	66138	2019	Electric	180x2	kW	8000	6500
121	C-3886	1FDFE4FS3HDC76054	2018	14500	2017	CNG	350	HP	39395	9152
122	C-3887	1FDFE4FS5HDC76055	2018	14500	2017	CNG	350	HP	32600	11753
123	C-3888	1FDFE4FS7HDC76056	2018	14500	2017	CNG	350	HP	29589	10804
124	C-3889	1FDFE4FS2HDC76062	2018	14500	2017	CNG	350	HP	42020	13122

^a VMT was estimated by multiplying fuel usage (gasoline gallon equivalent) with published bus miles per gallon (mpg).

^b VMT was estimated by multiplying the number of bus trips recorded in the Automatic Vehicle Identification System (AVI) with the set route distance (circuit) and adding 618 miles estimated for fueling trips for the year.

**MOU MEASURE NO. 3
ZERO-EMISSION BUS PROGRAM**

**Emission Inventory
MOU Measure 3 III.B.2.**

- I. PROGRAM DESCRIPTION - Replace 20% and 100% of LAWA-owned and operated buses with zero-emissions buses by January 1, 2023 and January 1, 2031, respectively.
- II. PROGRAM TIMEFRAME - Upon execution through 2032.

Reporting Year	Bus Fleet Count	% Electric	Emissions						
			<i>tpy</i>	<i>tpy</i>	<i>tpy</i>	<i>tpy</i>	<i>tpy</i>	<i>tpy</i>	<i>Mtpy</i>
			ROG	CO	NOx	PM10	PM2.5	SOx	CO2e
2021	124	16.0	0.41	207.95	3.60	0.57	0.23	0.00	9,104

The 2017 emission inventory baseline was performed for the LAX AQIM. The methodology and calculations were replicated to develop an emissions inventory for MOU reporting. In summary, these are the general steps used to calculate the Emission Inventory:

UBUS aggregate data is downloaded for the reporting year from CARB’s EMFAC2017 (v1.0.3) model for each type of fuel - gasoline, diesel, natural gas, and electricity.

An Excel SUMPRODUCT calculation is performed that multiplies the EMFAC value per fuel type [per day] times the fleet count of that fuel type, which is then divided by the fleet count total to get an average value per bus. Example: average Vehicle Miles Traveled (VMT) per day per bus, average tons per day of NOx per bus.

The average pollutant amounts [tons per day] are then divided by the average VMT per bus to get a tons per mile emissions amount. (It is at this step that the Global Warming Potential of CH4 and N2O are incorporated so that CO2e can be calculated.)

Then, the average VMT per bus per day is multiplied by the fleet count and converted to per year (multiplied by ~365), resulting in total VMT for all buses per year.

This VMT [miles per year] is then multiplied by each of the pollutant values [tons per mile] resulting in **tons per year**. This is the annual emissions inventory.

*Note: consistent with the 2017 LAX AQIM emissions inventory methodology, theoretical EMFAC VMT was used to calculate the **Emission Inventory**. The **Operating and Replacement/Replaced Lists** in this report shows actual VMT for each bus from available field logs.

**MOU MEASURE NO. 3
ZERO-EMISSION BUS PROGRAM**

**Replacement/Replaced List
MOU Measure 3 III.B.3.**

Reporting year: 2021

#	LAWA ID #	VIN	Vehicle Model Year	Vehicle GVWR	Engine Model Year	Fuel Type	Power Rating	Power Rating Unit	Odometer End	VMT	Replacement or replaced vehicle?	Purchase Date	Retired Date	Replaced Details
1	C-1435	TAW6985101U951120	1996	44975	1996	Diesel	136	HP	18077	0	Yes	3/5/1997	10/28/2020	Scrapped
2	C-1436	TAW6985101U951121	1996	44975	1996	Diesel	136	HP	21245	0	Yes	3/5/1997	10/28/2020	Scrapped
3	C-1437	TAW6985101U951122	1996	44975	1996	Diesel	136	HP	13602	0	Yes	3/5/1997	10/28/2020	Scrapped
4	C-1439	TAW6985101U951124	1996	44975	1996	Diesel	136	HP	17878	0	Yes	3/5/1997	9/16/2020	Scrapped
5	C-1440	TAW6985101U951125	1996	44975	1996	Diesel	136	HP	17999	0	Yes	3/5/1997	9/16/2020	Scrapped
6	C-1441	TAW6985101U951126	1996	44975	1996	Diesel	136	HP	17621	0	Yes	3/5/1997	9/16/2020	Scrapped
7	C-1444	TAW6985101U951127	1996	44975	1996	Diesel	136	HP	12253	0	Yes	3/5/1997	9/16/2020	Scrapped
8	C-1445	TAW6985101U951130	1996	44975	1996	Diesel	136	HP	20570	0	Yes	3/5/1997	10/28/2020	Scrapped
9	C-1446	TAW6985101U951131	1996	44975	1996	Diesel	136	HP	12295	0	Yes	3/5/1997	10/28/2020	Scrapped
10	C-1447	TAW6985101U951132	1996	44975	1996	Diesel	136	HP	22344	0	Yes	3/5/1997	10/28/2020	Scrapped
11	C-1449	TAW6985101U951184	1996	44975	1996	Diesel	136	HP	12440	0	Yes	3/5/1997	10/28/2020	Scrapped
12	C-1669	1N90350887A140069	2007	42540	2006	CNG	280	HP	144525	0	Yes	8/31/2007	7/14/2020	Scrapped
13	C-1677	1N90350807A140077	2007	42540	2006	CNG	280	HP	123458	0	Yes	9/24/2007	11/9/2021	Scrapped
14	C-1689	1N90350848A140505	2008	42540	2007	CNG	320	HP	201567	0	Yes	9/2/2008	11/16/2021	Scrapped