

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: 2020

#	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	14450	188
2	C-1435	TAW6985101U951120	1996	44975	1996	Diesel	136	HP	18077	107
3	C-1436	TAW6985101U951121	1996	44975	1996	Diesel	136	HP	21245	22
4	C-1437	TAW6985101U951122	1996	44975	1996	Diesel	136	HP	13602	287
5	C-1439	TAW6985101U951124	1996	44975	1996	Diesel	136	HP	17878	0
6	C-1440	TAW6985101U951125	1996	44975	1996	Diesel	136	HP	17999	35
7	C-1441	TAW6985101U951126	1996	44975	1996	Diesel	136	HP	17621	0
8	C-1444	TAW6985101U951127	1996	44975	1996	Diesel	136	HP	12253	0
9	C-1445	TAW6985101U951130	1996	44975	1996	Diesel	136	HP	20570	0
10	C-1446	TAW6985101U951131	1996	44975	1996	Diesel	136	HP	12295	16
11	C-1447	TAW6985101U951132	1996	44975	1996	Diesel	136	HP	22344	21
12	C-1449	TAW6985101U951184	1996	44975	1996	Diesel	136	HP	12440	27
13	C-1608	1GDM7C1C21J505505	2001	17500	2001	Diesel	250	HP	8199	78
14	C-1643	1N9AMACG46C084063	2006	42760	2005	CNG	190	HP	37136	57
15	C-1644	1N960B0286A140078	2006	68540	2006	CNG	320	HP	120980	2713
16	C-1645	1N960B02X6A140079	2006	68540	2006	CNG	320	HP	100600	7750
17	C-1646	1N960B0266A140080	2006	68540	2006	CNG	320	HP	84500	795
18	C-1647	1N960B0286A140081	2006	68540	2006	CNG	320	HP	91999	8498
19	C-1648	1N960B02X6A140082	2006	68540	2006	CNG	320	HP	104549	1969
20	C-1649	1N960B0216A140083	2006	68540	2006	CNG	320	HP	86500	122
21	C-1650	1N960B0206A140124	2006	68540	2006	CNG	320	HP	91775	915
22	C-1651	1N960B0226A140125	2006	68540	2006	CNG	320	HP	89553	883
23	C-1652	1N960B0246A140126	2006	68540	2006	CNG	320	HP	93353	3617
24	C-1653	1N960B0266A140127	2006	68540	2006	CNG	320	HP	68300	7842
25	C-1654	1N960B0286A140128	2006	68540	2006	CNG	320	HP	90669	3269
26	C-1655	1N960B02X6A140129	2006	68540	2006	CNG	320	HP	84855	1732
27	C-1658	1N90350877A140058	2007	42540	2006	CNG	280	HP	246691	22910
28	C-1659	1N90350897A140059	2007	42540	2006	CNG	280	HP	212533	21328
29	C-1660	1N90350857A140060	2007	42540	2006	CNG	280	HP	457078	13325
30	C-1661	1N90350877A140061	2007	42540	2006	CNG	280	HP	473710	22318
31	C-1662	1N90350897A140062	2007	42540	2006	CNG	280	HP	233579	5094
32	C-1663	1N90350807A140063	2007	42540	2006	CNG	280	HP	233180	8527
33	C-1664	1N90350827A140064	2007	42540	2006	CNG	280	HP	108018	580
34	C-1665	1N90350847A140065	2007	42540	2006	CNG	280	HP	78430	512
35	C-1666	1N90350867A140066	2007	42540	2006	CNG	280	HP	305387	19579
36	C-1667	1N90350887A140067	2007	42540	2006	CNG	280	HP	187395	8383
37	C-1668	1N903508X7A140068	2007	42540	2006	CNG	280	HP	253327	4130
38	C-1669	1N90350887A140069	2007	42540	2006	CNG	280	HP	144525	0
39	C-1670	1N90350887A140070	2007	42540	2006	CNG	280	HP	169760	21747
40	C-1671	1N90350887A140071	2007	42540	2006	CNG	280	HP	167381	5974

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Reporting year: 2020

#	LAWA ID #	VIN	Vehicle Model Year	Vehicle GVWR	Engine Model Year	Fuel Type	Power Rating	Power Rating Unit	Odometer End	VMT
41	C-1672	1N90350817A140072	2007	42540	2006	CNG	280	HP	195945	5677
42	C-1673	1N90350887A140073	2007	42540	2006	CNG	280	HP	232384	6898
43	C-1674	1N90350857A140074	2007	42540	2006	CNG	280	HP	146714	1350
44	C-1675	1N90350877A140075	2007	42540	2006	CNG	280	HP	125308	19221
45	C-1676	1N90350897A140076	2007	42540	2006	CNG	280	HP	194952	6670
46	C-1677	1N90350807A140077	2007	42540	2006	CNG	280	HP	123458	7724
47	C-1678	1N90350827A140078	2007	42540	2006	CNG	280	HP	194950	5663
48	C-1683	1N90350828A140499	2008	42540	2007	CNG	320	HP	248582	25040
49	C-1684	1N90350827A140500	2008	42540	2007	CNG	320	HP	114729	10580
50	C-1685	1N90350878A140501	2008	42540	2007	CNG	320	HP	211126	22801
51	C-1686	1N90350898A140502	2008	42540	2007	CNG	320	HP	442370	33209
52	C-1687	1N90350808A140503	2008	42540	2007	CNG	320	HP	270102	12394
53	C-1688	1N90350828A140504	2008	42540	2007	CNG	320	HP	286347	28346
54	C-1689	1N90350848A140505	2008	42540	2007	CNG	320	HP	201567	9292
55	C-1690	1N90350868A140506	2008	42540	2007	CNG	320	HP	295874	31010
56	C-1691	1N90350888A140507	2008	42540	2007	CNG	320	HP	277892	16227
57	C-1692	1N903508X8A140508	2008	42540	2007	CNG	320	HP	349146	27434
58	C-1693	1N90350818A140509	2008	42540	2007	CNG	320	HP	212649	36039
59	C-1694	1N90350888A140510	2008	42540	2007	CNG	320	HP	291960	33253
60	C-1695	1N903508X8A140511	2008	42540	2007	CNG	320	HP	176950	20791
61	C-1696	1N90350818A140512	2008	42540	2007	CNG	320	HP	273065	33914
62	C-1697	1N90350838A140513	2008	42540	2007	CNG	320	HP	219474	36929
63	C-1698	1N90350858A140514	2010	42540	2007	CNG	320	HP	184811	17885
64	C-1699	1N90350878A140515	2008	42540	2007	CNG	320	HP	185680	32904
65	C-1700	1N90350898A140516	2008	42540	2007	CNG	320	HP	316909	32004
66	C-1701	1N90350808A140517	2008	42540	2007	CNG	320	HP	265655	30142
67	C-1702	1N90350828A140518	2008	42540	2007	CNG	320	HP	370639	17647
68	C-1710	1N904220E8A140611	2008	42560	2008	CNG	280	HP	102000	1
69	C-1711	1N90422058A140614	2008	42560	2008	CNG	280	HP	145500	300
70	C-1712	1N9351819AA140433	2010	42540	2009	CNG	320	HP	327631	35853
71	C-1713	1N9351810AA140434	2010	42540	2009	CNG	320	HP	416161	28589
72	C-1714	1N9351812AA140435	2010	42540	2009	CNG	320	HP	422245	35435
73	C-1715	1N9351814AA140436	2010	42540	2009	CNG	320	HP	382218	35928
74	C-1716	1N9351816AA140437	2010	42540	2009	CNG	320	HP	249112	29542
75	C-1717	1N9351818AA140438	2010	42540	2009	CNG	320	HP	491903	31519
76	C-1718	1N935181XAA140439	2010	42540	2009	CNG	320	HP	403554	41335
77	C-1753	4UZAEJF6XKCKC3839	2019	25990	2019	CNG	220	HP	8281	8008
78	C-1754	4UZAEJE72JJP8151	2019	25990	2019	CNG	220	HP	5087	5087
79	C-1755	4UZAEJF65LCLU5935	2019	25990	2019	CNG	220	HP	10712	8008
80	C-1756	4UZAEJF69LCLU5937	2019	25990	2019	CNG	220	HP	8100	8008

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Operating List

MOU Measure 3 III.B.1.

Reporting year: 2020

#	LAWA ID #	VIN	Vehicle Model Year	Vehicle GVWR	Engine Model Year	Fuel Type	Power Rating	Power Rating Unit	Odometer End	VMT
81	C-1757	4UZA EJF67LCLU5936	2019	25990	2019	CNG	220	HP	8253	8008
82	C-1758	4UZA EJF60LCLU5938	2019	25990	2019	CNG	220	HP	7279	7279
83	C-1759	4UZA EJF66LCLU5944	2019	25990	2019	CNG	220	HP	8422	8008
84	C-1760	4UZA EJF69LCLU5940	2019	25990	2019	CNG	220	HP	6826	6826
85	C-1761	4UZA EJF62LCLU5939	2019	25990	2019	CNG	220	HP	10306	8008
86	C-1762	4UZA EJF6XLCLU5946	2019	25990	2019	CNG	220	HP	6681	6681
87	C-1763	4UZA EJF64LCLU5943	2019	25990	2019	CNG	220	HP	10571	8008
88	C-1764	4UZA EJF68LCLU5945	2019	25990	2019	CNG	220	HP	9375	8008
89	C-1765	4UZA EJF63LCLU5948	2019	25990	2019	CNG	220	HP	10113	8008
90	C-1766	4UZA EJF65LCLU5949	2019	25990	2019	CNG	220	HP	5280	0
91	C-1767	4UZA EJF62LCLU5942	2019	25990	2019	CNG	220	HP	9110	8008
92	C-1768	4UZA EJF60LCLU5941	2019	25990	2019	CNG	220	HP	12355	8008
93	C-1769	4UZA EJF63LCLU5951	2019	25990	2019	CNG	220	HP	11851	8008
94	C-1770	4UZA EJF61LCLU5950	2019	25990	2019	CNG	220	HP	7213	7213
95	C-1771	4UZA EJF65LCLU5952	2019	25990	2019	CNG	220	HP	11081	8008
96	C-1772	4UZA EJF61LCLU5947	2019	25990	2019	CNG	220	HP	7934	7934
97	C-1773	4UZA EJF67LCLU5953	2019	25990	2019	CNG	220	HP	6451	6451
98	C-1774	4UZA EJF60LCLU5954	2019	25990	2019	CNG	220	HP	8508	8008
99	C-1775	4UZA EJF69LCLU5954	2019	25990	2019	CNG	220	HP	8304	8008
100	C-1776	4UZA EJF62LCLU5956	2019	25990	2019	CNG	220	HP	8181	8008
101	C-1777	4UZA EJF66LCLU5958	2019	25990	2019	CNG	220	HP	8130	8008
102	C-1778	4UZA EJF64LCLU5957	2019	25990	2019	CNG	220	HP	6660	6660
103	C-1779	4UZA EJF68LCLU5959	2019	25990	2019	CNG	220	HP	10088	8008
104	C-1780	4UZA EJF61LCLU5964	2019	25990	2019	CNG	220	HP	11172	8008
105	C-1781	4UZA EJF68LCLU5962	2019	25990	2019	CNG	220	HP	10312	8008
106	C-1782	4UZA EJF67LCLU9559	2019	25990	2019	CNG	220	HP	4186	0
107	C-1783	4UZA EJF66LCLU5961	2019	25990	2019	CNG	220	HP	9965	8008
108	C-1784	4UZA EJF64LCLU5960	2019	25990	2019	CNG	220	HP	8857	8008
109	C-1785	4UZA EJF65LCLV9561	2019	25990	2019	CNG	220	HP	1464	1464
110	C-1786	4UZA EJF6XLCLU5963	2019	25990	2019	CNG	220	HP	5443	5443
111	C-1787	4UZA EJF63LCLV9560	2019	25990	2019	CNG	220	HP	4855	4855
112	C-1788	4UZA EJF65LCLV9558	2019	25990	2019	CNG	220	HP	8241	8008
113	C-1900	4B9KCGA81K2038024	2019	66138	2019	Electric	180x2	kW	4099	3649
114	C-1901	4B9KCGA84K2038017	2019	66138	2019	Electric	180x2	kW	3899	3427
115	C-1902	4B9KCGA86K2038018	2019	66138	2019	Electric	180x2	kW	3000	2553
116	C-1903	4B9KCGA88K2038019	2019	66138	2019	Electric	180x2	kW	6016	5634
117	C-1904	4B9KCGA8XK2038023	2019	66138	2019	Electric	180x2	kW	6054	5674
118	C-1905	4B9KCGA81K2038010	2019	66138	2019	Electric	180x2	kW	3915	3389
119	C-1906	4B9KCGA83K2038011	2019	66138	2019	Electric	180x2	kW	5803	5143
120	C-1907	4B9KCGA85K2038012	2019	66138	2019	Electric	180x2	kW	3914	3614

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

Operating List

MOU Measure 3 III.B.1.

Reporting year: 2020

#	LAWA ID #	VIN	Vehicle Model Year	Vehicle GVWR	Engine Model Year	Fuel Type	Power Rating	Power Rating Unit	Odometer End	VMT
121	C-1908	4B9KCGA88K2038005	2019	66138	2019	Electric	180x2	kW	4843	4292
122	C-1909	4B9KCGA8XK2038006	2019	66138	2019	Electric	180x2	kW	3200	2731
123	C-1910	4B9KCGA81K2038007	2019	66138	2019	Electric	180x2	kW	2348	1929
124	C-1911	4B9KCGA83K2038008	2019	66138	2019	Electric	180x2	kW	2713	2247
125	C-1912	4B9KCGA85K2038009	2019	66138	2019	Electric	180x2	kW	2000	1542
126	C-1913	4B9KCGA87K2038013	2019	66138	2019	Electric	180x2	kW	3144	2725
127	C-1914	4B9KCGA89K2038014	2019	66138	2019	Electric	180x2	kW	3787	3376
128	C-1915	4B9KCGA80K2038015	2019	66138	2019	Electric	180x2	kW	1770	1370
129	C-1916	4B9KCGA82K2038016	2019	66138	2019	Electric	180x2	kW	1248	807
130	C-1917	4B9KCGA84K2038020	2019	66138	2019	Electric	180x2	kW	1930	1516
131	C-1918	4B9KCGA86K2038021	2019	66138	2019	Electric	180x2	kW	1199	728
132	C-1919	4B9KCGA88K2038022	2019	66138	2019	Electric	180x2	kW	1500	1084
133	C-3886	1FD4E4FS3HDC76054	2018	14500	2017	CNG	350	HP	30243	6271
134	C-3887	1FD4E4FS5HDC76055	2018	14500	2017	CNG	350	HP	20847	8431
135	C-3888	1FD4E4FS7HDC76056	2018	14500	2017	CNG	350	HP	18785	4757
136	C-3889	1FD4E4FS2HDC76062	2018	14500	2017	CNG	350	HP	28898	9066

**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>miles per year</i>	<i>tpy</i>	<i>tpy</i>	<i>tpy</i>	<i>tpy</i>	<i>tpy</i>	<i>tpy</i>	<i>Mtpy</i>
			VMT	ROG	CO	NOx	PM10	PM2.5	SOx	CO2e
2020	136	14.7	5,256,584	0.23	64.86	1.79	0.15	0.06	0.00	2,899

The 2017 emission inventory baseline was performed for the LAX AQIM. The methodology and calculations were replicated to develop an emissions inventory for reporting in the 2021 year. In summary, these are the general steps used to calculate the Emission Inventory:

UBUS aggregate data is downloaded for the reporting year (2020 for reporting in 2021) 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: 2020

#	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	107	Yes	3/5/1997	10/28/2020	Scrapped
2	C-1436	TAW6985101U951121	1996	44975	1996	Diesel	136	HP	21245	22	Yes	3/5/1997	10/28/2020	Scrapped
3	C-1437	TAW6985101U951122	1996	44975	1996	Diesel	136	HP	13602	287	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	35	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	16	Yes	3/5/1997	10/28/2020	Scrapped
10	C-1447	TAW6985101U951132	1996	44975	1996	Diesel	136	HP	22344	21	Yes	3/5/1997	10/28/2020	Scrapped
11	C-1449	TAW6985101U951184	1996	44975	1996	Diesel	136	HP	12440	27	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