AREA SOURCE EMISSIONS FOR CALENDAR YEAR 2023
METHODOLOGY DOCUMENTATION

STATIONARY DIESEL ENGINES (NON-AGRICULTURE)

DESCRIPTION OF CATEGORY

This category estimates the emissions of TSP, SOX, NOX, TOG, and CO from internal combustion of diesel engines, including both stationary & portable IC engines (permitted to a fixed location), but excluding diesel engines related to agriculture.

CES	EIC	Name
89664	99-040-1200-0000	Stationary Diesel Engines (non-agriculture)

Previous Inventories

The South Coast AQMD updated emissions for this CES for 2008 base year as part of the 2012 Air Quality Management Plan (AQMP) development. However, emissions for CES, as well as emissions for stationary agricultural diesel engines, were overwritten by CARB inventories developed during its Airborne Toxic Control Measures (ATCM) process since the 2007 AQMP. Before CARB developing its ATCM, it worked with the air Districts and developed a 2002 base inventory for each county. The base inventory considered a variety engine types, horse-powers, usages, and ages. The methodology is described here: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full1-2.pdf. The approach used in this prospective Plan is slightly different and it is described in the next section.

METHODOLOGY AND ASSUMPTIONS

1. Engine Universe and Data Collection

A total of 12,907 emergency diesel engines are currently permitted under South Coast AQMD jurisdiction. To develop representative estimates, a stratified sample of 376 engines was selected. Records of hour meter readings from inspection reports were used to determine the overall operation hours of the emergency diesel engine universe. These usage rates were used to extrapolate overall activity across the full engine population. The overall operating hours in the basin based on reports is 17.27 hours per year.

2. Engine Tier Classification

The engine universe was disaggregated by U.S. EPA engine standard tiers (Tier 0 through Tier 4 Final). The distribution of engines by tier was used to categorize emission contributions according to regulatory benchmarks and applicable emission factors. The distribution of diesel emergency engines by tier is presented in Figure 1.

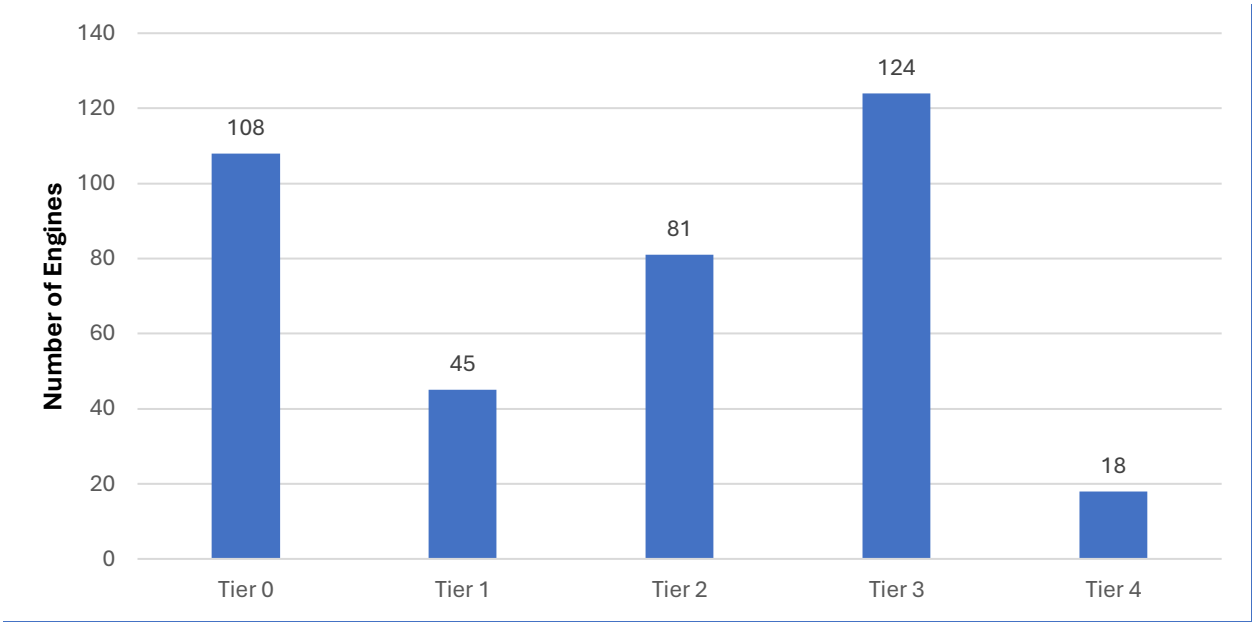

Figure 1. Distribution of engines by emission standard tier

3. Emission Factor Assignment

Emission factors were assigned according to the specific engine size and tier classification, as shown in the table below (Table 1). For each tier group, engine operation hours and associated NOx emissions were calculated based on the sampled data. These values were then scaled to represent the entire engine population by applying tier-specific weighting. Engineering evaluations were used to estimate emissions from Tier 0 engines, for which standard emission factors were not readily available. Emissions of SOx are based on full combustion of sulfur, assuming that ultra-low sulfur diesel contains 15 ppm of sulfur.

Table 1. Emission factors by engine size and tier standard

Engine Rating (hp)	Tier	Year(s)	NOx	CO	HC	PM
50 ≤ hp < 100	1	1998	6.9	4.1	1	0.6
	2	2004	5.3*	4.1	1	0.3
	3	2008	3.3*	4.1	1	0.3
50 ≤ hp < 75	4F	2013	3.3*	3.7	1	0.022
100 ≤ hp < 175	1	1997	6.9	3.7	1	0.6
	2	2003	4.6*	3.7	1	0.22
	3	2007	2.8*	3.7	1	0.22
75 ≤ hp < 175	4F	2012–2014	0.3	3.7	0.14	0.015
175 ≤ hp < 750	1	1996	6.9	8.5	1	0.4
175 ≤ hp < 300	2	2003	4.6*	2.6	1	0.15
300 ≤ hp < 600		2001	4.5*	2.6	1	0.15
600 ≤ hp < 750		2002	4.5*	2.6	1	0.15
175 ≤ hp < 750	3	2006	2.8*	2.6	1	0.15
	4F	2011–2014	0.3	2.6	0.14	0.015
hp ≥ 750	1	2000	6.9	8.5	1	0.4
	2	2006	4.5*	2.6	1	0.15
	4F	2015	0.5	2.6	0.14	0.022

*Emission factor includes NMHC + NOx, assuming 95% NOx and 5% NMHC

Table 2. Emissions from the emergency diesel engines universe in the South Coast Air Quality Management District jurisdiction

			Emissions (tons/year)			
	Size	**Units**	**NOx**	**CO**	**HC**	**PM**
Tier 0	50 ≤ hp < 100	509	6.9	2.7	0.4	0.4
	100 ≤hp < 175	691	18.5	4.6	1.2	1.2
	175 ≤ hp < 300	582	23.7	6.9	1.5	1.7
	300 ≤ hp < 600	873	66.5	16.2	3.8	3.3
	600 ≤ hp < 750	109	12.8	6.9	0.2	0.8
	hp ≥ 750	1,164	280.3	87.5	9.8	10.1
	Total Tier 0	**3,929**	**408.7**	**124.7**	**16.8**	**17.4**
Tier 1	50 ≤ hp < 100	109	1.1	0.7	0.2	0.1
	100 ≤hp < 175	400	7.0	3.8	1.0	0.6
	175 ≤ hp < 300	255	7.3	9.0	1.1	0.4
	300 ≤ hp < 600	182	10.2	12.5	1.5	0.6
	600 ≤ hp < 750	73	6.8	8.4	1.0	0.4
	hp ≥ 750	618	118.8	146.3	17.2	6.9
	Total Tier 1	**1,637**	**151.2**	**180.7**	**21.9**	**9.0**
Tier 2	50 ≤ hp < 100	255	2.1	1.6	0.4	0.1
	100 ≤hp < 175	327	4.3	3.4	0.9	0.2
	175 ≤ hp < 300	400	7.7	4.4	1.7	0.3
	300 ≤ hp < 600	400	14.6	8.2	3.2	0.5
	600 ≤ hp < 750	0	0.0	0.0	0.0	0.0
	hp ≥ 750	1,564	218.1	126.1	48.5	7.3
	Total Tier 2	**2,947**	**246.9**	**143.8**	**54.7**	**8.3**
Tier 3	50 ≤ hp < 100	473	2.6	3.2	0.8	0.2
	100 ≤hp < 175	982	7.8	10.2	2.8	0.6
	175 ≤ hp < 300	1,346	16.6	15.5	6.0	0.9
	300 ≤ hp < 600	1,528	35.5	33.0	12.7	1.9
	600 ≤ hp < 750	182	6.1	5.7	2.2	0.3
	Total Tier 3	**4,511**	**68.6**	**67.6**	**24.4**	**4.0**
Tier 4	75 ≤hp < 175	36	0.03	0.37	0.01	0.00
	175 ≤ hp < 750	73	0.14	1.21	0.07	0.01
	hp ≥ 750	546	9.55	49.77	2.68	0.38
	Total Tier 4	**655**	**9.73**	**51.35**	**2.76**	**0.39**
Total		**13,679**	**885.1**	**568.1**	**120.5**	**39.1**

	NOx	CO	HC	PM
Total Emissions (tons/day)	2.42	1.56	0.33	0.11

4. Spatial Allocation of Emissions

Spatial distribution of emissions was derived using maximum potential uncontrolled emissions as reported in individual engine permits. Each engine's location was identified by county and ZIP code. This information allowed for emissions to be geographically allocated across the South Coast and adjacent air basins. The estimated emission shares by region are shown in Table 3.

Table 3. Distribution of emissions amongst the subcounty areas under South Coast AQMD jurisdiction

County (Basin)	Emissions Allocation
Los Angeles (SC)	62%
Orange (SC)	18%
Riverside (SC)	8%
San Bernardino (SC)	9%
Riverside (Salton Sea)	2%
Riverside (Mojave Desert)	0%

Table 4. Emissions from emergency diesel engines by subcounty area (tons per year)

Area	NOx	CO	HC	PM	SOx
Los Angeles (SC)	547.2	351.2	74.5	24.2	0.6
Orange (SC)	158.3	101.6	21.6	7.0	0.2
Riverside (SC)	75.2	48.3	10.2	3.3	0.1
San Bernardino (SC)	82.2	52.7	11.2	3.6	0.1
Total South Coast	862.9	553.9	117.5	38.1	1.0
Riverside (Salton Sea)	22.2	14.3	3.0	1.0	0.0

5. Temporal Allocation

Current emissions inventory based on 2022 CEPAM for the PM2.5 Plan allocates monthly emissions using the following monthly profile:

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Factor	7.3	7.3	7.3	7.3	9.2	9.2	9.2	9.2	9.2	9.2	7.3	7.3

6. Speciation of TOG and PM Size Distribution

The speciation of TOG is based on the SPECIATE database from CARB. The profile for "Industrial ICE – distillate oil" (profile ID = 9) is used to determine the VOC fraction of TOG, which is 0.884.

The PM profile from the SPECIATE database corresponds to profile ID 116 – STAT I.C. Engine – Diesel. The fraction of PM2.5 and PM10 from total PM are 0.937 and 0.96, respectively.

SUMMARY AND NEW EMISSIONS

Below, emissions for calendar year 2023 are compared between the 2024 PM2.5 Plan and the Prospective SIP/AQMP. The 2024 PM2.5 plan used 2018 as the base year with projections based on the socioeconomic forecast from the 2020 RTP.

Table 5. Emissions from emergency diesel engines for base year 2023 (tons per day)

Pollutants	2022 AQMP	Prospective SIP/AQMP
VOC	0.12	0.32
NOx	2.26	2.36
CO	0.65	1.52
SOx	0.00	0.00
PM2.5	0.04	0.10
NH3	0.00	0.00