Appendix D

Air Quality, Greenhouse Gas, and Energy Modeling Data

ESA

Operational Mobile Source Emissions Calculations

ESA

ESGVAP
Air Quality and GHG Assessment
Operational Mobile Emissions

	Criteria Pollutant Emission Factors (lbs/mile)											GHG Emissions (metric tons/mile)				Criteria Pollutant Emissions (lbs/day)										GHG Emissions (metric tons/year)			
Year	**Weekday Daily VMT**	**VOC**	**NOx**	**CO**	**SOx**	**PM10 Road Dust**	**PM10**	**PM10 Total**	**PM2_5 Road Dust**	**PM2_5**	**PM2.5 Total**	**CO2**	**CH4**	**N2O**	**CO2e**	**VOC**	**NOx**	**CO**	**SOx**	**PM10 Road Dust**	**PM10**	**PM10 Total**	**PM2_5 Road Dust**	**PM2_5**	**PM2.5 Total**	**CO2**	**CH4**	**N2O**	**CO2e**
2035	29,161,029	7.09E-05	1.17E-04	1.89E-03	5.76E-06	6.61E-04	3.99E-05	7.01E-04	1.62E-04	1.34E-05	1.76E-04	2.64E-04	7.53E-09	7.03E-09	2.66E-04	2,067.30	3,409.61	55,200.63	167.88	19,277.09	1,163.13	20,440.22	4,731.65	391.21	5,122.86	2,812,057.49	80.11	74.80	2,836,351.95
2035	468,402	9.38E-05	5.12E-04	1.84E-03	8.61E-06	6.61E-04	1.89E-04	8.50E-04	1.62E-04	7.15E-05	2.34E-04	4.03E-04	6.06E-09	3.58E-08	4.13E-04	43.94	239.71	861.88	4.03	309.64	88.58	398.22	76.00	33.48	109.48	68,821.61	1.04	6.12	70,672.41
2035	358,223	4.90E-05	1.49E-03	1.02E-03	1.78E-05	6.61E-04	1.17E-04	7.78E-04	1.62E-04	4.24E-05	2.05E-04	8.54E-04	1.53E-08	1.06E-07	8.85E-04	17.55	535.39	365.23	6.36	236.81	41.86	278.67	58.12	15.20	73.32	111,603.06	2.00	13.85	115,779.95
2035	2,175,597	1.06E-04	3.78E-03	3.99E-03	2.44E-05	6.61E-04	2.98E-04	9.59E-04	1.62E-04	1.22E-04	2.85E-04	1.27E-03	1.45E-07	2.01E-07	1.33E-03	231.26	8,234.26	8,688.63	53.14	1,438.19	648.95	2,087.14	353.01	266.03	619.05	1,006,804.20	114.78	159.93	1,057,331.85
Totals																**2,360**	**12,419**	**65,116**	**231**			**23,204**			**5,925**				**4,080,136**
2035	29,054,234	7.09E-05	1.17E-04	1.89E-03	5.76E-06	6.61E-04	3.99E-05	7.01E-04	1.62E-04	1.34E-05	1.76E-04	2.64E-04	7.53E-09	7.03E-09	2.66E-04	2,059.73	3,397.12	54,998.48	167.27	19,206.49	1,158.87	20,365.36	4,714.32	389.78	5,104.10	2,801,759.02	79.82	74.53	2,825,964.52
2035	463,323	9.38E-05	5.12E-04	1.84E-03	8.61E-06	6.61E-04	1.89E-04	8.50E-04	1.62E-04	7.15E-05	2.34E-04	4.03E-04	6.06E-09	3.58E-08	4.13E-04	43.46	237.11	852.53	3.99	306.28	87.62	393.90	75.18	33.12	108.29	68,075.33	1.02	6.06	69,906.06
2035	354,318	4.90E-05	1.49E-03	1.02E-03	1.78E-05	6.61E-04	1.17E-04	7.78E-04	1.62E-04	4.24E-05	2.05E-04	8.54E-04	1.53E-08	1.06E-07	8.85E-04	17.35	529.55	361.25	6.29	234.22	41.41	275.63	57.49	15.03	72.52	110,386.50	1.97	13.70	114,517.86
2035	2,156,176	1.06E-04	3.78E-03	3.99E-03	2.44E-05	6.61E-04	2.98E-04	9.59E-04	1.62E-04	1.22E-04	2.85E-04	1.27E-03	1.45E-07	2.01E-07	1.33E-03	229.19	8,160.76	8,611.07	52.66	1,425.35	643.15	2,068.51	349.86	263.66	613.52	997,816.62	113.76	158.50	1,047,893.22
Totals																**2,350**	**12,325**	**64,823**	**230**			**23,103**			**5,898**				**4,058,282**

Source: EMFAC2021; Fehr & Peers, 2021 (VMT data)

ESGVAP
Road Dust Emission Factors

Paved Road Dust Emission Factors (Assumes No Precipitation)

Formula: $EF_{Dust,P} = (k\ (sL)^{0.91} \times (W)^{1.02})$

Where:

$EF_{Dust,P}$ =	Paved Road Dust Emission Factor (having the same units as k)
k =	particle size multiplier
sL =	road surface silt loading (g/m^2)
W =	average fleet vehicle weight (tons) (CARB uses 2.4 tons as a fleet average vehicle weight factor)

	Emission Factor (grams per VMT)	
	PM10	PM2.5
k	0.9979	0.2449
sL	0.1	0.1
W	2.4	2.4
$EF_{Dust,P}$	3.00E-01	7.36E-02

Unpaved Road Dust Emission Factors (Assumes No Precipitation)

Formula: $EF_{Dust,U} = (k\ (\ s / 12)^{1} \times (Sp / 30)^{0.5} / (M / 0.5)^{0.2}) - C)$

Where:

$EF_{Dust,U}$ =	Unpaved Road Dust Emission Factor (having the same units as k)
k =	particle size multiplier
s =	surface material silt content (%)
Sp =	mean vehicle speed (mph)
M =	surface material moisture content (%)
C =	Emission Factor for 1980s vehicle fleet exhaust, brake wear, and tire wear

	Emission Factor (grams per VMT)	
	PM10	PM2.5
k	816.47	81.65
s	4.3%	4.3%
Sp	15	15
M	0.5%	0.5%
C	0.00047	0.00036
$EF_{Dust,U}$	5.20E+00	5.19E-01

Sources:

SCAQMD, CalEEMod, Version 2011.1.
CARB, *Entrained Dust from Paved Road Travel: Emission Estimation Methodology Background Document* , (1997).
USEPA, *AP-42* , Fifth Edition, Volume I, Chapter 13.2.1 - Paved Roads, (2011).
ESA, 2020.

Operational Mobile Source Energy Calculations

ESA

ESGVAP
Operational Energy Analysis
Fuel Usage from VMT

Auto Daily VMT:	29,054,234	miles/day
Light Duty Truck Daily VMT:	463,323	miles/day
Medium Duty Truck Daily VMT:	354,318	miles/day
Heavy Duty Truck Daily VMT:	2,156,176	miles/day
Auto Annual VMT[4]:	10,604,795,388	miles/year
Light Duty Truck Annual VMT[4]:	169,112,948	miles/year
Medium Duty Truck Annual VMT[4]:	129,325,977	miles/year
Heavy Duty Truck Annual VMT[4]:	787,004,321	miles/year

Fuel Type:[1]	Gasoline	Diesel	Electricity	Natural Gas	Plug-in Hybrid
Auto Percent:	89.9%	0.3%	6.7%	0.0%	3.1%
Light Duty Truck Percent:	40.6%	35.0%	24.5%	0.0%	0.0%
Medium Duty Truck Percent:	13.4%	59.5%	25.9%	1.2%	0.0%
Heavy Duty Truck Percent:	1.6%	80.1%	11.9%	6.4%	0.0%
Auto Miles per Gallon Fuel:	29.9	27.1	-	-	64.5
Light Duty Truck Miles per Gallon:	15.4	20.1	-	-	-
Medium Duty Truck Miles per Gallon:	5.7	9.4	-	8.2	-
Heavy Duty Truck Miles per Gallon:	6.5	7.1	-	5.1	-
Auto Annual VMT by Fuel Type (miles):	9,532,670,096	34,858,680	711,284,742	-	325,981,870
Light Duty Truck Annual VMT by Fuel Type (miles):	68,607,765	59,145,017	41,360,166	-	-
Medium Duty Truck Annual VMT by Fuel Type (miles):	17,277,898	76,959,510	33,533,381	1,555,189	-
Heavy Duty Truck Annual VMT by Fuel Type (miles):	12,760,536	630,289,065	93,875,346	50,079,374	-
Auto Annual Fuel Usage (gallons):	319,099,803	1,284,938	-	-	5,052,349
Light Duty Truck Annual Fuel Usage (gallons):	4,443,303	2,939,221	-	-	-
Medium Duty Truck Annual Fuel Usage (gallons):	3,039,381	8,147,982	-	190,067	-
Heavy Duty Truck Annual Fuel Usage (gallons):	1,959,061	88,933,046	-	9,913,147	-
Medium Duty Truck Annual Natural Gas Use (kbtu):				24,308,610	
Heavy Duty Truck Annual Natural Gas Use (kbtu):				1,267,841,378	

	Los Angeles County Fuel Consumption [3]	
	Gasoline	Diesel
Los Angeles County:	2,770,000,000	610,204,082
No Project Total:	334,885,239	102,232,971
Project Annual Total:	333,593,897	101,305,187
Project Mobile Sources:	333,593,897	101,305,187
Project Emergency Generator:	-	-
Net Annual Total:	(1,291,343)	(927,784)
Percent Net Project of Los Angeles County:	-0.0466%	-0.1520%

1,292,149,988

Notes:

1. California Air Resources Board, EMFAC2021 (South Coast Air Basin; Annual; 2035', Aggregate Fleet).
2. Assumes electric vehicles would replace traditional gasoline-fueled vehicles.
3. California Energy Commission, California Retail Fuel Outlet Annual Reporting (CEC-A15) Results, 2020. Available at: https://ww2.energy.ca.gov/almanac/transportation_data/gasoline/piira_retail_survey.html. Accessed March 2022. Diesel is adjusted to account for retail (49%) and non-retail (51%) diesel sales.
4. Fehr & Peers, 2022

ESGVAP
Operational Energy Analysis
Fuel Usage from VMT

Auto Daily VMT:	29,161,029	miles/day
Light Duty Truck Daily VMT:	468,402	miles/day
Medium Duty Truck Daily VMT:	358,223	miles/day
Heavy Duty Truck Daily VMT:	2,175,597	miles/day
Auto Annual VMT[4]:	10,643,775,570	miles/year
Light Duty Truck Annual VMT[4]:	170,966,853	miles/year
Medium Duty Truck Annual VMT[4]:	130,751,268	miles/year
Heavy Duty Truck Annual VMT[4]:	794,093,060	miles/year

Fuel Type:[1]	Gasoline	Diesel	Electricity	Natural Gas	Plug-in Hybrid
Auto Percent:	89.9%	0.3%	6.7%	0.0%	3.1%
Light Duty Truck Percent:	40.6%	35.0%	24.5%	0.0%	0.0%
Medium Duty Truck Percent:	13.4%	59.5%	25.9%	1.2%	0.0%
Heavy Duty Truck Percent:	1.6%	80.1%	11.9%	6.4%	0.0%
Auto Miles per Gallon Fuel:	29.9	27.1	-	-	64.5
Light Duty Truck Miles per Gallon:	15.4	20.1	-	-	-
Medium Duty Truck Miles per Gallon:	5.7	9.4	-	8.2	-
Heavy Duty Truck Miles per Gallon:	6.5	7.1	-	5.1	-
Auto Annual VMT by Fuel Type (miles):	9,567,709,453	34,986,810	713,899,221	-	327,180,085
Light Duty Truck Annual VMT by Fuel Type (miles):	69,359,880	59,793,395	41,813,577	-	-
Medium Duty Truck Annual VMT by Fuel Type (miles):	17,468,316	77,807,675	33,902,949	1,572,328	-
Heavy Duty Truck Annual VMT by Fuel Type (miles):	12,875,473	635,966,232	94,720,904	50,530,451	-
Auto Annual Fuel Usage (gallons):	320,272,722	1,289,662	-	-	5,070,920
Light Duty Truck Annual Fuel Usage (gallons):	4,492,013	2,971,442	-	-	-
Medium Duty Truck Annual Fuel Usage (gallons):	3,072,877	8,237,781	-	192,162	-
Heavy Duty Truck Annual Fuel Usage (gallons):	1,976,707	89,734,087	-	10,002,437	-
Medium Duty Truck Annual Natural Gas Use (kbtu):				24,576,513	
Heavy Duty Truck Annual Natural Gas Use (kbtu):				1,279,261,134	

	Los Angeles County Fuel Consumption [3]	
	Gasoline	Diesel
Los Angeles County:	2,770,000,000	610,204,082
Existing Total:		
No Project Annual Total:	334,885,239	102,232,971
No Project Mobile Sources:	334,885,239	102,232,971
Project Emergency Generator:	-	-
Net Annual Total:	334,885,239	102,232,971
Percent Net Project of Los Angeles County:	12.0897%	16.7539%

1,303,837,647
(11,687,659)

Notes:

1. California Air Resources Board, EMFAC2021 (South Coast Air Basin; Annual; 2035', Aggregate Fleet).
2. Assumes electric vehicles would replace traditional gasoline-fueled vehicles.
3. California Energy Commission, California Retail Fuel Outlet Annual Reporting (CEC-A15) Results, 2020. Available at: https://ww2.energy.ca.gov/almanac/transportation_data/gasoline/piira_retail_survey.html. Accessed March 2022. Diesel is adjusted to account for retail (49%) and non-retail (51%) diesel sales.
4. Fehr & Peers, 2022