APPENDIX B-2

Supplemental Air Quality Study

November 5, 2018

Ms. Anne Surdzial, AICP
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Subject: MCC South Quarry Alternative Emission Calculations for Alternatives with Haul Trucks from Off-Site Sources

Dear Ms. Surdzial:

Yorke Engineering, LLC (Yorke) is providing this response to Comment 17-3 on the Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the South Quarry project.

Comment 17-3 on the Draft EIR/EIS for the South Quarry project noted that the comparison of air quality impacts for the Project alternatives did not include a detailed estimate of the emissions that would result from transporting high grade limestone ore from off-site locations, as would occur under Alternatives 2 and 3. Yorke has now calculated emissions for transporting high-grade limestone (at 1.3 million ton/year) from off-site sources under Alternatives 2 and 3.

The calculations were prepared for three different sources other than the South Quarry. These limestone sources were identified by MCC and its consultant, Lilburn Associates, based on the estimated quality and quantity of limestone reserves and the potential to obtain approvals to further develop those resources. Each of the three off-site sources involves a different mine, with the corresponding round trip length, based on a reasonable route as shown in the **attached** figures. The three locations are as follows: Omya at a distance of 128 miles each way (shortest distance), Big Maria at a distance of 173 miles each way, and Moapa at a distance of 248 miles each way (longest distance).

The number of trips per day and trips per year is based on 25 tons of rock/load (the capacity of the type of truck most commonly used in this service), the total throughput (1.3 million ton/year) and the 350 operating days/year scenario. In this document, Yorke will explain the emission factors used in pound per vehicle mile travelled (lb/VMT) and show the calculated emissions for each off-site source in lb/day and ton/year.

The following emission calculations are included in this analysis:

- Vehicle exhaust and related emissions obtained from the On-Road Motor Vehicle Emission Inventory Model (EMFAC2014), which is the most updated on-road vehicle calculation software available; and
- Paved road dust emissions obtained from Environmental Protection Agency (EPA) AP 42 emission factors, based on AP 42 guidance and parameters selected specifically for this project.

The purpose of this document is to provide the calculated emissions for the truck trips associated with hauling rock from off-site sources under Alternatives 2 and 3. The calculations include the following information:

- Truck description (same for all three off-site sources);
- Number of trips per day and per year (same for all three off-site sources);
- Truck trip length; and
- Trip location, including specific road sections used.

Table 1 presents the emission calculation parameters and other assumptions used in running the EMFAC2014 software. We have selected reasonable values for all parameters.

For truck size and type, we are using a T7 tractor, which is the standard type of vehicle used to transport limestone on public roads. For truck model year and calendar year, we have assumed 2019 calendar year and that all trucks are after 2014 (2015 or newer), and that the average turnover rate is five years. This means that, for the 2019 calendar year, the trucks are assumed to be evenly distributed between model years 2015, 2016, 2017, 2018, and 2019, and the average emission factors for those five cases are used. One key assumption that we are making is that the trucks travel an average of 50 mph. At this speed, the trip from the farthest off-site limestone source, Moapa, could be completed in approximately 10 hours. The 50 mph is an assumption applied to all three scenarios, and this assumption is reasonable and appropriate, given the truck type, load weight, and road segment types involved.

Table 2 presents the calculations for paved road dust emissions [particulate matter less than 2.5 or 10 microns in diameter ($PM_{2.5}$ and PM_{10})], based on EPA AP 42 emission factor equations and reasonable parameter values. The parameter values are based on average daily traffic rates obtained from a California Air Resources Board (CARB) reference where the road length is divided into segments according to the road category for each segment and appropriate values for average daily traffic rate, silt loading, and average vehicle weight are selected for each road category.

The vehicle exhaust emissions include the following components, as shown in Table 3:

- Running emissions (Runex);
- Idling emissions (Idlex);
- PM emissions from tire wear (PMTW); and
- PM emissions from brake wear (PMBW).

The results in Table 3 are calculated using the parameter values and assumptions in Table 1.

Table 4 presents the emission calculations for the three off-site limestone sources. The emission factor and trip length used in the calculations are different for each off-site source. The emission factor is different for each source because it is determined by the different road categories, assigned by road segment, which in turn reflect the silt content in the dust present on the road and the average vehicle weight of the existing traffic. The emissions are then calculated for each off-site source by multiplying the emission factor in lb/VMT by trip length). For all three off-site sources, we have assumed the same ratio of idling time to vehicle miles travelled, and we have used the same assumptions about the location (county) where the truck travel occurs.

The county selection has the following effects:

- For EMFAC calculations, the county is a parameter selected in the software, but in this case, this will have little effect because we are using a specially-defined fleet instead of the county typical fleet; and
- For paved road dust, CARB's default values that are used are county-dependent.

Given that the vast majority of the travel segments for all three scenarios are in San Bernardino County, the Mojave Desert Air Quality Management District (MDAQMD) section, this county selection reflects a reasonable estimate of the emissions under each scenario. There is a very small segment of one road that is in the South Coast Air Quality Management District (SCAQMD), but we are not using different parameters for this small segment. For the road segment in Nevada, we need to assign parameters from CARB's default values (since there are no values available for Nevada), so the selection for San Bernardino County is reasonable.

The number of trips per day (150) and trips per year (150 x 350) is also the same for each off-site source. Please note that, for the Moapa scenario, a portion of the route is located in Nevada. Reasonable routes from the other two off-site sources remain exclusively within California. Because the route is in Nevada, the emission increases actually occur in Nevada. To be conservative, we are not excluding those emissions from this analysis. Also, as noted above, it was necessary to select parameter values from those available for California counties, because there are no parameter values available for Nevada.

In addition to Tables 1 through 4 referenced above, we have included a number of supporting tables, as shown in the attached tables.

Emissions estimates are calculated assuming a fleet mix of vehicles from model years 2015 through 2019. This is a reasonable selection that reflects the likely vehicle fleet at the commencement of the Project. It is conceivable that more stringent engine emissions standards will be adopted in the future, which would result in lower emissions than shown in these calculations. However, the pollutants that might be affected and the degree of any such emissions reduction is entirely speculative. For the same reason, it is not possible at this time to differentiate the transportation emissions associated with Alternative 2, Partial Implementation, in which transportation of high-grade limestone from an off-site source would commence in approximately 40 years, and those associated with Alternative 3, No Action/No Project, in which transportation of high-grade limestone from an off-site source would commence in approximately 2019. Nonetheless, it is reasonable to use these estimates in comparing the air quality impacts of Alternatives 2 and 3 to the impacts of Alternative 1 because it is equally likely that improvements in engines and fuels will reduce air emissions from vehicles associated with the Alternative 1 over the same timeframe.

For the alternatives analysis with truck transport from nearby mines, Yorke has prepared carbon dioxide equivalent (CO_2e) greenhouse gas GHG) calculations, including methane (CH_4) and nitrous oxide (N_2O) using CARB/EPA standard emission factors for on-road truck trips from diesel fuel, and presented the three scenarios for Global Warming Potential (GWP) for CH_4 as shown in the attached table. The lowest CH_4 GWP of 25 is the value in current EPA GHG reporting regulatory documents and the values of 34 and 86 are from the IPCC Assessment Report 5 for 100-year and 20-year GWP, respectively. In all three cases of CH_4 GWP value, the contributions to CO_2e from CH_4 and N_2O are relatively small, so the effect of changing the CH_4 GWP on total CO_2e is small.

This concludes our response to Comment 17-3. Should you have any questions or concerns, please contact me at (949) 248-8490 x244.

Sincerely,

Anne McQueen
Principal Engineer
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Enclosures:

1. Attachment 1 – EMFAC Emission Calculation Tables for Transportation Scenarios and Figures

ATTACHMENT 1 – EMFAC EMISSION CALCULATION TABLES FOR TRANSPORTATION SCENARIOS AND FIGURES

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Table 1: Emission Calculation Parameters and Assumptions for Transportation of High Grade Limestone from Off-Site Sources

Param #	EMFAC Parameter	Units	Value Chosen	Reasoning
1	**Season**	N/A	Annual	Average across the year. Some pollutants are higher in the summer, and others are higher in the winter.
2	**EMFAC Version**	N/A	2014 (Software)	Most up-to-date version and includes all pollutants, whereas web version does not.
3	**Region**	N/A	San Bernardino County (MDAQMD)	County and section (MDAQMD) that the majority of the truck routes are in.
4	**CalYr**	N/A	2019	Beginning of project.
5	**Veh_Class**	N/A	T7 tractor	Heavy-Duty Diesel Vehicle class.
6	**MY**	N/A	2015-2019	For truck model year and calendar year, we have assumed 2019 calendar year and that all trucks are after 2014 (2015 or newer), and that the average turnover rate is five years. This means that, for the 2019 calendar year, the trucks are assumed to be evenly distributed between model years 2015, 2016, 2017, 2018, and 2019, and the average emission factors for those five cases are used.
7	**Speed**	mph	50	Presumed average speed on highways. Trucks must average at least 50mph for the Moapa scenario in order to complete 1 trip in a 10-hr day.
8	**Fuel**	N/A	DSL	Diesel Trucks.
9	**Temperature**	F	64	Average temperature of 2014, using Victorville #5 MET Station. Data taken from same year as AQ study data.
10	**Humidity**	%	38	Average humidity of 2014, using Victorville #5 MET Station. Data taken from same year as AQ study data.
Param #	**Paved Road Fugitive Dust Parameter**	**Units**	**Value Chosen**	**Reasoning**
11	**Silt Content**	g/m^2	0.015 to 0.84 (varies by route)	Values based on ARB Methodology 7.9, Table 3 -- ARB Roadway Category classification for a given road segment
12	**Average Vehicle Weight (based on Post-Project traffic)**	ton	2.5 to 21.8 (varies by route)	Values based on a traffic-count-average of California fleet average weight and MCC truck weights. California fleet average weight from ARB Methdology 7.9; traffic counts from Caltrans 2015 data, San Bernardino County 2012 data, and County of Riverside 2009 data; MCC trucks will be 50 tons heading towards MCC plant (loaded) and 25 tons heading away from MCC plant (empty).
13	**MCC empty truck weight**	ton	25	Empty trucks are 25 tons.
14	**MCC full truck weight**	ton	50	Full trucks will carry 25 tons material.

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Other Assumptions for Emission Calculations

1) Software version of EMFAC2014 was used instead of the web-version from CARB's website.
2) Since the majority of the routes are in San Bernardino County and the Mojave Air District, the subregion of San Bernardino (MD) was selected.
3) Truck and road emissions for the Moapa scenario assume the same calculation method for the portion of the road in Nevada.
4) Assuming vehicle class will be a T7 tractor, in the Heavy-Duty Diesel Vehicle class.
5) Temp/Humidity combination of 64F and 38% is the average temperature and humidity in 2014, based on data from the Victorville #5 MET station. Data taken from same year as AQ study data.
6) Trucks will be going an average of 50 mph, based on one truck completing a 496-mile trip in a 10-hr day.
7) There will be 150 daily round-trip truck trips, with 150 trucks completing one round-trip each day. One round-trip is from the quarry to Mitsubishi and back.
8) Trucks will be running 350 days per year.
9) A full truck assumes 25 tons of material per truckload.
10) The average vehicle weight values shown are a combination of the pre-project traffic at 2.4 tons/vehicle and the MCC trucks added for the project (at their respective weights for empty and full cases), where the MCC trucks represent between 0.4% and 55% of the total post-project traffic on the road, depending on the road segment.

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Table 2: On-Road Fugitive Dust Emission Factors for Transportation of High Grade Limestone from Off-Site Sources (page 1 of 2)

Development of PM Emission Factors[1]

$$E_f = [k * (sL)^{0.91} * (W)^{1.02}]$$

		[2]Omya - 128 mi. each way	[2]Big Maria Mountains - 173 mi. each way	[2,5]Moapa - 248 mi. each way	
		Segment 1: MCC to Barstow via CA 247 (44 mi. each way)	**Segment 1: MCC to Yucca Valley via CA 247 (55 mi. each way)**	**Segment 1: MCC to Barstow via CA 247 (44 mi. each way)**	
Equation element	**Symbol**	**Value**	**Value**	**Value**	**Assumption**
Particle size multiplier for PM10 (lb/VMT)	k	0.0022	0.0022	0.0022	EPA AP-42, Chapter 13.2.1-1
Particle size multiplier for PM2.5 (lb/VMT)	k	0.00054	0.00054	0.00054	EPA AP-42, Chapter 13.2.1-1
ARB Roadway Category		Major	Major	Major	ARB Methodology 7.9, Table 2
Paved surface silt content (g/m²)	sL	0.080	0.080	0.080	ARB Methodology 7.9, Table 3
Baseline annually-averaged daily traffic[3]		7,094	5,870	7,094	Caltrans 2015 Traffic Volumes on California State Highways
Baseline average vehicle weight (tons)		2.4	2.4	2.4	ARB Methodology 7.9
Post-Project annually-averaged daily traffic		7,394	6,170	7,394	150 additional trucks each day making 1 trip from quarry to MCC and 1 trip from MCC to quarry
Post-Project average vehicle weight (tons)[4]	W	3.8	4.1	3.8	150 50-ton trucks (loaded) and 150 25-ton trucks (empty) added to baseline ADT and weight
PM_{10} emission factor (lb/VMT)	E_f	8.68E-04	9.33E-04	8.68E-04	
$PM_{2.5}$ emission factor (lb/VMT)	E_f	2.13E-04	2.29E-04	2.13E-04	

		Segment 2: Barstow to Ludlow via I-40 (56 mi. each way)	**Segment 2: Yucca Valley to Rice via CA-62 (92 mi. each way)**	**Segment 2: Barstow to Moapa via I-215 (204 mi. each way)**	
Equation element	**Symbol**	**Value**	**Value**	**Value**	**Assumption**
Particle size multiplier for PM10 (lb/VMT)	k	0.0022	0.0022	0.0022	EPA AP-42, Chapter 13.2.1-1
Particle size multiplier for PM2.5 (lb/VMT)	k	0.00054	0.00054	0.00054	EPA AP-42, Chapter 13.2.1-1
ARB Roadway Category		Freeway	Major	Freeway	ARB Methodology 7.9, Table 2
Paved surface silt content (g/m²)	sL	0.015	0.080	0.015	ARB Methodology 7.9, Table 3
Baseline annually-averaged daily traffic[3]		34,700	15,230	82,932	Caltrans 2015 Traffic Volumes on California State Highways
Baseline average vehicle weight (tons)		2.4	2.4	2.4	ARB Methodology 7.9
Post-Project annually-averaged daily traffic		35,000	15,530	83,232	150 additional trucks each day making 1 trip from quarry to MCC and 1 trip from MCC to quarry
Post-Project average vehicle weight (tons)[4]	W	2.7	3.1	2.5	150 50-ton trucks (loaded) and 150 25-ton trucks (empty) added to baseline ADT and weight
PM_{10} emission factor (lb/VMT)	E_f	1.33E-04	6.95E-04	1.24E-04	
$PM_{2.5}$ emission factor (lb/VMT)	E_f	3.26E-05	1.71E-04	3.04E-05	

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Table 2: On-Road Fugitive Dust Emission Factors for Transportation of High Grade Limestone from Off-Site Sources (page 2 of 2)

		Segment 3: Ludlow to Amboy via National Trails Highway (28 mi. each way)	Segment 3: Rice to Big Maria Mountains via Midland Rd (26 mi. each way)		
Equation element	**Symbol**		**Value**		**Assumption**
Particle size multiplier for PM10 (lb/VMT)	k	0.0022	0.0022		EPA AP-42, Chapter 13.2.1-1
Particle size multiplier for PM2.5 (lb/VMT)	k	0.00054	0.00054		EPA AP-42, Chapter 13.2.1-1
ARB Roadway Category		Collector	Local		ARB Methodology 7.9, Table 2
Paved surface silt content (g/m^2)	sL	0.080	0.840		ARB Methodology 7.9, Table 3
Baseline annually-averaged daily traffic[3]		309	242		Most recent data from San Bernardino (2012) traffic counts for points along the route segment and from Riverside County (2009) traffic counts for closest count locations to the route segment
Baseline average vehicle weight (tons)		2.4	2.4		ARB Methodology 7.9
Post-Project annually-averaged daily traffic		609	542		150 additional trucks each day making 1 trip from quarry to MCC and 1 trip from MCC to quarry
Post-Project average vehicle weight (tons)[4]	W	19.7	21.8		150 50-ton trucks (loaded) and 150 25-ton trucks (empty) added to baseline ADT and weight
PM_{10} emission factor (lb/VMT)	E_f	4.62E-03	4.36E-02		
$PM_{2.5}$ emission factor (lb/VMT)	E_f	1.13E-03	1.07E-02		

		Distance-Weighted Average Emission Factors		
Parameter		**Value**	**Value**	**Value**
Segment 1 Length (miles)		44	55	44
Segment 1 PM_{10} emission factor (lb/VMT)		8.68E-04	9.33E-04	8.68E-04
Segment 1 $PM_{2.5}$ emission factor (lb/VMT)		2.13E-04	2.29E-04	2.13E-04
Segment 2 Length (miles)		56	92	204
Segment 2 PM_{10} emission factor (lb/VMT)		1.33E-04	6.95E-04	1.24E-04
Segment 2 $PM_{2.5}$ emission factor (lb/VMT)		3.26E-05	1.71E-04	3.04E-05
Segment 3 Length (miles)		28	26	
Segment 3 PM_{10} emission factor (lb/VMT)		4.62E-03	4.36E-02	
Segment 3 $PM_{2.5}$ emission factor (lb/VMT)		1.13E-03	1.07E-02	
Distance-weighted PM_{10} emission factor (lb/VMT)		**1.37E-03**	**7.22E-03**	**2.56E-04**
Distance-weighted $PM_{2.5}$ emission factor (lb/VMT)		**3.35E-04**	**1.77E-03**	**6.28E-05**

Notes:

1. Equation is from AP-42, Section 13.2.1, Paved Roads, equation 1.
2. Each route is broken into characteristic segments based on traffic volumes and roadway types covered by the route.
3. All traffic count points located along a project truck's route (or nearest to the route, if there are no traffic count points on the route itself) are averaged to obtain this value.
4. Average vehicle weights are calculated as follows: [(2.4 tons x Baseline AADT)+(50 tons x 150 loaded trips)+(25 tons x 150 empty trips)] / (Baseline AADT + 150 loaded trips + 150 empty trips)
5. Part of the Moapa route extends outside California into Nevada. Caltrans AADT data is only available for roads within California. The AADT value used for the portion of road within California was assumed to apply to the portion of road outside California. Similarly, the average baseline (non-project) vehicle weight of 2.4 tons was assumed for the non-California portion of road.

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Table 3: EMFAC2014 Emission Factors

	RUNEX (gms/mile)	IDLEX (gms/vehicle/day)	PMTW (gms/mile)	PMBW (gms/mile)	Active EF (lb/VMT)	Idle EF (lb/VMT)	Total Vehicle EF (lb/VMT)
NOx	0.301	15.510			6.64E-04	1.34E-04	7.98E-04
TOG	0.033	0.579			7.17E-05	4.99E-06	7.67E-05
CO	0.169	1.880			3.72E-04	1.62E-05	3.88E-04
SOx	0.013	0.053			2.80E-05	4.57E-07	2.84E-05
PM10	0.003	0.001	0.036	0.062	2.23E-04	1.29E-08	2.23E-04
PM2_5	0.003	0.001	0.009	0.026	8.53E-05	1.23E-08	8.54E-05
	RUNEX (gms/mile)	IDLEX (gms/vehicle/day)	PMTW (gms/mile)	PMBW (gms/mile)	Active EF (ton/VMT)	Idle EF (ton/VMT)	Total Vehicle EF (ton/VMT)
CO2	1328.951	5565.140			1.46E-03	2.40E-05	1.49E-03
CH4	0.054	0.226			1.19E-04	1.95E-06	1.21E-04
N2O	0.011	0.045			2.38E-05	3.89E-07	2.41E-05

	Total Vehicle EF (lb/VMT)	Paved Roads EF (lb/VMT)	Total EF (lb/VMT)
NOx	7.98E-04		7.98E-04
TOG	7.67E-05		7.67E-05
CO	3.88E-04		3.88E-04
SOx	2.84E-05		2.84E-05
PM10 - Omya	2.23E-04	1.37E-03	1.59E-03
PM10 - Big Maria Mtns	2.23E-04	7.22E-03	7.44E-03
PM10 - Moapa	2.23E-04	2.56E-04	4.79E-04
PM2_5 - Omya	8.54E-05	3.35E-04	4.21E-04
PM2_5 - Big Maria Mtns	8.54E-05	1.77E-03	1.86E-03
PM2_5 - Moapa	8.54E-05	6.28E-05	1.48E-04
	Total Vehicle EF (ton/VMT)	Paved Roads EF (ton/VMT)	Total EF (ton/VMT)
CO2	1.49E-03		1.49E-03
CH4	1.21E-04		1.21E-04
N2O	2.41E-05		2.41E-05

Parameters		
Conversion Factor:	453.6	g/lb
Conversion Factor:	2000	lb/ton
Minimum VMT per trip (Omya):	256	mi
CH4/CO2 ratio:	4.06E-05	
N2O/CO2 ratio:	8.11E-06	
CH4/CO2 and N2O/CO2 ratios from Title 40, Chapter I, Subchapter C, Part 98, Tables A-1, C-1, and C-2 are applied to EMFAC data to obtain CH4 and N2O emissions		

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Table 4: Emission Calculations for Transportation of High Grade Limestone from Off-Site Sources

			Emissions - Omya		Emissions - Big Maria Mountains		Emissions - Moapa	
	EF w/o Paved Roads	Total EF	128 mi. each way		173 mi. each way		248 mi. each way	
Pollutant	(lb/VMT)	(lb/VMT)	lb/d	ton/yr	lb/d	ton/yr	lb/d	ton/yr
NOx	7.98E-04	7.98E-04	30.63	5.36	41.40	7.24	59.35	10.39
TOG	7.67E-05	7.67E-05	2.94	0.52	3.98	0.70	5.70	1.00
CO	3.88E-04	3.88E-04	14.90	2.61	20.14	3.52	28.86	5.05
SOx	2.84E-05	2.84E-05	1.09	0.19	1.47	0.26	2.11	0.37
PM10	2.23E-04	Omya: 1.59E-03 Big Maria: 7.44E-03 Moapa: 4.79E-04	61.05	10.68	386.11	67.57	35.63	6.24
PM2_5	8.54E-05	Omya: 4.21E-04 Big Maria: 1.86E-03 Moapa: 1.48E-04	16.16	2.83	96.36	16.86	11.02	1.93
		Total EF	**Emissions - Omya**		**Emissions - Big Maria Mountains**		**Emissions - Moapa**	
Pollutant		(ton/VMT)	ton/d	ton/yr	ton/d	ton/yr	ton/d	ton/yr
CO2	1.49E-03	1.49E-03	5.72E+01	2.00E+04	7.73E+01	2.70E+04	1.11E+02	3.88E+04
CH4	1.21E-04	1.21E-04	4.64	0.81	6.27	1.10	8.99	1.57
N2O	2.41E-05	2.41E-05	0.93	0.16	1.25	0.22	1.80	0.31
CO2e - CH4 GWP=25			449.58	20,078.89	607.63	27,137.87	871.05	38,902.84
CO2e - CH4 GWP=34			491.36	20,086.20	664.10	27,147.75	952.00	38,917.01
CO2e - CH4 GWP=86			732.76	20,128.44	990.37	27,204.85	1,419.72	38,998.86

Equations

$$Total\ Emissions\left(\frac{lb}{d}\right) = EF_{total}\left(\frac{lb}{VMT}\right) * \frac{VMT}{\cancel{trip}} * \frac{trip}{d}$$

$$Total\ Emissions\left(\frac{ton}{yr}\right) = \mathrm{EMS}_{\frac{lb}{d}} * \frac{day}{yr} * \frac{1\ ton}{2000\ lb}$$

Parameters		Reference
CEQA Project date:	2019	
Round Trips per day:	150 round trips/d	1 round trip=both directions. Miles for each route shown above are one-way.
Avg speed of vehicles:	50 mi/hr	
# of vehicles:	150 vehicle	Estimated based on time 1 trip will take.
Round Trips per vehicle per day:	1 round trip/vehicle/d	1 round trip/veh/d based on (248 mi/trip x 2 = 496 mi/round trip at 50mi/hr average ~ 10 hr/d).
Days per year:	350 d/y	
Conversion Factor:	453.6 g/lb	
Conversion Factor:	2000 lb/ton	
CO2 GWP:	1	Title 40, Chapter I, Subchapter C, Part 98, Tables A-1, C-1, and C-2 for distillate fuel #2.
CH4 GWP[1]:	25, 34, 86	Title 40, Chapter I, Subchapter C, Part 98, Tables A-1, C-1, and C-2 for distillate fuel #2.
N2O GWP:	298	Title 40, Chapter I, Subchapter C, Part 98, Tables A-1, C-1, and C-2 for distillate fuel #2.

1) CH4 calculated with three different GWP values: GWP of 25 from EPA 40 CFR 98 Table A-1 as of May 4, 2017, and a 100-year GWP of 34 and a 20-year GWP of 86 from the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5.

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Supporting Table A: EMFAC2014 RUNEX Emission Factors

		RUNEX Emission Factor (g/mile) for Calendar Year 2019 and Model Years 2015-2019					
	Emiss Type	MY2015	MY2016	MY2017	MY2018	MY2019	Average
NOx	RUNEX	0.372	0.335	0.300	0.266	0.233	0.301
TOG	RUNEX	0.037	0.035	0.032	0.030	0.028	0.033
CO	RUNEX	0.194	0.181	0.168	0.156	0.144	0.169
SOx	RUNEX	0.013	0.013	0.013	0.013	0.013	0.013
PM10	RUNEX	0.004	0.004	0.003	0.003	0.003	0.003
PM2_5	RUNEX	0.004	0.004	0.003	0.003	0.003	0.003
CO2	RUNEX	1351.948	1351.948	1313.619	1313.619	1313.619	1328.951

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Supporting Table B: Traffic Counts Along Omya Route

MCC - Barstow Segment (Caltrans 2015 Traffic Count Data)												
Dist	**Route**	**County**	**Postmile**	**Description**	**Back Peak Hour**	**Back Peak Month**	**Back AADT**	**Ahead Peak Hour**	**Ahead Peak Month**	**Ahead AADT**	**Within Route**	**Total AADT**
8	18	SBD	65.756	MARBLE CANYON ROAD	590	3300	2900	860	4750	4200	Ahead	4200
8	18	SBD	73.783	LUCERNE VALLEY, JCT. RTE. 247	670	6200	6000	900	8400	8100	Back	6000
8	247	SBD	44.85	JCT. RTE. 18	270	2950	2850	200	1950	1850	Ahead	1850
8	247	SBD	46.114	RABBIT SPRING ROAD	200	1950	1850	190	1900	1800	Back and Ahead	3650
8	247	SBD	56.475	LUCERNE VALLEY CUTOFF ROAD	190	1900	1800	220	2150	2000	Back and Ahead	3800
8	247	SBD	73.181	STODDARD WELLS ROAD	220	2150	2000	190	1900	1750	Back and Ahead	3750
8	247	SBD	76.422	BARSTOW CITY LIMITS	190	1950	1800	1450	14300	13300	Back and Ahead	15100
8	247	SBD	78.096	BARSTOW, JCT. RTE. 15	2000	19800	18400				Back	18400
											Route Segment Average	7094

Barstow - Ludlow Segment (Caltrans 2015 Traffic Count Data)												
Dist	**Route**	**County**	**Postmile**	**Description**	**Back Peak Hour**	**Back Peak Month**	**Back AADT**	**Ahead Peak Hour**	**Ahead Peak Month**	**Ahead AADT**	**Within Route?**	**Total AADT**
8	15	SBD	73.543	JCT. RTE. 247 SOUTH, BARSTOW ROA	8300	87000	71000	7700	81000	66000	Ahead	66000
8	15	SBD	74.418	BARSTOW, JCT. RTE. 40 EAST	7700	81000	66000	5500	58000	47000	Back	66000
8	40	SBD	0	BARSTOW, JCT. RTE. 15				2600	22400	19600	Ahead	19600
8	40	SBD	0.794	MONTARA AVENUE	2600	22400	19600	2550	22600	19700	Back and Ahead	39300
8	40	SBD	2.348	MAIN STREET	2550	22600	19700	2350	20600	18000	Back and Ahead	37700
8	40	SBD	4.708	NEBO STREET	2350	20600	18000	2300	20000	17500	Back and Ahead	35500
8	40	SBD	7.181	A STREET	2300	20000	17500	2000	17500	15300	Back and Ahead	32800
8	40	SBD	12.191	AIRPORT ROAD	2000	17500	15300	1850	16300	14200	Back and Ahead	29500
8	40	SBD	18.446	WEST NEWBERRY ROAD	1850	16300	14200	1700	14800	12900	Back and Ahead	27100
8	40	SBD	23.334	FORT CADY ROAD	1700	14800	12900	1650	14400	12500	Back and Ahead	25400
8	40	SBD	32.496	HECTOR ROAD	1600	14600	12700	1600	14300	12400	Back and Ahead	25100
8	40	SBD	49.984	CRUCERO ROAD	1600	14300	12400	1450	13000	11300	Back	12400
											Route Segment Average	34700

Ludlow-Amboy Segment (San Bernardino County 2012 Traffic Count Data)						
Road Number	**Road Name**	**Location**	**Direction**	**Count Site**	**Date**	**ADT**
586600	NATIONAL TRAILS HIGHWAY	LUDLOW	TWO-WAY	E CRUCERO RD	3/1/2012	269
586600	NATIONAL TRAILS HIGHWAY	LUDLOW	TWO-WAY	E, ELLIOT	3/1/2012	108
586600	NATIONAL TRAILS HIGHWAY	LUDLOW	TWO-WAY	W AMBOY ROAD	3/1/2012	121
586600	NATIONAL TRAILS HIGHWAY	AMBOY	TWO-WAY	E AMBOY CUTOFF	3/27/2012	737
					Route Segment Average	309

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Supporting Table C: Traffic Counts Along or Nearest Big Maria Mountain Route

MCC - Yucca Valley Segment (Caltrans 2015 Traffic Count Data)												
Dist	**Route**	**County**	**Postmile**	**Description**	**Back Peak Hour**	**Back Peak Month**	**Back AADT**	**Ahead Peak Hour**	**Ahead Peak Month**	**Ahead AADT**	**Within Route?**	**Total AADT**
8	18	SBD	65.756	MARBLE CANYON ROAD	590	3300	2900	860	4750	4200	Ahead	4200
8	18	SBD	73.783	LUCERNE VALLEY, JCT. RTE. 247	670	6200	6000	900	8400	8100	Back	6000
8	247	SBD	0	YUCCA VALLEY, JCT. RTE. 62				1050	11600	11200	Ahead	11200
8	247	SBD	39.598	CAMP ROCK ROAD	270	2950	2850	220	2350	2250	Ahead and Back	5100
8	247	SBD	44.85	JCT. RTE. 18	270	2950	2850	200	1950	1850	Back	2850
											Route Segment Average	5870

Yucca Valley - Rice Segment (Caltrans 2015 Traffic Count Data)												
Dist	**Route**	**County**	**Postmile**	**Description**	**Back Peak Hour**	**Back Peak Month**	**Back AADT**	**Ahead Peak Hour**	**Ahead Peak Month**	**Ahead AADT**	**Within Route?**	**Total AADT**
8	62	SBD	12.404	YUCCA VALLEY, JCT. RTE. 247 NORTH	2800	29500	28000	2800	29000	27500	Ahead	27500
8	62	SBD	15.145	YUCCA MESA ROAD	2800	29000	27500	2050	21400	20400	Ahead and Back	47900
8	62	SBD	18.267	JOSHUA TREE, PARK BOULEVARD	1750	18200	17300	1750	18200	17300	Ahead and Back	34600
8	62	SBD	22.165	SUNFAIR ROAD	1750	18200	17300	1500	15200	14500	Ahead and Back	31800
8	62	SBD	31.196	TWENTYNINE PALMS, NATIONAL PARK/HATCH	1500	15200	14500	1600	16400	15600	Ahead and Back	30100
8	62	SBD	33.208	TWENTYNINE PALMS, ADOBE ROAD	1150	12000	11400	990	10300	9800	Ahead and Back	21200
8	62	SBD	34.223	29 PALMS/UTAH TRAIL	850	5800	5300	490	3350	3060	Ahead and Back	8360
8	62	SBD	79.476	SAN BERNARDINO/RIVERSIDE COUNTY LINE	140	940	860				Back	860
8	62	RIV	79.476	SAN BERNARDINO/RIVERSIDE COUNTY LINE				140	1200	860	Ahead	860
8	62	RIV	84.965	JCT. RTE. 177 SOUTH	230	1200	860	420	2200	1530	Ahead and Back	2390
8	62	RIV	90.203	RIVERSIDE/SAN BERNARDINO COUNTY LINE	420	2200	1530				Back	1530
8	62	SBD	90.203	RIVERSIDE/SAN BERNARDINO COUNTY LINE				420	2200	1530	Ahead	1530
8	62	SBD	102.254	CADIZ ROAD	420	2200	1530	420	2200	1530	Ahead and Back	3060
8	62	SBD	107.237	BLYTHE RICE ROAD	420	2200	1530	420	2200	1530	Back	1530
											Route Segment Average	15230

Rice - Big Maria Mountain Segment (County of Riverside 2009 Traffic Count Data)						
Location	**Direction**	**X-Street**	**Note**	**Date**	**Day**	**ADT**
MIDLAND RD	N	ARROWHEAD BLVD	CENSUS	6/11/2009	THURSDAY	242
					Route Segment Average	242

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Supporting Table D: Traffic Counts Along Moapa Route

MCC - Barstow Segment (Caltrans 2015 Traffic Count Data)												
Dist	Route	County	Postmile	Description	Back Peak Hour	Back Peak Month	Back AADT	Ahead Peak Hour	Ahead Peak Month	Ahead AADT	Within Route?	Total AADT
8	18	SBD	65.756	MARBLE CANYON ROAD	590	3300	2900	860	4750	4200	Ahead	4200
8	18	SBD	73.783	LUCERNE VALLEY, JCT. RTE. 247	670	6200	6000	900	8400	8100	Back	6000
8	247	SBD	44.85	JCT. RTE. 18	270	2950	2850	200	1950	1850	Ahead	1850
8	247	SBD	46.114	RABBIT SPRING ROAD	200	1950	1850	190	1900	1800	Back and Ahead	3650
8	247	SBD	56.475	LUCERNE VALLEY CUTOFF ROAD	190	1900	1800	220	2150	2000	Back and Ahead	3800
8	247	SBD	73.181	STODDARD WELLS ROAD	220	2150	2000	190	1900	1750	Back and Ahead	3750
8	247	SBD	76.422	BARSTOW CITY LIMITS	190	1950	1800	1450	14300	13300	Back and Ahead	15100
8	247	SBD	78.096	BARSTOW, JCT. RTE. 15	2000	19800	18400				Back	18400
											Route Segment Average	7094

Barstow - Moapa Segment (Caltrans 2015 Traffic Count Data)												
Dist	Route	County	Postmile	Description	Back Peak Hour	Back Peak Month	Back AADT	Ahead Peak Hour	Ahead Peak Month	Ahead AADT	Within Route?	Total AADT
8	15	SBD	73.543	JCT. RTE. 247 SOUTH, BARSTOW ROAD	8300	87000	71000	7700	81000	66000	Ahead	66000
8	15	SBD	74.418	BARSTOW, JCT. RTE. 40 EAST	7700	81000	66000	5500	58000	47000	Back and Ahead	113000
8	15	SBD	74.949	BARSTOW, EAST MAIN STREET	5500	58000	47000	5500	58000	47000	Back and Ahead	94000
8	15	SBD	76.883	JCT. RTE. 58 WEST	5500	58000	47000	5500	58000	47000	Back and Ahead	94000
8	15	SBD	79.593	FORT IRWIN/MERIDIAN ROADS	5500	58000	47000	5300	55000	45000	Back and Ahead	92000
8	15	SBD	81.84	GHOST TOWN ROAD	5300	55000	45000	5000	46000	43000	Back and Ahead	88000
8	15	SBD	84.641	YERMO/CALICO ROAD	5000	46000	43000	4900	45000	42000	Back and Ahead	85000
8	15	SBD	86.38	EAST YERMO	4900	45000	42000	4900	45000	42000	Back and Ahead	84000
8	15	SBD	88.489	MINNEOLA ROAD	4900	45000	42000	4900	45000	42000	Back and Ahead	84000
8	15	SBD	96.41	HARVARD ROAD	4900	45000	42000	4850	44500	41600	Back and Ahead	83600
8	15	SBD	103.633	FIELD ROAD	4850	44500	41600	4850	44500	41600	Back and Ahead	83200
8	15	SBD	111.592	AFTON ROAD	4850	44000	41500	4850	44000	41500	Back and Ahead	83000
8	15	SBD	120.425	BASIN ROAD	4850	44000	41500	4850	44000	41500	Back and Ahead	83000
8	15	SBD	124.237	RASOR ROAD	4850	44000	41500	4850	44000	41500	Back and Ahead	83000
8	15	SBD	130.181	ZZYZX ROAD	4850	44000	41500	4850	44000	41400	Back and Ahead	82900
8	15	SBD	135.806	WEST BAKER	4850	44000	41400	4200	38500	36200	Back and Ahead	77600
8	15	SBD	136.574	BAKER, JCT. RTE. 127	4200	38500	36200	4150	38000	35500	Back and Ahead	71700
8	15	SBD	138.456	EAST BAKER	4150	38000	35500	5100	45000	42000	Back and Ahead	77500
8	15	SBD	149.605	HALLORAN SPRINGS	5100	45000	42000	5100	44500	41600	Back and Ahead	83600
8	15	SBD	155.571	HALLORAN SUMMIT	5100	44500	41600	5100	44500	41700	Back and Ahead	83300
8	15	SBD	162.733	CIMA ROAD	5100	44500	41700	5100	45000	42000	Back and Ahead	83700
8	15	SBD	171.471	BAILEY ROAD	5100	45000	42000	5100	45000	42000	Back and Ahead	84000
8	15	SBD	176.459	NIPTON ROAD	5100	45000	42000	5200	45500	42600	Back and Ahead	84600
8	15	SBD	181.396	YATES WELL ROAD	5200	45500	42600	5200	46000	43000	Back and Ahead	85600
8	15	SBD	186.238	NEVADA STATE LINE	5200	46000	43000				Back	43000
											Route Segment Average	82932

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Supporting Table E: EMFAC2014 Input File


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Supporting Table F: EMFAC2014 Output File

Units: g/mile for RUNEX, PMBW and PMTW, g/vehicle/day for IDLEX

calendar_year	season_month	sub_area	vehicle_class	fuel	model_year	temperature	relative_humidity	process	speed_time	pollutant	emission_rate
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	HC	0.025951858
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	CO	0.194062744
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	NOx	0.372115264
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	SOx	0.012898221
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	PM	0.004158518
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	TOG	0.037414793
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	ROG	0.032865432
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	CO2	1351.948485
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	CH4	0.001526514
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	PM10	0.004133567
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2015	64	38	RUNEX	50	PM2_5	0.003954751
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	HC	0.024178436
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	CO	0.180801452
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	NOx	0.335141025
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	SOx	0.012898221
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	PM	0.003774089
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	TOG	0.034858051
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	ROG	0.030619571
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	CO2	1351.948485
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	CH4	0.0014222
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	PM10	0.003751444
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2016	64	38	RUNEX	50	PM2_5	0.003589158
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	HC	0.022479435
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	CO	0.168096668
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	NOx	0.299718402
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	SOx	0.012532537
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	PM	0.003405792
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	TOG	0.032408601
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	ROG	0.028467956
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	CO2	1313.618777
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	CH4	0.001322263
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	PM10	0.003385357
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2017	64	38	RUNEX	50	PM2_5	0.003238908
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	HC	0.020882942
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	CO	0.156158419
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	NOx	0.26643298
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	SOx	0.012532537
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	PM	0.003059716
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	TOG	0.030106938
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	ROG	0.026446158
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	CO2	1313.618777
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	CH4	0.001228356
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	PM10	0.003041357
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2018	64	38	RUNEX	50	PM2_5	0.00290979
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	HC	0.01926742
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	CO	0.144077868
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	NOx	0.2327508
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	SOx	0.012532537
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	PM	0.002709515
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	TOG	0.027777839
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	ROG	0.02440026
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	CO2	1313.618777
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	CH4	0.001133329
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	PM10	0.002693257
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019	64	38	RUNEX	50	PM2_5	0.002576748
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		HC	0.401541075
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		CO	1.879864083
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		NOx	15.50985636
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		SOx	0.053094036
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		PM	0.001506178
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		TOG	0.578901768
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		ROG	0.508511617
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		CO2	5565.139831
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		CH4	0.023619048
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		PM10	0.001497141
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			IDLEX		PM2_5	0.001432375
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			PMTW		PM	0.036
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			PMTW		PM10	0.036
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			PMTW		PM2_5	0.009
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			PMBW		PM	0.063
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			PMBW		PM10	0.06174
2019	Annual	San Bernardino (MD)	T7 Tractor	Dsl	2019			PMBW		PM2_5	0.02646

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