

## SMAQMD 2017 AREA SOURCE METHODOLOGY

### **FUEL COMBUSTION – AGRICULTURAL IRRIGATION I.C. ENGINES - DIESEL**

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#### **EMISSION INVENTORY SOURCE CATEGORY**

This area source methodology is used for determining emissions from all diesel-powered agricultural irrigation engines (diesel ag pumps). It includes both stationary and portable pump engines. Stationary pumps are fixed in place and portable pumps are moved from place to place depending on the need.

#### **EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION**

052-042-1200-0000 (83998) – Agricultural Irrigation I.C. Engines – Diesel/Distillate

This EIC is replaced by more specific EIC 052-042-1200-0010 (Stationary Ag Pumps) and EIC 052-042-1200-0011 (Portable Ag Pumps)

052-042-1200-0010 (92171) – Agricultural Irrigation I.C. Engines – Diesel – Stationary

052-042-1200-0011 (92189) – Agricultural Irrigation I.C. Engines – Diesel - Portable

#### **METHOD SUMMARY**

The 2017 diesel ag pump emissions are estimated using data from (1) diesel ag pumps registered by SMAQMD under the State of California Stationary Diesel Engine Airborne Toxic Control Measure (ATCM), and (2) 2017 point source inventory for West Coast Grape Farming Inc which is the only facility with diesel ag pump permits. The 2017 emission estimate, which uses a bottom-up approach, is compared to the 2017 emission forecasted by the California Emission Projection Analysis Model (CEPAM). The 2017 diesel ag pump population is compared to the top-down approach using the 2008 and 2013 Farm and Ranch Irrigation Survey.

#### **ACTIVITY**

##### ***Diesel Ag Pump ATCM***

SMAQMD registered 159 diesel ag pumps in 2008 under the State of California Stationary Diesel Engine Airborne Toxic Control Measure (ATCM). The district database shows that out of the 159 pumps, 33 were fixed location (stationary) pumps and 126 were transportable (portable) pumps. The ATCM has resulted in removal and replacement of diesel ag pumps with electric and cleaner units meeting Tier 3 and Tier 4 standards. See Attachment A for a list of diesel ag pump registered by SMAQMD. Table 1 shows the breakdown of the registered diesel ag pumps in Sacramento County by permit status, type, population and average horsepower (HP).

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Table 1. Diesel Ag Pumps ATCM Registration in Sacramento County		
Permit Status	Population	Average HP
<b>ACTIVE</b>	<b>36</b>	<b>154</b>
Fixed Location Pump	9	197
Transportable Pump	27	139
<b>CANCELLED</b>	<b>91</b>	<b>157</b>
Fixed Location Pump	22	244
Transportable Pump	69	130
<b>EXPIRED</b>	<b>25</b>	<b>160</b>
Fixed Location Pump	2	192
Transportable Pump	23	158
<b>UNPAID/EXPIRED</b>	<b>7</b>	<b>120</b>
Transportable Pump	7	120
<b>Grand Total</b>	<b>159</b>	<b>155</b>

Diesel ag pumps with “Active” status are pumps that are in use and meet ATCM emission standards (mostly Tier 3). Diesel ag pumps with “Cancelled” status are pumps with certified statements by their owners that they were removed from service. “Expired” status indicates that the pump permits have expired. Finally, “Unpaid/Expired” pumps are units with delinquent invoice payments. District inspectors have contacted the owner of each “Expired” or “Unpaid/Expired” pump and were told that the pump was either removed or no longer operational. Since the registration program is not funded after the initial registration and compliance deadline, there is no monitoring of the ag pumps. Therefore, only “Cancelled” pumps are assumed permanently removed. They may have been replaced with electric motors or spark-ignited engines (natural gas, propane, or gasoline). The 2017 diesel ag pump emissions are assumed to include emissions from “Active”, “Expired” and “Unpaid/Expired” pumps. “Expired” and “Unpaid/Expired” pumps are assumed to be in use since there is no certification of their removal from service.

The activity in hours of operation for each engine used for the emission calculation is 1,000 hours/year. It is based on the activity used in ARB’s 2003 Ag Pump Methodology (August 2006)<sup>1</sup> which is consistent with the Sacramento diesel ag pumps funded by the Carl Moyer Program. See Attachment B for ARB’s methodology for the 2003 diesel ag pump emissions.

### ***District Diesel Ag Pump Permits***

West Coast Grape Farming Inc is the only facility with diesel ag pumps permitted by the district. It has 9 stationary diesel ag pumps and it is inventoried as a point source.

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<sup>1</sup> ARB 2003 Ag Pump Methodology (August 2006), Page D-9, <file:///L:/PCD%20Folders/Emissions%20Inventory/Area%20Sources/052%20-%20Fuel%20Combustion%20-%20Food%20&%20Agricultural%20Processing/Agricultural%20Irrigation%20I.C.%20Engines%20-%20Diesel/2017/CARB%20ag%20pump%20-%20attach2.pdf>

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### **EMISSION CALCULATION**

#### ***Diesel Ag Pump ATCM***

Emissions for each diesel ag pump are estimated using HP, emission factor (grams/HP\_hr), load factor, clean fuel adjustment, hours of operation and Equation 1.

Equation 1:

$$\text{Emission (lbs/year)} = \text{Hours of Operation/Year} * \text{HP} * \text{Load Factor} * \text{Emission Factor (grams/HP_hr)} / 453.59 \text{ grams/lb} * \text{Clean Fuel Adjustment}$$

Where,

- HP is the maximum horsepower of the pump identified by the Diesel Ag Pump ATCM registration.
- Hours of Operation/Year is assumed 1,000 hours/year.
- Load factor is assumed 65 percent based on the load factor in ARB’s 2003 Ag Pump Methodology, page D-12.
- Emission factor is the sum of the zero-hour emission factor and the deterioration factor times cumulative hours of engine use for each pollutant. The zero-hour emission factor and deterioration factor for each pump associated with its HP and model year are from ARB’s 2017 Off-road Diesel Emission Factors downloaded from ARB website, <https://www.arb.ca.gov/msei/ordiesel.htm>. The cumulative hours of engine use is 1,000 hours/year times the age of the pump capping at the average useful life of the engine, which is 20 years (20,000 hours).
- Clean fuel adjustment (fuel correction factors) are also from ARB’s 2017 Off-road Diesel Emission Factors downloaded from ARB website, <https://www.arb.ca.gov/msei/ordiesel.htm>. See Attachment C for ARB’s 2017 off-road diesel emission factors and fuel correction factors.

Table 2 summarizes 2017 emissions for diesel ag pumps registered under the Diesel Ag Pump ACTM. The 2017 diesel ag pump emissions include emissions from “Active”, “Expired” and “Unpaid/Expired” pumps. The emissions presented for “Cancelled” pumps represent emission reductions from diesel ag pump removal/replacement resulting from the ATCM regulation. Attachment D contains the emissions and calculations for the registered diesel ag pumps. Additional emissions reductions, not determined or presented, are from “ACTIVE” pumps which meet ATCM diesel engine standards.

Table 2. Emission Summary of Sacramento County Diesel Ag Pumps Registered Under Diesel Ag Pump ATCM					
Permit Status	Population	2017 Emissions (tons/year)			
		PM	NOx	VOC	CO
ACTIVE	36	0.75	12.18	1.25	11.33
EXPIRED	25	0.93	23.20	2.66	8.82
UNPAID/EXPIRED	7	0.17	4.10	0.63	2.14
<b>Total</b>	<b>68</b>	<b>1.85</b>	<b>39.48</b>	<b>4.54</b>	<b>22.29</b>
CANCELLED (Emissions Reduced)	91	3.85	81.27	9.76	35.33
% Reduction	57%	68%	67%	68%	61%

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### ***District Diesel Ag Pump Permits***

West Coast Grape Farming Inc is surveyed and reported as point source annually. Its emissions are calculated using its permitted emission rates (grams/hp\_hr) and the 2017 hours of operation. Unlike the ATCM diesel ag pumps, emission calculations for the point source pumps do not include load factor (65%) or clean fuel adjustments (0.71 to 0.9 for PM and 0.93 to 0.95 for NOx and 0.9 for VOC). See Attachment E for the 2017 point source inventory for West Coast Grape Farming and CEIDARS point source to area source reconciliation report.

Table 3 summarizes 2017 diesel ag pump unreconciled emissions (total = area source + point source) by EIC. “Fixed Location” ag pump emissions are accounted for under Stationary and “Transportable” ag pump emissions are accounted for under Portable.

EIC	Description	Population	2017 Emissions (tons/year)			
			PM	NOx	VOC	CO
052-042-1200-0010	<b>Stationary Diesel Ag Pumps (Fixed Location)</b>	<b>20</b>	<b>0.78</b>	<b>16.12</b>	<b>3.97</b>	<b>12.07</b>
	<i>Diesel Ag Pump ATCM</i>	<i>11</i>	<i>0.27</i>	<i>5.91</i>	<i>0.57</i>	<i>3.22</i>
	<i>Point Source (West Coast Grape)</i>	<i>9</i>	<i>0.51</i>	<i>10.21</i>	<i>3.40</i>	<i>8.85</i>
052-042-1200-0011	<b>Portable Diesel Ag Pumps (Transportable)</b>	<b>57</b>	<b>1.58</b>	<b>33.57</b>	<b>3.96</b>	<b>19.07</b>
<b>Total</b>		<b>77</b>	<b>2.36</b>	<b>49.69</b>	<b>7.94</b>	<b>31.14</b>

The Excel spreadsheet used for the emission calculations can be found at: <\\Fs-0921\global\PCD Folders\Emissions Inventory\Area Sources\052 - Fuel Combustion - Food & Agricultural Processing\Agricultural Irrigation I.C. Engines - Diesel\2017\2017 Ag Pumps.xlsx>.

### **EMISSION SUMMARY**

ACTIVITY DATA SOURCE: SMAQMD Diesel Ag Pump ATCM registration database (retrieved August 2018); 1000 hours/year\_pump from Page D-9 of the ARB’s 2003 Ag Pump Methodology (August 2008)

DATE OF THE LAST UPDATE: August 2008 (by CARB)

EMISSION FACTOR SOURCE: ARB’s 2017 Off-road Diesel Emission Factors downloaded from ARB website, <https://www.arb.ca.gov/msei/ordiesel.htm>.

TEMPORAL DATA:

Daily Activity: 24 hours per day  
 Weekly Activity: 7 days/week  
 Monthly Activity: Uniform

Month	1	2	3	4	5	6	7	8	9	10	11	12
%	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3

Source: The relative monthly activity of the diesel ag pumps is assumed to be uniform throughout the year.

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**EMISSIONS (2017 - ANNUAL AVERAGE TONS/DAY) UNRECONCILED**

EIC	VOC	NOx	PM	CO
052-042-1200-0010				
Stationary Diesel Ag Pump (Fixed Location)	0.0109	0.0442	0.0021	0.0331
052-042-1200-0011				
Portable Diesel Ag Pump (Transportable)	0.0109	0.0920	0.0043	0.0523
<b>Total</b>	<b>0.0217</b>	<b>0.1361</b>	<b>0.0065</b>	<b>0.0853</b>

**CONTROL PROFILE**

The control profile (AG\_IC\_ENG) reflects State of California's Airborne Toxic Control Measure (ATCM) for diesel ag pumps. It is assigned to EIC 052-042-1200-0010 (Stationary Diesel Ag Pumps) and EIC 052-042-1200-0011 (Portable Diesel Ag Pumps).

<b>Control Profile for Diesel Ag Pump Stationary (AG_IC_ENG, EIC 52-042-1200-0010)</b>				
<b>Year</b>	<b>Control Factor</b>			
	<b>PM</b>	<b>NOx</b>	<b>TOG</b>	<b>CO</b>
2002	1	1	1	1
2005	0.936	0.942	0.926	0.948
2010	0.731	0.736	0.697	0.795
2012	0.449	0.476	0.394	0.625
2015	0.385	0.352	0.32	0.617
2017	0.103	0.127	0.074	0.515
2020	0.09	0.114	0.069	0.517
2025	0.09	0.105	0.069	0.527
2030	0.077	0.088	0.069	0.528
2035	0.077	0.088	0.069	0.528

<b>Control Profile for Diesel Ag Pump Portable (AG_IC_ENG, EIC 52-042-1200-0011)</b>				
<b>Year</b>	<b>Control Factor</b>			
	<b>PM</b>	<b>NOx</b>	<b>TOG</b>	<b>CO</b>
2002	1	1	1	1
2005	0.977	0.962	0.959	0.98
2010	0.864	0.835	0.811	0.924
2012	0.818	0.778	0.746	0.907
2015	0.705	0.686	0.648	0.881
2017	0.636	0.618	0.582	0.864
2020	0.523	0.512	0.467	0.841
2025	0.318	0.345	0.295	0.805
2030	0.182	0.233	0.18	0.781
2035	0.091	0.164	0.115	0.765

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**GROWTH PROFILE**

EIC 052-042-1200-0010 (Stationary Ag Pumps) and EIC 052-042-1200-0011 (Portable Ag Pumps) are mapped to AR\_HARVEST\_ACRES growth parameter.

AR\_HARVEST\_ACRES is human population data compiled by CARB using USDA-NASS summary of county Ag Commissioner’s reports and forecasted using trend in 1999-2010 Ag Commissioner’s data.

**Growth Data (PAD&GAP data – February 2017)**

<b>AB</b>	<b>CO</b>	<b>GROWTH_PARAM</b>	<b>YEAR</b>	<b>GROACT</b>	<b>GF</b>
SV	34	AR_HARVEST_ACRES	2002	137100	1.1146
SV	34	AR_HARVEST_ACRES	2005	131200	1.0667
SV	34	AR_HARVEST_ACRES	2010	125900	1.0236
SV	34	AR_HARVEST_ACRES	2012	123000	1
SV	34	AR_HARVEST_ACRES	2017	119900	0.9748
SV	34	AR_HARVEST_ACRES	2020	118200	0.9610
SV	34	AR_HARVEST_ACRES	2025	116700	0.9488
SV	34	AR_HARVEST_ACRES	2030	115200	0.9366
SV	34	AR_HARVEST_ACRES	2035	114500	0.9309

**CHANGES FROM PREVIOUS ESTIMATE**

Changes from CARB’s 2003 inventory are:

1. The 2017 Methodology (current estimate) is based on (1) population, HP, and model year from diesel ag pump ATCM registration and compliance database, and (2) 2017 point source inventory for West Coast Grape Farming. The 2003 Methodology was based on diesel ag pump data collected by the Carl Moyer Program.
2. The emission factors for the 2017 Methodology are based on the 2017 Off-Road Diesel Emission Factor Update for NOx and PM.
3. The following table compares 2017 (2017 Methodology) to 2003 (CARB’s 2003 Methodology) population and emissions. The 2017 inventory shows reduction in the diesel ag pump population and emission reductions from pump replacements with cleaner units. It also shows that there are much more portable ag pumps than stationary ag pumps as compared to the 2003 Methodology, which was based on the stationary and portable split used in the OFFROAD model.

<b>EIC</b>	<b>2017 (2017 Methodology)</b>					<b>2003 (2003 Methodology)</b>				
	<b>Pop</b>	<b>Emission (Tons/Year)</b>				<b>Pop</b>	<b>Emission (Tons/Year)</b>			
		<b>VOC</b>	<b>NOx</b>	<b>PM</b>	<b>CO</b>		<b>VOC</b>	<b>NOx</b>	<b>PM</b>	<b>CO</b>
052-042-1200-0010 Stationary Diesel Ag Pump	20	3.97	16.12	0.78	12.07	65	6.52	62.94	5.91	12.84
052-042-1200-0011 Portable Diesel Ag Pump	57	1.58	33.57	3.96	19.07	35	3.51	33.89	3.18	6.92
<b>Total</b>	<b>77</b>	<b>5.55</b>	<b>49.69</b>	<b>4.74</b>	<b>31.14</b>	<b>100</b>	<b>10.03</b>	<b>96.83</b>	<b>9.10</b>	<b>19.76</b>

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4. The following table compares 2017 emissions from 2017 Methodology to CEIDARS 2017 forecast for EIC 052-042-1200-0010 (Stationary Diesel Ag Pumps) and EIC 052-042-1200-0011 (Portable Diesel Ag Pumps). CEIDARS 2017 forecast is 2012 baseyear multiplied by growth and control factors.

EIC	2017 Emissions (Tons/Year)							
	2017 Methodology				Current CEIDARS			
	VOC	NOx	PM	CO	VOC	NOx	PM	CO
052-042-1200-0010 Stationary Diesel Ag Pump	3.97	16.12	0.78	12.07	0.58	8.48	0.29	11.75
052-042-1200-0011 Portable Diesel Ag Pump	1.58	33.57	3.96	19.07	2.40	16.83	1.10	9.60
<b>Total</b>	<b>5.55</b>	<b>49.69</b>	<b>4.74</b>	<b>31.14</b>	<b>2.98</b>	<b>25.31</b>	<b>1.39</b>	<b>21.35</b>

5. The diesel ag pump population in Sacramento County estimated using US Ag Census, Farm and Ranch Irrigation Survey (FRIS), is compared with diesel ag pump population estimated by the area source methodologies. See table below. Using a top-down approach, the population of diesel ag pump in Sacramento County is estimated using California diesel ag pump population from 2003, 2008 and 2013 FRIS and ratio of Sacramento County to California irrigated land acreage from 2002, 2007, 2012 Ag Census. It shows downward trend on the diesel ag pump population. It also shows that the diesel ag pump population might be underestimated in the 2003 Methodology. See Attachment F for Ag Census and FRIS data.

Estimation Method	Year of Estimate	Diesel Ag Pump Population
2003 Methodology	2003	101
2008 Diesel Ag Pump ACTM Registration	2008	159
2017 Methodology Diesel Ag Pump	2017	77
2003 Farm&Ranch Irrigation Survey	2003	180
2008 Farm&Ranch Irrigation Survey	2008	127
2013 Farm&Ranch Irrigation Survey	2013	114

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### **NEEDED CLARIFICATIONS/CORRECTIONS TO CURRENT METHOD**

1. The load factor of 65% used in ARB's 2003 Diesel Ag Pump methodology is applicable to SMAQMD pumps registered under Diesel Ag Pump ATCM.
2. The 2017 population of diesel ag pumps in Sacramento County is the sum of (1) "Active", "Expired" and "Unpaid/Expired" diesel ag pumps registered by the district for ATCM and (2) permitted diesel ag pumps from West Coast Grape Farming.
3. All point source pumps (West Coast Grape Farming) are assumed "Fixed Location" or Stationary.
4. Unlike the ATCM diesel ag pumps, emission calculation for the point source pumps does not include load factor (65%) and clean fuel adjustments (0.71 to 0.9 for PM and 0.93 to 0.95 for NOx and 0.9 for VOC).
5. The annual ag pump activity of 1000 hours/years used in ARB's 2003 Diesel Ag Pump methodology is applicable to "Active", "Expired" and "Unpaid/Expired" diesel ag pumps registered by the district for ATCM. The activity for each point source diesel ag pump is 2017 hours of operation from the point source survey.

### **FUTURE PLANS FOR METHOD UPDATE/REVISION**

1. Next scheduled update is in 2020 using 2018 Farm & Ranch Irrigation Survey. This emission inventory category should be updated based on the US Ag Census Farm & Ranch Irrigation Survey (FRIS) cycle which occurs every 5 years. Next FRIS is for 2018 data.

P:\PCD Folders\Emissions Inventory\Area Sources\052 - Fuel Combustion - Food & Agricultural Processing\Agricultural Irrigation I.C. Engines - Diesel\2017\2017 Diesel Ag Pumps20190214.docx    Hao Quinn    2/19/2019



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## ATTACHMENT A:

Diesel Ag Pumps Registered by SMAQMD for State of California Stationary Diesel Engine Airborne Toxic Control Measure (ATCM)

# Diesel Ag Pump Registered by SMAQMD for Diesel Engine ATCM

FarmName	FarmLoc	Engine	Status	Make	Model	Serial	HP	Date_Made	Tier	Use	Meter	D_Gal	D_hr	Parcel	E_Address1	E_City	E_Zip	E_Intersection
Windmill Ranch	9951 Grantline Rd	1	CANCELLED	0.			0		0	Emergency Generator	FALSE	1	1		9951 Grantline Rd	Elk Grove	95624-1411	
J.W. De Wit Farms	8757 E. Levee Rd.	2	CANCELLED	Case I H	4391 TA	JA0011213	120	01-Jan-99	1	Fixed Location Pump	TRUE	2500	500		8757 E. Levee Rd.	Elverta	95626	Elverta Rd.
Celli Brothers LLC	8464 New Hope Rd.	3	CANCELLED	Caterpillar	3056	1ML01184	96	01-Jan-93	0	Transportable Pump	FALSE	2000	650		9464 New Hope Rd.	Thornton		Thornton, CA - Thornton Rd.
Amistad - Ranches	157 Russell Rd.	4	CANCELLED	Deutz	BF6914C	8682821	150	01-Nov-03	2	Transportable Pump	TRUE	4000	850	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	5	CANCELLED	Deutz	BF6L913	8596744	150	01-Sep-00	1	Transportable Pump	TRUE	4000	850	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	6	CANCELLED	Deutz	BF4L913	8695804	98	01-Nov-03	2	Transportable Pump	TRUE	2000	750	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	7	CANCELLED	Deutz	BF4L913	8596274	98	01-Sep-00	1	Transportable Pump	TRUE	2000	750	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	8	CANCELLED	Deutz	BF4L913	8700588	98	01-Nov-04	2	Transportable Pump	TRUE	0	750	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	9	CANCELLED	Deutz	BF4L913	8700587	98	01-Nov-04	2	Transportable Pump	TRUE	2000	750	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	10	CANCELLED	Deutz	BF3L913	8700589	98	01-Nov-04	2	Transportable Pump	TRUE	2000	750	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	11	CANCELLED	Deutz	BF4L913	8694441	98	01-Nov-03	2	Transportable Pump	TRUE	2000	750	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	12	CANCELLED	Deutz	BF6914C	8682819	150	01-Nov-03	2	Transportable Pump	TRUE	4000	850	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Amistad - Ranches	157 Russell Rd.	13	ACTIVE	Deutz	BF4L914	8738138	98	01-Nov-05	2	Transportable Pump	TRUE	2000	750	146-0020-030-0000	157 Russell Rd.	Courtland	95615	
Clay Station Vineyards	13650 Borden Rd.	14	CANCELLED	John Deere	6068HF250B	784375	200	01-Jan-01	1	Fixed Location Pump	FALSE	1440	480		13650 Borden Rd.	Herald	95638	Herald, Borden Rd. and Clay Station Rd.
Jim Sopwith dba Sopwith Farms	4850 W. Riego Rd.	15	CANCELLED	Case	4TA-390	46096037	110	01-Jan-01	1	Transportable Pump	TRUE	500	100		4850 W. Riego Rd.	Sacramento	95836	
Wallace Chan Farms Inc.	11691 River Road Hwy 160	16	CANCELLED	Detroit Diesel	4-71	88474	80	01-Jan-49	0	Transportable Pump	FALSE	1200	400					
Wallace Chan Farms Inc.	11691 River Road Hwy 160	17	CANCELLED	Detroit Diesel	8W71	806	150	01-Jan-66	0	Transportable Pump	TRUE	1600	400					
Wallace Chan Farms Inc.	11691 River Road Hwy 160	18	CANCELLED	John Deere	414	51592	100	01-Jan-77	0	Transportable Pump	FALSE	1500	400					
Wallace Chan Farms Inc.	11691 River Road Hwy 160	19	CANCELLED	Caterpillar	3208	90N7175	150	01-Jan-91	0	Transportable Pump	FALSE	900	300					
Wallace Chan Farms Inc.	11691 River Road Hwy 160	20	CANCELLED	Detroit Diesel	4/71	MAYE52003	80	01-Jan-49	0	Transportable Pump	FALSE	900	300					
Wallace Chan Farms Inc.	11691 River Road Hwy 160	21	CANCELLED	Detroit Diesel	4-71	W0796	80	01-Jan-49	0	Transportable Pump	FALSE	1000	300					
RPM Farms	3750 E. Catlett Rd.	22	EXPIRED	Deutz	BF6L913CSP	8587932	258	01-Jan-99	1	Fixed Location Pump	TRUE	1800	500	021-110-0003-0000	3750 E. Catlett Rd.	Pleasant Grove	95668	Pleasant Grove, Catlett Rd. & Brewer Rd.
Hunn, Merwin, Merwin		23	CANCELLED	Deutz	913	635695	125	01-Jan-90	0	Transportable Pump	TRUE	1200	400					Beach Lake/River Road
Gold Springs Angus Ranch / Schneider Ranch	15024 Jackson Rd	24	CANCELLED	Cummins	BT5.9-C152	46187517	142		0	Transportable Pump	TRUE	4000	1000	128-70-60	15024 Jackson Rd.	Sloughhouse	95683	Sloughhouse / Ione Michigan Bar
Nilsen Farms		25	ACTIVE	Generac	2302030100	2067133	325	01-Feb-02	2	Emergency Generator	TRUE	500	50	128-0020-018	13345 Apple Rd	Wilton		Wilton / Dillard Rd.
Nilsen Farms		26	ACTIVE	Generac	1598080100	2063218	440	01-Apr-01	2	Emergency Generator	TRUE	500	50	128-0020-018	13542 Meiss Rd	Wilton		Wilton / Dillard rd.
Kirtlan Bros		27	CANCELLED	Perkins	SP111HP3	26280	225	01-Jan-75	0	Transportable Pump	FALSE	800	175	44-130-02	53140 S. River Rd.	Clarksburg	95612	Rose Rd.
The Herzog Company	12300 Herzog Rd.	28	EXPIRED	Deutz	F8L413	6358392	182	01-Jan-81	0	Transportable Pump	FALSE	500	280	146-0380-003-0000	12300 Herzog Rd.	Courtland	95615	Courtland / Lambert & Herzog Rd.
The Herzog Company	12300 Herzog Rd.	29	CANCELLED	Deutz	T61912	554202	98	01-Jan-78	0	Transportable Pump	TRUE	300	150	146-0380-023-0000	12300 Herzog Rd.	Courtland	95615	Courtland / Russel Rd
Sloughouse Operating	PO Box 299	30	EXPIRED	John Deere	6068DF150B	T06068D829195	125	01-Jan-99	1	Fixed Location Pump	TRUE	287	919	073-0080-060				North of Latrobe Rd. Sloughouse, CA
Sprague Ranch	13940 Latrobe Rd.	31	ACTIVE	Deutz	F6L-914	B718927	113	20-Oct-04	2	Transportable Pump	TRUE	500	300		13940 Latrobe Rd.	Sloughhouse	95683	Sloughhouse / Jackson Hwy & Latrobe & Kiefer
John Wiedmann & Son Inc	12680 Hwy 160	32	CANCELLED	John Deere	404D3H	23E196943	100	01-Jan-60	0	Fixed Location Pump	FALSE	1500	400		15169 Sutter Island Rd.	Courtland	95615	Sutter Island X Road
B&J Dairy	9950 Arno Rd.	33	ACTIVE	Caterpillar	D333	878920	110	01-Jan-87	0	Emergency Generator	FALSE	70	10	148-0020-035	9950 Arno Rd.	Galt	95632	Hwy 99 and Arno Rd.
Ceres Farms	14500 Borden Rd.	34	CANCELLED	John Deere	6125HF070	R66125H035458	425	01-Jan-03	2	Fixed Location Pump	TRUE	7500	1500	154-0110-020	14500Borden Rd.	Herald	95638	Herald / Clay Station Rd.
Nester Enterprises	13852 E. Peltier Rd.	35	CANCELLED	John Deere	4045TF150	T04045T867541	100	01-Jan-00	1	Fixed Location Pump	FALSE	7000	1400	138-060-020	12098 Clay Station Rd.	Herald	95638	Herald / Twin Cities Rd.
Nester Enterprises	13852 E. Peltier Rd.	36	ACTIVE	John Deere	6068HF275	PE6068H392254	225	01-Jan-04	2	Fixed Location Pump	TRUE	6500	1300	146-0030-074	12098 Clay Station Rd.	Herald	95638	Herald / Twin Cities Rd.
J & M Dairy	11910 Bruceville Rd.	37	ACTIVE	Cummins	495	25127196	170	01-Jan-82	0	Emergency Generator	FALSE	25	6	132-240-28	11910 Bruceville Rd.	Elk Grove	95757	Elk Grove / Lambert Rd.
Double M Farms, Inc.	13171 Grand Island Rd.	38	CANCELLED	Deutz (to be cancel	FG1912	7757581	101	01-Jan-89	0	Transportable Pump	FALSE	8500	1700		13171 Grand Island Rd.	Walnut Grove	95690	Grand Island
Double M Farms, Inc.	13171 Grand Island Rd.	39	CANCELLED	Perkins (to be cancel	TL	354UA20921	105		0	Transportable Pump	FALSE	10200	1700		13171 Grand Island Rd.	Walnut Grove	95690	Grand Island Rd.
Tom W. Tolson	38870 County Road 13	40	CANCELLED	John Deere	T06068T	T0706068T469194	133	01-Jan-94	0	Fixed Location Pump	TRUE	4800	800		38870 County Road 13	Woodland	95695	1/2 mile west of County Road 99E on Road 13
West Coast Grape Farms / Twin Cities Ranch	Hwy 104	41	CANCELLED	Volvo	TAD730P	2071096318	150	01-Jan-97	1	Fixed Location Pump	FALSE	0	1910	138-0190-009				
Laguna Creek Vineyard Partnership/Laguna Creek Ran	Hwy 104	42	CANCELLED	Volvo	TAD730P	2071096320	150	01-Jan-97	1	Fixed Location Pump	TRUE	0	1716	138-0090-030				
Sutter Home Vineyards	Sacramento and Yolo Counties	43	CANCELLED	John Deere	6068-T	6068T801623	170	01-Jan-97	0	Fixed Location Pump	FALSE	13800	1375	146-0030-032	2320 Lambert Rd	Elk Grove	95758	Courtland, I-5
Sutter Home Vineyards	Sacramento and Yolo Counties	44	CANCELLED	John Deere	6068-T	T06068T715730	170	01-Jan-97	0	Fixed Location Pump	TRUE	16500	1650	146-0040-001				
Double M Farms, Inc.	13171 Grand Island Rd.	45	ACTIVE	Deutz	D914L06	08797691	78	01-Jan-08	3	Transportable Pump	TRUE	0	1700	142004020				Grand Is. Rd.
Double M Farms, Inc.	13171 Grand Island Rd.	46	ACTIVE	Deutz	D914L06	08785891	116	01-Jan-07	3	Transportable Pump	TRUE	0	1800	142004020				Grand Is. Rd.
Double M Farms, Inc.	13171 Grand Island Rd.	47	ACTIVE	Deutz	D914L06	08800387	116	01-Jan-07	3	Transportable Pump	TRUE	0	1625	142004020				Grand Is. Rd.
Carli Ranch	11342 Florin Road	48	CANCELLED	Deutz	F5L912	863247	100	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Carlo Guidi Ranch	3834 State Highway 84	49	EXPIRED	Cummins	BTAS.9-P174	45633294	174	01-Jan-98	1	Transportable Pump	FALSE	0	0					
Carlo Guidi Ranch	3834 State Highway 84	50	EXPIRED	Cummins	BTAS.9-P174	45633295	174	01-Jan-98	1	Transportable Pump	FALSE	0	0					
Carmical Farms	8606 Elwyn Ave	51	UNPAID/E	Deutz	F6L913		121	01-Jan-02	0	Transportable Pump	FALSE	0	0					
Carmical Farms	8606 Elwyn Ave	52	UNPAID/E	Deutz	F6L913		121	01-Jan-00	0	Transportable Pump	FALSE	0	0					
Chris Burke	6623 Locust Road	53	CANCELLED	Case IH	6591A	46102216	168	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Chris Burke	6623 Locust Road	54	CANCELLED	Case IH	6591TA	46190264	133	01-Jan-02	0	Transportable Pump	FALSE	0	0					
Chris Burke	6623 Locust Road	55	CANCELLED	Case IH	6591T	45943955	135	01-Jan-00	0	Transportable Pump	FALSE	0	0					
Chris Burke	6623 Locust Road	56	CANCELLED	Case IH	6591T	45903861	135	01-Jan-00	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	57	CANCELLED	Cummins	BTAS.9-P174	45512290	174	01-Jan-98	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	58	CANCELLED	Cummins	BTAS.9-P174	45512351	174	01-Jan-98	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	59	CANCELLED	Deutz	D914L06		116	01-Jan-08	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	60	CANCELLED	Deutz	TC914L06		174	01-Jan-08	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	61	CANCELLED	Deutz	TC914L06		174	01-Jan-08	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	62	CANCELLED	Deutz	TC914L06		174	01-Jan-08	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	63	CANCELLED	Deutz	BF6L914C-6106	8679187	160	01-Jan-03	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	64	CANCELLED	Case IH	6591TA	45951579	168	01-Jan-00	0	Transportable Pump	FALSE	0	0					
E.A.B. Inc.	42305 Morse Road	65	CANCELLED	Deutz	BF6L914C	8712530	180	01-Jan-05	0	Transportable Pump	FALSE	0	0					
Ferreira Estate Co.	13545 Grand Island Road	66	CANCELLED	Deutz	BF6L913	864522	160	01-Jan-02	0	Transportable Pump	FALSE	0	0					
G. Caravantes Enterprises	322 N. 12th Street	67	UNPAID/E	John Deere														

# Diesel Ag Pump Registered by SMAQMD for Diesel Engine ATCM

FarmName	FarmLoc	Engine	Status	Make	Model	Serial	HP	Date Made	Tier	Use	Meter	D Gal	D hr	Parcel	E_Address1	E_City	E_Zip	E_Intersection
Hiramoto Ranch	42460 Morse	74	CANCELLED	Deutz	BF6L913SP	8521683	160	01-Jan-98	0	Transportable Pump	FALSE	0	0					
Jaime Rodriguez Farming	15277 Isleton Road	76	UNPAID/E	Deutz	BF6L914-5889	8691893	180	01-Jan-04	0	Transportable Pump	FALSE	0	0					
Jean Alfaro	3374 Pleasant Grove	77	CANCELLED	Cummins	3.9B	46220016	87	01-Jan-02	1	Transportable Pump	FALSE	0	0					
Joe Sanchez Farms	PO BOX 69	78	EXPIRED	Deutz	F3L913	8643241	55	01-Jan-03	1	Transportable Pump	FALSE	0	0					
Joe Sanchez Farms	PO BOX 69	79	ACTIVE	Deutz	D914L03	8822726	58	01-Jan-08	3	Transportable Pump	TRUE	0	800		HWY 160/Leary Rd	Walnut Grove	95690	
Joe Sanchez Farms	PO BOX 69	80	ACTIVE	Deutz	D914L04	8822658	78	01-Jan-08	3	Transportable Pump	TRUE	0	800		HWY 160/Leary Rd.	Walnut Grove	95690	
Joe Sanchez Farms	PO BOX 69	81	ACTIVE	Deutz	D914L06	8821909	116	01-Jan-08	3	Transportable Pump	TRUE	0	800		HWY 160/Leary Rd.	Walnut Grove	95690	
Joe Sanchez Farms	PO BOX 69	82	ACTIVE	Deutz	TC914L06	8822280	174	01-Jan-08	3	Transportable Pump	TRUE	0	950		HWY 160/Leary Rd.	Walnut Grove	95690	
Joe Sanchez Farms	PO BOX 69	83	ACTIVE	Deutz	TC914L06	8822281	174	01-Jan-08	3	Transportable Pump	TRUE	0	950		HWY 160/Leary Rd.	Walnut Grove	95690	
Joe Sanchez Farms	PO BOX 69	84	ACTIVE	Deutz	TC914L06	8822282	174	01-Jan-08	3	Transportable Pump	TRUE	0	950		HWY 160/Leary Rd.	Walnut Grove	95690	
Joe Sanchez Farms	PO BOX 69	85	ACTIVE	Deutz	TC914L06	8822283	174	01-Jan-08	3	Transportable Pump	TRUE	0	950		HWY 160/Leary Rd.	Walnut Grove	95690	
Joe Sanchez Farms	PO BOX 69	86	EXPIRED	Deutz	BF6L913SP	8622928	160	01-Jan-01	1	Transportable Pump	FALSE	0	0					
Joe Sanchez Farms	PO BOX 69	87	CANCELLED	Deutz	BF6L913SP	8588561	160	01-Jan-99	1	Transportable Pump	FALSE	0	0					
Joe Sanchez Farms	PO BOX 69	88	CANCELLED	Deutz	BF6L913SP	8588562	160	01-Jan-99	1	Transportable Pump	FALSE	0	0					
Joe Sanchez Farms	PO BOX 69	89	CANCELLED	Deutz	BF6L913SP	8588563	160	01-Jan-99	1	Transportable Pump	FALSE	0	0					
Joe Sanchez Farms	PO BOX 69	90	EXPIRED	Deutz	BF6L913SP	8588564	160	01-Jan-99	1	Transportable Pump	FALSE	0	0					
Joe Sanchez Farms	PO BOX 69	91	EXPIRED	Deutz	BF6L913CSP	8551922	180	01-Jan-99	1	Transportable Pump	FALSE	0	0					
Joe Silva Custom Farming	12017 Highway 160	92	CANCELLED	Jasper	460	42511293	101	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Joe Silva Custom Farming	12017 Highway 160	93	CANCELLED	Jasper	460	4Y885508	101	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Joe Silva Custom Farming	12017 Highway 160	94	CANCELLED	Ford	2.5L	86528	66	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Joe Silva Custom Farming	12017 Highway 160	95	CANCELLED	Jasper	460	418060	101	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Joe Silva Custom Farming	12017 Highway 160	96	CANCELLED	Jasper	460	421642	101	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Joe Silva Custom Farming	12017 Highway 160	97	CANCELLED	Ford	2.5L	17927	66	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Joe Silva Custom Farming	12017 Highway 160	98	CANCELLED	Jasper	7.4L	418056	101	01-Jan-02	0	Transportable Pump	FALSE	0	0					
Johnson Farms	9084 Twin Cities Road	99	UNPAID/E	Deutz	F4L913SP	8617448	80	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Johnson Farms	9084 Twin Cities Road	100	UNPAID/E	Deutz	F4L913SP	861449	80	01-Jan-01	0	Transportable Pump	FALSE	0	0					
Kay Dix	P. O. Box 248	101	EXPIRED	Deutz	BF6L913SP	8597291	160	01-Jan-01	1	Transportable Pump	FALSE	0	0		1/2 mile south of Andrus Island Rd.	Walnut Grove		
Kay Dix	P.O. Box 248	102	EXPIRED	Deutz	BF6L913SP	8597292	160	01-Jan-01	1	Transportable Pump	FALSE	0	0		13931 Isleton Rd.	Walnut Grove		
Ken Pombo Farms	Jackson Slough Road	103	ACTIVE	Deutz	D914L06	N/A	115	01-Jan-08	3	Transportable Pump	FALSE	0	0					
Ken Pombo Farms	Jackson Slough Road	104	ACTIVE	Deutz	D914L06	N/A	115	01-Jan-08	3	Transportable Pump	FALSE	0	0					
Leatherby's Family Creamery	2333 Arden Way	105	CANCELLED	U.S. Electric Motor	BG66	L01.83010216-00	100	01-Jan-07	3	Transportable Pump	FALSE	0	0		3540 S. Meridian Rd.	Meridian	95357	
Marvin Neves & Son	50079 Central Avenue	106	CANCELLED	Isuzu	6BG1TRW02	154744	174	01-Jan-03	0	Transportable Pump	FALSE	0	0					
Marvin Neves & Son	50079 Central Avenue	107	CANCELLED	Isuzu	6BG1TRW02	6BG1.186984	174	01-Jan-03	0	Transportable Pump	FALSE	0	0					
Marvin Neves & Son	50079 Central Avenue	108	CANCELLED	Case IH	6591T	DJA0013285	133	01-Jan-01	1	Transportable Pump	FALSE	0	0					
Marvin Neves & Son	50079 Central Avenue	109	CANCELLED	Case IH	4391T	DJA0013232	104	01-Jan-01	1	Transportable Pump	FALSE	0	0					
McDowell Farms	15265 Poverty Road	110	CANCELLED	Cummins	QS8 4.5	46613651	110	01-Jan-06	0	Transportable Pump	FALSE	0	0					
McDowell Farms	15265 Poverty Road	111	CANCELLED	Cummins	BT3.9-C110	45526633	110	01-Jan-98	0	Transportable Pump	FALSE	0	0					
Natomas Mutual Water Company	2601 W. Elkhorn Blvd.	112	CANCELLED	Case IH	6831TA	45883999	211	01-Jan-99	0	Transportable Pump	FALSE	0	0		2601 W. Elkhorn Blvd.	Rio Linda	95673	
Natomas Mutual Water Company	2601 W. Elkhorn Blvd.	113	CANCELLED	Case IH	6831TA	45884001	211	01-Jan-99	0	Transportable Pump	FALSE	0	0		2601 W. Elkhorn Blvd.	Rio Linda	95673	
Natomas Mutual Water Company	2601 W. Elkhorn Blvd.	114	CANCELLED	Deutz	F3L913SP	8617077	59	01-Jan-01	0	Transportable Pump	FALSE	0	0		2601 W. Elkhorn Blvd.	Rio Linda	95673	
R & B Farms	4067 Pleasant Grove Road	115	CANCELLED	Case IH	4391T	46198436	79	01-Jan-02	1	Transportable Pump	FALSE	0	0					
R & B Farms	4067 Pleasant Grove Road	116	CANCELLED	Case IH	6591T	DJA0015629	133	01-Jan-02	1	Transportable Pump	FALSE	0	0					
Sierra Cattle Co.	24163 Road 188	117	CANCELLED	Deutz	TC914L06		174	01-Jan-08	0	Transportable Pump	FALSE	0	0					
Sierra Cattle Co.	24163 Road 188	118	CANCELLED	Deutz	TC914L06		174	01-Jan-08	0	Transportable Pump	FALSE	0	0					
Silverdale Farms	1010 Twin Cities Road	119	EXPIRED	Deutz	BF6L913CSP	8632318	180	01-Jan-01	1	Transportable Pump	FALSE	0	0					
Silverdale Farms	1010 Twin Cities Road	120	EXPIRED	Deutz	BF6L913CSP	8641622	180	01-Jan-01	1	Transportable Pump	FALSE	0	0		1010 Twin Cities Road	Walnut Grove	95690	RIVER ROAD, WALNUT GROVE
Silverdale Farms	1010 Twin Cities Road	121	EXPIRED	Deutz	BF6L913CSP	8632696	180	01-Jan-01	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road, Walnut Grove
Silverdale Farms	1010 Twin Cities Road	122	EXPIRED	Deutz	BF6L913CSP	8632697	180	01-Jan-01	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road, Walnut Grove
Silverdale Farms	1010 Twin Cities Road	123	EXPIRED	Deutz	BF6L913CSP	8632698	180	01-Jan-01	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road, Walnut Grove
Silverdale Farms	1010 Twin Cities Road	124	EXPIRED	Deutz	BF6L913CSP	8632699	180	01-Jan-01	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road
Silverdale Farms	1010 Twin Cities Road	125	EXPIRED	Isuzu	6BG1TQW	133168	172	01-Jan-01	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road, Walnut Grove
Silverdale Farms	1010 Twin Cities Road	126	EXPIRED	Isuzu	6BG1T	131071	172	01-Jan-01	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road, Walnut Grove
Silverdale Farms	1010 Twin Cities Road	127	EXPIRED	Isuzu	6BG1T	133167	172	01-Jan-01	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road, Walnut Grove
Silverdale Farms	1010 Twin Cities Road	128	EXPIRED	Deutz	BF6L913	8668226	141	01-Jan-02	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road, Walnut Grove
Silverdale Farms	1010 Twin Cities Road	129	EXPIRED	Deutz	BF6L913C	8653457	180	01-Jan-02	1	Transportable Pump	FALSE	0	0	14601000780000	1010 Twin Cities Road	Walnut Grove	95690	River Road
The Fishery, Inc.	11583 Valensin Road	130	CANCELLED	Cummins	B5.9P	46050566	174	09-Nov-00	1	Transportable Pump	TRUE	11	3		11150 Valensin Road	Galt	95632	
The Fishery, Inc.	11583 Valensin Road	131	CANCELLED	Cummins	C8.3P	46037437	215	05-Oct-00	1	Transportable Pump	TRUE	75	19		11583 Valensin Road	Galt	95632	
Upper Swanson	2625 Fair Oaks Blvd.	132	CANCELLED	Case IH	6591T	45918664	135	01-Jan-00	0	Transportable Pump	FALSE	0	0					
Utterback Farm	9986 Horn Road	133	CANCELLED	John Deere	PE4045T150	PE4045T13158	81	01-Jan-01	1	Transportable Pump	TRUE	900	200		12800 Meiss Road, Sloughhouse			
Utterback Farm	9986 Horn Road	134	CANCELLED	John Deere	PE4045T150	PE4045T13157	81	01-Jan-01	1	Transportable Pump	TRUE	900	200		12800 Meiss Road, Sloughhouse			
Sheridan Mitigation Corp.	3888 Cincinnati Ave.	135	EXPIRED	Case IH	4391TA	DJA0014495	104	01-Jan-01	1	Transportable Pump	FALSE	0	0					
Sheridan Mitigation Corp.	3888 Cincinnati Ave.	136	EXPIRED	Case IH	4391TA	DJA0014497	104	01-Jan-01	1	Transportable Pump	FALSE	0	0					
Warnick Farms	2765 Mount Pleasant Road	137	CANCELLED	Case-IH	4391T	46198436	79	01-Jan-02	0	Fixed Location Pump	FALSE	0	0					
Warnick Farms	2765 Mount Pleasant Road	140	CANCELLED	Case-IH	6591T	DJA0015629	133	01-Jan-02	0	Fixed Location Pump	FALSE	0	0					
Utterback Farm	9986 Horn Road	141	ACTIVE	John Deere	6068HF285	P.E. 080322	173	01-Jan-09	3	Fixed Location Pump	TRUE	100	800		12800 Meiss Rd	Sloughhouse		Dillard Rd. & Meiss Rd.
Utterback Farm	9986 Horn Road	142	ACTIVE	John Deere	4045HF285	P.E. 086345	125	01-Jan-09	3	Fixed Location Pump	TRUE	100	900		12800 Meiss Rd.	Sloughhouse		Dillard Rd. & Meiss Rd.
Gallo Vineyards Inc	5206 Hammett Rd	143	CANCELLED	Deutz	BF6M1015C	9119239	350	01-Jan-96	1	Fixed Location Pump	FALSE	4370	460		11491 Arno Rd	Galt	95632	1/2 mile west of Colony Rd. 1 mile North of Arno
Gallo Vineyards Inc	5206 Hammett Rd	144	CANCELLED	Deutz	BF6M1015C	9119238	350	01-Jan-96	1	Fixed Location Pump	FALSE	7885	830		11491 Arno rd.	Galt	95632	1/2 mile West of Colony Rd. 1 mile North of Arno Rd.
Gallo Vineyards Inc	5206 Hammett Rd	145	CANCELLED	Deutz - (To Be Canc	BF6M1015C	9119236	350	01-Jan-96	1	Fixed Location Pump	FALSE	9120	960		11491 Arno Rd.	Galt	95632	3/4 mile North of Arno Rd. 1/4 mile West of Colony
Gallo Vineyards Inc	520																	

# Diesel Ag Pump Registered by SMAQMD for Diesel Engine ATCM

FarmName	FarmLoc	Engine	Status	Make	Model	Serial	HP	Date Made	Tier	Use	Meter	D Gal	D hr	Parcel	E Address1	E City	E Zip	E Intersection
Gallo Vineyards Inc	5206 Hammett Rd	150	CANCELLED	Deutz - (To be cano	BF6M1015C	9125129	350	01-Jan-98	1	Fixed Location Pump	FALSE	4725	525		11491 Arno rd.	Galt	95632	1.75 mi North of Arno Rd. 1/4 mi West of Colony
Gallo Vineyards Inc	5206 Hammett Rd	151	CANCELLED	Deutz	BF6M1015C	9125213	350	01-Jan-90	0	Fixed Location Pump	FALSE	8100	900		11491 Arno Rd.	Galt	95632	1.75 mi north of Arno Rd. 3/4 mi West of Colony Rd
Gallo Vineyards Inc	5206 Hammett Rd	152	CANCELLED	Delete this record	BF6M1015C	9125213	350	01-Jan-90	0	Fixed Location Pump	FALSE	8100	900		11491 Arno Rd	Galt	95632	1/4 mi North of Arno Rd. 3/4 mi West of Colony Rd.
Doug Chan Farms	11488 Highway 160	153	ACTIVE	Caterpillar	C-6.6	66611949	181	01-Jan-09	3	Transportable Pump	FALSE	2750	900		1400 Twin Cities Rd.	Walnut Grove	95690	River Road
Doug Chan Farms	11488 Highway 160	154	ACTIVE	Caterpillar	C-6.6	66611929	181	01-Jan-09	3	Transportable Pump	FALSE	2750	900		1400 Twin Cities Rd.	Walnut Grove	95690	River Road
Doug Chan Farms	11488 Highway 160	155	ACTIVE	Caterpillar	C-6.6	66611927	140	01-Jan-09	3	Transportable Pump	FALSE	2500	900		1400 Twin Cities	Walnut Grove	95690	River Road
Doug Chan Farms	11488 Highway 160	156	ACTIVE	Deutz	D914L06	08826600	135	01-Jan-09	3	Transportable Pump	FALSE	2500	1000		1400 Twin Cities Rd	Walnut Grove	95690	River Road
Doug Chan Farms	11488 Highway 160	157	ACTIVE	Deutz	D914L06	8826604	135	01-Jan-09	3	Transportable Pump	FALSE	2500	1000		1400 Twin Cities rd.	Walnut Grove	95690	River Rd
Doug Chan Farms	11488 Highway 160	158	ACTIVE	Deutz	TC914L06	8826736	174	01-Jan-09	3	Transportable Pump	FALSE	2750	900		1400 Twin Cities Rd.	Walnut Grove	95690	River Rd.
Doug Chan Farms	11488 Highway 160	159	ACTIVE	Deutz	TC914L06	8826735	174	01-Jan-09	3	Transportable Pump	FALSE	2750	900		1400 Twin Cities Rd.	Walnut Grove	95690	River Road
Doug Chan Farms	11488 Highway 160	160	ACTIVE	Deutz	TC914L06	8826737	174	01-Jan-09	3	Transportable Pump	FALSE	2750	900		1400 Twin Cities Rd.	Walnut Grove	95690	River Road
Doug Chan Farms	11488 Highway 160	161	ACTIVE	Deutz	TC914L06	8827020	174	01-Jan-09	3	Transportable Pump	FALSE	2750	900		1400 Twin Cities Rd.	Walnut Grove	95690	River Road
Laguna Creek Vineyard Partnership/Laguna Creek Ran	Hwy 104	162	ACTIVE	Cummins	QSL 9 C-300	46975752	300	01-Jan-09	3	Fixed Location Pump	FALSE	1204	8982	138-090-30	W/ Alta Mesa Rd. & S/ Valensin Rd.			Herald
West Coast Grape Farms / Twin Cities Ranch	Hwy 104	163	ACTIVE	Cummins	QSL 9 C-300	46989105	300	01-Jan-09	3	Fixed Location Pump	FALSE	8514	1909	138-0190-09	Twin Cities Rd./Highway 104	Harold		
Wallace Chan Farms Inc.	11691 River Road Hwy 160	164	CANCELLED	John Deere	414	R60833	100	01-Jan-77	0	Transportable Pump	FALSE	1000	400		Various Locations			
John Ullrich	13413 Ivie Rd.	165					0		0	FALSE	0	0						
Hunn, Merwin, Merwin		166	ACTIVE	Deutz	TC914L06	8822288	174	01-Jan-08	3	Transportable Pump	FALSE	3900	650		1300 Hood Franklin Rd	Hood		Stone Lake Rd.
Prince Vineyards LLC	12300 Herzog Road	167	EXPIRED	Deutz	T61912	554202	98	01-Jan-78	0	Transportable Pump	FALSE	300	70	146-0380-0023-0000	123 Herzog Rd.	Courtland	95615	Lambert Rd.
Delta Ranch		168	ACTIVE	John Deere	6068L	PE6068L036463	156	01-Jan-08	3	Fixed Location Pump	TRUE	0	0					
Delta Ranch		169	ACTIVE	John Deere	6068L	PE6068L047890	156	01-Jan-08	3	Fixed Location Pump	TRUE	0	0					
Petaluma Acquisition LLC	8101 Dillard Rd.	170	ACTIVE	Perkins	1104D-E44TG1	771037	72	01-Jan-96	0	Emergency Generator	FALSE	500	200		8101 Dillard Rd.	Wilton	95693	Wilton, CA Dillard Rd. and Meiss Rd.
Petaluma Acquisition LLC	8101 Dillard Rd.	171	ACTIVE	Perkins	1104D-E44TG1	773238	72	01-Jan-96	0	Emergency Generator	FALSE	500	200		8101 Dillard Rd.	Wilton	95693	Wilton, CA Dillard Rd. and Meiss Rd.
Petaluma Acquisition LLC	8101 Dillard Rd.	172	ACTIVE	Perkins	1104D-E44TG1	773246	72	01-Jan-96	0	Emergency Generator	TRUE	500	200		8101 Dillard Rd.	Wilton	95693	Wilton, CA Dillard Rd. and Meiss Rd.
Petaluma Acquisition LLC	8101 Dillard Rd.	173	ACTIVE	Generac	2640990100	2069148	350	01-Jan-99	1	Emergency Generator	FALSE	500	200		8101 Dillard Rd.	Wilton	95693	Wilton, CA Dillard Rd. and Meiss Rd.
New Hope Dairy LLC	9547 New Hope Road	174	ACTIVE	Allis Chalmers	25,000 Mark II	2503012	375	01-Jan-88	0	Emergency Generator	FALSE	30	30		9547 New Hope Road	Galt	95632	
Castle Hill Vineyards	14500 Borden Rd	175	CANCELLED	John Deere	6125HF070	R66125H035458	425	01-Jan-03	2	Fixed Location Pump	FALSE	0	0		14500 Borden Rd.	Herald	95638	Clay Station Rd. - Herald
Nester Enterprises	13852 E. Peltier Rd.	176	ACTIVE	John Deere	4045HF285	PE4045L174815	115	01-Jan-11	3	Fixed Location Pump	FALSE	12000	1500	138-0060-055	12098 Clay Station Rd.	Herald	95638	Herald / Twin Cities Rd
Demeter Corporation	2591 W. Elkhorn Blvd.	177	ACTIVE	John Deere	6868HFC94	PE6068R057875	225	01-Jan-13	4	Fixed Location Pump	TRUE	6100	2928	201-0220-034	2924 Elverta Rd.	Rio Linda	95673	SR99 - Elkhorn Blvd, Elverta
Wallace Chan Farms Inc.	11691 River Road Hwy 160	178	ACTIVE	New Holland	6677A/MEL	YSXEN01585	137	14-Feb-12	3	Transportable Pump	FALSE	2500	500	132-0190-063-0000	11691 River Rd.	Courtland	95615	Courtland / Randall Island Rd.

# SMAQMD 2017 AREA SOURCE METHODOLOGY

## ATTACHMENT B:

ARB's 2003 Ag Pump Methodology (August 2006)

## Appendix D

### Emission Inventory Methodology Agricultural Irrigation Pumps - Diesel

(Updated August 2006)

**EMISSION INVENTORY SOURCE CATEGORY**

Fuel Combustion / Food and Agricultural Processing

**EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION**

**052-042-1200-0000** Agricultural Irrigation I.C. Engines – Diesel/Distillate

### INTRODUCTION

Diesel-fueled agricultural irrigation pump engines are a significant source of emissions in California, especially during the April through October growing season. The Air Resources Board (ARB) estimates that in 2005, diesel-powered agricultural irrigation pump engines were the 8<sup>th</sup> largest source of nitrogen oxides and the 21<sup>st</sup> largest source of fine particulate matter in the San Joaquin Valley. For the Sacramento Valley, irrigation pump engines are the 10<sup>th</sup> largest source of nitrogen oxides and the 22<sup>nd</sup> largest source of fine particulate matter.

Irrigation pumps are used to pump water from either wells or supply canals to the field. They are also used for a number of other purposes, such as discharging water from tailwater pits, ponds, lakes, etc. Booster pumps are used to increase the water pressure for water that has already been removed from the source by another pump.

Pump engines can be either stationary or portable. A stationary pump engine is fixed in place; a portable pump engine is one that is mounted on a mobile piece of equipment or on skids and is moved from place to place depending on the need. Both well pumps and booster pump engines can be either portable or stationary.

### METHODS AND SOURCES

Emissions from the irrigation pump engines are estimated by multiplying the number of pump engines by their horsepower rating, load factor, annual operating hours, and emission factor.

The basic equation for calculating the emission of agricultural irrigation pump engines is:

$$E_y = \sum Pop * EF * Hrs * HP * \%Load$$

where

*E* = pollutant specific emissions (tons per year of NO<sub>x</sub>, HC, CO<sub>2</sub>, and diesel PM)  
*y* = inventory year  
*Pop* = population of diesel agricultural irrigation pump engines  
*EF* = emission factor (units of g/bhp-hr)  
*Hrs* = average annual use in hours  
*HP* = average brake horsepower of engine  
*%Load* = average engine load factor

### **Population**

The 2003 US Department of Agriculture Farm and Ranch Irrigation Survey (FRIS) (reference 1) stated that there are 83,216 electric or fuel-powered irrigation pumps in California, of which 12,535 (or approximately 14.1 percent) are powered with diesel engines. Assuming that well and booster pump engines are powered by the various fuels at the same relative amounts as the general pump engine population, 8,721 of the 12,535 diesel engine pumps are well pumps and the remaining 3,814 pumps are booster pumps, performing such tasks as discharging water from tailwater pits.

For inventory purposes, it is necessary to allocate pump engine populations among the various counties, air basins, and districts of California. This is normally done by one of two methods: the bottom-up method uses databases of individual pump locations to determine where in the state pumps are located; and the top-down method takes a statewide total and uses a surrogate (such as the amount of irrigated acres in a given area) to estimate the pump population in that area. The bottom-up method is usually preferred, but requires extensive databases that are often not available. The top-down method is less specific, but is a more straightforward calculation.

Because of the limited amount of data on individual pump locations, this methodology uses a hybrid approach and uses both bottom-up and top-down methods to allocate pumps (and therefore pump engines) statewide. To the extent possible, district data was used to allocate the number of stationary and portable pump engines to specific areas of the state. Where district data was not available or lacking in specificity, top-down estimates were made of pump engine locations.

### **Bottom-Up Inventories Used**

A database of well and lift pump engines in the Sacramento Ozone Non Attainment area (reference 2) shows 1,032 pump engines in that area; Sacramento Metropolitan AQMD staff estimate an additional 132 pump engines (both stationary and portable) that were not surveyed. The Sacramento Non-Attainment area includes all of Sacramento, Solano, Yolo, and Yuba Counties, and portions of Placer and Sutter Counties. In total, it is estimated that there are 1,164 diesel irrigation pump engines in the Sacramento Non-attainment area. The 132 additional pump engines

estimated by Sacramento Metro AQMD staff were assigned to counties within the non-attainment area using the top-down methods described below.

The South Coast AQMD surveyed farm operators in their district in January 2005 and again in 2006 to determine the number and size of irrigation pump engines. Results of these surveys demonstrated that there are 12 portable and 6 stationary diesel pump engines in the South Coast Air Basin (reference 3). For the purposes of this inventory, the portable engines were assumed to be booster pump engines and the stationary pump engines were assumed to be on well pumps. Because the survey did not include information on the specific county engines were located in, they were attributed to the counties in the South Coast Air Basin by top-down methods as described below.

### **Top-Down Inventories Used**

Top-down methods were used to allocate pump engine populations to all remaining areas of the state. Surrogates to allocate well pump engines and booster pump engine populations were developed using 2000 U.S. Geological Survey (USGS) data on the amount of ground and surface water withdrawals (reference 4). Ground water withdrawals were used to allocate well pump engine populations. USGS data on the amount of surface water withdrawals for agriculture was used to allocate booster pump engines by county. Because some surface water irrigation is done by gravity and thus does not require any pumping of any kind (for example, in rice fields), the amount of surface water withdrawals was multiplied by the ratio of sprinkler and drip irrigation acreage to total acreage irrigated by sprinkler, drip, and surface irrigation to estimate the potential gravity irrigation for a given county. Data on irrigation acreage by type was obtained from USGS (reference 4). Although surface irrigation can be accomplished by either gravity or pumping, no comprehensive regional data was available to estimate the proportion of surface irrigation that is pumped.

For counties split between air basins or non-attainment areas, GIS data on irrigated acreage developed by the California Department of Water Resources (reference 5) was used to estimate the proportions of pump engines in the split portions of a county.

All 18 estimated pump engines in the South Coast Air Basin and the 132 additional engines in the Sacramento Non-Attainment Area were allocated to counties within the respective regions using the surrogates described above.

Estimation of the split of stationary and portable pump engines by county was done based upon a methodology developed by Booz-Allen & Hamilton for the OFFROAD model (reference 6). This methodology was based upon interviews with engine manufacturers (DDC, Caterpillar, Cummins, and Deutz) and equipment manufacturers (Stewart & Stevenson and Valley Diesel) which suggested that the majority of generator, pump, and compressor engines greater than 100 horsepower were stationary. Table D-1 defines the percentages of portable and stationary engines by horsepower that were developed as a result of this work.



**Table D-1 – Portable vs. Stationary  
Engine Distribution**

<b>Horsepower Rating</b>	<b>Percent Portable</b>	<b>Percent Stationary</b>
0-25	100%	0%
26-50	90	10
51-120	70	30
121-175	20	80
176-250	15	85
251-500	10	90
501-750	10	90
>750	10	90

Table D-2 (on Page D-5) summarizes the resulting pump engines population used for the emissions estimates.

**Table D-2 – Estimated 2003 Diesel Agricultural Irrigation Pump Engine Population**

District	Portable	Stationary	Total
Amador County APCD	5	12	17
Antelope Valley APCD	2	17	19
Bay Area AQMD	49	98	147
Butte County AQMD	183	304	487
Calaveras County AQMD	1	3	4
Colusa County APCD	98	228	327
El Dorado County APCD	4	7	11
Feather River AQMD	214	315	529
Glenn County APCD	109	177	286
Great Basin Unified APCD	46	102	148
Imperial County APCD	46	69	115
Kern County APCD	4	11	15
Lake County AQMD	7	21	28
Lassen County APCD	48	121	169
Mariposa County APCD	0	1	1
Mendocino County AQMD	8	16	24
Modoc County APCD	35	72	107
Mojave Desert AQMD	0	2	2
Monterey Bay Unified APCD	161	513	674
North Coast Unified APCD	20	45	64
Northern Sierra AQMD	19	31	50
Northern Sonoma County APCD	7	12	20
Placer County APCD	27	34	61
Sacramento Metropolitan AQMD	35	65	101
San Diego County APCD	74	104	178
San Joaquin Valley Unified APCD	2092	4965	7057
San Luis Obispo County APCD	32	92	124
Santa Barbara County APCD	75	165	241
Shasta County AQMD	33	81	114
Siskiyou County APCD	87	161	248
South Coast AQMD	12	6	18
Tehama County APCD	60	135	195
Tuolumne County APCD	1	2	3
Ventura County APCD	44	100	145
Yolo/Solano AQMD	238	570	808
<b>Statewide</b>	<b>3879</b>	<b>8656</b>	<b>12535</b>

**Horsepower Distribution**

Where available, district data was used to define pump engine horsepower. Information on horsepower ratings of 1,032 engines from the Sacramento Non-Attainment Area and South Coast AQMD was used to allocate pump engines

for these areas. Also, Carl Moyer Program data for approximately 1,300 pump engines replaced between 1997 and 2003 was used to estimate emissions for engines in the Sacramento, San Joaquin, and Monterey Unified local air district jurisdictions.

To estimate the horsepower of pump engine populations across the state where no specific information was available, the minimum horsepower required to move water for irrigation was calculated. Where engine specific horsepower was available, comparisons were made between actual engine horsepower data and the estimated horsepower to ensure that the estimated horsepower profiles were reasonable estimates.

Three equations define the brake horsepower required to pump a given amount of water:

*Equation 1:*

$$TDH = SH + FH + VH + PH$$

*Where:*

*TDH = Total Dynamic Head (feet)*

*SH = Total Static Head (feet) (total vertical distance pump must lift water)*

*FH = Friction Head (feet) (pressure head loss due to friction in pipes)*

*VH = Velocity Head (feet) (energy imparted to water to get it in motion; usually negligible)*

*PH = Pressure Head (feet) (pressure required to operate the irrigation system)*

*(1 foot of pressure = 2.31 pounds per square inch)*

*Equation 2:*

$$WHP = Q * TDH / 3960$$

*Where:*

*WHP = Water Horse Power*

*Q = Flow Rate in gallons per minute*

*TDH = Total Dynamic Head (feet; from equation 1))*

*Equation 3:*

$$BHP = WHP / (PE * DE * LF * DRE)$$

*Where:*

*BHP = Brake Horsepower*

*WHP = Water Horsepower (from equation 2)*

*PE = Pump Efficiency (percent)*

*DE = Drive Efficiency (percent)*

*LF = Load Factor*

*DRE = Relative Efficiency of Diesel Engines compared to Electric Motors*

### **Well Pumps**

The total static head for well pumps is the depth to water for a well plus the drawdown (the lowering of the water table as a result of the pumped water). The average depth to water was obtained from USGS for over 10,000 wells in California (reference 7). A drawdown of 50 feet was assumed for wells with water depths of less than 500 feet; a drawdown of 100 feet was assumed for deeper wells. The depth of pump drawdowns can vary from well to well based on location and quality of the well. In general the drawdown of a well should be negligible. However, in practice the distance can change because of seasonal rain fall or pumping at a rate that exceed the ability of the

well to refresh itself. Therefore, the maximum drawdown is the distance between the initial water level and the top of the pump bowls formed by the water pumping. To compensate for this change in static head a minimum distance between the water level and the pump bowl is assumed to range from 50 to 100 feet depending on the depth of the well.

Well locations were determined with GIS software, and only wells located within irrigated agricultural fields (as defined in the Department of Water Resources land use data set found in reference 5) were used to determine horsepower. Because the USGS well database contains information on specific wells at specific locations, these data were used to determine horsepower profiles specific to each county, air basin, and district.

Because pumps are purchased to accomplish a wide variety of tasks, a pressure head of 75 pounds per square inch (psi) was assumed as an upper bound of typical operating pressures. This pressure would be typical of that found in a booster pump that lifts the water an additional 10 feet once the water has reached the surface and pressurizes a sprinkler system such as rainmakers.

Table D-3 lists the parameters used to calculate horsepower profiles for well pump engines. Data on flow rates and the static head of booster pumps were obtained from the 2003 FRIS (reference 1). Friction head was estimated at 2.54 feet, based on data contained in publication by the National Resources Conservation Service (reference 8), which represents the friction imparted by a flow rate of 900 gallons per minute through 100 feet of steel 8-inch diameter pipe. This value was selected as a mid-range estimate of friction loss. Friction head varies with the length of irrigation pipe, flow rate, and the diameter of pipe and can range between near zero to well over 20 feet for high flow rates and lengthy pipes.

**Table D-3 – Parameters Used to Calculate Horsepower of Irrigation Pump Engines**

Parameter	Well Pump	Booster Pumps		
		Tailwater Pump	Pond/Lake Discharge	Relift
Static Head	Average Depth to Water	11	20	19
Friction Head (feet)	2.54	2.54	2.54	2.54
Pressure Head (psi)	75	75	75	75
Flow Rate (gpm)	802	450-4937	450-4376	450-5277
Pump Efficiency	86%	80%	80%	80%
Drive Efficiency	85%	95%	95%	95%

The pump efficiency can vary between 70 and 90 percent depending on the type, size, and number of stages. A pump efficiency of 86 percent was assumed for these calculations. The drive efficiency is the efficiency of the drive between the engine and the pump itself; it varies between 70 percent and 100 percent depending on the method used to connect the motor and the pump. For these calculations, a drive efficiency of 85 percent was used. The relative efficiency of diesel engines compared to electric motors is about 75 percent; that is, an electric motor needs to be only 75 percent as powerful as a diesel engine to perform the same amount of work.

Table D-4 lists the average estimated horsepower and the range of horsepower used to calculate emissions. This data was used only when districts did not provide specific data. The bottom-up data for the Sacramento Non-Attainment Area has an average horsepower of 147 hp for well pump engines, which compares favorably with the 149 hp/157 hp estimates for engines in the Yolo/Solano AQMD and the Sacramento Metro AQMD local air districts. The average horsepower of the engines replaced under the Carl Moyer Program for the San Joaquin Valley is 197 hp, which is very close to the 196 hp estimate in Table D-4 for the San Joaquin Unified APCD. In 1996, Sonoma Technology (reference 9) surveyed San Joaquin Valley farmers on their irrigation pumps and showed an average horsepower of 161 hp for diesel engines. However, this average was based on only 35 responses out of 368 qualified respondents.

**Table D-4 – Estimated Horsepower of Diesel Well Pump Engines<sup>1</sup>**

District	Average	Minimum	Maximum
Bay Area AQMD	148	104	248
Butte County AQMD	129	102	157
Colusa County APCD	141	116	189
Feather River AQMD	144	99	190
Glenn County APCD	132	103	162
Imperial County APCD	114	98	205
Monterey Bay Unified APCD	149	112	187
Sacramento Metropolitan AQMD	157	98	203
San Diego County APCD	130	56	305
San Joaquin Valley Unified APCD	196	76	705
San Luis Obispo County APCD	162	100	346
Santa Barbara County APCD	151	63	446
South Coast AQMD	180	100	363
Ventura County APCD	181	98	401
Yolo/Solano AQMD	149	103	211
<b>Statewide Average</b>	<b>184</b>	<b>56</b>	<b>705</b>

1. Statewide average assigned to areas without data

## Booster Pumps

Data to calculate booster pump engine horsepower profiles is summarized in Table D-3. All parameters except for the pressure head and friction head are average values obtained from Tables 19 and 20 of the 2003 Farm and Ranch Irrigation Survey. Table D-5 summarizes the horsepower profiles of the three types of booster pump engines.

**Table D-5 – Estimated Horsepower of Diesel Booster Pump Engines**

Type	Percent of Type	Calculated HP
Tailwater	46%	51
Tailwater	23%	85
Tailwater	18%	141
Tailwater	3%	197
Tailwater	6%	282
Tailwater	3%	556
<b>Tailwater</b>	<b>Average</b>	<b>111</b>
Pond/Lake	10%	40
Pond/Lake	19%	66
Pond/Lake	9%	111
Pond/Lake	12%	155
Pond/Lake	37%	221
Pond/Lake	12%	387
<b>Pond/Lake</b>	<b>Average</b>	<b>176</b>
Relift	21%	53
Relift	19%	88
Relift	17%	147
Relift	16%	205
Relift	21%	294
Relift	4%	620
<b>Relift</b>	<b>Average</b>	<b>177</b>

## Activity

The average annual usage of diesel irrigation pump engines is assumed to be 1,000 hours. Data on electrical use for Pacific Gas and Electric small and large agricultural electric rate payers indicates that average pumping hours may have ranged from 187 to 4,569 for year 2003 (PG&E, 2004). The 2003 Farm and Ranch Irrigation Survey indicates that the average hours of operation of well pump engines was 1,016 hours. Finally, analysis of irrigation pump engines replaced under the Carl Moyer Program shows that the average pump usage is about 1,000 hours.

## Age Distribution

The average useful life of an irrigation pump engine is about 20 years; that is, half of the engines that were purchased 20 years ago will still be in operation. Engines

replaced under the Carl Moyer Program were as old as 61 years but averaged 18 years of age. The American Society of Agricultural Engineers has estimated the average agricultural engine is used 20,000 hours (ASAE, 2005). At an average annual usage of 1,000 hours, 20 years is a reasonable estimate of useful life. The actual age of irrigation pump engines was available for 1,032 engines in the Sacramento Non-Attainment area and the 1,300 pump engines replaced through the Carl Moyer Program from 1997 through 2003. For all other pump engines, an age distribution was calculated using the methodology used in the ARB OFFROAD model. Table D-6 shows the base year age distribution. The OFFROAD age distribution methodology takes into account an “S”-shaped scrappage curve and historic diesel engine populations reported in the Farm and Ranch Irrigation Surveys for the years 1984, 1988, 1994, 1998, and 2003. For all other years within the complete 40 year time span, the average yearly growth between the years 1984 and 2003 was assumed. (Note: for future years, different growth rates are assumed and will be discussed in the “Growth” section).

**Table D-6 – Base Year Age Distribution of Diesel Irrigation Pump Engines**

<b>Age</b>	<b>Model Year</b>	<b>Percent</b>
0	2003	8.3%
1	2002	7.7%
2	2001	7.5%
3	2000	7.2%
4	1999	3.1%
5	1998	3.0%
6	1997	2.8%
7	1996	2.6%
8	1995	4.4%
9	1994	4.3%
10	1993	4.1%
11	1992	3.9%
12	1991	3.7%
13	1990	3.5%
14	1989	4.5%
15	1988	4.3%
16	1987	4.0%
17	1986	3.7%
18	1985	2.5%
19	1984	2.9%
20	1983	2.4%
21	1982	1.5%
22	1981	1.3%
23	1980	1.1%
24	1979	1.0%
25	1978	0.8%
26	1977	0.7%
27	1976	0.6%
28	1975	0.5%
29	1974	0.4%
30	1973	0.4%
31	1972	0.3%
32	1971	0.2%
33	1970	0.2%
34	1969	0.2%
35	1968	0.1%
36	1967	0.1%
37	1966	0.1%
38	1965	0.1%
39	1964	0.1%
40	1963	0.0%



**Load Factor**

The load factor assumed for agricultural irrigation pump engines was 65 percent. This figure was based on extensive discussions with engine dealers, manufacturers, and irrigation experts.

**Emission Factors**

Emission factors for CO, hydrocarbons, NO<sub>x</sub>, PM, and CO<sub>2</sub> were used to estimate emissions. These emission factors are from the OFFROAD model and are based upon source tests of engines. The OFFROAD emission factors are in three parts: the zero hour emission factor; the base emission rate for a new engine; and a deterioration factor, which is dependant on the cumulative number of hours an engine has been in operation. The final emission factor is the zero hour emission factor plus the deterioration factor times the cumulative engine use (in hours). Because engines can only deteriorate a certain amount before they cease to operate, deterioration was capped at the average useful life of the engine, or 20 years (20,000 hours). These emission factors are summarized in Table D-7.

OFFROAD diesel emission factors require adjustment for calculation of TOG: hydrocarbon emissions must be multiplied by a factor of 1.44 to get TOG. OFFROAD emission factors for NO<sub>x</sub> and PM also need to be corrected for the difference between the fuels the factors were developed with and the fuels actually used in California. These fuel correction factors are specific for the year of emission estimates, the model year of the equipment, and the horsepower of the equipment. For NO<sub>x</sub>, the fuel correction factor varies between 0.93 and 1; for PM, the fuel correction factor varies between 0.72 and 1.0. For ROG, the fuel correction factor is 0.72 for diesel fuel.

**Table D-7 – Diesel Emission Factors**

		(g/hp-hr)	(g/hp-hr <sup>c</sup> )	(g/hp-hr)	(g/hp-hr <sup>c</sup> )	(g/hp-hr)	(g/hp-hr <sup>c</sup> )	(g/hp-hr)	(g/hp-hr <sup>c</sup> )
<b>HP</b>	<b>Year</b>	<b>HC</b>	<b>HC det</b>	<b>CO</b>	<b>CO det</b>	<b>NOX</b>	<b>NOX det</b>	<b>PM</b>	<b>PM det</b>
26 - 50	<= 1987	1.84	2.35E-04	5	5.13E-04	7	1.05E-04	0.76	5.89E-05
26 - 50	1988 - 1998	1.8	2.30E-04	5	5.13E-04	6.9	1.04E-04	0.76	5.89E-05
26 - 50	1999 - 2003	1.45	1.85E-04	4.1	4.20E-04	5.55	1.03E-04	0.6	4.65E-05
26 - 50	2004	0.64	9.80E-05	3.27	3.34E-04	5.1	9.33E-05	0.43	3.36E-05
26 - 50	2005	0.37	6.90E-05	3	3.05E-04	4.95	9.67E-05	0.38	2.93E-05
26 - 50	2006 - 2007	0.24	5.45E-05	2.86	2.90E-04	4.88	9.83E-05	0.35	2.72E-05
26 - 50	2008 - 2012	0.1	4.00E-05	2.72	2.76E-04	4.8	1.00E-04	0.16	1.22E-05
26 - 50	2013 - 2020	0.1	4.00E-05	2.72	2.76E-04	2.9	6.04E-05	0.01	1.11E-06
51 - 120	<= 1987	1.44	6.66E-05	4.8	1.27E-04	13	3.01E-04	0.84	6.11E-05
51 - 120	1988 - 1997	0.99	4.58E-05	3.49	9.23E-05	8.75	2.02E-04	0.69	5.02E-05
51 - 120	1998 - 2003	0.99	4.58E-05	3.49	9.23E-05	6.9	1.60E-04	0.69	5.02E-05
51 - 120	2004	0.46	3.33E-05	3.23	8.55E-05	5.64	1.03E-04	0.39	2.85E-05
51 - 120	2005	0.28	2.92E-05	3.14	8.33E-05	5.22	8.40E-05	0.29	2.12E-05
51 - 120	2006 - 2007	0.19	2.71E-05	3.09	8.21E-05	5.01	7.45E-05	0.24	1.76E-05
51 - 120	2008 - 2011	0.1	2.50E-05	3.05	8.10E-05	2.89	3.80E-05	0.2	1.45E-05
51 - 120	2012	0.09	2.31E-05	3.05	8.10E-05	2.53	3.33E-05	0.07	4.96E-06
51 - 120	2013 - 2014	0.09	2.31E-05	3.05	8.10E-05	2.53	3.33E-05	0.01	9.33E-07
51 - 120	2015 - 2020	0.07	1.74E-05	3.05	8.10E-05	1.4	1.84E-05	0.01	9.33E-07
121 - 175	<= 1969	1.32	6.11E-05	4.4	1.16E-04	14	3.24E-04	0.77	5.60E-05
121 - 175	1970 - 1971	1.1	5.09E-05	4.4	1.16E-04	13	3.01E-04	0.66	4.80E-05
121 - 175	1972 - 1979	1	4.63E-05	4.4	1.16E-04	12	2.78E-04	0.55	4.00E-05
121 - 175	1980 - 1984	0.94	4.35E-05	4.3	1.14E-04	11	2.54E-04	0.55	4.00E-05
121 - 175	1985 - 1987	0.88	4.07E-05	4.2	1.11E-04	11	2.54E-04	0.55	4.00E-05
121 - 175	1988 - 1996	0.68	3.15E-05	2.7	7.14E-05	8.17	1.89E-04	0.38	2.76E-05
121 - 175	1997 - 2002	0.68	3.15E-05	2.7	7.14E-05	6.9	1.60E-04	0.38	2.76E-05
121 - 175	2003	0.33	2.79E-05	2.7	7.14E-05	5.26	9.64E-05	0.24	1.70E-05
121 - 175	2004	0.22	2.63E-05	2.7	7.14E-05	4.72	7.52E-05	0.19	1.35E-05
121 - 175	2005 - 2006	0.16	2.57E-05	2.7	7.14E-05	4.44	6.46E-05	0.16	1.18E-05
121 - 175	2007 - 2011	0.1	2.50E-05	2.7	7.14E-05	2.45	3.20E-05	0.14	1.00E-05
121 - 175	2012 - 2014	0.09	2.17E-05	2.7	7.14E-05	2.27	2.96E-05	0.01	4.67E-07
121 - 175	2015 - 2020	0.05	1.17E-05	2.7	7.14E-05	0.27	3.56E-06	0.01	4.67E-07
176 - 250	<= 1969	1.32	6.11E-05	4.4	1.16E-04	14	3.24E-04	0.77	5.60E-05
176 - 250	1970 - 1971	1.1	5.09E-05	4.4	1.16E-04	13	3.01E-04	0.66	4.80E-05
176 - 250	1972 - 1979	1	4.63E-05	4.4	1.16E-04	12	2.78E-04	0.55	4.00E-05
176 - 250	1980 - 1984	0.94	4.35E-05	4.3	1.14E-04	11	2.54E-04	0.55	4.00E-05
176 - 250	1985 - 1987	0.88	4.07E-05	4.2	1.11E-04	11	2.54E-04	0.55	4.00E-05
176 - 250	1988 - 1995	0.68	3.15E-05	2.7	7.14E-05	8.17	1.89E-04	0.38	2.76E-05
176 - 250	1996 - 2002	0.32	1.48E-05	0.92	2.43E-05	6.25	1.45E-04	0.15	7.96E-06
176 - 250	2003	0.19	2.09E-05	0.92	2.43E-05	5	9.05E-05	0.12	6.51E-06
176 - 250	2004	0.14	2.30E-05	0.92	2.43E-05	4.58	7.23E-05	0.11	6.03E-06
176 - 250	2005 - 2006	0.12	2.40E-05	0.92	2.43E-05	4.38	6.33E-05	0.11	5.79E-06
176 - 250	2007 - 2010	0.1	2.50E-05	0.92	2.43E-05	2.45	3.18E-05	0.11	5.59E-06
176 - 250	2011 - 2013	0.07	1.83E-05	0.92	2.43E-05	1.36	1.77E-05	0.01	4.55E-07
176 - 250	2014 - 2020	0.05	1.17E-05	0.92	2.43E-05	0.27	3.56E-06	0.01	4.55E-07

**Table D-7 – Diesel Emission Factors (Continued)**

	(g/hp-hr)	(g/hp-hr <sup>c</sup> )	(g/hp-hr)	(g/hp-hr <sup>c</sup> )	(g/hp-hr)	(g/hp-hr <sup>c</sup> )	(g/hp-hr)	(g/hp-hr <sup>c</sup> )	
<b>HP</b>	<b>Year</b>	<b>HC</b>	<b>HC det</b>	<b>CO</b>	<b>CO det</b>	<b>NOX</b>	<b>NOX det</b>	<b>PM</b>	<b>PM det</b>
251 - 500	<= 1969	1.26	4.39E-05	4.2	8.32E-04	14	2.33E-04	0.74	3.93E-05
251 - 500	1970 - 1971	1.05	3.66E-05	4.2	8.32E-04	13	2.16E-04	0.63	3.34E-05
251 - 500	1972 - 1979	0.95	3.31E-05	4.2	8.32E-04	12	2.00E-04	0.53	2.81E-05
251 - 500	1980 - 1984	0.9	3.14E-05	4.2	8.32E-04	11	1.83E-04	0.53	2.81E-05
251 - 500	1985 - 1987	0.84	2.93E-05	4.1	8.12E-04	11	1.83E-04	0.53	2.81E-05
251 - 500	1988 - 1995	0.68	2.37E-05	2.7	5.35E-05	8.17	1.36E-04	0.38	2.02E-05
251 - 500	1996 - 2000	0.32	1.12E-05	0.92	1.82E-05	6.25	1.04E-04	0.15	7.96E-06
251 - 500	2001	0.19	1.95E-05	0.92	1.82E-05	4.95	7.34E-05	0.12	6.51E-06
251 - 500	2002	0.14	2.22E-05	0.92	1.82E-05	4.51	6.32E-05	0.11	6.03E-06
251 - 500	2003 - 2004	0.12	2.36E-05	0.92	1.82E-05	4.29	5.81E-05	0.11	5.79E-06
251 - 500	2005	0.1	2.50E-05	0.92	1.82E-05	4	5.30E-05	0.11	5.55E-06
251 - 500	2006 - 2010	0.1	2.50E-05	0.92	1.82E-05	2.45	3.18E-05	0.11	5.55E-06
251 - 500	2011 - 2013	0.07	1.83E-05	0.92	1.82E-05	1.36	1.77E-05	0.01	4.55E-07
251 - 500	2014 - 2020	0.05	1.17E-05	0.92	1.82E-05	0.27	3.56E-06	0.01	4.55E-07
501 - 750	<= 1969	1.26	4.39E-05	4.2	8.32E-04	14	2.33E-04	0.74	3.93E-05
501 - 750	1970 - 1971	1.05	3.66E-05	4.2	8.32E-04	13	2.16E-04	0.63	3.34E-05
501 - 750	1972 - 1979	0.95	3.31E-05	4.2	8.32E-04	12	2.00E-04	0.53	2.81E-05
501 - 750	1980 - 1984	0.9	3.14E-05	4.2	8.32E-04	11	1.83E-04	0.53	2.81E-05
501 - 750	1985 - 1987	0.84	2.93E-05	4.1	8.12E-04	11	1.83E-04	0.53	2.81E-05
501 - 750	1988 - 1995	0.68	2.37E-05	2.7	5.35E-05	8.17	1.36E-04	0.38	2.02E-05
501 - 750	1996 - 2001	0.32	1.12E-05	0.92	1.82E-05	6.25	1.04E-04	0.15	7.96E-06
501 - 750	2002	0.19	1.95E-05	0.92	1.82E-05	4.95	7.34E-05	0.12	6.51E-06
501 - 750	2003	0.14	2.22E-05	0.92	1.82E-05	4.51	6.32E-05	0.11	6.03E-06
501 - 750	2004 - 2005	0.12	2.36E-05	0.92	1.82E-05	4.29	5.81E-05	0.11	5.79E-06
501 - 750	2006 - 2010	0.1	2.50E-05	0.92	1.82E-05	2.45	3.18E-05	0.11	5.55E-06
501 - 750	2011 - 2013	0.07	1.83E-05	0.92	1.82E-05	1.36	1.77E-05	0.01	4.55E-07
501 - 750	2014 - 2020	0.05	1.17E-05	0.92	1.82E-05	0.27	3.56E-06	0.01	4.55E-07
751 - 9999	<= 1969	1.26	4.39E-05	4.2	8.32E-04	14	2.33E-04	0.74	3.93E-05
751 - 9999	1970 - 1971	1.05	3.66E-05	4.2	8.32E-04	13	2.16E-04	0.63	3.34E-05
751 - 9999	1972 - 1979	0.95	3.31E-05	4.2	8.32E-04	12	2.00E-04	0.53	2.81E-05
751 - 9999	1980 - 1984	0.9	3.14E-05	4.2	8.32E-04	11	1.83E-04	0.53	2.81E-05
751 - 9999	1985 - 1987	0.84	2.93E-05	4.1	8.12E-04	11	1.83E-04	0.53	2.81E-05
751 - 9999	1988 - 1999	0.68	1.12E-05	2.7	5.35E-05	8.17	1.36E-04	0.38	2.02E-06
751 - 9999	2000 - 2005	0.32	1.12E-05	0.92	1.82E-05	6.25	1.04E-04	0.15	7.96E-06
751 - 9999	2006	0.19	1.95E-05	0.92	1.82E-05	4.95	7.34E-05	0.12	6.51E-06
751 - 9999	2007	0.14	2.22E-05	0.92	1.82E-05	4.51	6.32E-05	0.11	6.03E-06
751 - 9999	2008 - 2009	0.12	2.36E-05	0.92	1.82E-05	4.29	5.81E-05	0.11	5.79E-06
751 - 9999	2010	0.1	2.50E-05	0.92	1.82E-05	4.08	5.30E-05	0.11	5.55E-06
751 - 9999	2011 - 2014	0.1	2.50E-05	0.92	1.82E-05	2.36	3.06E-05	0.06	2.78E-06
751 - 9999	2015 - 2020	0.05	1.17E-05	0.92	1.82E-05	2.36	3.06E-05	0.02	1.11E-06

## Growth

In April, 2005, the ARB agricultural advisory committee approved a set of growth factors for various types of agricultural equipment. For most categories, including irrigation pump engines, the growth factor selected was irrigated acreage, as collected by the California Department of Conservation's Farmland Monitoring and Mapping Program for the years 1996-2002 (reference 12). These growth factors are defined by county for the San Joaquin Valley; an average is used for the rest of the State. Table D-8 presents these growth factors. With the exception of Madera and Merced counties, the growth of irrigated acreage is declining.

Since usage of diesel agricultural irrigation pump engines is not only defined by the amount of agricultural acreage, but also by market forces including energy costs, the growth rate of these engines will be revisited in future years as the USDA publishes new Farm and Ranch Irrigation Surveys. These surveys are performed approximately every five years.

**Table D-8 – Growth Rates by County**

<b>County Name</b>	<b>Growth Factor (per year)</b>
Fresno	-0.73%
Kern	-0.33%
Kings	-0.14%
Madera	0.20%
Merced	0.03%
San Joaquin	-0.32%
Stanislaus	-0.12%
Tulare	-0.62%
<b>All Other Counties</b>	<b>-0.26%</b>

To calculate emissions growth for future years, the base year population was grown using the growth factors described above using the methodology used for the ARB OFFROAD model. Because the number of diesel irrigation engines increased dramatically between 1998 and 2003, the base year age distribution contains a large percentage of late model engines that declines in future years as these engines are retired.

## RESULTS

Table D-9 shows the statewide emissions for the base year (2003) by local air district for all diesel pump engines. More than half of the emissions of diesel irrigation pump engines are in the San Joaquin Valley Unified APCD, due to both the large number of pump engines in that district and because wells on the west side of the district tend to be very deep and therefore require much larger engines. Table D-10 shows the statewide emissions by horsepower and by pump engine portability. About two-thirds of the statewide emissions are from stationary pump engines based on the Booz-Hamilton assumption presented in table D-1. Table D-11 shows the forecasted statewide emissions (does not include the benefits of the regulation). Emissions decline over time because of the negative growth rate which reflects the disappearance of agricultural land in California and because as time goes on, existing federal off-road compression ignition engine certification standards result in the replacement of older, dirtier engines with newer, cleaner engines. By 2025, emissions of all pollutants (except CO<sub>2</sub>) are less than half those seen in 2003.

**Table D-9 – 2003 Diesel Agricultural Irrigation Pump Engine Emissions  
By Local Air District  
(tons per day)**

District Name	CO	CO2	DPM	HC	NOx	PM	PM10	PM25	ROG	SOx	TOG
Amador County APCD	0.0	3.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Antelope Valley APCD	0.1	7.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Bay Area AQMD	0.2	28.4	0.0	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.1
Butte County AQMD	0.7	85.4	0.1	0.2	1.4	0.1	0.1	0.1	0.1	0.0	0.2
Calaveras County AQMD	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colusa County APCD	0.4	57.6	0.0	0.1	0.9	0.1	0.0	0.0	0.1	0.0	0.2
El Dorado County APCD	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feather River AQMD	0.7	86.5	0.1	0.2	1.4	0.1	0.1	0.1	0.1	0.0	0.2
Glenn County APCD	0.4	48.7	0.0	0.1	0.8	0.1	0.0	0.0	0.1	0.0	0.1
Great Basin Unified APCD	0.2	29.6	0.0	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.1
Imperial County APCD	0.1	20.4	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1
Kern County APCD	0.0	3.6	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Lake County AQMD	0.0	5.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Lassen County APCD	0.3	34.1	0.0	0.1	0.5	0.0	0.0	0.0	0.1	0.0	0.1
Mariposa County APCD	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mendocino County AQMD	0.0	4.5	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Modoc County APCD	0.2	21.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1
Mojave Desert AQMD	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Monterey Bay Unified APCD	0.8	122.0	0.1	0.2	2.0	0.1	0.1	0.1	0.2	0.0	0.3
North Coast Unified APCD	0.1	13.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Northern Sierra AQMD	0.1	9.7	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Northern Sonoma County APCD	0.0	3.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Placer County APCD	0.1	9.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Sacramento Metropolitan AQMD	0.1	16.9	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
San Diego County APCD	0.3	32.9	0.0	0.1	0.5	0.0	0.0	0.0	0.1	0.0	0.1
San Joaquin Valley Unified APCD	11.2	1451.2	1.1	2.4	22.9	1.3	1.1	1.1	2.1	0.1	3.5
San Luis Obispo County APCD	0.2	23.4	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.1
Santa Barbara County APCD	0.3	42.9	0.0	0.1	0.7	0.0	0.0	0.0	0.1	0.0	0.1
Shasta County AQMD	0.2	23.3	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.1
Siskiyou County APCD	0.4	48.5	0.0	0.1	0.8	0.0	0.0	0.0	0.1	0.0	0.1
South Coast AQMD	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tehama County APCD	0.3	39.2	0.0	0.1	0.6	0.0	0.0	0.0	0.1	0.0	0.1
Tuolumne County APCD	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura County APCD	0.2	29.1	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.1
Yolo/Solano AQMD	0.9	143.2	0.1	0.3	2.3	0.1	0.1	0.1	0.2	0.0	0.4
<b>Statewide Total</b>	<b>18.7</b>	<b>2452.1</b>	<b>1.9</b>	<b>4.2</b>	<b>39.0</b>	<b>2.3</b>	<b>1.9</b>	<b>1.9</b>	<b>3.7</b>	<b>0.2</b>	<b>6.1</b>

**Table D-10 – 2003 Diesel Agricultural Irrigation Pump Engine Emissions  
By Horsepower and Portability  
(tons per day)**

Portability	Horsepower	CO	CO2	DPM	HC	NOx	PM	PM10	PM25	ROG	SOx	TOG
Portable	26 to 50 Horsepower	0.1	6.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Portable	51 to 120 Horsepower	1.9	231.8	0.3	0.6	4.1	0.4	0.3	0.3	0.5	0.0	0.9
Portable	121 to 175 Horsepower	1.1	162.5	0.1	0.3	2.7	0.2	0.1	0.1	0.3	0.0	0.4
Portable	176 to 250 Horsepower	0.5	98.8	0.1	0.1	1.5	0.1	0.1	0.1	0.1	0.0	0.2
Portable	251 to 500 Horsepower	0.6	55.8	0.0	0.1	0.8	0.0	0.0	0.0	0.1	0.0	0.1
Portable	501 to 750 Horsepower	0.1	7.9	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
<b>Portable Total</b>		<b>4.3</b>	<b>563.0</b>	<b>0.6</b>	<b>1.2</b>	<b>9.3</b>	<b>0.7</b>	<b>0.6</b>	<b>0.6</b>	<b>1.0</b>	<b>0.0</b>	<b>1.7</b>
Stationary	26 to 50 Horsepower	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stationary	51 to 120 Horsepower	0.8	98.5	0.1	0.3	1.7	0.2	0.1	0.1	0.2	0.0	0.4
Stationary	121 to 175 Horsepower	4.4	649.9	0.5	1.2	10.6	0.6	0.5	0.5	1.0	0.1	1.7
Stationary	176 to 250 Horsepower	2.7	560.7	0.4	0.8	8.8	0.4	0.4	0.3	0.7	0.0	1.2
Stationary	251 to 500 Horsepower	5.6	505.3	0.3	0.7	7.4	0.3	0.3	0.3	0.6	0.0	1.0
Stationary	501 to 750 Horsepower	0.9	71.2	0.0	0.1	1.1	0.1	0.0	0.0	0.1	0.0	0.1
Stationary	>751 Horsepower	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Stationary Total</b>		<b>14.4</b>	<b>1889.1</b>	<b>1.4</b>	<b>3.0</b>	<b>29.7</b>	<b>1.6</b>	<b>1.4</b>	<b>1.3</b>	<b>2.6</b>	<b>0.1</b>	<b>4.4</b>
<b>All Engines Total</b>		<b>18.7</b>	<b>2452.1</b>	<b>1.9</b>	<b>4.2</b>	<b>39.0</b>	<b>2.3</b>	<b>1.9</b>	<b>1.9</b>	<b>3.7</b>	<b>0.2</b>	<b>6.1</b>

**Table D-11 – Forecasted Diesel Agricultural  
Irrigation Pump Engine Emissions  
(tons per day)**

Pollutant	2003	2005	2010	2015	2020
CO	18.7	17.7	15.0	12.9	11.3
CO2	2452.1	2439.4	2407.5	2375.6	2343.7
DPM	1.9	1.9	1.6	1.4	1.0
HC	4.2	4.1	3.6	3.0	2.4
NOx	39.0	37.6	32.5	26.3	19.3
PM	2.3	2.2	1.9	1.6	1.2
PM10	1.9	1.9	1.6	1.4	1.0
PM25	1.9	1.8	1.6	1.3	1.0
ROG	3.7	3.5	3.1	2.6	2.1
SOx	0.2	0.2	0.2	0.1	0.1
TOG	6.1	5.9	5.1	4.3	3.5

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# SMAQMD 2017 AREA SOURCE METHODOLOGY

## ATTACHMENT C:

ARB's 2017 Off-road Diesel Emission Factors

# ARB's 2017 Off-Road Diesel Fuel Correction Factors

Model_Yea	Calendar_Y	PM_fcf	NOx_fcf	HC_fcf
1945	2017	0.71	0.93	0.9
1946	2017	0.71	0.93	0.9
1947	2017	0.71	0.93	0.9
1948	2017	0.71	0.93	0.9
1949	2017	0.71	0.93	0.9
1950	2017	0.71	0.93	0.9
1951	2017	0.71	0.93	0.9
1952	2017	0.71	0.93	0.9
1953	2017	0.71	0.93	0.9
1954	2017	0.71	0.93	0.9
1955	2017	0.71	0.93	0.9
1956	2017	0.71	0.93	0.9
1957	2017	0.71	0.93	0.9
1958	2017	0.71	0.93	0.9
1959	2017	0.71	0.93	0.9
1960	2017	0.71	0.93	0.9
1961	2017	0.71	0.93	0.9
1962	2017	0.71	0.93	0.9
1963	2017	0.71	0.93	0.9
1964	2017	0.71	0.93	0.9
1965	2017	0.71	0.93	0.9
1966	2017	0.71	0.93	0.9
1967	2017	0.71	0.93	0.9
1968	2017	0.71	0.93	0.9
1969	2017	0.71	0.93	0.9
1970	2017	0.71	0.93	0.9
1971	2017	0.71	0.93	0.9
1972	2017	0.71	0.93	0.9
1973	2017	0.71	0.93	0.9
1974	2017	0.71	0.93	0.9
1975	2017	0.71	0.93	0.9
1976	2017	0.71	0.93	0.9
1977	2017	0.71	0.93	0.9
1978	2017	0.71	0.93	0.9
1979	2017	0.71	0.93	0.9
1980	2017	0.71	0.93	0.9
1981	2017	0.71	0.93	0.9
1982	2017	0.71	0.93	0.9
1983	2017	0.71	0.93	0.9
1984	2017	0.71	0.93	0.9
1985	2017	0.71	0.93	0.9
1986	2017	0.71	0.93	0.9
1987	2017	0.71	0.93	0.9
1988	2017	0.71	0.93	0.9
1989	2017	0.71	0.93	0.9
1990	2017	0.71	0.93	0.9

# ARB's 2017 Off-Road Diesel Fuel Correction Factors

Model_Yea	Calendar_Y	PM_fcf	NOx_fcf	HC_fcf
1991	2017	0.71	0.93	0.9
1992	2017	0.71	0.93	0.9
1993	2017	0.71	0.93	0.9
1994	2017	0.71	0.93	0.9
1995	2017	0.71	0.93	0.9
1996	2017	0.71	0.93	0.9
1997	2017	0.71	0.93	0.9
1998	2017	0.71	0.93	0.9
1999	2017	0.71	0.93	0.9
2000	2017	0.71	0.93	0.9
2001	2017	0.71	0.93	0.9
2002	2017	0.71	0.93	0.9
2003	2017	0.71	0.93	0.9
2004	2017	0.71	0.93	0.9
2005	2017	0.71	0.93	0.9
2006	2017	0.71	0.93	0.9
2007	2017	0.86	0.95	0.9
2008	2017	0.86	0.95	0.9
2009	2017	0.86	0.95	0.9
2010	2017	0.9	0.95	0.9
2011	2017	0.9	0.95	0.9
2012	2017	0.9	0.95	0.9
2013	2017	0.9	0.95	0.9
2014	2017	0.9	0.95	0.9
2015	2017	0.9	0.95	0.9
2016	2017	0.9	0.95	0.9
2017	2017	0.9	0.95	0.9

# ARB's 2017 Off-Road Diesel Emission Factors

HP	Model_Year	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
75	1945	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1946	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1947	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1948	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1949	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1950	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1951	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1952	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1953	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1954	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1955	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1956	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1957	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1958	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1959	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1960	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1961	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1962	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1963	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1964	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1965	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1966	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1967	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1968	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1969	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1970	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1971	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1972	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1973	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1974	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1975	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1976	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1977	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1978	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1979	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1980	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1981	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1982	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1983	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1984	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1985	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1986	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1987	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
75	1988	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1989	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1990	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05

# ARB's 2017 Off-Road Diesel Emission Factors

HP	Model_Yea	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
75	1991	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1992	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1993	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1994	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1995	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1996	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1997	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1998	8.302	0.000193	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
75	1999	5.308389	0.000123	0.417392	3.04E-05	0.99	4.58E-05	3.49	9.23E-05
75	2000	5.398589	0.000125	0.198363	1.44E-05	0.99	4.58E-05	3.49	9.23E-05
75	2001	5.367991	0.000124	0.267081	1.94E-05	0.99	4.58E-05	3.49	9.23E-05
75	2002	5.179786	0.00012	0.25896	1.88E-05	0.99	4.58E-05	3.49	9.23E-05
75	2003	5.179786	0.00012	0.25896	1.88E-05	0.99	4.58E-05	3.49	9.23E-05
75	2004	4.652919	8.50E-05	0.171056	1.25E-05	0.46	3.33E-05	3.23	8.55E-05
75	2005	4.551827	7.32E-05	0.190972	1.40E-05	0.28	2.92E-05	3.14	8.33E-05
75	2006	4.551827	6.77E-05	0.190972	1.40E-05	0.19	2.71E-05	3.09	8.21E-05
75	2007	4.076597	6.06E-05	0.198787	1.46E-05	0.19	2.71E-05	3.09	8.21E-05
75	2008	2.968145	3.90E-05	0.171132	1.26E-05	0.1	2.50E-05	3.05	8.10E-05
75	2009	2.964669	3.90E-05	0.173561	1.28E-05	0.1	2.50E-05	3.05	8.10E-05
75	2010	2.936823	3.86E-05	0.167207	1.23E-05	0.1	2.50E-05	3.05	8.10E-05
75	2011	2.903107	3.82E-05	0.159426	1.17E-05	0.1	2.50E-05	3.05	8.10E-05
75	2012	2.903107	3.82E-05	0.159426	1.17E-05	0.1	2.50E-05	3.05	8.10E-05
75	2013	2.632101	3.46E-05	0.030183	2.82E-06	0.1	2.50E-05	3.05	8.10E-05
75	2014	2.688321	3.53E-05	0.038382	3.58E-06	0.1	2.50E-05	3.05	8.10E-05
75	2015	2.695533	3.54E-05	0.035502	3.31E-06	0.1	2.50E-05	3.05	8.10E-05
75	2016	2.757453	3.63E-05	0.055345	5.16E-06	0.1	2.50E-05	3.05	8.10E-05
75	2017	2.757453	3.62E-05	0.013065	1.22E-06	0.1	2.50E-05	3.05	8.10E-05
75	2018	2.757453	3.62E-05	0.013065	1.22E-06	0.1	2.50E-05	3.05	8.10E-05
75	2019	2.757453	3.62E-05	0.013065	1.22E-06	0.1	2.50E-05	3.05	8.10E-05
75	2020	2.757453	3.62E-05	0.013065	1.22E-06	0.1	2.50E-05	3.05	8.10E-05
100	1945	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1946	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1947	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1948	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1949	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1950	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1951	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1952	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1953	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1954	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1955	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1956	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1957	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1958	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1959	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1960	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127

# ARB's 2017 Off-Road Diesel Emission Factors

HP	Model_Year	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
100	1961	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1962	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1963	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1964	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1965	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1966	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1967	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1968	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1969	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1970	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1971	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1972	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1973	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1974	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1975	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1976	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1977	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1978	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1979	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1980	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1981	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1982	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1983	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1984	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1985	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1986	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1987	13	0.000301	0.84	6.11E-05	1.44	6.66E-05	4.8	0.000127
100	1988	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1989	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1990	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1991	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1992	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1993	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1994	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1995	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1996	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1997	8.302	0.000192	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1998	8.302	0.000193	0.722	5.26E-05	0.99	4.58E-05	3.49	9.23E-05
100	1999	5.682182	0.000132	0.230085	1.67E-05	0.99	4.58E-05	3.49	9.23E-05
100	2000	5.59343	0.00013	0.238581	1.74E-05	0.99	4.58E-05	3.49	9.23E-05
100	2001	5.590347	0.00013	0.245554	1.79E-05	0.99	4.58E-05	3.49	9.23E-05
100	2002	5.412696	0.000126	0.231722	1.69E-05	0.99	4.58E-05	3.49	9.23E-05
100	2003	5.412696	0.000126	0.231722	1.69E-05	0.99	4.58E-05	3.49	9.23E-05
100	2004	4.49444	8.21E-05	0.181735	1.33E-05	0.46	3.33E-05	3.23	8.55E-05
100	2005	4.552871	7.33E-05	0.187443	1.37E-05	0.28	2.92E-05	3.14	8.33E-05
100	2006	4.552871	6.77E-05	0.187443	1.37E-05	0.19	2.71E-05	3.09	8.21E-05

# ARB's 2017 Off-Road Diesel Emission Factors

HP	Model_Year	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
100	2007	3.738287	5.56E-05	0.199942	1.47E-05	0.19	2.71E-05	3.09	8.21E-05
100	2008	2.997441	3.94E-05	0.185765	1.37E-05	0.1	2.50E-05	3.05	8.10E-05
100	2009	2.843561	3.74E-05	0.192182	1.42E-05	0.1	2.50E-05	3.05	8.10E-05
100	2010	2.817068	3.70E-05	0.183671	1.35E-05	0.1	2.50E-05	3.05	8.10E-05
100	2011	2.785615	3.66E-05	0.187505	1.38E-05	0.1	2.50E-05	3.05	8.10E-05
100	2012	2.785615	3.67E-05	0.187505	8.76E-06	0.09	2.17E-05	3.05	8.10E-05
100	2013	2.563077	3.38E-05	0.116444	5.44E-06	0.09	2.17E-05	3.05	8.10E-05
100	2014	2.490638	3.28E-05	0.098539	4.60E-06	0.09	2.17E-05	3.05	8.10E-05
100	2015	2.721805	3.59E-05	0.182696	8.53E-06	0.05	1.17E-05	3.05	8.10E-05
100	2016	2.364746	3.12E-05	0.14681	6.86E-06	0.05	1.17E-05	3.05	8.10E-05
100	2017	1.836	2.42E-05	0.116	5.42E-06	0.05	1.17E-05	3.05	8.10E-05
100	2018	1.652	2.18E-05	0.108	5.04E-06	0.05	1.17E-05	3.05	8.10E-05
100	2019	1.467	1.93E-05	0.099	4.62E-06	0.05	1.17E-05	3.05	8.10E-05
100	2020	1.283	1.69E-05	0.09	4.20E-06	0.05	1.17E-05	3.05	8.10E-05
175	1945	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1946	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1947	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1948	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1949	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1950	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1951	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1952	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1953	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1954	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1955	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1956	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1957	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1958	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1959	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1960	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1961	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1962	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1963	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1964	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1965	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1966	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1967	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1968	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1969	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1970	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1971	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1972	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1973	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1974	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1975	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1976	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114

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HP	Model_Year	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
175	1977	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1978	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1979	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1980	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1981	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1982	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1983	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1984	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
175	1985	11	0.000254	0.55	4.00E-05	0.88	4.07E-05	4.2	0.000111
175	1986	11	0.000254	0.55	4.00E-05	0.88	4.07E-05	4.2	0.000111
175	1987	11	0.000254	0.55	4.00E-05	0.88	4.07E-05	4.2	0.000111
175	1988	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1989	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1990	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1991	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1992	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1993	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1994	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1995	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1996	9.606667	0.000222	0.44	3.20E-05	0.68	3.15E-05	2.7	7.14E-05
175	1997	5.892246	0.000137	0.17279	1.26E-05	0.68	3.15E-05	2.7	7.14E-05
175	1998	5.892246	0.000137	0.17279	1.26E-05	0.68	3.15E-05	2.7	7.14E-05
175	1999	5.837918	0.000135	0.185201	1.35E-05	0.68	3.15E-05	2.7	7.14E-05
175	2000	5.772438	0.000134	0.169127	1.23E-05	0.68	3.15E-05	2.7	7.14E-05
175	2001	5.650934	0.000131	0.176032	1.28E-05	0.68	3.15E-05	2.7	7.14E-05
175	2002	5.44042	0.000126	0.187931	1.36E-05	0.68	3.15E-05	2.7	7.14E-05
175	2003	5.44042	9.97E-05	0.187931	1.33E-05	0.33	2.79E-05	2.7	7.14E-05
175	2004	4.18785	6.67E-05	0.146119	1.04E-05	0.22	2.63E-05	2.7	7.14E-05
175	2005	3.966098	5.77E-05	0.150145	1.11E-05	0.16	2.57E-05	2.7	7.14E-05
175	2006	3.966098	5.77E-05	0.150145	1.11E-05	0.16	2.57E-05	2.7	7.14E-05
175	2007	2.855912	3.73E-05	0.17094	1.22E-05	0.1	2.50E-05	2.7	7.14E-05
175	2008	2.760031	3.60E-05	0.146518	1.05E-05	0.1	2.50E-05	2.7	7.14E-05
175	2009	2.659283	3.47E-05	0.146016	1.04E-05	0.1	2.50E-05	2.7	7.14E-05
175	2010	2.991957	3.91E-05	0.13551	9.68E-06	0.1	2.50E-05	2.7	7.14E-05
175	2011	2.672659	3.49E-05	0.11988	8.56E-06	0.1	2.50E-05	2.7	7.14E-05
175	2012	2.672659	3.49E-05	0.11988	5.60E-06	0.09	2.17E-05	2.7	7.14E-05
175	2013	1.950444	2.54E-05	0.038839	1.81E-06	0.09	2.17E-05	2.7	7.14E-05
175	2014	1.87413	2.44E-05	0.044228	2.07E-06	0.09	2.17E-05	2.7	7.14E-05
175	2015	1.126007	1.48E-05	0.044516	2.08E-06	0.05	1.17E-05	2.7	7.14E-05
175	2016	0.895668	1.18E-05	0.035898	1.68E-06	0.05	1.17E-05	2.7	7.14E-05
175	2017	1.152	1.52E-05	0.026	1.21E-06	0.05	1.17E-05	2.7	7.14E-05
175	2018	0.954	1.26E-05	0.014	6.54E-07	0.05	1.17E-05	2.7	7.14E-05
175	2019	0.757	9.98E-06	0.009158	4.28E-07	0.05	1.17E-05	2.7	7.14E-05
175	2020	0.559	7.37E-06	0.009158	4.28E-07	0.05	1.17E-05	2.7	7.14E-05
300	1945	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1946	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114



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HP	Model_Year	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
300	1947	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1948	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1949	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1950	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1951	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1952	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1953	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1954	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1955	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1956	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1957	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1958	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1959	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1960	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1961	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1962	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1963	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1964	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1965	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1966	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1967	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1968	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1969	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1970	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1971	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1972	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1973	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1974	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1975	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1976	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1977	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1978	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1979	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1980	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1981	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1982	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1983	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1984	11	0.000254	0.55	4.00E-05	0.94	4.35E-05	4.3	0.000114
300	1985	11	0.000254	0.55	4.00E-05	0.88	4.07E-05	4.2	0.000111
300	1986	11	0.000254	0.55	4.00E-05	0.88	4.07E-05	4.2	0.000111
300	1987	11	0.000254	0.55	4.00E-05	0.88	4.07E-05	4.2	0.000111
300	1988	7.338571	0.00017	0.37	2.69E-05	0.68	3.15E-05	2.7	7.14E-05
300	1989	7.338571	0.00017	0.37	2.69E-05	0.68	3.15E-05	2.7	7.14E-05
300	1990	7.338571	0.00017	0.37	2.69E-05	0.68	3.15E-05	2.7	7.14E-05
300	1991	7.338571	0.00017	0.37	2.69E-05	0.68	3.15E-05	2.7	7.14E-05
300	1992	7.338571	0.00017	0.37	2.69E-05	0.68	3.15E-05	2.7	7.14E-05

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HP	Model_Year	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
300	1993	7.338571	0.00017	0.37	2.69E-05	0.68	3.15E-05	2.7	7.14E-05
300	1994	7.338571	0.00017	0.37	2.69E-05	0.68	3.15E-05	2.7	7.14E-05
300	1995	7.338571	0.00017	0.37	2.69E-05	0.68	3.15E-05	2.7	7.14E-05
300	1996	5.788048	0.000134	0.183042	9.71E-06	0.32	1.48E-05	0.92	2.43E-05
300	1997	5.739228	0.000133	0.187393	9.94E-06	0.32	1.48E-05	0.92	2.43E-05
300	1998	5.739228	0.000133	0.187393	9.94E-06	0.32	1.48E-05	0.92	2.43E-05
300	1999	5.957755	0.000138	0.184929	9.81E-06	0.32	1.48E-05	0.92	2.43E-05
300	2000	5.906923	0.000137	0.18003	9.55E-06	0.32	1.48E-05	0.92	2.43E-05
300	2001	5.695998	0.000132	0.162767	8.64E-06	0.32	1.48E-05	0.92	2.43E-05
300	2002	5.527084	0.000128	0.166894	8.86E-06	0.32	1.48E-05	0.92	2.43E-05
300	2003	5.527084	0.0001	0.166894	9.05E-06	0.19	2.09E-05	0.92	2.43E-05
300	2004	4.372747	6.90E-05	0.126759	6.95E-06	0.14	2.30E-05	0.92	2.43E-05
300	2005	4.077636	5.89E-05	0.116988	6.16E-06	0.12	2.40E-05	0.92	2.43E-05
300	2006	4.077636	5.89E-05	0.116988	6.16E-06	0.12	2.40E-05	0.92	2.43E-05
300	2007	2.697275	3.50E-05	0.104092	5.25E-06	0.1	2.50E-05	0.92	2.43E-05
300	2008	2.583104	3.35E-05	0.101719	5.13E-06	0.1	2.50E-05	0.92	2.43E-05
300	2009	2.578531	3.35E-05	0.099294	5.01E-06	0.1	2.50E-05	0.92	2.43E-05
300	2010	2.673409	3.47E-05	0.098364	4.96E-06	0.1	2.50E-05	0.92	2.43E-05
300	2011	1.515386	1.97E-05	0.056263	2.08E-06	0.07	1.83E-05	0.92	2.43E-05
300	2012	1.515386	1.97E-05	0.056263	2.08E-06	0.07	1.83E-05	0.92	2.43E-05
300	2013	1.630995	2.12E-05	0.038582	1.43E-06	0.07	1.83E-05	0.92	2.43E-05
300	2014	0.836675	1.10E-05	0.033556	1.24E-06	0.05	1.17E-05	0.92	2.43E-05
300	2015	0.645391	8.51E-06	0.030201	1.12E-06	0.05	1.17E-05	0.92	2.43E-05
300	2016	0.886197	1.17E-05	0.029828	1.10E-06	0.05	1.17E-05	0.92	2.43E-05
300	2017	0.332	4.38E-06	0.015	5.55E-07	0.05	1.17E-05	0.92	2.43E-05
300	2018	0.120781	1.59E-06	0.009321	3.45E-07	0.05	1.17E-05	0.92	2.43E-05
300	2019	0.120781	1.59E-06	0.009321	3.45E-07	0.05	1.17E-05	0.92	2.43E-05
300	2020	0.120781	1.59E-06	0.009321	3.45E-07	0.05	1.17E-05	0.92	2.43E-05
600	1945	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1946	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1947	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1948	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1949	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1950	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1951	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1952	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1953	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1954	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1955	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1956	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1957	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1958	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1959	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1960	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1961	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1962	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832

# ARB's 2017 Off-Road Diesel Emission Factors

HP	Model_Year	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
600	1963	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1964	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1965	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1966	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1967	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1968	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1969	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1970	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1971	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1972	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1973	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1974	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1975	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1976	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1977	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1978	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1979	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1980	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1981	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1982	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1983	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1984	11	0.000183	0.53	2.81E-05	0.9	3.14E-05	4.2	0.000832
600	1985	11	0.000183	0.53	2.81E-05	0.84	2.93E-05	4.1	0.000812
600	1986	11	0.000183	0.53	2.81E-05	0.84	2.93E-05	4.1	0.000812
600	1987	11	0.000183	0.53	2.81E-05	0.84	2.93E-05	4.1	0.000812
600	1988	7.338571	0.000122	0.37	1.97E-05	0.68	2.37E-05	2.7	5.35E-05
600	1989	7.338571	0.000122	0.37	1.97E-05	0.68	2.37E-05	2.7	5.35E-05
600	1990	7.338571	0.000122	0.37	1.97E-05	0.68	2.37E-05	2.7	5.35E-05
600	1991	7.338571	0.000122	0.37	1.97E-05	0.68	2.37E-05	2.7	5.35E-05
600	1992	7.338571	0.000122	0.37	1.97E-05	0.68	2.37E-05	2.7	5.35E-05
600	1993	7.338571	0.000122	0.37	1.97E-05	0.68	2.37E-05	2.7	5.35E-05
600	1994	7.338571	0.000122	0.37	1.97E-05	0.68	2.37E-05	2.7	5.35E-05
600	1995	7.338571	0.000122	0.37	1.97E-05	0.68	2.37E-05	2.7	5.35E-05
600	1996	5.832042	9.70E-05	0.15215	8.07E-06	0.32	1.12E-05	0.92	1.82E-05
600	1997	5.906001	9.83E-05	0.137448	7.29E-06	0.32	1.12E-05	0.92	1.82E-05
600	1998	5.906001	9.83E-05	0.137448	7.29E-06	0.32	1.12E-05	0.92	1.82E-05
600	1999	5.743146	9.56E-05	0.133553	7.09E-06	0.32	1.12E-05	0.92	1.82E-05
600	2000	5.667642	9.43E-05	0.133962	7.11E-06	0.32	1.12E-05	0.92	1.82E-05
600	2001	5.449034	8.08E-05	0.108575	5.89E-06	0.19	1.95E-05	0.92	1.82E-05
600	2002	5.275708	7.39E-05	0.10776	5.91E-06	0.14	2.22E-05	0.92	1.82E-05
600	2003	5.275708	7.14E-05	0.10776	5.67E-06	0.12	2.36E-05	0.92	1.82E-05
600	2004	4.160772	5.63E-05	0.106553	5.61E-06	0.12	2.36E-05	0.92	1.82E-05
600	2005	4.041008	5.35E-05	0.104354	5.27E-06	0.1	2.50E-05	0.92	1.82E-05
600	2006	4.041008	5.25E-05	0.104354	5.27E-06	0.1	2.50E-05	0.92	1.82E-05
600	2007	2.807265	3.64E-05	0.121204	6.12E-06	0.1	2.50E-05	0.92	1.82E-05
600	2008	2.567221	3.33E-05	0.111548	5.63E-06	0.1	2.50E-05	0.92	1.82E-05

## ARB's 2017 Off-Road Diesel Emission Factors

HP	Model_Yea	NOXzh	NOXdr	PMzh	PMdr	THCzh	THCdr	COzh	COdr
600	2009	2.541838	3.30E-05	0.111217	5.61E-06	0.1	2.50E-05	0.92	1.82E-05
600	2010	2.550453	3.31E-05	0.110622	5.58E-06	0.1	2.50E-05	0.92	1.82E-05
600	2011	1.234322	1.61E-05	0.052633	1.95E-06	0.07	1.83E-05	0.92	1.82E-05
600	2012	1.234322	1.61E-05	0.052633	1.95E-06	0.07	1.83E-05	0.92	1.82E-05
600	2013	1.497162	1.95E-05	0.045208	1.67E-06	0.07	1.83E-05	0.92	1.82E-05
600	2014	0.972672	1.28E-05	0.036456	1.35E-06	0.05	1.17E-05	0.92	1.82E-05
600	2015	0.812617	1.07E-05	0.035361	1.31E-06	0.05	1.17E-05	0.92	1.82E-05
600	2016	0.904128	1.19E-05	0.038471	1.42E-06	0.05	1.17E-05	0.92	1.82E-05
600	2017	0.231	3.05E-06	0.022	8.14E-07	0.05	1.17E-05	0.92	1.82E-05
600	2018	0.132647	1.75E-06	0.017	6.29E-07	0.05	1.17E-05	0.92	1.82E-05
600	2019	0.132647	1.75E-06	0.012	4.44E-07	0.05	1.17E-05	0.92	1.82E-05
600	2020	0.132647	1.75E-06	0.009293	3.44E-07	0.05	1.17E-05	0.92	1.82E-05

# SMAQMD 2017 AREA SOURCE METHODOLOGY

## ATTACHMENT D:

Emissions and Emission Calculation for Diesel Ag Pumps Under ATCM Registration Program

# Emission Calculation for Diesel Ag Pump Registered by SMAQMD for Diesel Engine ATCM

FarmName	FarmLoc	Engine	Exp_Date	Status	Cancelled Date	Make	Model	Serial	HP	Date_Made	model year	Use	cumulative hrs	Deterioration Factor				Fuel Correction Factor			Zero-Hour Emission Factor				Emission (lbs/year)			
														dPM	dNOx	dCO	dNMHC	fcPM	fcNOx	fcHC	zPM	zNOx	zCO	zNMHC	PM	NOx	CO	NMHC
J.W. De Wit Farms	8757 E. Levee Rd.	2	2015	CANCELLED	6/13/2011	Case I	4391 TA	JA0011213	120	01-Jan-99	1999	Fixed Location Pump	19000	1.35E-05	1.35E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.185200511	5.837917836	2.7	0.68	54	1345	698	198
Celli Brothers LLC	8464 New Hope Rd.	3	2011	CANCELLED		Caterpillar	3056	1M101184	120	01-Jan-93	1993	Transportable Pump	20000	5.26E-05	1.92E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.722	8.302	3.49	0.99	173	1553	734	236
Amistad - Ranches	157 Russell Rd.	4	2016	CANCELLED		Deutz	BF6914C	8682821	150	01-Nov-03	2003	Transportable Pump	15000	1.33E-05	9.97E-05	7.14E-05	2.79E-05	0.71	0.93	0.90	0.187931328	5.44041968	2.7	0.68	59	1387	811	145
Amistad - Ranches	157 Russell Rd.	5	2015	CANCELLED		Deutz	BF6L913	8596744	150	01-Sep-00	2000	Transportable Pump	18000	1.28E-05	1.34E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.169126746	5.772437974	2.7	0.68	60	1636	857	241
Amistad - Ranches	157 Russell Rd.	6	2016	CANCELLED		Deutz	BF4L913	8695804	98	01-Nov-03	2003	Transportable Pump	15000	1.69E-05	1.26E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.23172216	5.412695756	3.49	0.99	48	953	685	212
Amistad - Ranches	157 Russell Rd.	7	2015	CANCELLED		Deutz	BF4L913	8596274	98	01-Sep-00	2000	Transportable Pump	18000	1.74E-05	1.30E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.238580994	5.593430275	3.49	0.99	55	1035	723	229
Amistad - Ranches	157 Russell Rd.	8	2017	CANCELLED		Deutz	BF4L913	8700588	98	01-Nov-04	2004	Transportable Pump	14000	1.33E-05	8.21E-05	8.55E-05	3.33E-05	0.71	0.93	0.90	0.181735344	4.49439657	3.23	0.46	37	737	622	117
Amistad - Ranches	157 Russell Rd.	9	2017	CANCELLED		Deutz	BF4L913	8700587	98	01-Nov-04	2004	Transportable Pump	14000	1.33E-05	8.21E-05	8.55E-05	3.33E-05	0.71	0.93	0.90	0.181735344	4.49439657	3.23	0.46	37	737	622	117
Amistad - Ranches	157 Russell Rd.	10	2017	CANCELLED		Deutz	BF3L913	8700589	98	01-Nov-04	2004	Transportable Pump	14000	1.33E-05	8.21E-05	8.55E-05	3.33E-05	0.71	0.93	0.90	0.181735344	4.49439657	3.23	0.46	37	737	622	117
Amistad - Ranches	157 Russell Rd.	11	2016	CANCELLED		Deutz	BF4L913	8694441	98	01-Nov-03	2003	Transportable Pump	15000	1.69E-05	1.26E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.23172216	5.412695756	3.49	0.99	48	953	685	212
Amistad - Ranches	157 Russell Rd.	12	2016	CANCELLED		Deutz	BF6914C	8682819	150	01-Nov-03	2003	Transportable Pump	15000	1.33E-05	9.97E-05	7.14E-05	2.79E-05	0.71	0.93	0.90	0.187931328	5.44041968	2.7	0.68	59	1387	811	145
Amistad - Ranches	157 Russell Rd.	13	2018	ACTIVE		Deutz	BF4L913	8731138	98	01-Nov-05	2005	Transportable Pump	13000	1.37E-05	7.33E-05	8.33E-05	2.92E-05	0.71	0.93	0.90	0.187443314	4.55270569	3.14	0.28	36	719	593	83
Clay Station Vineyards	13650 Borden Rd	14	2014	CANCELLED	4/22/2014	John Deere	6068HF2508	784375	200	01-Jan-01	2001	Fixed Location Pump	17000	8.64E-06	1.32E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.162766922	5.69599817	0.92	0.32	63	2117	382	147
Jim Sopwith dba Sopwith Farms	4850 W. Riego Rd.	15	2015	CANCELLED		Case	4TA-390	46096037	110	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	44	1155	617	172
Wallace Chan Farms Inc.	11691 River Road Hwy 160	16	2011	CANCELLED	7/31/2012	Detroit Diesel	4-71	88474	80	01-Jan-99	1999	Transportable Pump	20000	6.11E-05	3.01E-04	1.27E-04	6.66E-05	0.71	0.93	0.90	0.184928908	5.95775485	4.8	1.44	168	2028	841	286
Wallace Chan Farms Inc.	11691 River Road Hwy 160	17	2010	CANCELLED	11/5/2010	Detroit Diesel	8V71	806	150	01-Jan-66	1966	Transportable Pump	20000	4.00E-05	2.54E-04	1.14E-04	4.35E-05	0.71	0.93	0.90	0.55	11	4.3	0.94	206	3214	1414	350
Wallace Chan Farms Inc.	11691 River Road Hwy 160	18	2010	CANCELLED	11/5/2010	John Deere	414	51592	100	01-Jan-77	1977	Transportable Pump	20000	6.11E-05	3.01E-04	1.27E-04	6.66E-05	0.71	0.93	0.90	0.84	13	4.8	1.44	210	2535	1052	358
Wallace Chan Farms Inc.	11691 River Road Hwy 160	19	2010	CANCELLED	11/5/2010	Caterpillar	3208	90N7175	150	01-Jan-91	1991	Transportable Pump	20000	3.20E-05	2.22E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.44	9.606666667	2.7	0.68	165	2809	887	253
Wallace Chan Farms Inc.	11691 River Road Hwy 160	20	2011	CANCELLED	7/31/2012	Detroit Diesel	4/71	MAYE52003	80	01-Jan-99	1999	Transportable Pump	20000	6.11E-05	3.01E-04	1.27E-04	6.66E-05	0.71	0.93	0.90	0.84	13	4.8	1.44	168	2028	841	286
Wallace Chan Farms Inc.	11691 River Road Hwy 160	21	2011	CANCELLED	7/31/2012	Detroit Diesel	4-71	W0796	80	01-Jan-99	1999	Transportable Pump	20000	6.11E-05	3.01E-04	1.27E-04	6.66E-05	0.71	0.93	0.90	0.84	13	4.8	1.44	168	2028	841	286
RPM Farms	3750 E. Catlett Rd.	22	2014	EXPIRED		Deutz	BF6L913CSP	8587932	258	01-Jan-99	1999	Fixed Location Pump	19000	9.81E-06	1.38E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.184928908	5.95775485	0.92	0.32	97	2951	511	200
Hunn, Merwin, Merwin		23	2010	CANCELLED	10/13/2010	Deutz	913	635695	125	01-Jan-90	1990	Transportable Pump	20000	3.20E-05	2.22E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.44	9.606666667	2.7	0.68	137	2341	739	211
Gold Springs Angus Ranch / Schneid	15024 Jackson Rd	24		CANCELLED		Cummins	815.9-C152	46187517	142	assumed 1987	1987	Transportable Pump	20000	4.00E-05	2.54E-04	1.14E-04	4.07E-05	0.71	0.93	0.90	0.55	11	4.2	0.88	195	3043	1306	310
Kirtlan Bros		25	2010	CANCELLED	11/2/2010	Perkins	5P111HP3	26280	225	01-Jan-75	1975	Transportable Pump	20000	4.00E-05	2.54E-04	1.14E-04	4.35E-05	0.71	0.93	0.90	0.55	11	4.3	0.94	309	4822	2122	525
The Herzog Company	12300 Herold Rd.	26	2010	EXPIRED		Deutz	FL8413	6358392	182	01-Jan-81	1981	Transportable Pump	20000	4.00E-05	2.54E-04	1.14E-04	4.35E-05	0.71	0.93	0.90	0.55	11	4.3	0.94	250	3900	1716	425
The Herzog Company	12300 Herold Rd.	27	2011	CANCELLED		Deutz	T61912	554202	98	01-Jan-78	1978	Transportable Pump	20000	6.11E-05	3.01E-04	1.27E-04	6.66E-05	0.71	0.93	0.90	0.84	13	4.8	1.44	206	2484	1031	350
Sloughouse Operating	PO Box 299	30	2015	EXPIRED		John Deere	6068DF150B	T06068D821915	125	01-Jan-99	1999	Fixed Location Pump	19000	1.35E-05	1.35E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.185200511	5.837917836	2.7	0.68	56	1401	727	206
Sprague Ranch	13940 Latrobe Rd.	31	2017	ACTIVE		Deutz	FL6-914	8718927	113	20-Oct-04	2004	Transportable Pump	14000	1.04E-05	6.67E-05	7.14E-05	2.63E-05	0.71	0.93	0.90	0.146119451	4.187850481	2.7	0.22	34	771	599	86
John Wiedmann & Son Inc	12680 Hwy 160	32	2010	CANCELLED	11/2/2010	John Deere	404D3H	23E196943	100	01-Jan-60	1960	Fixed Location Pump	20000	6.11E-05	3.01E-04	1.27E-04	6.66E-05	0.71	0.93	0.90	0.84	13	4.8	1.44	210	2535	1052	358
Ceres Farms	14500 Borden Rd	34	2016	CANCELLED	9/11/2013	John Deere	G125HF070	RG6125H035458	425	01-Jan-91	1993	Fixed Location Pump	15000	5.67E-06	7.14E-05	1.82E-05	2.36E-05	0.71	0.93	0.90	0.107760094	5.27570829	0.92	0.12	83	3595	727	260
Nester Enterprises	13852 E. Peltier Rd.	35	2015	CANCELLED	4/17/2014	John Deere	4045TF150	T04045T867541	100	01-Jan-00	2000	Fixed Location Pump	18000	1.74E-05	1.30E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.238580994	5.593430275	3.49	0.99	56	1057	738	234
Nester Enterprises	13852 E. Peltier Rd.	36	2017	ACTIVE		John Deere	6068HF275	PE6068H392254	225	01-Jan-04	2004	Fixed Location Pump	14000	6.95E-06	6.90E-05	2.43E-05	2.30E-05	0.71	0.93	0.90	0.162766922	4.372746765	0.92	0.14	51	1601	406	134
Double M Farms, Inc.	13171 Grand Island Rd.	38		CANCELLED	12/1/2010	Deutz (to be cancelled)	FG1912	7577581	101	01-Jan-89	1989	Transportable Pump	20000	3.20E-05	2.22E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.44	9.606666667	2.7	0.68	111	1891	597	171
Double M Farms, Inc.	13171 Grand Island Rd.	39		CANCELLED	12/1/2010	Perkins (to be cancelled)	TL	354UA20921	105	assumed 1987	1987	Transportable Pump	20000	4.00E-05	2.54E-04	1.14E-04	4.07E-05	0.71	0.93	0.90	0.55	11	4.2	0.88	144	2250	966	229
Tom W. Tolson	38870 County Road 13	40		CANCELLED		John Deere	T06068T	T070608T469194	133	01-Jan-94	1994	Fixed Location Pump	20000	3.20E-05	2.22E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.44	9.606666667	2.7	0.68	145	2491	787	225
West Coast Grape Farms / Twin Citie	Hwy 104	41	2015	CANCELLED	11/17/2010	Volvo	TAD730P	T021096318	150	01-Jan-97	1997	Fixed Location Pump	20000	1.26E-05	1.37E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.172790228	5.892245582	2.7	0.68	65	1724	887	253
Laguna Creek Vineyard Partnership/	Hwy 104	42	2015	CANCELLED	11/17/2010	Volvo	TAD730P	T021096320	150	01-Jan-97	1997	Fixed Location Pump	20000	1.26E-05	1.37E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.172790228	5.892245582	2.7	0.68	65	1724	887	253
Sutter Home Vineyards	Sacramento and Yolo Counties	43	2010	CANCELLED	9/13/2010	John Deere																						

# Emission Calculation for Diesel Ag Pump Registered by SMAQMD for Diesel Engine ATCM

FarmName	FarmLoc	Engine	Exp_Date	Status	Cancelled Date	Make	Model	Serial	HP	Date_Made	model year	Use	cumulative hrs	Deterioration Factor				Fuel Correction Factor			Zero-Hour Emission Factor				Emission (lbs/year)			
														dPM	dNOx	dCO	dNMHC	fcPM	fcNOx	fcHC	zPM	zNOx	zCO	zNMHC	PM	NOx	CO	NMHC
Joe Silva Custom Farming	12017 Highway 160	96		CANCELLED		Jasper	460	42162	101	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	40	1060	566	158
Joe Silva Custom Farming	12017 Highway 160	97		CANCELLED		Ford	2.5L	17927	66	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.267080762	5.367991373	3.49	0.99	40	658	478	151
Joe Silva Custom Farming	12017 Highway 160	98		CANCELLED		Jasper	7.4L	418056	101	01-Jan-02	2002	Transportable Pump	16000	1.36E-05	1.26E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.187931328	5.44041968	2.7	0.68	42	1004	556	154
Johnson Farms	9084 Twin Cities Road	99	2015	UNPAID/EXPIRED		Deutz	F4L9135P	8611448	80	01-Jan-01	2001	Transportable Pump	17000	1.79E-05	1.30E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.245554012	5.590347356	3.49	0.99	45	811	580	182
Johnson Farms	9084 Twin Cities Road	100	2015	UNPAID/EXPIRED		Deutz	F4L9135P	861449	80	01-Jan-01	2001	Transportable Pump	17000	1.79E-05	1.30E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.245554012	5.590347356	3.49	0.99	45	811	580	182
Kay Dix	P.O. Box 248	101	2015	EXPIRED		Deutz	BF6L9135P	8597291	160	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	64	1680	897	251
Kay Dix	P.O. Box 248	102	2015	EXPIRED		Deutz	BF6L9135P	8597292	160	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	64	1680	897	251
Ken Pombo Farms	Jackson Slough Road	103	9999	ACTIVE		Deutz	D914L06	N/A	115	01-Jan-08	2008	Transportable Pump	10000	1.05E-05	3.60E-05	7.14E-05	2.50E-05	0.86	0.95	0.90	0.146517886	2.760030529	2.7	0.1	36	488	563	52
Ken Pombo Farms	Jackson Slough Road	104	9999	ACTIVE		Deutz	D914L06	N/A	115	01-Jan-08	2008	Transportable Pump	10000	1.05E-05	3.60E-05	7.14E-05	2.50E-05	0.86	0.95	0.90	0.146517886	2.760030529	2.7	0.1	36	488	563	52
Marvin Neves & Son	50079 Central Avenue	106		CANCELLED		Isuzu	68G1TRW02	158744	174	01-Jan-03	2003	Transportable Pump	15000	1.33E-05	9.97E-05	7.14E-05	2.79E-05	0.71	0.93	0.90	0.187931328	5.44041968	2.7	0.33	69	1608	940	168
Marvin Neves & Son	50079 Central Avenue	107		CANCELLED		Isuzu	68G1TRW02	6841186984	174	01-Jan-03	2003	Transportable Pump	15000	1.33E-05	9.97E-05	7.14E-05	2.79E-05	0.71	0.93	0.90	0.187931328	5.44041968	2.7	0.33	69	1608	940	168
Marvin Neves & Son	50079 Central Avenue	108	2016	CANCELLED		Case IH	6591T	DIA0013285	133	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	53	1396	746	208
Marvin Neves & Son	50079 Central Avenue	109	2016	CANCELLED		Case IH	4391T	DIA0013232	104	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	42	1092	583	163
McDowell Farms	15265 Poverty Road	110	2018	CANCELLED	2/22/2017	Cummins	QSB 4.5	46613651	110	01-Jan-06	2006	Transportable Pump	12000	1.11E-05	5.77E-05	7.14E-05	2.57E-05	0.71	0.93	0.90	0.150144836	3.966097982	2.7	0.16	32	683	661	66
McDowell Farms	15265 Poverty Road	111	2015	CANCELLED	2/22/2016	Cummins	B13.9-C110	45526633	110	01-Jan-98	1998	Transportable Pump	20000	1.26E-05	1.37E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.172790228	5.892245582	2.7	0.68	48	1264	651	186
Natomas Mutual Water Company	2601 W. Elkhorn Blvd.	112	2010	CANCELLED	6/22/2010	Case IH	6831TA	45883999	211	01-Jan-99	1999	Transportable Pump	19000	9.81E-06	1.38E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.184928908	5.95775485	0.92	0.32	80	2414	418	164
Natomas Mutual Water Company	2601 W. Elkhorn Blvd.	113	2010	CANCELLED	6/22/2010	Case IH	6831TA	45884001	211	01-Jan-99	1999	Transportable Pump	19000	9.81E-06	1.38E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.184928908	5.95775485	0.92	0.32	80	2414	418	164
Natomas Mutual Water Company	2601 W. Elkhorn Blvd.	114	2015	CANCELLED	6/22/2010	Deutz	F3L9135P	8617077	59	01-Jan-01	2001	Transportable Pump	17000	1.94E-05	1.24E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.267080762	5.367991373	3.49	0.99	36	588	428	135
R & B Farms	4067 Pleasant Grove Road	115	2015	CANCELLED	8/26/2011	Case IH	4391T	46198436	79	01-Jan-02	2002	Transportable Pump	16000	1.69E-05	1.26E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.23172216	5.412695756	3.49	0.99	40	781	562	176
R & B Farms	4067 Pleasant Grove Road	116	2015	CANCELLED	8/26/2011	Case IH	6591T	DIA0015629	133	01-Jan-02	2002	Transportable Pump	16000	1.36E-05	1.26E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.187931328	5.44041968	2.7	0.68	55	1322	732	203
Sierra Cattle Co.	24163 Road 188	117		CANCELLED		Deutz	TC0914L06		174	01-Jan-08	2008	Transportable Pump	10000	1.05E-05	3.60E-05	7.14E-05	2.50E-05	0.86	0.95	0.90	0.146517886	2.760030529	2.7	0.1	54	739	851	79
Sierra Cattle Co.	24163 Road 188	118		CANCELLED		Deutz	TC0914L06		174	01-Jan-08	2008	Transportable Pump	10000	1.05E-05	3.60E-05	7.14E-05	2.50E-05	0.86	0.95	0.90	0.146517886	2.760030529	2.7	0.1	54	739	851	79
Silverdale Farms	1010 Twin Cities Road	119	2014	EXPIRED		Deutz	BF6L9135P	8632318	180	01-Jan-01	2001	Transportable Pump	17000	8.64E-06	1.32E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.162766922	5.69599817	0.92	0.32	57	1905	344	133
Silverdale Farms	1010 Twin Cities Road	120	2014	EXPIRED		Deutz	BF6L9135P	8641622	180	01-Jan-01	2001	Transportable Pump	17000	8.64E-06	1.32E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.162766922	5.69599817	0.92	0.32	57	1905	344	133
Silverdale Farms	1010 Twin Cities Road	121	2014	EXPIRED		Deutz	BF6L9135P	8632696	180	01-Jan-01	2001	Transportable Pump	17000	8.64E-06	1.32E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.162766922	5.69599817	0.92	0.32	57	1905	344	133
Silverdale Farms	1010 Twin Cities Road	122	2014	EXPIRED		Deutz	BF6L9135P	8632697	180	01-Jan-01	2001	Transportable Pump	17000	8.64E-06	1.32E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.162766922	5.69599817	0.92	0.32	57	1905	344	133
Silverdale Farms	1010 Twin Cities Road	123	2014	EXPIRED		Deutz	BF6L9135P	8632698	180	01-Jan-01	2001	Transportable Pump	17000	8.64E-06	1.32E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.162766922	5.69599817	0.92	0.32	57	1905	344	133
Silverdale Farms	1010 Twin Cities Road	124	2014	EXPIRED		Deutz	BF6L9135P	8632699	180	01-Jan-01	2001	Transportable Pump	17000	8.64E-06	1.32E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.162766922	5.69599817	0.92	0.32	57	1905	344	133
Silverdale Farms	1010 Twin Cities Road	125	2015	EXPIRED		Isuzu	68G1TQW	133168	172	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	69	1806	965	270
Silverdale Farms	1010 Twin Cities Road	126	2015	EXPIRED		Isuzu	68G1T	133071	172	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	69	1806	965	270
Silverdale Farms	1010 Twin Cities Road	127	2015	EXPIRED		Isuzu	68G1T	133167	172	01-Jan-01	2001	Transportable Pump	17000	1.28E-05	1.31E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.176032054	5.650933736	2.7	0.68	69	1806	965	270
Silverdale Farms	1010 Twin Cities Road	128	2015	EXPIRED		Deutz	BF6L913	8668226	141	01-Jan-02	2002	Transportable Pump	16000	1.36E-05	1.26E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.187931328	5.44041968	2.7	0.68	58	1402	776	215
Silverdale Farms	1010 Twin Cities Road	129	2014	EXPIRED		Deutz	BF6L913C	8653457	180	01-Jan-02	2002	Transportable Pump	16000	8.86E-06	1.28E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.166894318	5.527084263	0.92	0.32	57	1818	338	129
The Fishery, Inc.	11583 Valenin Road	130	2015	CANCELLED		Cummins	B5.9P	46050566	174	09-Nov-00	2000	Transportable Pump	18000	1.23E-05	1.34E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.169126746	5.772437974	2.7	0.68	69	1897	994	280
The Fishery, Inc.	11583 Valenin Road	131	2014	CANCELLED		Cummins	CB.3P	46037437	215	05-Oct-00	2000	Transportable Pump	18000	9.55E-06	1.37E-04	2.43E-05	1.48E-05	0.71	0.93	0.90	0.180029822	5.906922544	0.92	0.32	77	2399	418	163
Upper Swanson	2625 Fair Oaks Blvd.	132		CANCELLED		Case IH	6591T	45918664	135	01-Jan-00	2000	Transportable Pump	18000	1.23E-05	1.34E-04	7.14E-05	3.15E-05	0.71	0.93	0.90	0.169126746	5.772437974	2.7	0.68	54	1472	771	217
Utterback Farm	9986 Horn Road	133	2015	CANCELLED		John Deere	PE4045T150	PE4045T13158	81	01-Jan-01	2001	Transportable Pump	17000	1.79E-05	1.30E-04	9.23E-05	4.58E-05	0.71	0.93	0.90	0.245554012	5.590347356	3.49	0.99	45	841	587	185
Utterback Farm	9986 Horn Road	134																										





# SMAQMD 2017 AREA SOURCE METHODOLOGY

## ATTACHMENT E:

2017 Point Source Inventory for West Coast Grape Farming Inc

**SACRAMENTO AIR QUALITY MANAGEMENT DISTRICT  
EMISSION INVENTORY**

YEAR: 2017  
 FACILITY ID: 5066  
 FACILITY NAME: WEST COAST GRAPE FARMING

ENGINEER: KET  
 DATE: 5/9/2018 Note: These permits are cancelled. Hq 7/3/2013

EMISSION FACTORS FROM PERMIT - ROC, CO, PM10 BASED ON AP-42 TABLE 3.3-1 (10/96) EMISSIONS DATA.  
 NOx EF BASED ON TIER I EMISSIONS DATA. SOx EF BASED ON 0.0015% SULFUR BY WEIGHT IN THE FUEL.

**IC ENGINES**

Permit	Ranch	Pump	Make	Model	HP Rating	Hours of Operation	Diesel Usage (gal/yr)	EMISSION FACTOR, grams/hp_hr							EMISSION, tons per year								
								PM	PM10	SOX	NOX	CO	TOG	ROG	PM	PM10	SOX	NOX	CO	TOG	ROG		
21532	LV Island	71-1	Cummins	QSL9C	300	1424	7250	0.15	0.15	0.005	3	2.6	1.00	1	0.071	0.071	0.002	1.411	1.223	0.470	0.470		
21534	LV Island	71-2	Cummins	QSC8.3	260	1642	11684	0.15	0.15	0.005	3	2.6	1.00	1	0.071	0.071	0.002	1.411	1.222	0.470	0.470		
21529	104	76-2	Cummins	QSC 8.3	260	542	3477	0.15	0.15	0.005	3	2.6	1.00	1	0.023	0.023	0.001	0.466	0.404	0.155	0.155		
21530	104	76-3	Cummins	QSM11	340	0	0	0.15	0.15	0.005	3	2.6	1.00	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
21531	104	76-4	Cummins	QSL9	300	2018	20265	0.15	0.15	0.005	3	2.6	1.00	1	0.100	0.100	0.003	2.000	1.734	0.667	0.667		
21533	Mountain Top	81-3	Cummins	QSX15	450	1942	18972	0.15	0.15	0.005	3	2.6	1.00	1	0.144	0.144	0.005	2.887	2.502	0.962	0.962		
21535	Mountain Top	81-4	Cummins	QSB6.7	190	1719	16352	0.15	0.15	0.005	3	2.6	1.00	1	0.054	0.054	0.002	1.079	0.935	0.360	0.360		
21536	Mountain Top	81-5	Cummins	QSL9	280	185	1290	0.15	0.15	0.005	3	2.6	1.00	1	0.009	0.009	0.000	0.171	0.148	0.057	0.057		
21537	Mountain Top	81-8	Deutz	F4L913SP	76	electric																	
21538	Mountain Top	81-9	Cummins	QSB4.5	130	1835	6000	0.15	0.15	0.005	3	2.6	1.00	1	0.039	0.039	0.001	0.788	0.683	0.263	0.263		
							Total, gal/yr	85290								total, tpy	0.51	0.51	0.02	10.21	8.85	3.40	3.40

**TOTAL FACILITY EMISSIONS:**

SOx =	0.02 TPY
TOG =	3.40 TPY
ROG =	3.40 TPY
CO =	8.85 TPY
NOx =	10.21 TPY
PM =	0.51 TPY
PM10 =	0.51 TPY

**SAVE FOR %MONTHLY ACTIVITY**

Month	Facility Estimate of 2010 NOx, lbs/yr	%
JAN	0	0%
FEB	43.8	0%
MAR	100.29	0%
APR	461.2	2%
MAY	2149.8	9%
JUN	7195.9	30%
JUL	5689.6	24%
AUG	3111.6	13%
SEP	3065.2	13%
OCT	1795.7	8%
NOV	303.3	1%
DEC	0.0	0%

TOTAL 23916 lbs/yr  
11.958 tpy

0

**CARB TAD REPORT**

DEVICE:	1	SCC NO:	2-02-001-02
TOTAL IC ENGINE FUEL OIL PROCESS RATE =	85.3 MGAL/YR		
EMISSION FACTOR	EMISSION		
PM =	11.98 lbs/mgal	0.51 TPY	
PM10 =	11.98 lbs/mgal	0.51 TPY	
SOx =	0.40 lbs/mgal	0.02 TPY	
NOx =	239.50 lbs/mgal	10.21 TPY	
CO =	207.57 lbs/mgal	8.85 TPY	
TOG =	79.83 lbs/mgal	3.40 TPY	
ROG =	79.83 lbs/mgal	3.40 TPY	

# SMAQMD 2017 AREA SOURCE METHODOLOGY

## ATTACHMENT F:

2002, 2007, 2012 Agricultural Census & 2003, 2008, 2013 Farm and Ranch Irrigation Survey

	2003			2008		
	CA	SAC	%SAC of CA	CA	SAC	%SAC of CA
2002 Censi irrigated acres	8709353	124931	1.43%	8016159	113427	1.41%
2003 FRIS # diesel ag pumps	12535	180	1.43%	8992	127	1.41%
2003 FRIS \$diesel expenses	\$ 53,888,000	\$ 765,822	1.43%			
2003 EIA Diesel Used, mgal/yr (@\$4.126/gal)						
	2013			2013		
	CA	SAC	%SAC of CA			
2012 Censi irrigated acres	7861964	85979	1.09%			
2013 FRIS # diesel ag pumps	10416	114	1.09%			
2013 FRIS \$diesel expenses	\$ 82,707,000	\$ 904,490	1.09%			
2013 EIA Diesel Used, mgal/yr (@\$4.126/gal)	20045	219	1.09%			
	2013 CA			2013		
#electric pumps	70370		85%			
# natural gas pumps	810		1%			
# LPG pumps	1105		1%			
# diesel ag pumps	10416		13%			
# gasoline ag pumps	24		0%			
Total	82725		100%			

2013 [https://www.agcensus.usda.gov/Publications/2012/Online\\_Resources/Farm\\_and\\_Ranch\\_Irrigation\\_Survey/fris13\\_1\\_012\\_012.pdf](https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Farm_and_Ranch_Irrigation_Survey/fris13_1_012_012.pdf)

agcensus.usda.gov/Publications/2012/Online\_Resources/Farm\_and\_Ranch\_Irrigation\_Survey/fris13\_1\_012\_012.pdf

EPA census

### 42 2013 FRIS - Entire Farm Data

## 2012 Census of Agriculture

USDA, National Agricultural Statistics Service

### Table 12. On-Farm Energy Expense for Pumping Irrigation Water by Water Source and Type of Energy: 2013 (continued)

[Excludes institutional, research, and experimental farms. For meaning of abbreviations and symbols see introductory text.]

Geographic area	Farms	Pumps powered	Acres in the open by water source				Expenses (\$1,000)	Expenses per acre <sup>2</sup> (dollars)	
			Water from wells		Surface water			Water from wells	Surface water
			Water from wells	Surface water	Water from wells	Surface water			
United States	33,196	122,704	10,079,483	3,267,971	239,411,251	86,463,751	554,003	45.61	31.45
Alabama	180	423	26,057	29,607	(D)	(D)	2,874	40.63	63.94
Alaska	8	12	(D)	(D)	2,560	(D)	(D)	(D)	(D)
Arizona	84	275	19,939	41,062	-	-	53.32	41.63	15.64
Arkansas	2,871	26,781	2,529,855	418,849	(D)	(D)	88,679	32.15	25.54
California	3,538	10,416	538,641	811,217	(D)	(D)	82,707	120.68	38.13

[https://www.eia.gov/dnav/pet/pet\\_pri\\_omd\\_a\\_epd2d\\_pte\\_dpgal\\_a.htm](https://www.eia.gov/dnav/pet/pet_pri_omd_a_epd2d_pte_dpgal_a.htm)

EIA - Petroleum & Other Liquids

Retail Prices for Diesel

Product: Diesel - All Types Period: Annual

Weekly Retail Gasoline and Diesel Prices (Dollars per Gallon, Including Taxes)

Product: Diesel - All Types Period: Annual

Product	Area	Graph	Clear	2012	2013	2014	2015	2016	2017	View History
U.S.				3.958	3.922	3.825	2.707	2.304	2.650	1994-2017
East Coast (PADD 1)				4.012	3.947	3.877	2.791	2.333	2.681	1994-2017
New England (PADD 1A)				4.128	4.079	4.007	2.892	2.380	2.690	1997-2017
Central Atlantic (PADD 1B)				4.100	4.010	3.987	2.927	2.437	2.822	1997-2017
Lower Atlantic (PADD 1C)				3.924	3.876	3.767	2.668	2.244	2.579	1997-2017
Midwest (PADD 2)				3.899	3.903	3.806	2.640	2.259	2.596	1994-2017
Gulf Coast (PADD 3)				3.876	3.835	3.701	2.576	2.177	2.484	1994-2017
Rocky Mountain (PADD 4)				3.982	3.876	3.848	2.674	2.310	2.712	1994-2017
West Coast (PADD 5)				4.163	4.051	3.933	2.898	2.557	2.963	1994-2017
West Coast less California				4.085	3.963	3.848	2.755	2.438	2.833	2011-2017

Estimation Method	Year of Estimate	Diesel Ag Pump Population
2003 Methodology	2003	101
2008 Diesel Ag Pump ACTM Registration	2008	159
2017 Methodology Diesel Ag Pump	2017	77
2003 Farm&Ranch Irrigation Survey	2003	180
2008 Farm&Ranch Irrigation Survey	2008	127
2013 Farm&Ranch Irrigation Survey	2013	114

2008 [https://www.agcensus.usda.gov/Publications/2007/Online\\_Highlights/Farm\\_and\\_Ranch\\_Irrigation\\_Survey/](https://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Farm_and_Ranch_Irrigation_Survey/)

Table 20. Energy Expenses for On-Farm Pumping of Irrigation Water by Water Source and Type of Energy: 2008 and 2003 - Con.

[Excludes institutional, research, and experimental farms and farms with horticulture. For meaning of abbreviations and symbols, see introductory text.]

Geographic area	Farms	Pumps powered	Acres irrigated by water source		Expenses (\$1,000)	Expenses per acre <sup>2</sup> (dollars)		Farms with energy expenses of -								
			Water from wells	Surface water		Water from wells	Surface water	\$1 to \$50	\$1,000 to \$5,000	\$10,000 to \$50,000	\$100,000 or more					
United States	2003..	39,681	119,249	12,247,973	2,874,002	874,616	14.20	11.94	9,397	2,989	1,099	6,964	3,398	2,424	8,823	
2008 DATA	2003..	39,689	112,115	9,421,693	3,007,205	281,175	18.20	16.23	13,228	1,343	1,097	8,358	3,980	2,424	8,823	
Alabama	209	476	12,330	36,336	3,451	69.40	34	11	60	29	32	36	17			
Alaska	8	12	(D)	(D)	2,560	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Arizona	3,022	275	5,993	37,681	2,992	120.71	27.92	280	117	485	146	486	707	15	15	
Arkansas	4,052	2,992	2,848,824	618,374	110,323	432.89	52.23	1,584	233	829	261	872	154	154	154	
California	220	976	50,718	10,866	1,429	29.96	48.10	4	10	130	42	38	9			
Colorado	241	487	29,493	1,212	4,831	68.98	10	10	67	41	32	14	13			
Delaware	2,584	811	487,008	132,672	34,811	68.77	17.72	602	202	784	484	102	158			
Florida	1,062	4,318	277,231	129,809	34,811	68.47	31.20	129	204	425	290	318	168			
Georgia	18	88	(D)	(D)	1,851	(D)	93.68	14	11	1	1	1	1			

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Data 3: States

Sourcekey

Date

EMD\_EPDI  
2D\_PTE\_S  
CA\_DPC  
No 2  
Diesel  
Retail  
Prices  
(Dollars  
per  
Gallon)

1995	1.295
1996	1.441
1997	1.383
1998	1.184
1999	1.348
2000	1.672
2001	1.543
2002	1.45
2003	1.657
2004	2.099
2005	2.608
2006	2.922
2007	3.094
2008	3.925
2009	2.607
2010	3.157
2011	
2012	4.23
2013	4.126
2014	4.004
2015	3.015
2016	2.654
2017	3.067

California	4,230	4,126	4,004	3,015	2,654	3,067	1995-2017
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Click on the source key icon to learn how to download series into Excel, or to embed a chart or map on your website.

No Data Reported, -- = Not Applicable, NA = Not Available, W = Withheld to avoid disclosure of individual company data.

Notes: Conventional area is any area that does not require the sale of reformulated gasoline. All types of finished motor gasoline may be sold in this area. RFG area is an ozone nonattainment area designated by the Environmental Protection Agency which requires the use of reformulated gasoline. Publication of Low Sulfur On-Highway Diesel (LSD) prices at the U.S. level was discontinued on December 9, 2008 due to a diminishing number of stations selling LSD as a result of EPA diesel fuel regulations. EIA continued to collect LSD prices from retail outlets and included them in the Diesel Average All Types price until July 25, 2010, when no more outlets reported LSD sales. Beginning July 26, 2010 publication of Ultra Low Sulfur Diesel (ULSD) price became fully represented by the Diesel Average All Types price. As of December 1, 2010 (September 1, 2006 in California), any on-highway diesel fuel sold in ULSD as mandated by EPA on-highway diesel fuel regulations. EIA did not collect weekly retail motor gasoline data between December 10, 1990 and January 14, 1991. Monthly and annual averages are simple averages of the weekly data contained therein. For months and years with incomplete weekly data series, the monthly and/or annual averages are not available. See Definitions, Sources, and Notes link above for more information on this table.

Release Date: 5/6/2015  
Next Release Date: 8/13/2018

[https://www.agcensus.usda.gov/Publications/2012/Full\\_Report/Volume\\_1\\_Chapter\\_2\\_County\\_Level/California/st06\\_2\\_010\\_010.pdf](https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1_Chapter_2_County_Level/California/st06_2_010_010.pdf)

**Table 10. Irrigation: 2012 and 2007**

[For meaning of abbreviations and symbols, see introductory text.]

Item	California	Alameda	Alpine	Amador	Butte	Calaveras	Colusa
Farms ..... number, 2012	53,546	159	3	236	1,547	224	665
..... 2007	53,400	215	3	192	1,429	201	682
Land in irrigated farms ..... acres, 2012	16,039,761	51,969	(D)	89,665	308,576	32,162	409,640
..... 2007	16,231,930	51,757	(D)	86,952	315,456	78,495	431,304
Harvested cropland ..... farms, 2012	48,276	149	3	186	1,403	177	631
..... 2007	45,769	186	3	136	1,245	148	632
..... acres, 2012	7,753,480	8,056	(D)	8,019	198,631	2,683	262,051
..... 2007	7,465,841	9,086	(D)	6,355	196,559	2,299	275,499
Other cropland, excluding cropland pastured ..... farms, 2012	6,080	16	-	17	183	22	71
..... 2007	6,318	20	-	16	126	11	67
..... acres, 2012	654,791	567	(D)	225	14,964	358	10,862
..... 2007	620,748	385	(D)	729	3,094	47	10,536
Pastureland, excluding woodland pastured ..... farms, 2012	11,535	28	3	113	288	97	99
..... 2007	15,438	73	3	100	382	112	143
..... acres, 2012	5,998,187	40,395	(D)	67,038	64,336	20,747	112,075
..... 2007	6,630,443	39,667	(D)	67,618	89,949	65,660	123,129
Irrigated land ..... acres, 2012	7,861,964	8,893	239	11,321	199,662	4,523	260,859
..... 2007	8,016,159	9,687	(D)	10,132	202,234	4,888	277,332
Harvested cropland ..... farms, 2012	47,972	149	3	173	1,391	166	629
..... 2007	45,412	188	3	133	1,236	141	631
..... acres, 2012	7,371,411	7,635	(D)	6,719	193,721	2,356	252,047
..... 2007	7,274,248	8,456	(D)	5,678	192,928	2,061	268,737
Pastureland and other land ..... farms, 2012	7,884	17	2	73	225	76	55
..... 2007	10,546	34	2	69	263	79	77
..... acres, 2012	450,553	1,258	(D)	4,602	5,941	2,167	8,812
..... 2007	741,911	1,231	(D)	4,454	9,306	2,827	8,595

**Table 10. Irrigation: 2012 and 2007 (continued)**

[For meaning of abbreviations and symbols, see introductory text.]

Item	Napa	Nevada	Orange	Placer	Plumas	Riverside	Sacramento
Farms ..... number, 2012	1,353	475	207	875	68	1,926	788
..... 2007	1,202	421	203	1,027	50	2,206	844
Land in irrigated farms ..... acres, 2012	181,250	26,185	56,201	63,391	115,430	275,538	172,027
..... 2007	148,163	53,805	80,254	109,155	94,876	234,216	238,098
Harvested cropland ..... farms, 2012	1,347	292	207	451	48	1,847	598
..... 2007	1,197	194	193	414	28	1,993	536
..... acres, 2012	50,179	1,414	9,720	18,643	11,140	153,338	89,065
..... 2007	48,223	2,454	7,823	21,614	7,632	159,354	110,151
Other cropland, excluding cropland pastured ..... farms, 2012	102	19	11	119	7	236	79
..... 2007	98	34	14	101	7	292	88
..... acres, 2012	2,904	377	1,896	3,748	875	32,688	6,802
..... 2007	4,296	517	2,179	6,128	728	23,129	7,167
Pastureland, excluding woodland pastured ..... farms, 2012	95	272	5	567	60	204	333
..... 2007	192	302	22	760	44	491	458
..... acres, 2012	52,636	12,487	37,720	29,589	97,843	67,786	64,221
..... 2007	46,575	41,399	(D)	70,772	76,764	30,517	106,415
Irrigated land ..... acres, 2012	54,580	5,314	8,054	20,674	19,142	145,961	85,979
..... 2007	51,604	7,223	8,955	30,247	20,229	168,051	113,427
Harvested cropland ..... farms, 2012	1,347	286	207	439	48	1,842	592
..... 2007	1,193	186	193	399	28	1,986	531
..... acres, 2012	(D)	1,226	(D)	14,031	10,105	142,249	77,557
..... 2007	46,403	2,367	(D)	15,168	6,717	158,437	102,160
Pastureland and other land ..... farms, 2012	28	244	2	531	30	126	250
..... 2007	33	276	15	703	40	283	367
..... acres, 2012	(D)	4,088	(D)	6,643	9,037	3,712	8,422
..... 2007	5,201	4,856	(D)	15,079	13,512	9,614	11,267