

SECTION 4.3

OIL & GAS PRODUCTION PUMPS, COMPRESSORS, AND WELL HEADS

(January 1989)

EMISSION INVENTORY SOURCE CATEGORY

Petroleum Production and Marketing / Oil and Gas Production

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION

310-306-1600-0000 (81984) Oil Production Fugitive Losses - Pumps

310-308-1600-0000 (81992) Oil Production Fugitive Losses - Compressors

310-310-1600-0000 (82008) Oil Production Fugitive Losses - Well Heads

METHODS AND SOURCES

The data from these sources were taken from the 1987 State of California Department of Oil and Gas (D.O.G or DOG) tape.¹ The emission factors are supplied by KVB, Inc.² and emissions can be calculated based on the number of active wells. The fugitive emissions from pumps, compressors, and well heads are associated with each active well; therefore, emissions are calculated using active wells as the process rate. Emission factors are set for each field and lease within the ARB program. Emission factors for individual components are shown in Table I and Table II.

Table I

Emission Factors for Pumps and Compressors²

<u>Equipment</u>	<u>Emission factor/component (lb/day/unit)</u>
Pump	0.141
Compressor	25.00

Table II

Emission Factors for Well Heads²

<u>Fluids</u>	<u>lb/day/well</u>	
	<u>Onshore</u>	<u>Offshore</u>
Gas	4.24	0.412
Heavy crude	No prediction	NP
Light crude	1.73	0.155
Condensate	0.151	0.0130
Mixtures	2.93×10^{-3}	2.15×10^{-4}

DISTRIBUTION

The emissions from pumps, compressors, and well heads are highest in Kern county.

TEMPORAL DATA

Emission factors are based on an average for the year. Temporal changes are accounted for in the average emission factors.

SAMPLE CALCULATIONS

The following is a sample calculation of pump emissions:

$$\begin{aligned} \text{Pump emissions} &= \frac{365 \text{ day/year} \times 0.004 \text{ lb/day/well} \times 20 \text{ active wells}}{2000 \text{ lb/ton}} \\ &= 0.01 \text{ tons/year} \end{aligned}$$

The following is a sample calculation of compressor emissions:

$$\begin{aligned} \text{Compressor emissions} &= \frac{365 \text{ day/year} \times 0.07 \text{ lb/day/well} \times 20 \text{ active wells}}{2000 \text{ lb/ton}} \\ &= 0.26 \text{ tons/yr} \end{aligned}$$

The following is a sample calculation of well head emissions:

$$\begin{aligned} \text{Well head emissions} &= \frac{365 \text{ day/year} \times 0.0100 \text{ lb/day/well} \times 20 \text{ active wells}}{2000 \text{ lb/ton}} \\ &= 0.04 \text{ tons/yr} \end{aligned}$$

REFERENCES

1. Division of Oil & Gas, State of California. Department of Oil and Gas 1987 Tape.
2. KVB, Inc., Emission Characteristics of Crude Oil Production Operations in California, (January 1983), contract #A8-127-31.

PREPARED BY

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Table III
 1987 Area Source Emissions
 Activity: Oil & Gas Extraction
 Process: Petroleum & Related
 Entrainment: Process Loss
 Dimn: Primary / Secondary Operation Fugitive
 CES: 81984
 Process Rate Unit: Well-Year

AB	County	Process Rate	TOG Emis. (Tons / Year)	CO Emis. (Tons / Year)	NOX Emis. (Tons / Year)	SOX Emis. (Tons / Year)	PM Emis. (Tons / Year)
NC	HUMBOLDT	38	0.00	0.00	0.00	0.00	0.00
NCC	MONTEREY	590	0.30	0.00	0.00	0.00	0.00
	SAN BENITO	54	0.30	0.00	0.00	0.00	0.00
SC	LOS ANGELES	5779	19.90	0.00	0.00	0.00	0.00
	ORANGE	2982	11.00	0.00	0.00	0.00	0.00
	RIVERSIDE	19	0.10	0.00	0.00	0.00	0.00
	SAN BERNARDINO	40	0.10	0.00	0.00	0.00	0.00
SCC	SAN LUIS OBISPO	337	2.30	0.00	0.00	0.00	0.00
	SANTA BARBARA	1481	8.00	0.00	0.00	0.00	0.00
	VENTURA	2607	15.40	0.00	0.00	0.00	0.00
SJV	FRESNO	2588	3.60	0.00	0.00	0.00	0.00
	KERN	35120	74.80	0.00	0.00	0.00	0.00
	KINGS	16	0.80	0.00	0.00	0.00	0.00
	MADERA	48	0.20	0.00	0.00	0.00	0.00
	MERCED	3	0.00	0.00	0.00	0.00	0.00
	SAN JOAQUIN	159	1.00	0.00	0.00	0.00	0.00
	TULARE	80	0.50	0.00	0.00	0.00	0.00
SV	BUTTE	25	0.00	0.00	0.00	0.00	0.00
	COLUSA	236	1.80	0.00	0.00	0.00	0.00
	GLENN	225	2.30	0.00	0.00	0.00	0.00
	SACRAMENTO	188	1.60	0.00	0.00	0.00	0.00
	SUTTER	254	1.80	0.00	0.00	0.00	0.00
	TEHAMA	88	0.60	0.00	0.00	0.00	0.00
	YOLO	176	1.50	0.00	0.00	0.00	0.00
TOTAL		53133	147.90	0.00	0.00	0.00	0.00

Fraction of Reactive Organic Gases (FROG): .5070
 (Reactive Organic Gases (ROG) Emissions = TOG X FROG)
 Fraction of PM10 (FRPM10): .6100
 (PM10 Emissions = PM X FRPM10)

Table IV
 1987 Area Source Emissions
 Activity: Oil & Gas Extraction
 Process: Petroleum & Related
 Entrainment: Process Loss
 Dimn: Primary / Secondary Operation Fugitive
 CES: 81992
 Process Rate Unit: Well-Year

AB	County	Process Rate	TOG Emis. (Tons / Year)	CO Emis. (Tons / Year)	NOX Emis. (Tons / Year)	SOX Emis. (Tons / Year)	PM Emis. (Tons / Year)
SC	LOS ANGELES	5779	173.70	0.00	0.00	0.00	0.00
	ORANGE	2982	100.80	0.00	0.00	0.00	0.00
	RIVERSIDE	19	0.90	0.00	0.00	0.00	0.00
SCC	SAN LUIS OBISPO	337	25.10	0.00	0.00	0.00	0.00
	SANTA BARBARA	1481	103.90	0.00	0.00	0.00	0.00
	VENTURA	2607	185.30	0.00	0.00	0.00	0.00
SJV	FRESNO	2588	16.70	0.00	0.00	0.00	0.00
	KERN	35120	723.40	0.00	0.00	0.00	0.00
	KINGS	162	7.40	0.00	0.00	0.00	0.00
SV	SAN JOAQUIN	159	1.10	0.00	0.00	0.00	0.00
	SACRAMENTO	188	12.80	0.00	0.00	0.00	0.00
	TEHAMA	88	1.60	0.00	0.00	0.00	0.00
TOTAL		51510	1352.70	0.00	0.00	0.00	0.00

Fraction of Reactive Organic Gases (FROG): .2700
 (Reactive Organic Gases (ROG) Emissions = TOG X FROG)
 Fraction of PM10 (FRPM10): .6100
 (PM10 Emissions = PM X FRPM10)

Table V
 1987 Area Source Emissions
 Activity: Oil & Gas Extraction
 Process: Petroleum & Related
 Entrainment: Process Loss
 Dimn: Primary / Secondary Operation Fugitive
 CES: 82008
 Process Rate Unit: Well-Year

AB	County	Process Rate	TOG Emis. (Tons / Year)	CO Emis. (Tons / Year)	NOX Emis. (Tons / Year)	SOX Emis. (Tons / Year)	PM Emis. (Tons / Year)
NC	HUMBOLDT	14	0.00	0.00	0.00	0.00	0.00
NCC	MONTEREY	99	0.00	0.00	0.00	0.00	0.00
	SAN BENITO	51	0.00	0.00	0.00	0.00	0.00
SC	LOS ANGELES	5779	0.70	0.00	0.00	0.00	0.00
	ORANGE	2982	0.30	0.00	0.00	0.00	0.00
	RIVERSIDE	20	0.00	0.00	0.00	0.00	0.00
	SAN BERNARDINO	31	0.00	0.00	0.00	0.00	0.00
SCC	SAN LUIS OBISPO	97	0.00	0.00	0.00	0.00	0.00
	SANTA BARBARA	1481	0.40	0.00	0.00	0.00	0.00
	VENTURA	2607	0.30	0.00	0.00	0.00	0.00
SJV	FRESNO	2588	0.10	0.00	0.00	0.00	0.00
	KERN	35120	4.60	0.00	0.00	0.00	0.00
	KINGS	162	0.00	0.00	0.00	0.00	0.00
	MADERA	49	0.00	0.00	0.00	0.00	0.00
	MERCED	3	0.00	0.00	0.00	0.00	0.00
	SAN JOAQUIN	129	0.00	0.00	0.00	0.00	0.00
	TULARE	81	0.00	0.00	0.00	0.00	0.00
SV	BUTTE	14	0.00	0.00	0.00	0.00	0.00
	COLUSA	236	0.00	0.00	0.00	0.00	0.00
	GLENN	162	0.00	0.00	0.00	0.00	0.00
	SACRAMENTO	181	0.00	0.00	0.00	0.00	0.00
	SUTTER	254	0.00	0.00	0.00	0.00	0.00
	TEHAMA	65	0.00	0.00	0.00	0.00	0.00
	YOLO	211	0.00	0.00	0.00	0.00	0.00
TOTAL		52416	6.40	0.00	0.00	0.00	0.00

Fraction of Reactive Organic Gases (FROG): .6250
 (Reactive Organic Gases (ROG) Emissions = TOG X FROG)
 Fraction of PM10 (FRPM10): .6100
 (PM10 Emissions = PM X FRPM10)