

SECTION 4.10

GASOLINE DISPENSING FACILITIES

(Revised May 1999)

EMISSION INVENTORY SOURCE CATEGORY

Petroleum Production and Marketing / Petroleum Marketing

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION

330-374-1100-0000 (46532) Gasoline Dispensing Tanks - Working Losses

330-376-1100-0000 (46557) Gasoline Dispensing Tanks - Breathing Losses

330-378-1100-0000 (46540) Vehicle Refueling - Vapor Displacement

330-380-1100-0000 (46565) Vehicle Refueling - Spillage

METHODS AND SOURCES

These categories are used to report the organic gas emissions resulting from the storage and transfer operations at gasoline dispensing facilities. Emissions from storage and transfer operations include the working losses and breathing losses from underground tanks, vapors displaced through vehicle refueling, and spillage. Gasoline dispensing facilities consist of gasoline retail outlets and private dispensing facilities.

Gasoline retail outlets in California include the following four types: ^{1,2,3}

- (a) Majors - Traditional gasoline stations selling a major brand gasoline, company-owned or franchised (full-service, mini-service, self-service, or a combination).
- (b) Secondaries - Discount gasoline stations providing little service and selling non-branded gasoline, but owned and operated by a major oil company.
- (c) Independents - Gasoline stations independently owned and operated, and not affiliated with a major oil company.
- (d) Non-Gasoline Stations - Retail stores selling gasoline incidental to their business (deriving less than 50 percent of the gross revenues from gasoline sales).

Private gasoline dispensing facilities are also known as bulk (exempt) customers.

The method for estimating emissions is described below using 1997 data.

The California Department of Transportation issues an annual report which contains the throughput of gasoline distributed in the state by county. The total gasoline sales for service stations in the State by County were from the Annual Report from the California State Board of Equalization. The 1997 calendar year report was used for the 1997 gasoline throughput. These gasoline throughputs were estimated using several variables, which are strongly correlated with gasoline consumption. The variables included several categories of taxable sales, population, vehicle miles of travel, and the number of registered vehicles. The weighted average share for all the variables was then computed for each county. The above variables were used to divide the total gasoline sales in each county into highway sales and non-highway sales. Highway sales are assumed to be gasoline sales from service stations and non-highway sales are assumed to be gasoline sales from tax exempt gasoline dispensing facilities. Adjustments were made to account for county-specific factors such as business and recreational trips.⁴ The air basin splits were divided by the ratio of the 1997 population.

Total organic gas emission factors (uncontrolled and controlled) are based on the CAPCOA Air Toxics "Hot Spots" Program Gasoline Service Station Industrywide Risk Assessment Guidelines Document⁵ and a June 24, 1994 internal memo from Jim Fries to Dale Shimp estimating the benefits of cleaner burning gasoline⁶ (see Table I). The use of control factors versus uncontrolled factors is based on all service stations that pump more than 480,000 gallons per year.

Private gasoline dispensing facilities, which account for about two percent of a given county's throughput each year, are assumed to be exempt from vapor recovery regulations. Since uncontrolled emission factors are up to 20 times as high as controlled factors, these facilities would contribute 15 to 26 percent of the total emissions.

ASSUMPTIONS

1. The report, "Travel and Related Factors," by the California Department of Transportation and the report "Taxable Sales in California (Sales & Use Tax) during 1997" are accurate representations of the use of gasoline in California.
2. The effective emission reduction for Stage I and Stage II vapor recovery systems is near the theoretical control efficiency (95 percent in each case) of the equipment.
3. A defect rate for vapor recovery equipment for the vehicle refueling category is assumed to be 5%.

4. All non-highway gasoline sales are assumed not to be using stage II vapor recovery systems.

TEMPORAL ACTIVITY

For underground tank working and breathing losses, the annual, weekly, and daily activities are all uniform.

For vehicle refueling and spillage losses, the annual activity is uniform throughout the year. The weekly activity is nearly uniform, with slightly lower activity on the weekend. The daily activity follows a pattern, which peaks during the after-work hours in the evening and bottoms between midnight and 6 a.m.

COMMENTS AND RECOMMENDATIONS

It is assumed in this method that the actual emission reduction rates of vapor recovery systems in place are equal to the design control efficiencies except for the vehicle refueling category where the defect rate is assumed to be 5%. This assumption should be validated by evaluation testing of the field effectiveness of the control equipment. Field tests would also provide information on whether the actual efficiencies are uniform or variable across the state. A defect rate for all vapor recovery control equipment is highly recommended.

CHANGES IN METHOD AND EMISSION ESTIMATES

There is a higher activity rate (gasoline throughput) for 1997 than for 1990. With full implementation of the Benzene rule and the introduction of cleaner burning gasoline, emissions were reduced. Thus, the 1997 statewide emissions are lower than the 1990 emissions. The emission factors are lower from the previous years due to the reduced vapor pressure of cleaner burning gasoline. The spillage factor was lower due to lower flow rates at the dispensing pumps. Test performed by the ARB showed that with lower flow rates for the balance systems, the spillage rate was lower.⁷

SAMPLE CALCULATIONS

To estimate the working loss emissions from the underground tanks at gasoline service stations in Sacramento County, the following method is used:

Given:

1997 Total sales for Sacramento County = 476,936,834 gallons

1997 Highway sales for Sacramento County = 467,411,000 gallons

1997 Non-Highway sales for Sacramento County = 9,525,834 gallons

Emission factor for Highway (with vapor recovery) = 0.42 lbs/1,000 gallons

Emission factor for Non-Highway (without control) = 8.4 lbs/1,000 gallons

TOG emissions for Highway

= 1997 Hwy sales (1,000 gal) x Hwy emission factor x 1 ton/2000 lbs

= 467,411 (1,000 gal) x 0.42 lbs/1,000 gal x 1 ton/2000 lbs

= 98.16 tons/year

TOG emissions for Non-Highway

= 1997 Non-Hwy sales (1,000 gal) x Non-Hwy emission factor x 1 ton/2000 lbs

= 9,526 (1,000 gal) x 8.4 lbs/1,000 gal x 1 ton/2000 lbs

= 40.01 tons/year

Total TOG emissions = 98.16 tons/year + 40.01 tons/year = 138.16 tons/year

TABLE I
 EMISSION FACTORS FOR GASOLINE DISPENSING FACILITIES
 (UNIT: lb. TOG/1,000 gallons throughput)

<u>CES</u>	<u>Description</u>	<u>E.F. Without Control</u>	<u>E.F. With Vapor Recovery Control</u>
46532	Underground Tanks - Working Loss	8.4	0.42
46540	Vehicle Refueling - Vapor Displacement	8.4	0.74
46557	Underground Tanks - Breathing Loss	0.84*	0.1*
46565	Vehicle Refueling - Spillage	0.64	0.42

* The emission factor for breathing loss is 0.84 if no control or only Stage I control is in effect; the factor is 0.1 if both Stage I and Stage II controls are in effect.

REFERENCES

1. The Lundberg Letter, Vol. IX, Number 45 (September 10, 1982).
2. The Lundberg Letter, Vol. IX, Number 49 (October 8, 1982).
3. Ms. Trilby Lundberg, Editor, The Lundberg Letter, North Hollywood, CA., Phone (213) 768-5111, personal communication (January 1983).
4. California Department of Transportation, Travel and Related Factors in California (1997).
5. CAPCOA Air Toxics "Hot Spots" Program Gasoline Service Station Industrywide Risk Assessment Guidelines (December 1997).
6. ARB Memorandum: Proposed Adjustments to Control Profiles for Phase 1 and 2 Reformulated Gasoline Benefits in Stationary Sources (June 24, 1994).
7. James J. Morgester, Robert L. Fricker, G. Henry Jordan, "Comparison of Spill Frequencies and Amounts at Vapor Recovery and Conventional Service Stations in California", Journal of Air & Waste Management Association, Vol. 42 No.3, pp. 284-289, March 1992.

UPDATED BY

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TABLE II
1997 EMISSIONS FOR GASOLINE DISPENSING FACILITIES

COUNTY NAME	Gasoline Dispensing Tanks			Vehicle Refueling	
	Process Rate (1,000 gallons)	Working Losses	Breathing Losses	Vapor Displacement	Spillage
		EIC 330-374-1100-0000	EIC 330-376-1100-0000	EIC 330-378-1100-0000	EIC 330-380-1100-0000
		TOG total (tons/yr)	TOG total (tons/yr)	TOG total (tons/yr)	TOG total (tons/yr)
ALAMEDA	616,016	178.45	35.35	275.05	130.53
ALPINE	825	0.24	0.05	0.37	0.17
AMADOR	13,069	3.79	0.75	5.84	2.77
BUTTE	73,322	21.24	4.21	32.74	15.54
CALAVERAS	14,031	4.06	0.81	6.26	2.97
COLUSA	10,043	2.91	0.58	4.48	2.13
CONTRA COSTA	385,181	111.58	22.11	171.98	81.62
DEL NORTE	8,529	2.47	0.49	3.81	1.81
EL DORADO (mc)	57,933	16.78	3.32	25.87	12.28
EL DORADO (lt)	5,209	1.51	0.30	2.33	1.10
FRESNO	278,293	80.62	15.97	124.26	58.97
GLENN	11,005	3.19	0.63	4.91	2.33
HUMBOLDT	51,862	15.02	2.98	23.16	10.99
IMPERIAL	47,598	13.79	2.73	21.25	10.09
INYO	13,206	3.83	0.76	5.90	2.80
KERN (sjv)	201,264	58.30	11.55	89.86	42.65
KERN (mj)	46,629	13.51	2.68	20.82	9.88
KINGS	35,630	10.32	2.04	15.91	7.55
LAKE	19,396	5.62	1.11	8.66	4.11
LASSEN	12,518	3.63	0.72	5.59	2.65
LOS ANGELES (sc)	3,624,532	1,050.00	208.01	1,618.34	768.03
LOS ANGELES (moj)	119,432	34.60	6.85	53.33	25.31
MADERA	38,243	11.08	2.19	17.08	8.10
MARIN	125,459	36.34	7.20	56.02	26.58
MARIPOSA	6,878	1.99	0.39	3.07	1.46
MENDOCINO	39,068	11.32	2.24	17.44	8.28
MERCED	71,534	20.72	4.11	31.94	15.16
MODOC	4,264	1.24	0.24	1.90	0.90
MONO	8,392	2.43	0.48	3.75	1.78
MONTEREY	153,798	44.55	8.83	68.67	32.59
NAPA	52,825	15.30	3.03	23.59	11.19
NEVADA	39,756	11.52	2.28	17.75	8.42
ORANGE	1,243,862	360.34	71.39	555.38	263.57
PLACER (mc)	21,624	6.26	1.24	9.66	4.58
PLACER (lt)	5,241	1.52	0.30	2.34	1.11
PLACER (sv)	84,510	24.48	4.85	37.73	17.91
PLUMAS	8,942	2.59	0.51	3.99	1.89
RIVERSIDE (sc, sc)	431,187	124.91	24.75	192.52	91.37
RIVERSIDE (moj, sc)	1,100	0.32	0.06	0.49	0.23
RIVERSIDE (moj, moj)	7,150	2.07	0.41	3.19	1.52
RIVERSIDE (ss, sc)	110,547	32.02	6.34	49.36	23.42
SACRAMENTO	476,937	138.16	27.37	212.95	101.06
SAN BENITO	16,232	4.70	0.93	7.25	3.44
SAN BERNARDINO (sc)	487,741	141.29	27.99	217.77	103.35
SAN BERNARDINO (moj)	148,083	42.90	8.50	66.12	31.38
SAN DIEGO	1,145,778	331.92	65.76	511.59	242.79
SAN FRANCISCO	409,255	118.56	23.49	182.73	86.72
SAN JOAQUIN	205,797	59.62	11.81	91.89	43.61
SAN LUIS OBISPO	105,237	30.49	6.04	46.99	22.30
SAN MATEO	369,774	107.12	21.22	165.10	78.35
SANTA BARBARA	166,729	48.30	9.57	74.44	35.33
SANTA CLARA	826,627	239.47	47.44	369.09	175.16
SANTA CRUZ	103,449	29.97	5.94	46.19	21.92

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		EIC 330-374-1100-0000	EIC 330-376-1100-0000	EIC 330-378-1100-0000	EIC 330-380-1100-0000
COUNTY NAME	Process Rate (1,000 gallons)	TOG total (tons/yr)	TOG total (tons/yr)	TOG total (tons/yr)	TOG total (tons/yr)
SHASTA	68,232	19.77	3.92	30.47	14.46
SIERRA	1,651	0.48	0.09	0.74	0.35
SISKIYOU	21,047	6.10	1.21	9.40	4.46
SOLANO (sf)	133,961	38.81	7.69	59.81	28.39
SOLANO (sv)	18,736	5.43	1.08	8.37	3.97
SONOMA (sf)	135,037	39.12	7.75	60.29	28.61
SONOMA (sv)	59,205	17.15	3.40	26.43	12.55
STANISLAUS	158,750	45.99	9.11	70.88	33.64
SUTTER	27,513	7.97	1.58	12.28	5.83
TEHAMA	22,561	6.54	1.29	10.07	4.78
TRINITY	4,540	1.32	0.26	2.03	0.96
TULARE	112,529	32.60	6.46	50.24	23.84
TUOLUMNE	21,047	6.10	1.21	9.40	4.46
VENTURA	302,093	87.51	17.34	134.88	64.01
YOLO	70,433	20.40	4.04	31.45	14.92
YUBA	18,984	5.50	1.09	8.48	4.02
Total	13,737,858	3,979.75	788.42	6,133.90	2,911.02