SECTION 5.2

WINERIES-AGING

(Updated February 1992)

EMISSION INVENTORY SOURCE CATEGORY
Industrial and Other Processes

EMISSION INVENTORY CODES (CES) AND DESCRIPTIONS
420-410-6090-0000   (60467) Wine Aging

METHODS AND SOURCES

This category is an inventory of the ethanol emissions from the aging of brandy in 50-gallon oak barrels.

Brandy is produced via a distillation process which separates and concentrates ethanol and other volatile substances from wine or fermented juices. The brandy is then aged for a period of two to ten years. During the aging process, there is considerable ethanol loss which is attributed to absorption of alcohol by the wood of the barrels. The alcohol is eventually released from the wood into the atmosphere. In a letter to the Fresno County Air Pollution Control District [1] from Hugh Cook of the Wine Institute an emission factor of 0.0136 pounds per day per 50-gallon barrel was obtained. This emission factor was derived by assuming that brandy is 120 proof on the average, and there is an alcohol loss of 2.5% per year per barrel (see sample calculations).

Brandy inventories in California for 1992 are reported by the Wine Institute [2] to be 44,487,000 gallons in storage. This statewide total was distributed to the counties based on the amount of grapes crushed and produced in each county. The California Department of Food and Agriculture (CDFA) annually reports the amount of grapes crushed in each of the 17 grape growing districts in the State [3] (Table I). The amount of grapes crushed in each county (Table II) was estimated by disaggregating the district total according to the proportion of the grapes produced in the county to the district. The grape production in each county was taken from the Annual Crop and Livestock Report [4] prepared by each Agricultural Commissioner's office. The amount of grapes produced and/or crushed in counties that belong to more than one grape growing district, e.g., Sacramento County, was determined with the aid of CDFA's map (Figure 1) delineating the grape growing districts.

The statewide ethanol emissions for 1990 from brandy production by county are presented in Table III.

ASSUMPTIONS

1.   Brandy is 120 proof (60% alcohol) on the average.

2.   Alcohol is lost during aging at a rate of 2.5% per year per barrel.

3.   The amount of brandy in storage for each county is proportional to the amount of grapes crushed and can be used to apportion the statewide brandy storage to the counties.

4.   The amount of grapes crushed is proportional to the amount of grapes produced and can be used to apportion the grapes crushed in a district to the counties.

COMMENTS AND RECOMMENDATION

Two other sources of ethanol emissions in the production of brandy may be significant; the distillation process and the bottling process. These sources of emissions have not been inventoried due to lack of information.

CHANGES IN METHODOLOGY

There have been no changes in the methodology since the 1979 inventory.

DIFFERENCES BETWEEN 1987 AND 1979 EMISSION ESTIMATES

The 1990 emission estimates are slightly lower than the 1987 estimates because of an error found in the 1987 emission estimates. The process rates for 1990 are lower than 1987 because there is less demand for Brandy.

TEMPORAL ACTIVITY

Brandy is aged for a period of two to ten years. During this period emissions are released into the atmosphere 365 days per year and 24 hours per day.

SAMPLE CALCULATIONS

1. Estimate the amount of brandy stored in Alameda County in 1990.

   A) First, estimate the amount of grapes crushed in Alameda. Alameda is one of the six counties that comprise District 6 with 8978.4 tons of grapes crushed in 1990. Calculate Alameda's share of the district's total amount of grapes crushed based on the amount of grapes produced.

   $$\frac{4629 \text{ tons grapes produced in ALA}}{9680 \text{ tons grapes produced in District}} \times 8978.4 \text{ tons grapes crushed in District 6}$$

   = 4293.49 tons grapes crushed in Alameda

   B) Estimate the amount of brandy stored in Alameda County.

   $$\frac{4293.49 \text{ tons grapes crushed in ALA}}{2,576,005 \text{ tons grapes crushed in CA}} \times 44,487,000 \text{ gal of brandy stored in CA}$$

   = 74,147.56 gallons /50 = 1483 barrels (based on 50 gallons per barrel)

2. Determination of the Wine Institute's Emission Factor:

   $$\text{Specific gravity of ETOH at 60°F} \times \frac{8.388 \text{ lbs}}{\text{gal}} \times \frac{2.5\% \text{ ETHOH lost}}{\text{year}} \times \frac{50 \text{ gal}}{\text{barrel}} \times 60\% \text{ ETHOH at 120 proof}$$

   = .79384 x 8.338 x .025 x 50 x .60 = 4.96 lbs/barrel-year

3. Emissions from Storage of Brandy in Alameda County:

   = amount of brandy in storage x emission factor

   = 1483 barrels x 4.96 lbs/barrel-year/2,000 lbs/ton

   = 3.68 tons/yr ethanol emissions in Alameda County

REFERENCES

1. Letter from Hugh Cook of the Wine Institute to Robert Bashian of the Fresno County APCD (Jan. 13, 1978).

2. Personal Communication, Wade Stevenson, Wine Institute, (4I5) 512-0151 (February 1992).

3. California Department of Food and Agriculture, <u>Final Grape Crush Report 1990 Crop</u>, (March 11, 1991).

4. County Agricultural Commissioner's Office, <u>1990 Agricultural Crop and Livestock Report</u>, California (1991).

UPDATED BY

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MAP & DEFINITIONS
OF CALIFORNIA
GRAPE PRICING DISTRICTS

1. Mendocino County
2. Lake County
3. Sonoma and Marin Counties
4. Napa County
5. Solano County
6. Alameda, Contra Costa, Santa Clara, San Francisco, San Mateo, and Santa Cruz Counties
7. Monterey and San Benito Counties
8. San Luis Obispo, Santa Barbara and Ventura Counties
9. Yolo County north of Interstate 80 to the junction of Interstate 80 and U.S. 50 and north of U.S. 50; Sacramento County north of U.S. 50; Del Norte, Siskiyou, Modoc, Humboldt, Trinity, Shasta, Lassen, Tehama, Plumas, Glenn, Butte, Colusa, Sutter, Yuba, and Sierra Counties.
10. Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne and Mariposa Counties
11. San Joaquin County north of State Highway 4; and Sacramento County south of U.S. 50 and east of Interstate 5.
12. San Joaquin County south of State Highway 4; Stanislaus and Merced Counties
13. Madera, Fresno, Alpine, Mono, Inyo Counties; and Kings and Tulare Counties north of Nevada Avenue (Avenue 192)
14. Kings and Tulare Counties south of Nevada Avenue (Avenue 192); and Kern County
15. Los Angeles and San Bernardino Counties
16. Orange, Riverside, San Diego, and Imperial Counties
17. Yolo County south of Interstate 80 from the Solano County line to the junction of Interstate 80 and U.S. 50 and south of U.S. 50 and Sacramento County south of U.S. 50 and west of Interstate 5.
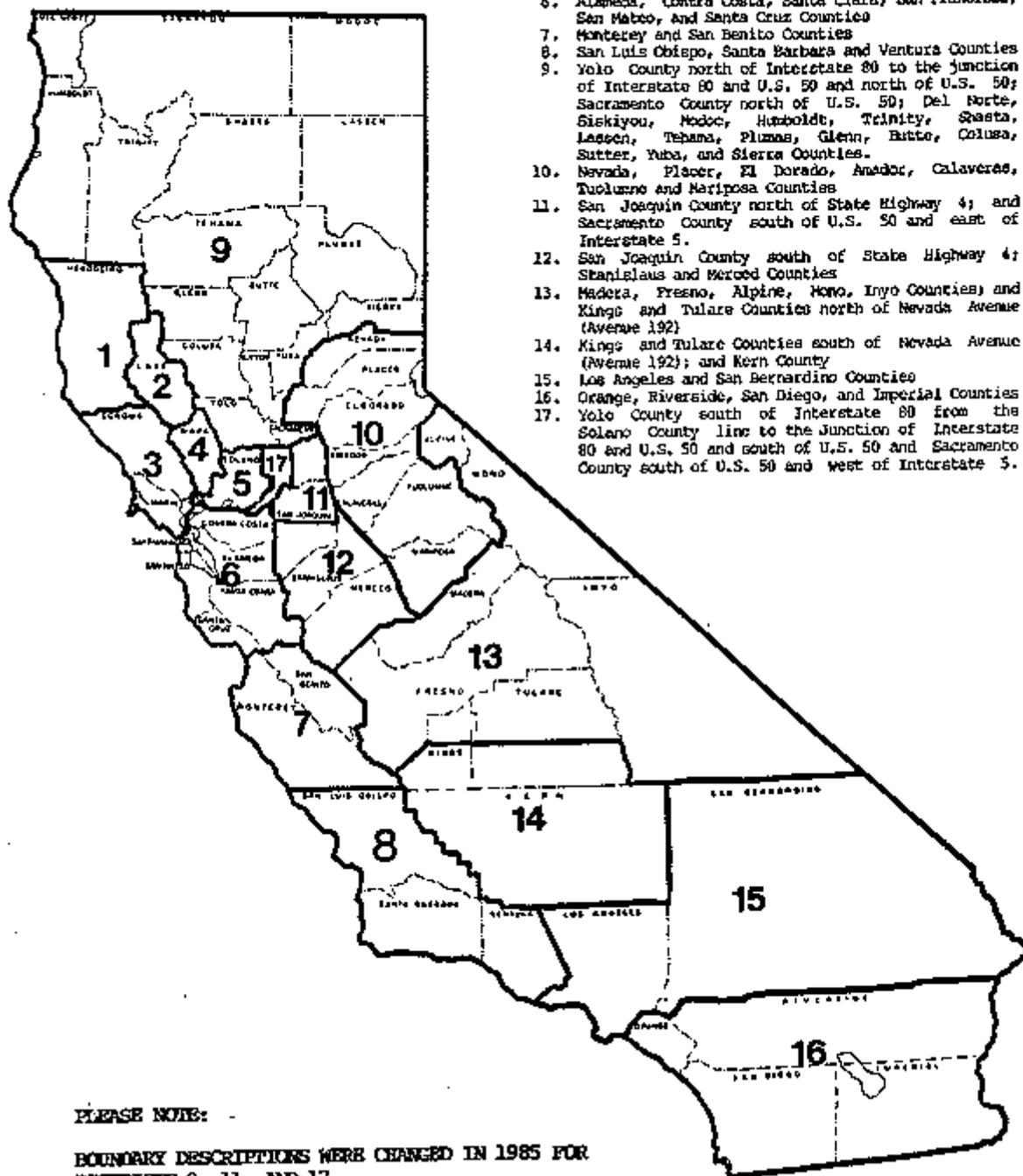
PLEASE NOTE:

BOUNDARY DESCRIPTIONS WERE CHANGED IN 1985 FOR DISTRICTS 9, 11, AND 17.

TABLE I
1990 AMOUNT OF GRAPES CRUSHED IN CALIFORNIA BY DISTRICT [a]

DISTRICT [b]	GRAPES CRUSHED (TONS/YR)
1	39,778.9
2	7,710.7
3	111,930.1
4	114,303.7
5	6,094.2
6	8,978.4
7	105,080.0
8	61,546.9
9	17,880.8
10	8,694.4
11	286,441.7
12	325,379.3
13	1,007,494.3
14	448,029.1
15	2,633.0
16	9,309.2
17	14,720.2
STATE TOTAL	2,576,005.0

a. Abstracted from Reference 3.
b. Grape growing districts are shown in Figure 1, Reference 3.

Table II

1990 Grapes Crushed (Tons) in California by Counties

County Name	Air Basin	Grapes Crushed
ALAMEDA	SF	4293.49
ALPINE	GBF	0
AMADOR	MC	5155.79
BUTTE	SV	0
CALAVERAS	MC	328.94
COLUSA	SV	0
CONTRA COSTA	SF	1975.62
DEL NORTE	NC	0
EL DORADO	SV	2416.63
EL DORADO	LT	0
FRESNO	SJV	675783.97
GLENN	SV	0
HUMBOLDT	NC	0
IMPERIAL	SED	0
INYO	GBV	0
KERN	SED	0
KERN	SJV	305423.06
KINGS	SJV	16358.86
LAKE	LC	7991.00
LASSEN	NEP	0
LOS ANGELES	SC	0
LOS ANGELES	SED	0
MADERA	SJV	242734.07
MARIN	SF	0
MARIPOSA	MC	85.88
MENDOCINO	NC	39778.80
MERCED	SJV	90453.69
MODOC	NEP	0
MONO	GBV	0
MONTEREY	NCC	98606.44
NAPA	SF	114303.70
NEVADA	MC	481.50
ORANGE	SC	0
PLACER	LT	0
PLACER	MC	0
PLACER	SV	225.57
PLUMAS	MC	0
RIVERSIDE	SED	0
RIVERSIDE	SC	9272.43
SACRAMENTO	SV	57954.27
SAN BENITO	NCC	6473.53
SAN BERNARDINO	SC	2633.00
SAN BERNARDINO	SED	0
SAN DIEGO	SD	36.77
SAN FRANCISCO	SF	0
SAN JOAQUIN	SJV	379637.58
SAN LUIS OBISPO	SCC	33179.62
SAN MATEO	SF	0
SANTA BARBARA	SCC	28367.28
SANTA CLARA	SF	3594.14
SANTA CRUZ	NCC	222.60
SHASTA	SV	0
SIERRA	MC	0
SISKIYOU	NEP	0
SOLANO	SF	6094.30
SOLANO	SV	0
SONOMA	NC	55965.05
SONOMA	SF	55965.05
STANISLAUS	SJV	114505.25
SUTTER	SV	0
TEHAMA	SV	0
TRINITY	NC	0
TULARE	SJV	219145.76
TUOLUMNE	MC	0
VENTURA	SCC	0
YOLO	SV	29436.68
YUBA	SV	0
TOTAL		2,608,880.44

Table III
1990 Area Source Emissions
Activity: Wines & Brandy
Process: Food & Agricultural
Entrainment: Process Loss
Dimn: Aging Wine
CES: 60467
Process Rate Unit: BBL-Year of Stored Brandy

AB	County	Process Rate	TOG Emis. (Tons / Year)	CO Emis. (Tons / Year)	NOX Emis. (Tons / Year)	SOX Emis. (Tons / Year)	PM Emis. (Tons / Year)
LC	LAKE	2760	6.84	0.00	0.00	0.00	0.00
MC	AMADOR	1781	4.42	0.00	0.00	0.00	0.00
	CALAVERAS	114	0.28	0.00	0.00	0.00	0.00
	MARIPOSA	30	0.07	0.00	0.00	0.00	0.00
NC	MENDOCINO	13739	34.07	0.00	0.00	0.00	0.00
	SONOMA	19330	47.94	0.00	0.00	0.00	0.00
NCC	MONTEREY	34058	84.46	0.00	0.00	0.00	0.00
	SAN BENITO	2236	5.55	0.00	0.00	0.00	0.00
	SANTA CRUZ	77	0.19	0.00	0.00	0.00	0.00
SC	RIVERSIDE	3203	7.94	0.00	0.00	0.00	0.00
	SAN BERNARDINO	909	2.26	0.00	0.00	0.00	0.00
SCC	SAN LUIS OBISPO	11460	28.42	0.00	0.00	0.00	0.00
	SANTA BARBARA	9798	24.30	0.00	0.00	0.00	0.00
SD	SAN DIEGO	13	0.03	0.00	0.00	0.00	0.00
SF	ALAMEDA	1483	3.68	0.00	0.00	0.00	0.00
	CONTRA COSTA	682	1.69	0.00	0.00	0.00	0.00
	NAPA	39480	97.91	0.00	0.00	0.00	0.00
	SANTA CLARA	1241	3.08	0.00	0.00	0.00	0.00
	SOLANO	2105	5.22	0.00	0.00	0.00	0.00
	SONOMA	19330	47.94	0.00	0.00	0.00	0.00
SJV	FRESNO	233413	578.86	0.00	0.00	0.00	0.00
	KERN	105492	261.62	0.00	0.00	0.00	0.00
	KINGS	5650	14.01	0.00	0.00	0.00	0.00
	MADERA	83839	207.92	0.00	0.00	0.00	0.00
	MERCED	31242	77.48	0.00	0.00	0.00	0.00
	SAN JOAQUIN	131126	325.19	0.00	0.00	0.00	0.00
	STANISLAUS	39550	98.08	0.00	0.00	0.00	0.00
	TULARE	31092	187.72	0.00	0.00	0.00	0.00
SV	EL DORADO	835	2.07	0.00	0.00	0.00	0.00
	NEVADA	166	0.41	0.00	0.00	0.00	0.00
	PLACER	78	0.19	0.00	0.00	0.00	0.00
	SACRAMENTO	20017	49.64	0.00	0.00	0.00	0.00
	SOLANO	0	0.00	0.00	0.00	0.00	0.00
	YOLO	10167	25.21	0.00	0.00	0.00	0.00
TOTAL		856496	2234.69	0.00	0.00	0.00	0.00

Fraction of Reactive Organic Gases (FROG):   1.0000
          (Reactive Organic Gases (ROG) Emissions = TOG X FROG)
Fraction of PM10 (FRPM10):   .7000
          (PM10 Emissions = PM X FRPM10)