

SECTION 3.1

DRY CLEANING

(Revised December 2002)

EMISSION INVENTORY SOURCE CATEGORY

Cleaning & Surface Coatings/ Laundering

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION

210-200-8150-0000 (46797) Dry Cleaning - Petroleum Solvent

210-200-3300-0000 (46805) Dry Cleaning – Perchloroethylene

210-200-8102-0000 (82305) Dry Cleaning – Other Synthetic Solvents

METHODS AND SOURCES

Cleaning garments without using water dates back to the days of Pompeii. Garments cleaners called fullers used lye and ammonia and a type of clay called fuller's earth to absorb stains and greases from clothing too delicate to wash in water. 1690 was the first published reference of turpentine being used to remove tar and varnish from fabric.

It wasn't until 1716 that turpentine was used regularly, to supplement the wet cleaning process, as a "dry cleaner" for grease and oil stains. In 1825, Jolly Belin, a French tailor, is credited for using a petroleum solvent to clean fabric and starting the first commercial dry cleaner. The dry cleaning process soon spread to other countries. Various petroleum based solvents were used such as turpentine, benzene, kerosene and gasoline. These solvents were flammable, making dry cleaning a hazardous profession. In 1926, the Stoddard solvent was introduced. It didn't readily ignite and was odor and impurity free. In the 1930's, perchloroethylene was introduced and is still the most widely used dry cleaning solvent. Today, because of its toxic effects, efforts are underway to reduce the use of perchloroethylene by using other methods to dry clean clothing.

This method will estimate total organic gas (TOG) emissions from perchloroethylene dry cleaning establishments. The process rate information is taken from national consumption rates¹ for the year 2001 and apportioned to California by the ratio of the state population² versus the national population³. The TOG emissions from perchloroethylene dry cleaners are estimated by applying a solvent recovery rate factor of 0.75⁴ to perchloroethylene consumption; this assumes a 25% recovery rate. The county emissions data are summarized in Table I.

The emissions from dry cleaners using other synthetic solvents and petroleum solvents are not updated at this time. Statewide, the emissions from each of these categories are less than 1 ton per day TOG. ARB's Stationary Source Division is currently conducting a survey of the dry cleaning industry. When completed, the survey results will be reviewed for possible inclusion in the emissions inventory.

ASSUMPTIONS

The process rate data is valid for the year 2001. The solvent recovery rate is accurate for the average dry cleaning facility. All solvent used, except for recovered solvent, are emitted as TOG. Population ratios, used to disaggregate the use of perchloroethylene, accurately describe where dry cleaning emissions occur.

TEMPORAL ACTIVITY

The temporal activity is uniform year round, with deliveries assumed to be continuous 24 hours per day, seven days per week and 52 weeks per year.

COMMENTS AND RECOMMENDATIONS

An accurate statewide inventory of dry cleaning facilities, their capacities and control equipment would better describe where perchloroethylene emissions occur. Socioeconomic data would more accurately describe where dry cleaning facilities are located. Trends show that higher income areas have more dry cleaning facilities while poorer areas have more coin operated laundry facilities.

CHANGES IN METHOD AND EMISSION ESTIMATES

This method uses updated process rates. The solvent recovery factor is the first attempt at capturing recovered solvents.

SAMPLE CALCULATIONS

To estimate the TOG emissions from dry cleaning facilities in Yolo County using perchloroethylene, the following data are used. The nation's consumption of perchloroethylene in 2001 was 52 million pounds. The population for 2000 in the U.S. was 281,421,906. The population for California in 2000 was 33,871,648. The population for Yolo County in 2000 was 168,660. The 2000 population estimates were used because projected 2001 population estimates were not available. The solvent recovery factor is 0.75 for 25% recovery. Applying this to perc's density of 13.5 pounds per gallon yields an emission factor of 10.125 pounds per gallon. From these data, the TOG emissions in Yolo County are calculated:

Calif. usage = National consumption in pounds x (California population/U.S. Population) x perc density
= 52,000,000 lbs x (33,871,648/281,421,906) x gallon/13.5 pounds
= 463,605 gallons

Yolo County process rate = California usage x (Yolo County Population/California Population)
= 463,605 gallons x (168,660/33,871,648)
= 2308.47 gallons

Yolo County TOG emissions = Yolo County process rate x TOG emission factor
= 2308.47 gallons x 10.125 lbs/gal x 1 ton/2000 lbs
= 11.69 tons/year

REFERENCES

1. Halogenated Solvents Industry Alliance, Inc., Solvents Update, July / August 2002, <http://www.hsia.org/updates/july-aug%2002.pdf>.
2. 2000 Census, United States Department of Census, <http://quickfacts.census.gov/std/states/06000.html>
3. 2000 California Population by County, California Department of Finance, http://www.dof.ca.gov.html/DEMOGRAP/SCDC_Products.htm
4. Draft CAPCOA Air Toxic "Hot Spots" Program Perchloroethylene Dry Cleaners Industry-wide Risk Assessment Guidelines, June 20, 2000

UPDATED BY

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December 2002

TABLE I
2001 DRY CLEANING EMISSIONS - PERCHLOROETHYLENE

County Name	Air Basin	2000 Population	Process Rate (Gallons)	Emission Factor (lb/gal)	TOG Emissions (Tons/year)
ALPINE	GBV	1,208	16.53	10.125	0.08
INYO	GBV	17,945	245.62	10.125	1.24
MONO	GBV	12,853	175.92	10.125	0.89
LAKE	LC	58,309	798.08	10.125	4.04
EL DORADO (lt)	LT	40,638	556.22	10.125	2.82
PLACER (lt)	LT	15,152	207.39	10.125	1.05
AMADOR	MC	35,100	480.42	10.125	2.43
CALAVERAS	MC	40,554	555.07	10.125	2.81
EL DORADO (mc)	MC	115,661	1,583.06	10.125	8.01
MARIPOSA	MC	17,130	234.46	10.125	1.19
NEVADA	MC	92,033	1,259.67	10.125	6.38
PLACER (mc)	MC	34,031	465.79	10.125	2.36
PLUMAS	MC	20,824	285.02	10.125	1.44
SIERRA	MC	3,555	48.66	10.125	0.25
TUOLUMNE	MC	54,501	745.96	10.125	3.78
KERN (mj)	MD	89,984	1,231.62	10.125	6.24
LOS ANGELES (moj)	MD	180,867	2,475.55	10.125	12.53
RIVERSIDE (moj, sc)	MD	3,091	42.31	10.125	0.21
RIVERSIDE (moj, moj)	MD	20,090	274.97	10.125	1.39
SAN BERNARDINO (moj)	MD	326,502	4,468.87	10.125	22.62
DEL NORTE	NC	27,507	376.49	10.125	1.91
HUMBOLDT	NC	126,518	1,731.67	10.125	8.77
MENDOCINO	NC	86,265	1,180.72	10.125	5.98
SONOMA (nc)	NC	63,289	866.24	10.125	4.39
TRINITY	NC	13,022	178.23	10.125	0.90
MONTEREY	NCC	401,762	5,498.96	10.125	27.84
SAN BENITO	NCC	53,234	728.62	10.125	3.69
SANTA CRUZ	NCC	255,602	3,498.45	10.125	17.71
LASSEN	NEP	33,828	463.01	10.125	2.34
MODOC	NEP	9,449	129.33	10.125	0.65
SISKIYOU	NEP	44,301	606.35	10.125	3.07
LOS ANGELES (sc)	SC	9,338,471	127,816.69	10.125	647.07
ORANGE	SC	2,846,289	38,957.47	10.125	197.22
RIVERSIDE (sc, sc)	SC	1,211,583	16,583.07	10.125	83.95
SAN BERNARDINO (sc)	SC	1,382,932	18,928.34	10.125	95.82
SAN LUIS OBISPO	SCC	246,681	3,376.35	10.125	17.09
SANTA BARBARA	SCC	399,347	5,465.91	10.125	27.67
VENTURA	SCC	753,197	10,309.09	10.125	52.19
SAN DIEGO	SD	2,813,833	38,513.24	10.125	194.97
ALAMEDA	SF	1,443,741	19,760.64	10.125	100.04
CONTRA COSTA	SF	948,816	12,986.55	10.125	65.74
MARIN	SF	247,289	3,384.67	10.125	17.13
NAPA	SF	124,279	1,701.02	10.125	8.61
SAN FRANCISCO	SF	776,733	10,631.23	10.125	53.82
SAN MATEO	SF	707,161	9,678.99	10.125	49.00
SANTA CLARA	SF	1,682,585	23,029.73	10.125	116.59
SOLANO (sf)	SF	326,681	4,471.32	10.125	22.64
SOMONA (sf)	SF	395,325	5,410.86	10.125	27.39

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County Name	Air Basin	2000 Population	Process Rate (Gallons)	Emission Factor (lb/gal)	TOG Emissions (Tons/year)
FRESNO	SJV	799,407	10,941.57	10.125	55.39
KERN (sjv)	SJV	571,661	7,824.39	10.125	39.61
KINGS	SJV	129,461	1,771.95	10.125	8.97
MADERA	SJV	123,109	1,685.01	10.125	8.53
MERCED	SJV	210,554	2,881.88	10.125	14.59
SAN JOAQUIN	SJV	563,598	7,714.03	10.125	39.05
STANISLAUS	SJV	446,997	6,118.10	10.125	30.97
TULARE	SJV	368,021	5,037.14	10.125	25.50
IMPERIAL	SS	142,361	1,948.51	10.125	9.86
RIVERSIDE (ss, sc)	SS	310,623	4,251.53	10.125	21.52
BUTTE	SV	203,171	2,780.82	10.125	14.08
COLUSA	SV	18,804	257.37	10.125	1.30
GLENN	SV	26,453	362.07	10.125	1.83
PLACER (sv)	SV	199,216	2,726.69	10.125	13.80
SACRAMENTO	SV	1,223,499	16,746.17	10.125	84.78
SHASTA	SV	163,256	2,234.50	10.125	11.31
SOLANO (sv)	SV	67,861	928.82	10.125	4.70
SUTTER	SV	78,930	1,080.32	10.125	5.47
TEHAMA	SV	56,039	767.01	10.125	3.88
YOLO	SV	168,660	2,308.47	10.125	11.69
YUBA	SV	60,219	824.22	10.125	4.17
Total		33,871,648	463,605.00		2,346.92