



**PETROLEUM PRODUCTION AND
MARKETING
PETROLEUM MARKETING
NATURAL GAS TRANSMISSION LOSSES
2006 - ACTIVITY 22**

EMISSION INVENTORY CODES (EIC/CES CODES) AND DESCRIPTION:

Natural Gas Transmission Losses	330-318-0110-0000 (58685)
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DESCRIPTION:

This activity is used to compile evaporative emissions from the storage and transfer operations at gasoline dispensing facilities and bulk plants, gasoline cargo tanks, soil decontamination activities and fugitive emissions from transmission of processed natural gas from production facilities and its distribution to end-users. Emissions from gasoline dispensing facilities and bulk plants and soil decontamination operations are estimated by the district and described in separate methodology documents. The California Air Resources Board estimates emissions from gasoline Cargo Tanks. This methodology document describes procedures used to estimate emissions from natural gas transmission losses.

METHODOLOGY:

The 2006 methodology represents a departure from the previous methodology, developed by South Coast AQMD, which relied on total natural gas consumption and a composite 0.12% fugitive loss rate (Reference 1). The new emission estimation technique is modeled after a San Joaquin Valley Unified APCD (SJVUAPCD) method "Emission Inventory Methodology 330 Natural Gas Transmission Losses" (Reference 2). The SJVUAPCD method is based on an approach developed by the EPA Emission Inventory Improvement Program (EIIP) to estimate methane emissions from natural gas and oil systems in "Volume VIII Chapter 5 Methods for Estimating Methane Emissions from Natural Gas and Oil Systems" August 2004 (Reference 3), and modified by Sonoma Technology, Incorporated (STI) to estimate ROG emissions for the Central California Ozone Study (CCOS) in attachment H "Petroleum Marketing" (Reference 4). The 2006 methodology is a component population based approach, and depends on natural gas *transmission system* miles of pipeline and number of natural gas processing facilities and *distribution system* miles of pipeline and number of service connections by material type. U.S. Department of Transportation Office of Pipeline Safety (OPS) statewide transmission and distribution system pipeline and service connection data (Reference 5) were allocated to the county level on the basis of housing obtained from the California Department of Finance (Reference 6). Although the SJVUAPCD/EIIP/STI method utilizes county pipeline miles to allocate state transmission pipeline mileage to the local level, housing was used here due to the unavailability of county pipeline mileage data. The number of transmission system facilities (compressor stations and gas storage fields) is based on information from the U.S. Department of

Energy Information Administration (Reference 7) and STI. Natural gas transmission system gathering and transmission pipeline miles and natural gas transmission facilities, and distribution system pipeline miles and service connections are shown in Table 1.

Emission factors from the EPA/EIIP State Inventory Tool (SIT) for Natural Gas and Oil Systems developed in October 2007 (Reference 8) were used to estimate annual metric tons of methane emissions. Total Organic Gas (TOG) annual emissions in tons/year are estimated by converting annual metric tons of methane to tons/year and dividing by the methane fraction from CARB's organic profile #520 for composite natural gas, 93.7% (Reference 9). ROG emissions are determined by multiplying TOG emissions by the reactive fraction (FROG = 0.0120) from organic profile #520.

The resulting ROG emission estimate from natural gas transmission losses is 81.9 tons/year, shown in Table 1. The process rate for the natural gas transmission loss area source category in CARB's CEIDARS2.5 database is expressed in units of million cubic feet processed. Total natural gas usage in Ventura County for 2006 was 38,592.4 million cubic feet, based on data from the California Energy Commission for residential, commercial and industry sectors (Reference 10) and electric generation sector (Reference 11) and Southern California Gas Company for Natural Gas Vehicles (Reference 12). The TOG emission factor is derived by dividing total TOG emissions by 2006 county-wide natural gas consumption.

TEMPORAL DISTRIBUTION:

Daily: Uniform activity 24 hours a day.

Weekly: Uniform activity seven days a week.

Annual:

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3

SPATIAL DISAGGREGATION: Population.

GROWTH PARAMETER: Population.

ORGANIC REACTIVE FRACTION: 0.0120 (Profile Number 520)

2006 PROCESS RATE: (million cubic feet processed)

Annual
38,592.4

EMISSION FACTORS: (pounds per million cubic feet processed)

<u>TOC</u>	<u>ROC</u>
353.846	4.246

2006 NATURAL GAS DISRIBUTION EMISSIONS:

	<u>TOC</u>	<u>ROC</u>
Planning (tons/day):	18.63	0.22
Annual (tons/year):	6,827.9	81.93

ASSUMPTIONS:

1. Fugitive natural gas transmission TOG and ROG emissions can be estimated based on miles of natural gas pipeline, number of service components and number of natural gas transmission facilities.
2. Statewide miles of transmission and distribution pipeline and service components can be allocated to the county level based on the ratio of county to state housing.
3. Natural gas transmission methane emissions can be used to estimate TOG and ROG emissions based on CARB's organic profile for composite natural gas.
4. Emission factors can be derived from pollutant emissions and the total county-wide natural gas consumption.

REFERENCES:

1. South Coast Air Quality Management District, Area Source Methodology "Area Source Emissions for C/Y 1995 from Natural Gas Transmission Losses in the SCAQMD Air Basins", July 1999.
2. San Joaquin Valley Unified Air Pollution Control District Emission Inventory Methodology 330 –“Natural Gas Transmission Losses” (December 2006).
3. EPA/EIIP Technical Report Series Volume 8 Estimating Greenhouse Gas Emissions, Chapter 5 "Methods for Estimating Methane Emissions from Natural Gas and Oil Systems (August 2004).
4. Sonoma Technology, Inc (STI), Central California Ozone Study, attachment H "Petroleum Marketing" (2002).
5. U.S. Department of Transportation Office of Pipeline Safety Natural Gas Distribution and Transmission Systems Data for 2006 (October 2007).
6. California Department of Finance, Table 1: E-5 County/State Population and Housing Estimates, 10/03/2007.
7. U.S. Department of Energy Energy Information Administration Form 191 "Underground Storage Report" (October 2007).
8. EPA/EIIP State Inventory Tool for Estimating Methane Emissions from Natural Gas and Oil Systems (October 2007).

9. California Air Resources Board, Organic Profile #520 "Composite Natural Gas".
10. Andrea Gough, California Energy Commission; Ventura County Natural Gas Consumption in 2006, October 1, 2007.
11. Michael Nyberg, California Energy Commission; Ventura County 2006 Natural Gas Usage EG, October 19, 2007.
12. Steve Simons, Southern California Gas Company; 2006 Natural Gas Usage by End User Group, 10/3/2007.

Table 1 2006 Natural Gas Transmission and Distribution Loss Emissions

Emission Source	Number in Ventura County	Units	Source Estimate	Ref	Emission Factor metric tons CH ₄ (7)	CH ₄ metric tons/year	TOG tons/year	ROG tons/year
Transmission System Emissions								
Compressor Stations	1.0	stations	STI 2002	1	984	983.66	1,157.20	13.89
LNG Storage Stations	0.0	stations	STI 2002	1	1185	0.00	0.00	0.00
Underground Gas Storage Fields	0.0	fields	U.S. DOE/EIA 2005	2	964	0.00	0.00	0.00
Transmission Pipeline ^a	259.2	miles	U.S. DOT OPS 2006	3	0.62	160.32	188.61	2.26
Gathering Pipeline ^a	14.7	miles	U.S. DOT OPS 2006	3	0.40	5.90	6.94	0.08
Distribution System Emissions								
Steel Unprotected Main Pipeline	203.3	miles	U.S. DOT OPS 2006	3	2.12	431.35	507.45	6.09
Steel Protected Main Pipeline	946.9	miles	U.S. DOT OPS 2006	3	0.06	56.86	66.89	0.80
Plastic Main Pipeline	1,055.7	miles	U.S. DOT OPS 2006	3	0.37	392.34	461.56	5.54
Cast Iron Main Pipeline	4.7	miles	U.S. DOT OPS 2006	3	5.80	27.04	31.81	0.38
Service Connection Emissions								
Unprotected Steel	22,945.5	services	U.S. DOT OPS 2006	3	0.033	751.47	884.05	10.61
Protected Steel	50,974.5	services	U.S. DOT OPS 2006	3	0.003	173.35	203.94	2.45
Total Connections	184,818.0	services	U.S. DOT OPS 2006	3	0.015	2,821.64	3,319.45	39.83
Total Emissions						5,803.93	6,827.90	81.93
Annual Natural Gas Throughput ^b	38,592.4	mmcf	CEC 2007, SCG 2007	4,5				
CEIDARS2.5 TOG Emission Factor	353.846	lbs/mmcf		6				

References

- 1 Sonoma Technology, Inc (STI), Central California Ozone Study, attachment H "Petroleum Marketing" (2002).
2. U.S. Department of Energy Energy Information Administration Form 191 "Underground Storage Report" (October 2007).
3. U.S. Department of Transportation Office of Pipeline Safety Natural Gas Distribution and Transmission Systems Data for 2006 (October 2007).
4. California Energy Commission Natural Gas Consumption by Sector for Ventura County (October 2007).
5. Southern California Gas Natural Gas Consumption by End-User Group (October 2007).
6. CARB Organic Profile #520 "Composite Natural Gas".
7. EPA/EIIP State Inventory Tool for Estimating Methane Emissions from Natural Gas and Oil Systems (October 2007).

Notes

^a allocation based on housing instead of pipeline length.

^b Total natural gas consumption = (CEC October 2007) + Natural Gas Vehicles (So Cal Gas October 2007).

TOG = (CH₄*metric ton conversion factor)/CH₄ fraction.

ROG = TOG*reactive fraction.

tons/metric ton conversion factor = 1.102311.

CH₄ fraction of natural gas CARB Organic Profile # 520 "Composite Natural Gas" = 0.937.

Reactive Fraction of natural gas CARB Organic Profile #520 "Composite Natural Gas" = 0.012.