



2006 Area Source Emissions Inventory Methodology

030 – FUEL COMBUSTION OIL & GAS PRODUCTION

I. Purpose

This document describes the Area Source Methodology used to estimate emissions of carbon monoxide (CO), nitrogen oxides (NO_x), fine particulate matter less than 10 microns (PM₁₀), volatile organic compounds (VOC) and sulfur oxides (SO_x) from internal combustion engines at oil and gas production facilities using gaseous (natural gas, propane) and liquid (gasoline) fuel in the San Joaquin Valley Air Basin. An area source category is a collection of similar emission units within a geographic area (i.e., a County). An area source category collectively represent individual sources that are small and numerous, and that may not have been inventoried as specific point, mobile, or biogenic sources. The California Air Resources Board (CARB) has grouped these individual sources with other like sources into area source categories. These source categories are grouped in such a way that they can be estimated collectively using one methodology

II. Applicability

The emission calculations from this Area Source Methodology apply to facilities that are identified by the following Category of Emission Source (CES) codes and Reconciliation Emission Inventory Codes (REIC):

Table 1. Emission inventory codes.

CES	REIC	Description
82081	30-040-0100-0000	Petroleum Production Fuel Combustion – Gaseous Fuel
82073	30-040-1000-0000	Petroleum Production Fuel Combustion – Liquid Fuel*

*Excludes Stationary Engines – Diesel, which are reconciled to the 099 - Other Fuel Combustion category.

III. Point Source Reconciliation

Emissions from the area source inventory and point source inventory are reconciled against each other to prevent double counting. This is done using relationships created by the California Air Resources Board (ARB) between the area source REIC and the point sources' Standard Industry Classification (SIC) code and emissions process Source Category Code (SCC) combinations. The area sources in this methodology reconcile against processes in our point source inventory with the following SIC/SCC combinations :

Table 2. EIC, SCC and SIC codes in the District’s 2006 point source inventory that reconciled to REIC 030-040-0110-0000.

EIC	SCC	Point Source Type	SIC
030-040-0110-0000	20100202	INTERNLCOMBUSTION - ELECTRIC GENERATN - NATURAL GAS - RECIPROCATING	1311
	20200202	INTERNLCOMBUSTION - INDUSTRIAL - NATURAL GAS - RECIPROCATING	1311, 1321, 1389
030-040-0124-0000	20201001	INTERNLCOMBUSTION - INDUSTRIAL - PROPANE - RECIPROCATING	1311, 1389
030-045-0110-0000	20200201	INTERNLCOMBUSTION - INDUSTRIAL - NATURAL GAS - TURBINE	1321

Table 3. EIC, SCC and SIC codes in the District’s 2006 point source inventory that reconciled to REIC 030-040-1000-0000.

EIC	SCC	Point Source Type	SIC
030-040-1100-0000	20200301	INTERNLCOMBUSTION - INDUSTRIAL - GASOLINE - RECIPROCATING	1311, 1389

IV. Methodology Description

The purpose of this methodology is to estimate emissions from internal combustion engines at oil and gas production facilities in the District that use gaseous (natural gas, propane) or liquid (gasoline) fuels. Diesel-fired internal combustion engines are not included in this estimate as their emissions are included in a statewide inventory under EIC 099-040-1200-0000 (Stationary Engines – Diesel). The District permits all internal combustion engines located at oil and gas production facilities that are greater than 50 horsepower. Emissions from these permitted engines are reported each year through the District’s point source inventory. This methodology assumes emissions from the permit exempt engines are insignificant, and that all emissions for these source categories are reported through the point source inventory. Therefore, the area source emissions for these source categories are set to zero.

V. Activity Data

The activity data for each facility associated with these source categories is reported through the District’s point source inventory.

VI. Emission Factors

The emission factors for processes associated with these source categories are reported through the District’s point source inventory and are derived from continuous emission monitoring (CEMS) equipment, source tests, or approved emission factors.

VII. Emissions Calculations

A. Assumptions

All internal combustion engines located at oil and gas production facilities within the District are permitted, and data for each facility is collected annually through the point source inventory.

B. Sample Calculations

Not applicable.

VIII. Temporal Variation

The temporal data for the facilities associated with these source categories is reported through the District's point sources inventory.

IX. Spatial Variation

The spatial data for each facility associated with these source categories is reported through the District's point sources inventory.

X. Growth Factor

Growth factors are developed by either the District's Planning Department or CARB for each EIC. These factors are used to estimate emissions in future years. The growth factors associated with this emissions category may be obtained from the Air Quality Analysis Section of the District's Planning Department.

XI. Control Level

Control levels are developed by either the District's Planning Department or CARB for each EIC. Control levels are used to estimate emissions reductions in future years due to implementation of District rules. These control levels take into account the effect of control technology, compliance and exemptions at full implementation of the rules.

Emission units within this area source category may be subject to the following District Rules:

Table 4. District rules applicable to REIC 030-040-0100-0000 and 030-040-1000-0000.

Rule No.	Rule Description
4701	Internal Combustion Engines - Phase 1
4702	Internal Combustion Engines - Phase 2
4703	Stationary Gas Turbines

Control levels associated with these emissions categories may be obtained from the Air Quality Analysis Section of the District's Planning Department.

XII. ARB Chemical Speciation

CARB has developed organic gas profiles in order to calculate reactive organic gasses (ROG), volatile organic compounds (VOC) or total organic gas (TOG) given any one of the three values. For each speciation profile, the fraction of TOG that is ROG and VOC is given. The organic gas profile codes can also be used to lookup associated toxics. CARB's organic gas speciation profile for petroleum production liquid and gas-fired internal combustion engines are presented in Table 5.

Table 5. CARB organic gas speciation profiles for 030-040-0100-0000 and 030-040-1000-0000.

Profile Description	ARB Organic Gas Profile#	Fractions	
		ROG	VOC
Species unknown - all category composite	600	0.4222	0.4222

CARB has developed particulate matter speciation profiles in order to calculate particulate matter (PM), particulate matter with a diameter less than or equal to 10 microns (PM₁₀) or particulate matter with a diameter less than or equal to 2.5 microns (PM_{2.5}) given any one of the three values. For each speciation profile, the fraction of PM that is PM₁₀ and PM_{2.5} is given. The particulate matter profile codes can also be used to lookup associated toxics. CARB's organic gas speciation profile for petroleum production liquid and gas-fired internal combustion engines are presented in Table 6.

Table 6. CARB particulate matter speciation profiles for 030-040-0100-0000 AND 030-040-1000-0000.

Profile Description	ARB PM Profile#	Fractions	
		PM ₁₀	PM _{2.5}
Species unknown - all category composite	900	0.967	0.967

XIII. Assessment Of Methodology

This methodology assumes that all internal combustion engines operating at oil and gas production facilities are under district permit, and their emissions reported through the point source inventory. Since engines of 50 horsepower or less are exempt from permit, this assumption will result in an underestimation of emissions for these source categories. In CARB's 2002 statewide stationary diesel engine population and emissions estimate, engines of less than 50 horsepower accounted for 1.3% of the total NOx emissions (CARB, 2003). Assuming CARB's estimate of diesel engine population and emissions is representative of the population of engines in this methodology, this estimate may under represent NOx emissions by approximately 6 tons per year (0.016 tons per day). In 2006 the District passed Rule

2250 - Permit-Exempt Equipment Registration (PEER) to determine compliance of permit-exempt equipment with applicable rules and regulations. This registration database will be used in future updates of this category to more accurately estimate area source emissions.

XIV. Emissions

The area source emissions for REIC 030-040-0100-0000 and 030-040-1000-0000 have been set to zero. The 2006 total unreconciled (point source plus area source) emissions for these source categories is presented in the table below. The emissions are reported for each county in the District.

Table 7. Total emissions for petroleum production fuel combustion (2006).

County	Emissions (tons/year)				
	NO _x	CO	SO _x	VOC	PM ₁₀
PET. PROD. FUEL COMBUSTION - GASEOUS FUEL (030-040-0100-0000)					
Fresno	1.40	0.60	0.01	0.10	0.20
Kern	431.50	1,841.20	1.10	156.60	0.20
Kings	1.30	10.67	0.02	1.10	6.60
Madera	0.00	0.00	0.00	0.00	0.34
Merced	0.00	0.00	0.00	0.00	0.00
San Joaquin	0.50	21.50	0.10	0.20	0.40
Stanislaus	0.00	0.00	0.00	0.00	0.00
Tulare	0.00	0.00	0.00	0.00	0.00
TOTAL	434.70	1,873.97	1.23	158.00	7.74
PET. PROD. FUEL COMBUSTION - LIQUID FUEL (030-040-1000-0000)					
Fresno	0.00	0.00	0.00	0.00	0.00
Kern	0.00	0.00	0.00	0.00	0.00
Kings	0.00	0.00	0.00	0.00	0.00
Madera	0.00	0.00	0.00	0.00	0.00
Merced	0.00	0.00	0.00	0.00	0.00
San Joaquin	0.00	0.00	0.00	0.00	0.00
Stanislaus	0.00	0.00	0.00	0.00	0.00
Tulare	0.00	0.00	0.00	0.00	0.00
TOTAL	0.00	0.00	0.00	0.00	0.00

- (1) The District only reports ROG to ARB. As noted in Section XII, ROG is the same as VOC.
- (2) At this time, the District does not calculate PM_{2.5} emissions. PM_{2.5} emissions can be estimated using the speciation profiles found in Section XII.

The 2005 emissions inventory data was obtained from ARB’s CEIDARS database and the table below presents the net change in total unreconciled emissions between this update (2006 inventory year) and the previous year’s inventory (2005).

Table 8. Net change in emissions for petroleum production fuel combustion emissions (2006-2005).

County	Emissions (tons/year)				
	NOx	CO	SOx	VOC	PM ₁₀
PET. PROD. FUEL COMBUSTION - GASEOUS FUEL (030-040-0100-0000)					
Fresno	-531.67	-1,720.36	-1.00	-22.86	-11.36
Kern	-1,576.34	-600.21	-3.23	-2,787.12	-47.68
Kings	1.30	10.67	0.02	1.10	6.60
Madera	0.00	0.00	0.00	0.00	0.34
Merced	0.00	0.00	0.00	0.00	0.00
San Joaquin	-9.11	10.40	0.10	-17.66	0.40
Stanislaus	0.00	0.00	0.00	0.00	0.00
Tulare	0.00	0.00	0.00	0.00	0.00
TOTAL	-2,115.82	-2,299.5	-4.11	-2,826.54	-51.70
PET. PROD. FUEL COMBUSTION - LIQUID FUEL (030-040-1000-0000)					
Fresno	0.00	0.00	0.00	0.00	0.00
Kern	0.00	0.00	0.00	0.00	0.00
Kings	0.00	0.00	0.00	0.00	0.00
Madera	0.00	0.00	0.00	0.00	0.00
Merced	0.00	0.00	0.00	0.00	0.00
San Joaquin	0.00	0.00	0.00	0.00	0.00
Stanislaus	0.00	0.00	0.00	0.00	0.00
Tulare	0.00	0.00	0.00	0.00	0.00
TOTAL	0.00	0.00	0.00	0.00	0.00

(3) The District only reports ROG to ARB. As noted in Section XII, ROG is the same as VOC.

(4) At this time, the District does not calculate PM_{2.5} emissions. PM_{2.5} emissions can be estimated using the speciation profiles found in Section XII.

XV. Revision History

2006. This is a new District methodology.

XVI. Update Schedule

In an effort to provide inventory information to ARB and other District programs and maximize limited resources, the District has developed an update cycle based on emissions within the source category as shown in Table 9.

Table 9. Area source update frequency criteria.

Total Emissions (tons/day)	Update Cycle (years)
<1	4
>1 and <= 2.5	3
>2.5 and <=5	2
>5	1

Since carbon monoxide emissions from these source categories are greater than 5 ton per day, they will be updated every year.

Table 10. Resource Recovery Area Source Methodology Update Frequency

EIC	Frequency (years)	Source of Emissions (Point Source Inventory / Data Gathering)
030-040-0100-0000	1	Point Source Inventory
030-040-1000-0000	1	Point Source Inventory

XVII. References

1. California Air Resources Board. 2003. Section 1.2: Stationary diesel engines (non-agricultural engines). <http://www.arb.ca.gov/ei/areasrc/FULLPDF/FULL1-2.pdf>.
2. California Department of Conservation, Division of Oil, Gas & Geothermal Resources. Annual report of California oil and gas production. <http://www.consrv.ca.gov/DOG>