San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

2009 Area Source Emissions Inventory Methodology
199 – VOLATILE ORGANIC WASTE DISPOSAL - EVAPORATION

I. Purpose

This document describes the Area Source Methodology used to estimate volatile organic compound (VOC) and ammonia (NH_3) emissions from liquid waste disposal impoundments, primarily Publicly Owned Treatment Works (POTWs), in the San Joaquin Valley Air Basin. An area source is a collection of similar emission units within a geographic area (ie., a County). Area sources 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) code and Reconciliation Emission Inventory Code (REIC):

Table 1. Emission inventory codes.

CES	REIC	Description
82065	199-190-0300-0000	Volatile Organic Waste Disposal (Evaporation)

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. Point source reconciliation relationships for REIC 199-190-0300-0000.

EIC	SIC	SCC	Point Source Type
199-190-0300-0000	4952	50300801	POTW Surface Impoundments

IV. Methodology Description

Each waste water treatment facility (WWTF) has a unique combination of collection and treatment devices that is specific to the properties of wastewater that is received. The majority of fugitive emissions from WWTF s comes from volatilization of volatile organic compounds and ammonia at the surface of the liquid, in other words, when the liquid is exposed to the ambient air. This methodology estimates fugitive emissions from both publicly and privately owned waste water treatment facilities by applying emission factors to the annual influent of facilities in the San Joaquin Valley Air Basin (SJVAB).

V. Activity Data

A list of WWTFs within the District was obtained from the California Environmental Protection Agency, State Water Resources Board (2010). Their database included the design flow of each facility. A list of facilities within the District is provided in Appendix A.

VI. Emission Factors

The ammonia emission factor for WWTFs was obtained from documentation for the 2002 National Emissions Inventory (EPA, 2002). The VOC emission factor was derived from source tests conducted at the Oxnard, CA WWTF (Ventura Co., 1994). The following data elements and assumptions were used to develop an emission factor:

- VOC concentration in the wastewater is 90.4 µg/L (from the Oxnard source test data).
- We assume that all VOC measured is emitted.
- The density of the wastewater is 1,000 g/L.

The emission factor is calculated as follows:

$$\frac{lb\,VOC}{1{,}000{,}000\ gal\ \ flow} = \left[\frac{90.4\ \mu g}{1\ L}\right] x \left[\frac{1\ lb}{453{,}592{,}370\ \ \mu g}\right] x \left[\frac{3{,}785{,}411.78\ \ L}{1{,}000{,}000\ gal}\right]$$

$$\frac{lb\,VOC}{1{,}000{,}000\ gal\ \ flow} = 0.754$$

Table 3. POTW emission factors.

Pollutant Name	Emission Factor (lb/MMGal)
Volatile Organic Compound (VOC)	0.754
Ammonia (NH_3)	0.169

Note: lb = pounds; MMGal = millions of gallons

VII. Emissions Calculations

A. Assumptions

- Facilities receive wastewater seven days per week, 52 weeks per year.
- POTW design flow as reported in the California Department of Water Resources database is representative of their actual flow for 2009.
- VOC is emitted at a rate of 0.754 pounds per million gallons of wastewater received.
- Ammonia is emitted at a rate of 0.169 pounds per million gallons of wastewater received.

B. Sample Calculations

Step 1. Multiply the design flow for the waste water treatment facility by the VOC emission factor:

$$E_{VOC\ lb\ d}^{-1} = EF_{VOC\ lb\ mgd}^{-1} \times V_{mgd}$$

where:

$E_{VOC\ lb\ d}^{-1}$ = *VOC emissions, pounds per day*
$EF_{VOC\ lb\ mgd}^{-1}$ = *VOC emission factor, pounds per million gallons of waste*
V_{mgd} = *volume of waste water processed, millions of gallons per day*

Example:

Given that the a facility in Fresno County has a design flow of 1.2 mgd:

$E_{VOC\ lb\ d}^{-1} = 0.754\ lb\ VOC\ mg^{-1} \times 1.2\ mgd$
$E_{VOC\ lb\ d}^{-1} = 0.9\ lb\ VOC\ per\ day$

Step 2. Convert the emissions from pounds per day to tons per year:

$$E_{VOC\ tons\ y^{-1}} = E_{VOC\ lb\ d^{-1}} \times \frac{365\ days}{1\ year} \times \frac{1\ ton}{2{,}000\ pounds}$$

where:

$E_{VOC\ tons\ y}^{-1}$ = *VOC emissions, tons per year*
$E_{VOC\ lb\ d}^{-1}$ = *VOC emissions, pounds per day*

Example:

$$E_{VOC\ tons\ y^{-1}} = 0.9\ pounds\ VOC\ per\ day\ x\ \frac{365\ days}{1\ year}\ x\ \frac{1\ ton}{2{,}000\ pounds}$$

$$E_{VOC\ tons\ y^{-1}} = 0.16\ tons\ per\ year$$

VIII. Temporal Variation

A. Daily

ARB Code 24. 24 hours per day - uniform activity during the day.

B. Weekly

ARB Code 7. 7 days per week - uniform activity every day of the week

C. Monthly

Uniform monthly activity: 8.33% per month

IX. Spatial Variation

The location of waste water treatment facilities is reported by the State Water Board. Within each county, emissions should be allocated to grid cells containing waste water treatment facilities.

X. Growth Factor

Growth factors are developed by either the District's Strategies and Incentives 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 District's Strategies and Incentives Department.

XI. Control Level

Control levels are developed by either the District's Strategies and Incentives 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.

Fugitive VOC emissions from waste water treatment facilities are not subject to source specific prohibitory rules. Control levels associated with this emissions category may be obtained from the District's Strategies and Incentives 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 speciation profile for wastewater treatment plants is presented in the following table:

Table 4. CARB organic gas speciation profile for wastewater treatment plants.

Profile Description	ARB Organic Gas Profile#	Fractions	
		ROG	VOC
POTW Wastewater Treatment, AB2588 Data, US EPA 50% unidentified	1402	0.566	0.566

XIII. Assessment Of Methodology

EPA's preferred method for estimating emissions from wastewater treatment and collection system is the use of a computer based model such as Water9 (EPA, 1997). However, these models require specific information about the chemical and physical properties of the waste, and the configuration of the collection and treatment devices for each plant to be modeled. Due to these data requirements, the District chose EPA's alternate method which is the use of an emission factor.

In the future, this estimate could be improved by incorporating more site specific information, such as source test data to refine the emission factors, and confirm the annual throughput of each facility.

XIV. Emissions

Following is the 2009 area source emissions inventory for REIC 199-190-0300-0000 estimated by this methodology. Emissions are reported for each county in the District.

Table 5. Area source emissions for REIC 199-190-0300-0000 (2009).

County	Criteria Emissions (tons/year)						Toxic Emissions (lbs/yr)
	NOx	CO	SOx	VOC[(1)]	PM_{10}	$PM_{2.5}$	NH_3
Fresno	--	--	--	19.08	--	--	7,588
Kern	--	--	--	10.23	--	--	4,069
Kings	--	--	--	2.83	--	--	1,126
Madera	--	--	--	1.90	--	--	756
Merced	--	--	--	4.56	--	--	1,813
San Joaquin	--	--	--	15.05	--	--	5,985
Stanislaus	--	--	--	26.05	--	--	10,360
Tulare	--	--	--	7.91	--	--	3,144
TOTAL	--	--	--	87.61	--	--	34,841

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

Following is the 2009 point source emissions inventory for REIC 199-190-0300-0000 as reported to the District by our permit holders. Emissions are reported for each county in the District.

Table 6. Point source emissions for REIC 199-190-0300-0000 (2009).

County	Criteria Emissions (tons/year)						Toxic Emissions (lbs/yr)
	NOx	CO	SOx	VOC[(1)]	PM_{10}	$PM_{2.5}$	NH_3
Fresno	--	--	--	0.00	--	--	0
Kern	--	--	--	0.00	--	--	0
Kings	--	--	--	0.50	--	--	0
Madera	--	--	--	0.00	--	--	0
Merced	--	--	--	0.00	--	--	0
San Joaquin	--	--	--	0.00	--	--	0
Stanislaus	--	--	--	0.00	--	--	0
Tulare	--	--	--	0.00	--	--	0
TOTAL	--	--	--	0.50	--	--	0

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

Following is the 2009 total unreconciled (point source plus area source) emissions inventory for REIC 199-190-0300-0000. Emissions are reported for each county in the District.

Table 7. Total unreconciled (point source plus area source) emissions for REIC 199-190-0300-0000 (2009).

County	Criteria Emissions (tons/year)						Toxic Emissions (lbs/yr)
	NOx	CO	SOx	VOC[(1)]	PM_{10}	$PM_{2.5}$	NH_3
Fresno	--	--	--	19.08	--	--	7,588
Kern	--	--	--	10.23	--	--	4,069
Kings	--	--	--	3.33	--	--	1,126
Madera	--	--	--	1.90	--	--	756
Merced	--	--	--	4.56	--	--	1,813
San Joaquin	--	--	--	15.05	--	--	5,985
Stanislaus	--	--	--	26.05	--	--	10,360
Tulare	--	--	--	7.91	--	--	3,144
TOTAL	--	--	--	88.11	--	--	34,841

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

Following is the net change in total unreconciled emissions between this update (2009 inventory year) and the previous update (2008 inventory year) for REIC 199-190-0300-0000. The change in emissions are reported for each county in the District.

Table 8. Net emissions change for REIC 199-190-0300-0000 (2009-2008).

County	Criteria Emissions (tons/year)						Toxic Emissions (lbs/yr)
	NOx	CO	SOx	VOC[(1)]	PM_{10}	$PM_{2.5}$	NH_3
Fresno	--	--	--	-26.58	--	--	7,588
Kern	--	--	--	-16.61	--	--	4,069
Kings	--	--	--	3.33	--	--	1,126
Madera	--	--	--	-2.31	--	--	756
Merced	--	--	--	-4.32	--	--	1,813
San Joaquin	--	--	--	-20.28	--	--	5,985
Stanislaus	--	--	--	2.24	--	--	10,360
Tulare	--	--	--	-13.11	--	--	3,144
TOTAL	--	--	--	-77.64	--	--	34,841

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

XV. Revision History

2010. This is a new District methodology.

XVI. Update Schedule

In an effort to provide needed information to CARB and other District departments and to maximize the limited resource available, the following criteria are used by the District to determine the appropriate update cycle for each area source methodology.

Table 9. District area source update frequency criteria.

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

Based upon these criteria, this area source category will be updated every four years.

XVII. References

1. California Environmental Protection Agency, State Water Resources Board. 2007. All active regulated publicly owned treatment works (POTW). Online database accessed October 11, 2007 at http://www.waterboards.ca.gov/swim/index.html.

2. Environmental Protection Agency. 1995. Waste water collection, treatment and storage. *In*: Compilation of Air Pollutant Emission Factors, Vol. 1: Stationary Point and Area Emission Units (AP-42), 5th ed. (January 1995), Chapter 4.3. Report prepared by Office of Air Quality Planning and Standards of the EPA, Research Triangle Park, NC.

3. Environmental Protection Agency. 1997. Preferred and alternative methods for estimating air emissions from wastewater collection and treatment. *In*: Emission inventory improvement program volume II, chapter 5. Final report prepared by the Eastern Research Group for the Point Sources Committed of the Emission Inventory Improvement Program.

4. Environmental Protection Agency. Factor information retrieval (FIRE) program. Version 6.23.

5. Pechan, E.H. and Associates. 2006. Appendix A - Publicly owned treatment works (POTW). *In*: Documentation for the final 2002 nonpoint sector (Feb 06 version) national emission inventory for criteria and hazardous air pollutants, appendix A. Report prepared for the Emissions Inventory And Analysis Group, Air Quality Assessment Division, U.S. EPA. EPA contract 68-D-02-063.

6. Ventura County. 1994. CES 47084 - Wastewater treatment plant.

XVIII. Appendices

Appendix A. District Waste Water Treatment Facilities

Appendix A. District Waste Water Treatment Facilities

Table 10. Waste water treatment facilities located within the San Joaquin Valley Air Pollution Control District.

County	Facility Name	WDID
Fresno	Big Creek School WWTF	5C101002001
	Biola WWTF	5D100100001
	Clovis WWTF	5C10NP00012
	Clovis WWTF	5C10NP00012
	Coalinga WWTF	5D100101001
	Coalinga-Avenal Roadside Rest	5D100804003
	Del Rey WWTF	5D100128003
	Elkhorn Correctional Facility	5D100106003
	Firebaugh WWTF	5C100103001
	Foothill Middle School WWTF	5C101109001
	Fresno Co #1-Tamarack Estates WWTF	5C101012001
	Fresno Co #30-El Porvenir WWTF	5D100102001
	Fresno Co #31b-Shaver Lake WWTF	5C100106004
	Fresno Co #32-Cantua Creek WWTF	5D100102002
	Fresno Co #34-Millerton New Town WWTF	5C100106003
	Fresno Co #38-Sky Harbour WWTF	5SSO11288
	Fresno Co #40-Shaver Springs WWTF	5SSO11290
	Fresno Co #41-Shaver Lake WWTF	5C100106002
	Fresno Co #44a-Millerton Lake MHV WWTF	5C101017001
	Fresno Co #44-D Monte Verde Estates WWTF	5D100139001
	Fresno Co #47-Quail Lake WWTF	5SSO11289
	Fresno Regional WWTF	5D100105001
	Huron WWTF	5D100107001
	Kerman WWTF	5D100108001
	Lassen Ave Roadside Rest	5D100804001
	Laton WWTF	5D100123001
	Malaga CWD WWTF	5D100124001
	Mendota WWTF	5D100109001
	Millerton Lake State Recreation Area	5C100800001
	Miramonte Conservation Camp	5D100802001
	North Fresno WWTF	5D101129001
	Orange Cove WWTF	5D100110001
	Parlier WWTF	5D100118001
	Pleasant Valley State Prison WWTF	5D100805001
	Reedley WWTF	5C10NC00167
	Riverdale WWTF	5D100114001
	San Joaquin WWTF	5D100116001
	Sanger WWTF	5D100115001
	Sierra High School WWTF	5C101003001

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County	Facility Name	WDID
Fresno	SKF CSD WWTF	5D100104001
	Tranquility WWTF	5D100117001
Kern	Arvin WWTF	5D150107001
	Bakersfield WWTP #2	5D150100001
	Bakersfield WWTP #3	5D150100002
	Buttonwillow WWTF	5D150101001
	Delano WWTF	5D150102001
	Five And Forty Six WWTF	5D151024001
	Kern Co CSA 30.2 Tract 3902	5D150120001
	Kern Co CSA 39.8-Reeder Tract WWF	5D150303029
	Kern Co CSA 39-Zone 2	5D150303020
	Kern Co CSA 40-Pine Mountain Club	5D150103001
	Kern Co CSA 51 Los Padres Estates	5D151002001
	Kern Co CSA 54 Tract 3707	5D151086001
	Kern Co CSA 54 Tracts 3906-3909	5D150121001
	Kern Co Csa 56 Tract 3848	5D151089001
	Kern Co Csa 58 Tracts 3619, 3620, 3964	5D151053001
	Kern Co CSA 71.3 Tract 3695	5D151022001
	Kern Co Sheriff`S Lerdo WWTF	5D150106001
	Kern Sanitation Authority WWTF	5D150105001
	Kern Valley State Prison	5C15NC00056
	Lamont WWTF	5D150108001
	Lebec SRRA (Tejon Pass)	5D150801001
	Lost Hills WWTF	5D150114001
	Maricopa WWTF	5D150123001
	McFarland WWTF	5D150109001
	North Of River WWTF	5D150129001
	Shafter Airport WWTF	5D150104001
	STOCO WWTF	5D152000001
	Taft Federal Prison WWTF	5D150115002
	Taft WWTF	5C15NC00095
	Tehachapi Correctional Institution WWTF	5D150803001
	Tejon Industrial Complex WWTF	5D151014003
	Wasco State Prison WWTF	5D150803003
	Wasco WWTF	5D150117001

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County	Facility Name	WDID
Kings	Armona CSD WWTF	5D160100001
	Avenal WWTF	5D160101001
	Corcoran State Prison WWTF	5D160801001
	Corcoran WWTF	5D160102001
	Hanford WWTF	5D160103001
	Kettleman City WWTF	5D160109001
	Lemoore NAS WWTF	5D160700001
	Lemoore WWTF	5D160104001
	Stratford WWTF	5D160105001
Madera	CDC CCWF & VSP WWTF	5C200800001
	Chowchilla WWTF	5C200100001
	Eastman Lake Admin Area	5B20NC00005
	Eastman Lake Chowchilla Rec	5C20NC00004
	Eastman Lake Cordoniz Rec	5C20NC00005
	Hensley Lake	5C200701001
	Liberty High School WWTF	5C200702001
	Madera Co #14-Chukchanse WWTF	5C200103001
	Madera Co #19-Parkwood WWTF	5C200102005
	Madera Co #22a-Oakhurst WWTF	5C200102006
	Madera Co #24 Teaford Meadow Lakes WWTF	5C200102007
	Madera Co #27-Goldside Estates WWTF	5C200102003
	Madera Co #28 Ripperdan WWTF	5C201005001
	Madera Co #2-Bass Lake WWTF	5C200102001
	Madera Co #37-La Vina WWTF	5C200102010
	Madera Co #6-Lake Shore Park WWTF	5C200102002
	Madera Co #7 Marina View Heights WWTF	5C200102009
	Madera Co #8a-North Fork WWTF	5C200102004
	Madera WWTF	5C200101001

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County	Facility Name	WDID
Merced	Atwater WWTF	5C240100001
	Barret Cove	5C220100001
	Delhi WWTF	5C240101001
	Dos Palos WWTF	5C240102001
	Fox Hills WWTF	5C240117001
	Franklin WWTF	5C240109001
	Gustine WWTF	5C240103002
	Hilmar CWD WWTF	5C240104002
	Horseshoe Bend Rec Area	5C220100004
	Le Grand WWTF	5C240105001
	Livingston Domestic WWTF	5C240106002
	Los Banos WWTF	5C240107001
	Mc Swain Rec Area	5C220100003
	McClure Point Rec Area	5C220100002
	Merced & Los Banos Family Centers	5C240114001
	Merced WWTF	5C240108001
	Planada WWTF	5C240110001
	Romero Overlook	5C240800003
	San Luis Hills WWTF	5C240116001
	San Luis Pump And Gen Plant	5C240701001
	San Luis Rec Area/Basalt Camp	5C240801004
	San Luis State Rec Area	5C240801003
	Sandy Mush WWTF	5C240109003
	Santa Nella WWTF	5C240113001
	Snelling WWTF	5C240111001

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County	Facility Name	WDID
San Joaquin	Apricot Acres WWTF, Csa 44, Zone E	5B39NC00005
	City Of Lathrop Water Recycling Plant (WRP)	5B39NC00042
	Csa 15 - Stp	5B391008002
	Ddjc, Tracy - WWTP, Stormwater	5B390701004
	Deuel Vocational Institution	5B390100001
	Escalon Treatment Plant	5B390101001
	Lathrop Industrial WWTP	5B391076001
	Linden Co Water Dist Wtf	5B390111001
	Linne Estates WWTF	5B39NC00035
	Lockeford CSD WWTP	5B390102002
	Manteca Wastewater Quality Control Facility	5B390104001
	Migrant Housing, Harney Ln	5B390106002
	Mountain House WWTP - 1	5B391078003
	Oakwood Lake WWTP	5B391070001
	Ripon Industrial & Domestic TP	5B390105001
	Stockton STP-Main Plant	5B390107001
	Thornton Farm Labor Camp	5B390112001
	Tracy WWTP	5B390108001
	Tracy WWTP	5B39NC00164
	White Slough Water Pollution Control Facility	5B390103002
	Woodbridge Sd-Sewage Treatment	5B390109001
Stanislaus	Ceres WWTP	5C500100001
	Del Rio East HOA WWTP	5B50NC00018
	Grayson Community Service Dist WTF	5C500110001
	Hughson WWTF	5C500101002
	Modesto Reservoir WWTP	5C500112003
	Modesto Water Quality Control Facility	5C500102001
	Modesto Wqcf WW Land Disposal	5C500102005
	Newman WWTF	5C500103001
	Oakdale WWTF	5C500104001
	Patterson WWTF	5B50NC00002
	Riverbank WWTP	5C500106002
	Salida WWTP	5C500107001
	Stanislaus County Sheriff Laird Park Honor Farm	5C500112002
	Turlock WWTP	5C500108001
	Waterford WWTP	5C500113001
	Westley Community Sewage Treatment Facility	5C500111001
	Woodward Reservoir Regional Park	5C500112001

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County	Facility Name	WDID
Tulare	Ash Mountain WWTF	5D541003004
	Buckeye WWTF	5D541003001
	Cedar Grove WWTF	5D540700002
	Clover Cr WWTF	5D541003003
	Col Allensworth State Historic Park	5D540700003
	Cutler-Orosi WWTF	5D540132001
	Delft Colony WWTF	5D540136004
	Dinuba WWTF	5D540101001
	Earlimart WWTF	5D540102001
	Exeter WWTF	5D540103001
	Farmersville WWTF	5D540117001
	Grant Grove WWTF	5D540700001
	Ivanhoe WWTF	5D540104001
	Lake Kaweah/Terminus Dam	5D540701001
	Lemon Cove WWTF	5D540118001
	Lindsay WWTF	5D540105001
	Linnell Farm Labor Center	5D541012001
	London WWTF	5D540119001
	Mtn Home Conservation Camp	5C54NC00299
	Philip S Raine SRRA	5D540801001
	Poplar WWTF	5D540137001
	Porterville Nuckols Reclamation Project	5D540133001
	Porterville WWTF	5D540107001
	Richgrove WWTF	5D541024001
	Sequoia Dawn Farm Labor Center	5D540112001
	Sequoia Field WWTF	5D540135001
	Springville WWTF	5D540130001
	Strathmore WWTF	5D540108001
	Success Reservoir Campground	5D540112004
	Terra Bella WWTF	5D540109001
	Tipton WWTF	5D540116001
	Tooleville WWTF	5D540136001
	Traver WWTF	5D540136003
	Tulare WWTF	5D540110001
	Upper Sherman Tree OWTS	5C54NC00167
	Visalia WWTF	5D540113001
	Woodlake Sentinel Butte Recycling Project	5B54WR00001
	Woodlake WWTF	5D540114001
	Woodville Farm Labor Center	5D540112003
	Woodville WWTF	5D540115001