

**Appendix III-A**  
**Air Quality Modeling for Jaxon Enterprises**  
**Asphalt Oil Facility**

## Urbemis 2007 Version 9.2.4

## Combined Annual Emissions Reports (Tons/Year)

File Name:

Project Name: Jaxon Enterprises Asphalt Oil Facility

Project Location: Madera County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

## CONSTRUCTION EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
2011 TOTALS (tons/year unmitigated)	0.12	0.99	0.55	0.00	0.45	0.05	0.50	0.09	0.05	0.14	98.68
2011 TOTALS (tons/year mitigated)	0.12	0.99	0.55	0.00	0.03	0.05	0.08	0.01	0.05	0.05	98.68
Percent Reduction	0.00	0.00	0.00	0.00	92.99	0.00	83.86	92.96	0.00	62.85	0.00
2012 TOTALS (tons/year unmitigated)	0.59	0.68	0.55	0.00	0.15	0.04	0.19	0.03	0.04	0.07	92.72
2012 TOTALS (tons/year mitigated)	0.58	0.68	0.55	0.00	0.01	0.04	0.05	0.00	0.04	0.04	92.72
Percent Reduction	2.29	0.00	0.00	0.00	92.23	0.00	72.83	91.69	0.00	42.36	0.00

## AREA SOURCE EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	0.07	0.15	0.26	0.00	0.00	0.00	176.63
TOTALS (tons/year, mitigated)	0.06	0.12	0.13	0.00	0.00	0.00	141.35
Percent Reduction	14.29	20.00	50.00	NaN	NaN	NaN	19.97

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OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	0.16	0.19	1.35	0.00	0.10	0.02	112.84
TOTALS (tons/year, mitigated)	0.16	0.18	1.26	0.00	0.09	0.02	105.47
Percent Reduction	0.00	5.26	6.67	NaN	10.00	0.00	6.53

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	0.23	0.34	1.61	0.00	0.10	0.02	289.47
TOTALS (tons/year, mitigated)	0.22	0.30	1.39	0.00	0.09	0.02	246.82
Percent Reduction	4.35	11.76	13.66	NaN	10.00	0.00	14.73

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
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Building 02/20/2012-04/27/2012	0.04	0.28	0.28	0.00	0.00	0.02	0.02	0.00	0.01	0.01	48.50
Building Off Road Diesel	0.03	0.20	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	22.33
Building Vendor Trips	0.01	0.07	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.07
Building Worker Trips	0.00	0.01	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.09
Coating 04/09/2012-05/04/2012	0.50	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
Architectural Coating	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
Asphalt 04/16/2012-05/11/2012	0.02	0.11	0.09	0.00	0.00	0.01	0.01	0.00	0.01	0.01	11.90
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.11	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.79
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32
Paving Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.79

Phase Assumptions

Phase: Fine Grading 11/7/2011 - 2/3/2012 - Fine Grading Description

Total Acres Disturbed: 2.16

Maximum Daily Acreage Disturbed: 0.54

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Mass Grading 10/3/2011 - 1/11/2012 - Mass Site Grading Description

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Total Acres Disturbed: 2.16

Maximum Daily Acreage Disturbed: 0.54

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

- 1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day
- 1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day
- 1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day
- 1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 4/16/2012 - 5/11/2012 - Paving Driveway and Loading Area

Acres to be Paved: 0.54

Off-Road Equipment:

- 4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day
- 1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day
- 1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day
- 1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Building Construction 2/20/2012 - 4/27/2012 - Construction of Tanks and move on Office

Off-Road Equipment:

- 1 Cranes (399 hp) operating at a 0.43 load factor for 4 hours per day
- 2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day
- 1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Architectural Coating 4/9/2012 - 5/4/2012 - Paint Tanks

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 130

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 130

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250



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Mass Grading 10/03/2011-01/11/2012	0.01	0.08	0.04	0.00	0.00	0.00	0.01	0.00	0.00	0.00	8.22
Mass Grading Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Off Road Diesel	0.01	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.87
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36
Building 02/20/2012-04/27/2012	0.04	0.28	0.28	0.00	0.00	0.02	0.02	0.00	0.01	0.01	48.50
Building Off Road Diesel	0.03	0.20	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	22.33
Building Vendor Trips	0.01	0.07	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.07
Building Worker Trips	0.00	0.01	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.09
Coating 04/09/2012-05/04/2012	0.49	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
Architectural Coating	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
Asphalt 04/16/2012-05/11/2012	0.02	0.11	0.09	0.00	0.00	0.01	0.01	0.00	0.01	0.01	11.90
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.11	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.79
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32
Paving Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.79

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 11/7/2011 - 2/3/2012 - Fine Grading Description

For Soil Stabilizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stabilizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stabilizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

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PM10: 55% PM25: 55%

For Soil Stabilizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

The following mitigation measures apply to Phase: Mass Grading 10/3/2011 - 1/11/2012 - Mass Site Grading Description

For Soil Stabilizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stabilizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stabilizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Soil Stabilizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

The following mitigation measures apply to Phase: Architectural Coating 4/9/2012 - 5/4/2012 - Paint Tanks

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
Natural Gas	0.01	0.15	0.12	0.00	0.00	0.00	176.38
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscape	0.01	0.00	0.14	0.00	0.00	0.00	0.25
Consumer Products	0.00						
Architectural Coatings	0.05						
TOTALS (tons/year, unmitigated)	0.07	0.15	0.26	0.00	0.00	0.00	176.63

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Area Source Mitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Annual Tons Per Year, Mitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
Natural Gas	0.01	0.12	0.10	0.00	0.00	0.00	141.10
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscape	0.00	0.00	0.03	0.00	0.00	0.00	0.25
Consumer Products	0.00						
Architectural Coatings	0.05						
TOTALS (tons/year, mitigated)	0.06	0.12	0.13	0.00	0.00	0.00	141.35

Area Source Mitigation Measures Selected

<u>Mitigation Description</u>	<u>Percent Reduction</u>
Industrial Increase Energy Efficiency Beyond Title 24	20.00
Percent of Commercial and Industrial Landscape Equipment that are Electrically Powered and have Electrical Outlets Available	80.00
For Nonresidential Exterior Use Low VOC Coating	10.00

Area Source Changes to Defaults

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Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
General heavy industry	0.16	0.19	1.35	0.00	0.10	0.02	112.84
TOTALS (tons/year, unmitigated)	0.16	0.19	1.35	0.00	0.10	0.02	112.84
Less OnRoad Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS (tons/year, unmitigated)	0.16	0.19	1.35	0.00	0.10	0.02	112.84

Operational Mitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Annual Tons Per Year, Mitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
General heavy industry	0.16	0.18	1.26	0.00	0.09	0.02	105.47
TOTALS (tons/year, mitigated)	0.16	0.18	1.26	0.00	0.09	0.02	105.47
Less OnRoad Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS (tons/year, mitigated)	0.16	0.18	1.26	0.00	0.09	0.02	105.47

Operational Mitigation Options Selected

Residential Mitigation Measures

Nonresidential Mitigation Measures

Non-Residential Mix of Uses Mitigation

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Percent Reduction in Trips is 0.55%

Inputs Selected:

The number of housing units within a 1/2 mile radius of the project, plus the number of residential units included in the project are 2500.

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Nonresidential Mitigation Measures

The employment for the study area (within a 1/2 mile radius of the project) is 650.

Non-Residential Local-Serving Retail Mitigation

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Percent Reduction in Trips is 2%

Inputs Selected:

The Presence of Local-Serving Retail checkbox was selected.

Non-Residential Pedestrian/Bicycle Friendliness Mitigation

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Percent Reduction in Trips is 3.98%

Inputs Selected:

The Number of Intersections per Square Mile is 360

The Percent of Streets with Sidewalks on One Side is 30%

The Percent of Streets with Sidewalks on Both Sides is 50%

The Percent of Arterials/Collectors with Bike Lanes or where Suitable,

Direct Parallel Routes Exist is 40%

Non-Residential On-Road Truck Mitigation:Pounds/Day & Tons/Year Estimates

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Inputs Selected:

	ROG	NOx	CO	SO2	PM10
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Pounds per Day Reduction	0	0	0	0	0
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Nonresidential Mitigation Measures

Tons per Year Reduction 0 0 0 0 0

Operational Settings:

Includes correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2013 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
General heavy industry		1.50	1000 sq ft	47.00	70.50	597.64
					70.50	597.64

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	37.7	0.8	98.9	0.3
Light Truck < 3750 lbs	16.7	2.4	91.0	6.6
Light Truck 3751-5750 lbs	20.5	1.0	98.5	0.5
Med Truck 5751-8500 lbs	11.4	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	2.6	0.0	73.1	26.9
Lite-Heavy Truck 10,001-14,000 lbs	1.1	0.0	45.5	54.5
Med-Heavy Truck 14,001-33,000 lbs	1.0	0.0	20.0	80.0
Heavy-Heavy Truck 33,001-60,000 lbs	2.4	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.0	0.0	0.0	0.0
Motorcycle	4.7	53.2	46.8	0.0
School Bus	0.2	0.0	0.0	100.0
Motor Home	1.6	0.0	87.5	12.5

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
General heavy industry				90.0	5.0	5.0

Operational Changes to Defaults

**Appendix V-A**  
**SJVAPCD Rule 4641 and Discussion of Asphalt Paving**

**RULE 4641 CUTBACK, SLOW CURE, AND EMULSIFIED ASPHALT, PAVING AND MAINTENANCE OPERATIONS (Adopted April 11, 1991, Amended September 19, 1991, Amended December 17, 1992)**

**1.0 Purpose**

The purpose of this rule is to limit VOC emissions by restricting the application and manufacturing of certain types of asphalt for paving and maintenance operations.

**2.0 Applicability**

This rule applies to the manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations.

**3.0 Definitions**

**3.1 Asphalt:** a dark-brown to black refined liquid or solid cementitious material of which the main constituents are bitumens suitable for use in the manufacture of paving materials or dust palliatives.

**3.2 Cutback Asphalt:** paving grade asphalt liquified with petroleum distillate and conforming to specification of the American Society for Testing & Materials (ASTM) as following:

**3.2.1 Rapid cure type:** ASTM D2028-76 (Reapproved 1981)

**3.2.2 Medium cure type:** ASTM D2027-76 (Reapproved 1981)

**3.3 Dust Palliative:** any light application of cutback asphalt, slow cure asphalt or emulsified asphalt for the express purpose of controlling loose dust.

**3.4 Emulsified Asphalt:** any asphalt liquified with water containing an emulsifier. The two kinds of emulsions most pertinent are the anionic and cationic types.

**3.5 Organic Compound:** any compound which contains VOCs.

**3.6 Paving and Maintenance Operations:** all activities involved in the new construction and maintenance of roadways and parking areas.

**3.7 Penetrating Prime Coat:** any application of asphalt to an absorptive surface to penetrate and bind the aggregate surface and promote adhesion between it and the new superimposed construction. Prime coats do not include dust palliative or tack coats.

**3.8 Road Oils:** shall be synonymous with slow cure asphalt.

- 3.9 San Joaquin Valley Air Basin: all of San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare Counties and the San Joaquin Valley portion of Kern County.
- 3.10 Slow Cure Asphalt: paving grade asphalt conforming to specification of the ASTM D2026-72 (Reapproved 1979).
- 3.11 Tack Coat: any application of asphalt applied to an existing surface to provide a bond between new surfacing and existing surface and to eliminate slippage planes where the new and existing surfaces meet.

#### 4.0 Exemptions

- 4.1 The requirements of Section 5.0 shall not apply to the manufacture of cutback asphalt or emulsified asphalt in the manufacturing of paving materials where such materials are for shipment and use outside of the District .
- 4.2 The requirements of Section 5.1.2 shall not apply to the use of medium cure asphalt where the National Weather Service official forecast of the high temperature for the 24 hour period following application is below 50°F.

#### 5.0 Requirements

- 5.1 A person shall not manufacture for sale nor use any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations:
  - 5.1.1 Rapid cure cutback asphalt;
  - 5.1.2 Medium cure cutback asphalt;
  - 5.1.3 Slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate at 500°F or lower.
  - 5.1.4 Emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500°F or lower.

#### 6.0 Administrative Requirements

##### 6.1 Recordkeeping

- 6.1.1 The manufacturer of cutback, slow cure or emulsified asphalt for dust palliative, or any other road paving and maintenance operations shall maintain records showing the types and amounts of cutback asphalt,

slow cure asphalt and emulsified asphalt which contain organic compounds produced and the destination of these products.

6.1.2 The users of cutback slow cure or emulsified asphalt for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations shall maintain records showing the types, amounts received, and amounts used.

6.1.3 Such records shall be maintained daily and retained and available for inspection by the APCO for the previous 24 month period.

## 6.2 Test Methods

6.2.1 Analysis of cutback asphalt samples for VOC content shall be in accordance with ASTM Method D402-76 (Reapproved 1987).

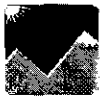
6.2.2 Analysis of emulsified asphalt samples for VOC content shall be in accordance with ASTM Method D244-88.

6.2.3 Analysis for halogenated exempt compounds shall be by ARB Method 432.

## 7.0 Compliance Schedule

All manufacturers and users of cutback, slow cure, and emulsified asphalt which are subject to this rule shall be in full compliance with the provisions of this rule by November 1, 1991.

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## 2008 Area Source Emissions Inventory Methodology 540 – ASPHALT PAVING

### I. Purpose

This document describes the Area Source Methodology used to estimate emissions of volatile organic compounds (VOC) from asphalt paving operations 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 represents 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 operations that are identified by the following Category of Emission Source (CES) codes and Reconciliation Emission Inventory Codes (REIC):

**Table 1. Emission inventory codes.**

<b>CES</b>	<b>REIC</b>	<b>Description</b>
46870	540-560-0400-0000	Asphalt Paving –Cutback Asphalt
46888	540-562-0400-0000	Asphalt Paving –Road Oils (Slow Cure)
46896	540-564-0400-0000	Asphalt Paving –Hot Mix Asphalt
46904	540-566-0400-0000	Asphalt Paving –Emulsified Asphalt
82057	540-995-0400-0000	Asphalt Paving –Unspecified

### 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 (CARB) between the area source REIC and the point sources' Standard Industry Classification (SIC) code and emissions process Source Category Code (SCC) combinations. While the production of asphalt at refineries and asphalt plants is permitted by the District and their emissions included in the point source inventory, the application of asphalt to roads and parking lots is not subject to District permit. Therefore, the area sources

in this methodology are not represented within our point source inventory and reconciliation is not necessary.

#### IV. Methodology Description

This methodology estimates emissions of Volatile Organic Compounds (VOC) from asphalt paving materials during and after paving. It does not include VOC emissions from the manufacture of asphaltic materials, since these processes are subject to District permit and their emissions are included in our point source inventory.

Asphalt and road oils are used to pave, seal, and repair surfaces such as roads, parking lots, drives, walkways, and airport runways. The most commonly used forms of asphalt are hot-mix, cutback, and emulsified. Hot-mix asphalt is a mixture of heated asphalt cement and aggregate. Asphalt cutbacks are asphalt cements thinned with petroleum distillates (diluent). Asphalt emulsions are mixtures of asphalt cement with water and emulsifiers. Each is discussed below.

- **Hot mix asphalt** is prepared at a hot-mix asphalt plant by heating asphalt cement before adding the aggregate. Mixing is generally performed with the aggregate at about 300-330°F, and the asphalt cement at 200°F. Paving and compaction must be performed while the asphalt is still hot. To maintain a liquid mixture, hot mix asphalt plants must be near the paving site. In some cases, mobile facilities are used. For hot-mix asphalt, the organic components have high molecular weights and low vapor pressures. Therefore, hot-mix asphalts emit little VOC.
- **Cut-back asphalt** is produced by dissolving (“cutting back”) asphalt cement with diesel or another diluent. While in its dissolved state, the asphalt is less viscous and the mix is easy to work and compact. After the mix is applied, the solvent evaporates and the asphalt hardens. Cutback asphalt is used in tack and seal operations, in priming roadbeds for hot-mix application, and for pavements up to several inches thick. Cutback asphalt is prepared at a refinery. For cutback asphalt, emissions are primarily from the diluents that contain VOCs. Cutback asphalt has the highest levels of VOCs emissions of the three asphalt categories. There are three basic types of cutback asphalt cement based upon the diluents used:
  - **Slow cure cut-back asphalt**, which includes **road oil**, conforms to the specification of the American Society for Testing & Materials (ASTM) D2026-72 and uses low volatility fuel solvents (such as diesel) as diluents. .
  - **Medium cure cut-back asphalt** conforms to specification of ASTM D2027-76 and uses kerosene as a diluent.
  - **Rapid cure cut-back asphalt** conforms to the specification of ASTM D2028-76 and uses gasoline or naphthas as diluents.

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- **Emulsified asphalt** is produced by emulsifying the asphalt in water with a surfactant (soap) prior to mixing with the aggregate. While emulsified, the asphalt is easy to work and compact. When the water evaporates, the emulsified asphalt will harden. Emulsified asphalts have lower VOC emissions than cutback asphalts since they have little or no diluent.

Asphalt may also be modified through the addition of rubbers, plastics, fillers, extenders, fibers, oxidants, antioxidants or hydrocarbons to improve their performance. The California Department of Transportation (Caltrans) has been testing the use of rubberized asphalt concrete (RAC). California Assemble Bill 338 requires Caltrans to gradually phase in the use of crumb rubber on state highway construction and repair projects, to the extent feasible.

Hot mix asphalt process rates were obtained from the District's point source inventory. Cut back and emulsified asphalt consumption for the state of California was obtained from the Asphalt Institute. Asphalt consumption was disaggregated to the counties using vehicles miles traveled as a surrogate. VOC emissions from asphalt paving were calculated by multiplying the amount of asphalt paving material applied in the District by emission factors.

## V. Activity Data

### A. Hot mix asphalt.

The total amount of hot mix asphalt paving material produced in the District in 2008 was obtained from the point source inventory. Since hot mix asphalt needs to be applied within a few hours of being produced, it was assumed that all hot mix asphalt produced in the District was applied in the District. The total amount of hot mix asphalt produced in the District was then disaggregated to the county level using vehicle miles traveled (CARB, 2010) as a surrogate. The amount of hot mix asphalt applied in each county in the District in 2008 is presented in the following table:

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Table 2. SJVAPCD hot mix asphalt paving material applied, 2008.

County	Vehicle Miles Traveled <sup>1</sup> (1,000's)	Vehicle Miles Traveled (% of District)	Hot Mix Paving Material (tons)	Asphaltic Oil <sup>2</sup> (tons)	Aggregate <sup>2</sup> (tons)
Fresno	21,694	22.41%	1,119,066	55,953	1,063,113
Kern	18,707	19.32%	964,984	48,249	916,735
Kings	3,892	4.02%	200,765	10,038	190,727
Madera	5,059	5.22%	260,964	13,048	247,916
Merced	8,413	8.69%	433,977	21,699	412,278
San Joaquin	17,241	17.80%	889,362	44,468	844,894
Stanislaus	11,479	11.85%	592,134	29,607	562,528
Tulare	10,351	10.69%	533,947	26,697	507,250
District Total	<b>96,836</b>	<b>100.00%</b>	<b>4,995,199</b>	<b>249,759</b>	<b>4,745,441</b>

<sup>1</sup>CARB, 2010.

<sup>2</sup>Hot mix asphalt paving material assumed to be 95% aggregate and 5% asphaltic oil.

**B. Cutback and emulsified asphalt.**

The total amount of cutback asphalt cement (slow, medium and rapid cure) and emulsified asphalt cement used in California in 2008 was obtained from the Asphalt Institute and is presented in the following table:

Table 3. Amount of asphalt paving material consumed in the State of California in 2008 (Asphalt Institute, 2010).

Asphalt Type	Tons of Material
Cutback Asphalt Cement	30,657
Emulsified asphalt	151,767

Cutback asphalt was assumed to be 95% slow cure, 5% medium cure and 0% rapid cure based on a survey of permitted refineries. Asphalt usage was distributed to the counties in the District using vehicle miles traveled. The total vehicle miles traveled in 2008 by county was obtained from CARB (2010). The amount of medium cure cutback, slow cure cutback (road oil), modified asphalt, and emulsified asphalt distributed to each county in the District is presented in the table below:

Table 4. SJVAPCD cold applied asphalt usage, 2008.

County	Vehicle Miles Traveled <sup>1</sup> (1,000's)	Vehicle Miles Traveled (% of State)	Slow Cure Cutback (tons)	Medium Cure Cutback (tons)	Emulsified Asphalt (tons)
Fresno	21,694	2.33%	678	36	678
Kern <sup>2</sup>	18,707	2.01%	585	31	585
Kings	3,892	0.42%	122	6	122
Madera	5,059	0.54%	158	8	158
Merced	8,413	0.90%	263	14	263
San Joaquin	17,241	1.85%	539	28	539
Stanislaus	11,479	1.23%	359	19	359
Tulare	10,351	1.11%	324	17	324
District Total	<b>96,836</b>	<b>10.39%</b>	<b>3,028</b>	<b>159</b>	<b>3,028</b>
State Total	<b>931,495</b>	<b>100.00%</b>	<b>29,124</b>	<b>1,533</b>	<b>151,767</b>

<sup>1</sup>CARB, 2010.<sup>2</sup>Includes only the valley portion of Kern County.

## VI. Emission Factors

Asphalt paving emission factors are summarized in the following table:

Table 5. Asphalt paving emission factors.

Asphalt Type	Emission Factor (lbs VOC/ton)	Source
Hot mix asphalt paving (5% asphaltic oil plus 95% aggregate)	0.002	KVB (1978)
Slow cure asphalt/road oil	70.4	Sonoma Technology, Inc. (2003)
Medium cure asphalt	268.3	Sonoma Technology, Inc. (2003)
Emulsified asphalt	17.9	Sonoma Technology, Inc. (2003)

## VII. Emissions Calculations

### A. Assumptions

- VOC is the only pollutant emitted from paving operations.
- Each ton of applied hot-mix asphalt paving emits 0.002 pounds VOC.

### B. Sample Calculation

#### Given:

- There were 1,119,066 tons of hot-mix asphalt consumed in Fresno County in 2008.
- Each ton of applied hot-mix asphalt paving emitted 0.002 pounds VOC.

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### **Calculate Emissions:**

Emissions from asphalt paving operations can be calculated using the following equation:

$$\frac{\text{Tons VOC}}{\text{Year}} = \text{Tons Paving Applied} \times \frac{\text{Pounds VOC}}{\text{Ton Paving}} \times \frac{1 \text{ Ton}}{2,000 \text{ Pounds}}$$

VOC emissions from hot-mix asphalt paving in Fresno county is calculated as follows:

$$\frac{\text{Tons VOC}_{\text{Hot-Mix}}}{\text{Year}} = 1,119,066 \text{ Tons Paving Applied} \times \frac{0.002 \text{ Pounds VOC}}{\text{Ton Paving}} \times \frac{1 \text{ Ton}}{2,000 \text{ Pounds}}$$

$$\frac{\text{Tons VOC}_{\text{Hot-Mix}}}{\text{Year}} = 1.12$$

## **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**

Monthly activity within the District is assumed to be uniform throughout the year (Eastern Research Group, 2001).

## **IX. Spatial Variation**

Emissions within each county may be distributed to paved roads.

## **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. The application and manufacturing of certain types of asphalt for paving and maintenance operations is subject to District Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations). 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 profiles for asphalt paving operations are presented in the table below. Organic gas profile #716 is applied to cutback asphalt (REIC 540-560-0400-0000). Organic gas profile #715 is applied to road oils (slow cure asphalt (REIC 540-562-0400-0000), hot mix asphalt (REIC 540-564-0400-0000), emulsified asphalt (REIC 540-566-0400-0000) and unspecified asphalt (REIC 540-995-0400-0000).

**Table 6. CARB chemical speciation profiles for Asphalt Paving Operation.**

Profile Description	ARB Organic Gas Profile#	Fractions	
		ROG	VOC
Medium Cure Asphalt	716	1	1
Slow Cure Asphalt	715	1	1

## XIII. Assessment Of Methodology

The amount of hot-mix asphalt paving material produced by asphalt plants permitted to operate in the District was queried from the District's point source emissions inventory database. In estimating emissions from hot-mix asphalt paving operations, the District assumes that all hot-mix asphalt produced in the District is consumed in the District, and that no hot-mix asphalt produced outside of the District is consumed in the District. Since hot-mix asphalt must be applied before it cools (within a few hours of leaving the plant), this assumption is reasonable.

The amount of cutback and emulsified asphalt applied in the District was estimated from statewide production data obtained from the Asphalt Institute. This statewide data was disaggregated to the county level using VMT. For this estimate we assume that the data from the Asphalt Institute accurately represents the state's production, and that VMT is a good surrogate for disaggregating state level data to

## 540 - Asphalt Paving

the counties in the District. The Asphalt Institute also reports the amount of modified asphalt produced in the state. Based on information from our permit holders, we assume that modified asphalt is used as a hot mix and is included in the hot mix process rate submitted to the District's point source inventory.

This estimate could be improved by surveying local contractors and public works agencies to determine the actual amounts and types of material applied.

### XIV. Emissions

Following are the 2008 total unreconciled emissions for asphalt paving operations. These area source categories do not have point sources associated with them. Emissions are reported for each county in the District

**Table 7. Total emissions for asphalt paving in the SJVAPCD, 2008.**

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC <sup>(1)</sup>	PM <sub>10</sub>	PM <sub>2.5</sub> <sup>(2)</sup>
<b>Asphalt Paving –Cutback Asphalt (540-560-0400-0000)</b>						
Fresno	--	--	--	4.79	--	--
Kern <sup>(3)</sup>	--	--	--	4.13	--	--
Kings	--	--	--	0.86	--	--
Madera	--	--	--	1.12	--	--
Merced	--	--	--	1.86	--	--
San Joaquin	--	--	--	3.81	--	--
Stanislaus	--	--	--	2.53	--	--
Tulare	--	--	--	2.29	--	--
<b>TOTAL</b>	--	--	--	<b>21.39</b>	--	--
<b>Asphalt Paving –Road Oils, Slow Cure (540-562-0400-0000)</b>						
Fresno	--	--	--	23.88	--	--
Kern <sup>(3)</sup>	--	--	--	20.59	--	--
Kings	--	--	--	4.28	--	--
Madera	--	--	--	5.57	--	--
Merced	--	--	--	9.26	--	--
San Joaquin	--	--	--	18.97	--	--
Stanislaus	--	--	--	12.63	--	--
Tulare	--	--	--	11.39	--	--
<b>TOTAL</b>	--	--	--	<b>106.57</b>	--	--
<b>Asphalt Paving –Hot Mix Asphalt (540-564-0400-0000)</b>						
Fresno	--	--	--	1.12	--	--
Kern <sup>(3)</sup>	--	--	--	0.96	--	--
Kings	--	--	--	0.20	--	--
Madera	--	--	--	0.26	--	--
Merced	--	--	--	0.43	--	--
San Joaquin	--	--	--	0.89	--	--
Stanislaus	--	--	--	0.59	--	--
Tulare	--	--	--	0.53	--	--
<b>TOTAL</b>	--	--	--	<b>4.98</b>	--	--

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Table 7 cont. Total emissions for asphalt paving in the SJVAPCD, 2008.

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC <sup>(1)</sup>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Asphalt Paving – Emulsified Asphalt (540-566-0400-0000)</b>						
Fresno	--	--	--	31.63	--	--
Kern <sup>(3)</sup>	--	--	--	27.28	--	--
Kings	--	--	--	5.68	--	--
Madera	--	--	--	7.38	--	--
Merced	--	--	--	12.27	--	--
San Joaquin	--	--	--	25.14	--	--
Stanislaus	--	--	--	16.74	--	--
Tulare	--	--	--	15.09	--	--
<b>TOTAL</b>	--	--	--	<b>141.21</b>	--	--
<b>Asphalt Paving – Unspecified (540-995-0400-0000)</b>						
Fresno	--	--	--	0.00	--	--
Kern <sup>(2)</sup>	--	--	--	0.00	--	--
Kings	--	--	--	0.00	--	--
Madera	--	--	--	0.00	--	--
Merced	--	--	--	0.00	--	--
San Joaquin	--	--	--	0.00	--	--
Stanislaus	--	--	--	0.00	--	--
Tulare	--	--	--	0.00	--	--
<b>TOTAL</b>	--	--	--	<b>0.00</b>	--	--

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

<sup>(2)</sup> Reflects only the Valley portion of Kern County.

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Following is the net change in total unreconciled emissions between this update (2008 inventory year) and the previous update (2007 inventory year) for asphalt paving operations. The changes in emissions are reported for each county in the District.

Table 8. Net change in emissions for asphalt paving in the SJVAPCD (2008-2007).

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC <sup>(1)</sup>	PM <sub>10</sub>	PM <sub>2.5</sub> <sup>(2)</sup>
<b>Asphalt Paving –Cutback Asphalt (540-560-0400-0000)</b>						
Fresno	--	--	--	4.79	--	--
Kern <sup>(3)</sup>	--	--	--	4.13	--	--
Kings	--	--	--	0.86	--	--
Madera	--	--	--	1.12	--	--
Merced	--	--	--	1.86	--	--
San Joaquin	--	--	--	3.81	--	--
Stanislaus	--	--	--	2.53	--	--
Tulare	--	--	--	2.29	--	--
<b>TOTAL</b>	--	--	--	<b>21.39</b>	--	--
<b>Asphalt Paving –Road Oils, Slow Cure (540-562-0400-0000)</b>						
Fresno	--	--	--	17.94	--	--
Kern <sup>(3)</sup>	--	--	--	15.61	--	--
Kings	--	--	--	3.07	--	--
Madera	--	--	--	3.37	--	--
Merced	--	--	--	7.39	--	--
San Joaquin	--	--	--	17.66	--	--
Stanislaus	--	--	--	11.20	--	--
Tulare	--	--	--	6.59	--	--
<b>TOTAL</b>	--	--	--	<b>82.83</b>	--	--
<b>Asphalt Paving –Hot Mix Asphalt (540-564-0400-0000)</b>						
Fresno	--	--	--	-26.43	--	--
Kern <sup>(3)</sup>	--	--	--	-19.47	--	--
Kings	--	--	--	-3.75	--	--
Madera	--	--	--	-2.67	--	--
Merced	--	--	--	-6.10	--	--
San Joaquin	--	--	--	-15.54	--	--
Stanislaus	--	--	--	-13.45	--	--
Tulare	--	--	--	-10.61	--	--
<b>TOTAL</b>	--	--	--	<b>-98.02</b>	--	--
<b>Asphalt Paving – Emulsified Asphalt (540-566-0400-0000)</b>						
Fresno	--	--	--	-59.11	--	--
Kern <sup>(3)</sup>	--	--	--	-40.16	--	--
Kings	--	--	--	-7.51	--	--
Madera	--	--	--	-2.66	--	--
Merced	--	--	--	-8.88	--	--
San Joaquin	--	--	--	-31.24	--	--
Stanislaus	--	--	--	-30.22	--	--
Tulare	--	--	--	-20.99	--	--
<b>TOTAL</b>	--	--	--	<b>-200.77</b>	--	--

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Table 8 cont. Net change in emissions for asphalt paving in the SJVAPCD (2008-2007).

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC <sup>(1)</sup>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Asphalt Paving – Unspecified (540-995-0400-0000)</b>						
Fresno	--	--	--	0.00	--	--
Kern <sup>(2)</sup>	--	--	--	0.00	--	--
Kings	--	--	--	0.00	--	--
Madera	--	--	--	0.00	--	--
Merced	--	--	--	0.00	--	--
San Joaquin	--	--	--	0.00	--	--
Stanislaus	--	--	--	0.00	--	--
Tulare	--	--	--	0.00	--	--
<b>TOTAL</b>	--	--	--	<b>0.00</b>	--	--

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

<sup>(2)</sup> Reflects only the Valley portion of Kern County.

**XV. Revision History**

2008. This is a new District methodology.

**XVI. Update Schedule**

In an effort to provide inventory information to CARB 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 the following table:

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 the VOC emissions from this category are less than one (1) ton per day, it is recommended that this methodology be updated and revised every four years.

## XVII. References

- 1) American Society for Testing and Materials. 1972. ASTM D2026-72: Standard Specification for Cutback Asphalt (Slow-Curing Type). 2 pages.
- 2) American Society for Testing and Materials. 1976. ASTM D2027-76: Standard Specification for Cutback Asphalt (Medium-Curing Type). 2 pages.
- 3) American Society for Testing and Materials. 1976. ASTM D2028-76: Standard Specification for Cutback Asphalt (Rapid-Curing Type). 2 pages.
- 4) Asphalt Institute. 2009. 2008 Asphalt Usage Survey for the United States and Canada. <<http://www.asphaltinstitute.org>>
- 5) California Air Resources Board. 2010. CEPAM: 2009 Almanac - Population and Vehicle Trends. (Accessed June 16, 2010). <[http://www.arb.ca.gov/app/emsinv/trends/ems\\_trends.php](http://www.arb.ca.gov/app/emsinv/trends/ems_trends.php)>
- 6) California Air Resources Board. 2005. Draft memo dated 5/11/05: Comparison of Asphalt Paving Emission Factors. 2 pages. <[www.arb.ca.gov/ei/areasrc/draftmeth/asphcompar.pdf](http://www.arb.ca.gov/ei/areasrc/draftmeth/asphcompar.pdf)>
- 7) California Assembly Bill No. 338, Chapter 709 (Levine). Recycling: Crumb Rubber. <[http://info.sen.ca.gov/pub/05-06/bill/asm/ab\\_0301-0350/ab\\_338\\_bill\\_20051007\\_chaptered.pdf](http://info.sen.ca.gov/pub/05-06/bill/asm/ab_0301-0350/ab_338_bill_20051007_chaptered.pdf)>
- 8) Eastern Research Group, Inc. 2001. Emission Inventory Improvement Program (EIIP) (2000). Volume III: Chapter 17 - Asphalt Paving. Report prepared for the Area Source Committee of the Emission Inventory Improvement Committee, and for Charles Mann of the Air Pollution Prevention and Control Division, U.S. Environmental Protection Agency. 54 pages. <[http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii17\\_apr2001.pdf](http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii17_apr2001.pdf)>
- 9) KVB . 1978. Control of Hydrocarbon Emissions from Stationary Sources in the California South Coast Air Basin. Section 2, page 88.
- 10) Lutes, C.C., R.J. Thomas, and R. Burnette. 1994. Final Report - Evaluation of Emissions from Paving Asphalts. Report prepared for the United States Environmental Protection Agency, Office of Air Quality Planning and Standards EPA-600/R-94-135. Research Triangle Park, North Carolina. 207 pages.
- 11) Sonoma Technology, Inc. 2003. Central California Ozone Study, Attachment C: Asphalt Paving and Roofing. 27 pages. <[http://www.arb.ca.gov/ei/areasrc/ccosmeth/att\\_c\\_asphalt.doc](http://www.arb.ca.gov/ei/areasrc/ccosmeth/att_c_asphalt.doc)>
- 12) State of California Department of Transportation, Division of Maintenance. 2008. 2007 State of the Pavement. 34 pages. <[http://www.dot.ca.gov/hq/maint/2007\\_SOP\\_8\\_7\\_08.pdf](http://www.dot.ca.gov/hq/maint/2007_SOP_8_7_08.pdf)>

## 540 - Asphalt Paving

- 13) State of California Department of Transportation. 2008. Analysis of Cost Differential Between Asphalt Containing Crumb Rubber and conventional Asphalt for 2007 Public Resources Code Section 42703. Report prepared for the State of California Business, Transportation and Housing Agency. 17 pages.  
<<http://www.dot.ca.gov/hq/oppd/rescons/ab338/Analysis-of-Cost-Differential-Btwn-AC-w-Crumb-Rubber-&-Conventional-AC-2007-Data-FINAL.pdf>>
- 14) State of California Department Of Transportation, Division of Transportation System Information. 2009. 2008 Californian Public Road Data. 86 pages.  
<<http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary/hpmspdf/2008PRD.pdf>>



## 2008 Area Source Emissions Inventory Methodology

### 540 – ASPHALT PAVING

#### I. Purpose

This document describes the Area Source Methodology used to estimate emissions of volatile organic compounds (VOC) from asphalt paving operations 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 represents 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 operations 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
46870	540-560-0400-0000	Asphalt Paving –Cutback Asphalt
46888	540-562-0400-0000	Asphalt Paving –Road Oils (Slow Cure)
46896	540-564-0400-0000	Asphalt Paving –Hot Mix Asphalt
46904	540-566-0400-0000	Asphalt Paving –Emulsified Asphalt
82057	540-995-0400-0000	Asphalt Paving –Unspecified

#### 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 (CARB) between the area source REIC and the point sources' Standard Industry Classification (SIC) code and emissions process Source Category Code (SCC) combinations. While the production of asphalt at refineries and asphalt plants is permitted by the District and their emissions included in the point source inventory, the application of asphalt to roads and parking lots is not subject to District permit. Therefore, the area sources

in this methodology are not represented within our point source inventory and reconciliation is not necessary.

#### IV. Methodology Description

This methodology estimates emissions of Volatile Organic Compounds (VOC) from asphalt paving materials during and after paving. It does not include VOC emissions from the manufacture of asphaltic materials, since these processes are subject to District permit and their emissions are included in our point source inventory.

Asphalt and road oils are used to pave, seal, and repair surfaces such as roads, parking lots, drives, walkways, and airport runways. The most commonly used forms of asphalt are hot-mix, cutback, and emulsified. Hot-mix asphalt is a mixture of heated asphalt cement and aggregate. Asphalt cutbacks are asphalt cements thinned with petroleum distillates (diluent). Asphalt emulsions are mixtures of asphalt cement with water and emulsifiers. Each is discussed below.

- **Hot mix asphalt** is prepared at a hot-mix asphalt plant by heating asphalt cement before adding the aggregate. Mixing is generally performed with the aggregate at about 300-330°F, and the asphalt cement at 200°F. Paving and compaction must be performed while the asphalt is still hot. To maintain a liquid mixture, hot mix asphalt plants must be near the paving site. In some cases, mobile facilities are used. For hot-mix asphalt, the organic components have high molecular weights and low vapor pressures. Therefore, hot-mix asphalts emit little VOC.
- **Cut-back asphalt** is produced by dissolving (“cutting back”) asphalt cement with diesel or another diluent. While in its dissolved state, the asphalt is less viscous and the mix is easy to work and compact. After the mix is applied, the solvent evaporates and the asphalt hardens. Cutback asphalt is used in tack and seal operations, in priming roadbeds for hot-mix application, and for pavements up to several inches thick. Cutback asphalt is prepared at a refinery. For cutback asphalt, emissions are primarily from the diluents that contain VOCs. Cutback asphalt has the highest levels of VOCs emissions of the three asphalt categories. There are three basic types of cutback asphalt cement based upon the diluents used:
  - **Slow cure cut-back asphalt**, which includes **road oil**, conforms to the specification of the American Society for Testing & Materials (ASTM) D2026-72 and uses low volatility fuel solvents (such as diesel) as diluents. .
  - **Medium cure cut-back asphalt** conforms to specification of ASTM D2027-76 and uses kerosene as a diluent.
  - **Rapid cure cut-back asphalt** conforms to the specification of ASTM D2028-76 and uses gasoline or naphthas as diluents.

- **Emulsified asphalt** is produced by emulsifying the asphalt in water with a surfactant (soap) prior to mixing with the aggregate. While emulsified, the asphalt is easy to work and compact. When the water evaporates, the emulsified asphalt will harden. Emulsified asphalts have lower VOC emissions than cutback asphalts since they have little or no diluent.

Asphalt may also be modified through the addition of rubbers, plastics, fillers, extenders, fibers, oxidants, antioxidants or hydrocarbons to improve their performance. The California Department of Transportation (Caltrans) has been testing the use of rubberized asphalt concrete (RAC). California Assemble Bill 338 requires Caltrans to gradually phase in the use of crumb rubber on state highway construction and repair projects, to the extent feasible.

Hot mix asphalt process rates were obtained from the District's point source inventory. Cut back and emulsified asphalt consumption for the state of California was obtained from the Asphalt Institute. Asphalt consumption was disaggregated to the counties using vehicles miles traveled as a surrogate. VOC emissions from asphalt paving were calculated by multiplying the amount of asphalt paving material applied in the District by emission factors.

## V. Activity Data

### A. Hot mix asphalt.

The total amount of hot mix asphalt paving material produced in the District in 2008 was obtained from the point source inventory. Since hot mix asphalt needs to be applied within a few hours of being produced, it was assumed that all hot mix asphalt produced in the District was applied in the District. The total amount of hot mix asphalt produced in the District was then disaggregated to the county level using vehicle miles traveled (CARB, 2010) as a surrogate. The amount of hot mix asphalt applied in each county in the District in 2008 is presented in the following table:

**Table 2. SJVAPCD hot mix asphalt paving material applied, 2008.**

County	Vehicle Miles Traveled <sup>1</sup> (1,000's)	Vehicle Miles Traveled (% of District)	Hot Mix Paving Material (tons)	Asphaltic Oil <sup>2</sup> (tons)	Aggregate <sup>2</sup> (tons)
Fresno	21,694	22.41%	1,119,066	55,953	1,063,113
Kern	18,707	19.32%	964,984	48,249	916,735
Kings	3,892	4.02%	200,765	10,038	190,727
Madera	5,059	5.22%	260,964	13,048	247,916
Merced	8,413	8.69%	433,977	21,699	412,278
San Joaquin	17,241	17.80%	889,362	44,468	844,894
Stanislaus	11,479	11.85%	592,134	29,607	562,528
Tulare	10,351	10.69%	533,947	26,697	507,250
District Total	<b>96,836</b>	<b>100.00%</b>	<b>4,995,199</b>	<b>249,759</b>	<b>4,745,441</b>

<sup>1</sup>CARB, 2010.

<sup>2</sup>Hot mix asphalt paving material assumed to be 95% aggregate and 5% asphaltic oil.

**B. Cutback and emulsified asphalt.**

The total amount of cutback asphalt cement (slow, medium and rapid cure) and emulsified asphalt cement used in California in 2008 was obtained from the Asphalt Institute and is presented in the following table:

**Table 3. Amount of asphalt paving material consumed in the State of California in 2008 (Asphalt Institute, 2010).**

Asphalt Type	Tons of Material
Cutback Asphalt Cement	30,657
Emulsified asphalt	151,767

Cutback asphalt was assumed to be 95% slow cure, 5% medium cure and 0% rapid cure based on a survey of permitted refineries. Asphalt usage was distributed to the counties in the District using vehicle miles traveled. The total vehicle miles traveled in 2008 by county was obtained from CARB (2010). The amount of medium cure cutback, slow cure cutback (road oil), modified asphalt, and emulsified asphalt distributed to each county in the District is presented in the table below:

**Table 4. SJVAPCD cold applied asphalt usage, 2008.**

County	Vehicle Miles Traveled <sup>1</sup> (1,000's)	Vehicle Miles Traveled (% of State)	Slow Cure Cutback (tons)	Medium Cure Cutback (tons)	Emulsified Asphalt (tons)
Fresno	21,694	2.33%	678	36	678
Kern <sup>2</sup>	18,707	2.01%	585	31	585
Kings	3,892	0.42%	122	6	122
Madera	5,059	0.54%	158	8	158
Merced	8,413	0.90%	263	14	263
San Joaquin	17,241	1.85%	539	28	539
Stanislaus	11,479	1.23%	359	19	359
Tulare	10,351	1.11%	324	17	324
District Total	<b>96,836</b>	<b>10.39%</b>	<b>3,028</b>	<b>159</b>	<b>3,028</b>
State Total	<b>931,495</b>	<b>100.00%</b>	<b>29,124</b>	<b>1,533</b>	<b>151,767</b>

<sup>1</sup>CARB, 2010.<sup>2</sup>Includes only the valley portion of Kern County.

## VI. Emission Factors

Asphalt paving emission factors are summarized in the following table:

**Table 5. Asphalt paving emission factors.**

Asphalt Type	Emission Factor (lbs VOC/ton)	Source
Hot mix asphalt paving (5% asphaltic oil plus 95% aggregate)	0.002	KVB (1978)
Slow cure asphalt/road oil	70.4	Sonoma Technology, Inc. (2003)
Medium cure asphalt	268.3	Sonoma Technology, Inc. (2003)
Emulsified asphalt	17.9	Sonoma Technology, Inc. (2003)

## VII. Emissions Calculations

### A. Assumptions

1. VOC is the only pollutant emitted from paving operations.
2. Each ton of applied hot-mix asphalt paving emits 0.002 pounds VOC.

### B. Sample Calculation

#### Given:

1. There were 1,119,066 tons of hot-mix asphalt consumed in Fresno County in 2008.
2. Each ton of applied hot-mix asphalt paving emitted 0.002 pounds VOC.

**Calculate Emissions:**

Emissions from asphalt paving operations can be calculated using the following equation:

$$\frac{\text{Tons VOC}}{\text{Year}} = \text{Tons Paving Applied} \times \frac{\text{Pounds VOC}}{\text{Ton Paving}} \times \frac{1 \text{ Ton}}{2,000 \text{ Pounds}}$$

VOC emissions from hot-mix asphalt paving in Fresno county is calculated as follows:

$$\frac{\text{Tons VOC}_{\text{Hot-Mix}}}{\text{Year}} = 1,119,066 \text{ Tons Paving Applied} \times \frac{0.002 \text{ Pounds VOC}}{\text{Ton Paving}} \times \frac{1 \text{ Ton}}{2,000 \text{ Pounds}}$$

$$\frac{\text{Tons VOC}_{\text{Hot-Mix}}}{\text{Year}} = 1.12$$

**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**

Monthly activity within the District is assumed to be uniform throughout the year (Eastern Research Group, 2001).

**IX. Spatial Variation**

Emissions within each county may be distributed to paved roads.

**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. The application and manufacturing of certain types of asphalt for paving and maintenance operations is subject to District Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations). 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 profiles for asphalt paving operations are presented in the table below. Organic gas profile #716 is applied to cutback asphalt (REIC 540-560-0400-0000). Organic gas profile #715 is applied to road oils (slow cure asphalt (REIC 540-562-0400-0000), hot mix asphalt (REIC 540-564-0400-0000), emulsified asphalt (REIC 540-566-0400-0000) and unspecified asphalt (REIC 540-995-0400-0000).

**Table 6. CARB chemical speciation profiles for Asphalt Paving Operation.**

Profile Description	ARB Organic Gas Profile#	Fractions	
		ROG	VOC
Medium Cure Asphalt	716	1	1
Slow Cure Asphalt	715	1	1

## XIII. Assessment Of Methodology

The amount of hot-mix asphalt paving material produced by asphalt plants permitted to operate in the District was queried from the District's point source emissions inventory database. In estimating emissions from hot-mix asphalt paving operations, the District assumes that all hot-mix asphalt produced in the District is consumed in the District, and that no hot-mix asphalt produced outside of the District is consumed in the District. Since hot-mix asphalt must be applied before it cools (within a few hours of leaving the plant), this assumption is reasonable.

The amount of cutback and emulsified asphalt applied in the District was estimated from statewide production data obtained from the Asphalt Institute. This statewide data was disaggregated to the county level using VMT. For this estimate we assume that the data from the Asphalt Institute accurately represents the state's production, and that VMT is a good surrogate for disaggregating state level data to

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the counties in the District. The Asphalt Institute also reports the amount of modified asphalt produced in the state. Based on information from our permit holders, we assume that modified asphalt is used as a hot mix and is included in the hot mix process rate submitted to the District's point source inventory.

This estimate could be improved by surveying local contractors and public works agencies to determine the actual amounts and types of material applied.

## XIV. Emissions

Following are the 2008 total unreconciled emissions for asphalt paving operations. These area source categories do not have point sources associated with them. Emissions are reported for each county in the District

**Table 7. Total emissions for asphalt paving in the SJVAPCD, 2008.**

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC <sup>(1)</sup>	PM <sub>10</sub>	PM <sub>2.5</sub> <sup>(2)</sup>
<b>Asphalt Paving –Cutback Asphalt (540-560-0400-0000)</b>						
Fresno	--	--	--	4.79	--	--
Kern <sup>(3)</sup>	--	--	--	4.13	--	--
Kings	--	--	--	0.86	--	--
Madera	--	--	--	1.12	--	--
Merced	--	--	--	1.86	--	--
San Joaquin	--	--	--	3.81	--	--
Stanislaus	--	--	--	2.53	--	--
Tulare	--	--	--	2.29	--	--
<b>TOTAL</b>	--	--	--	<b>21.39</b>	--	--
<b>Asphalt Paving –Road Oils, Slow Cure (540-562-0400-0000)</b>						
Fresno	--	--	--	23.88	--	--
Kern <sup>(3)</sup>	--	--	--	20.59	--	--
Kings	--	--	--	4.28	--	--
Madera	--	--	--	5.57	--	--
Merced	--	--	--	9.26	--	--
San Joaquin	--	--	--	18.97	--	--
Stanislaus	--	--	--	12.63	--	--
Tulare	--	--	--	11.39	--	--
<b>TOTAL</b>	--	--	--	<b>106.57</b>	--	--
<b>Asphalt Paving –Hot Mix Asphalt (540-564-0400-0000)</b>						
Fresno	--	--	--	1.12	--	--
Kern <sup>(3)</sup>	--	--	--	0.96	--	--
Kings	--	--	--	0.20	--	--
Madera	--	--	--	0.26	--	--
Merced	--	--	--	0.43	--	--
San Joaquin	--	--	--	0.89	--	--
Stanislaus	--	--	--	0.59	--	--
Tulare	--	--	--	0.53	--	--
<b>TOTAL</b>	--	--	--	<b>4.98</b>	--	--

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Table 7 cont. Total emissions for asphalt paving in the SJVAPCD, 2008.

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC <sup>(1)</sup>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Asphalt Paving – Emulsified Asphalt (540-566-0400-0000)</b>						
Fresno	--	--	--	31.63	--	--
Kern <sup>(3)</sup>	--	--	--	27.28	--	--
Kings	--	--	--	5.68	--	--
Madera	--	--	--	7.38	--	--
Merced	--	--	--	12.27	--	--
San Joaquin	--	--	--	25.14	--	--
Stanislaus	--	--	--	16.74	--	--
Tulare	--	--	--	15.09	--	--
<b>TOTAL</b>	--	--	--	<b>141.21</b>	--	--
<b>Asphalt Paving – Unspecified (540-995-0400-0000)</b>						
Fresno	--	--	--	0.00	--	--
Kern <sup>(2)</sup>	--	--	--	0.00	--	--
Kings	--	--	--	0.00	--	--
Madera	--	--	--	0.00	--	--
Merced	--	--	--	0.00	--	--
San Joaquin	--	--	--	0.00	--	--
Stanislaus	--	--	--	0.00	--	--
Tulare	--	--	--	0.00	--	--
<b>TOTAL</b>	--	--	--	<b>0.00</b>	--	--

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

<sup>(2)</sup> Reflects only the Valley portion of Kern County.

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Following is the net change in total unreconciled emissions between this update (2008 inventory year) and the previous update (2007 inventory year) for asphalt paving operations. The changes in emissions are reported for each county in the District.

**Table 8. Net change in emissions for asphalt paving in the SJVAPCD (2008-2007).**

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC <sup>(1)</sup>	PM <sub>10</sub>	PM <sub>2.5</sub> <sup>(2)</sup>
<b>Asphalt Paving –Cutback Asphalt (540-560-0400-0000)</b>						
Fresno	--	--	--	4.79	--	--
Kern <sup>(3)</sup>	--	--	--	4.13	--	--
Kings	--	--	--	0.86	--	--
Madera	--	--	--	1.12	--	--
Merced	--	--	--	1.86	--	--
San Joaquin	--	--	--	3.81	--	--
Stanislaus	--	--	--	2.53	--	--
Tulare	--	--	--	2.29	--	--
<b>TOTAL</b>	--	--	--	21.39	--	--
<b>Asphalt Paving –Road Oils, Slow Cure (540-562-0400-0000)</b>						
Fresno	--	--	--	17.94	--	--
Kern <sup>(3)</sup>	--	--	--	15.61	--	--
Kings	--	--	--	3.07	--	--
Madera	--	--	--	3.37	--	--
Merced	--	--	--	7.39	--	--
San Joaquin	--	--	--	17.66	--	--
Stanislaus	--	--	--	11.20	--	--
Tulare	--	--	--	6.59	--	--
<b>TOTAL</b>	--	--	--	82.83	--	--
<b>Asphalt Paving –Hot Mix Asphalt (540-564-0400-0000)</b>						
Fresno	--	--	--	-26.43	--	--
Kern <sup>(3)</sup>	--	--	--	-19.47	--	--
Kings	--	--	--	-3.75	--	--
Madera	--	--	--	-2.67	--	--
Merced	--	--	--	-6.10	--	--
San Joaquin	--	--	--	-15.54	--	--
Stanislaus	--	--	--	-13.45	--	--
Tulare	--	--	--	-10.61	--	--
<b>TOTAL</b>	--	--	--	-98.02	--	--
<b>Asphalt Paving – Emulsified Asphalt (540-566-0400-0000)</b>						
Fresno	--	--	--	-59.11	--	--
Kern <sup>(3)</sup>	--	--	--	-40.16	--	--
Kings	--	--	--	-7.51	--	--
Madera	--	--	--	-2.66	--	--
Merced	--	--	--	-8.88	--	--
San Joaquin	--	--	--	-31.24	--	--
Stanislaus	--	--	--	-30.22	--	--
Tulare	--	--	--	-20.99	--	--
<b>TOTAL</b>	--	--	--	-200.77	--	--

**Table 8 cont. Net change in emissions for asphalt paving in the SJVAPCD (2008-2007).**

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC <sup>(1)</sup>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Asphalt Paving – Unspecified (540-995-0400-0000)</b>						
Fresno	--	--	--	0.00	--	--
Kern <sup>(2)</sup>	--	--	--	0.00	--	--
Kings	--	--	--	0.00	--	--
Madera	--	--	--	0.00	--	--
Merced	--	--	--	0.00	--	--
San Joaquin	--	--	--	0.00	--	--
Stanislaus	--	--	--	0.00	--	--
Tulare	--	--	--	0.00	--	--
<b>TOTAL</b>	--	--	--	0.00	--	--

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

<sup>(2)</sup> Reflects only the Valley portion of Kern County.

## XV. Revision History

2008. This is a new District methodology.

## XVI. Update Schedule

In an effort to provide inventory information to CARB 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 the following table:

**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 the VOC emissions from this category are less than one (1) ton per day, it is recommended that this methodology be updated and revised every four years.

## XVII. References

- 1) American Society for Testing and Materials. 1972. ASTM D2026-72: Standard Specification for Cutback Asphalt (Slow-Curing Type). 2 pages.
- 2) American Society for Testing and Materials. 1976. ASTM D2027-76: Standard Specification for Cutback Asphalt (Medium-Curing Type). 2 pages.
- 3) American Society for Testing and Materials. 1976. ASTM D2028-76: Standard Specification for Cutback Asphalt (Rapid-Curing Type). 2 pages.
- 4) Asphalt Institute. 2009. 2008 Asphalt Usage Survey for the United States and Canada. <<http://www.asphaltinstitute.org>>
- 5) California Air Resources Board. 2010. CEPAM: 2009 Almanac - Population and Vehicle Trends. (Accessed June 16, 2010). <[http://www.arb.ca.gov/app/emsinv/trends/ems\\_trends.php](http://www.arb.ca.gov/app/emsinv/trends/ems_trends.php)>
- 6) California Air Resources Board. 2005. Draft memo dated 5/11/05: Comparison of Asphalt Paving Emission Factors. 2 pages. <[www.arb.ca.gov/ei/areasrc/draftmeth/asphcompar.pdf](http://www.arb.ca.gov/ei/areasrc/draftmeth/asphcompar.pdf)>
- 7) California Assembly Bill No. 338, Chapter 709 (Levine). Recycling: Crumb Rubber. <[http://info.sen.ca.gov/pub/05-06/bill/asm/ab\\_0301-0350/ab\\_338\\_bill\\_20051007\\_chaptered.pdf](http://info.sen.ca.gov/pub/05-06/bill/asm/ab_0301-0350/ab_338_bill_20051007_chaptered.pdf)>
- 8) Eastern Research Group, Inc. 2001. Emission Inventory Improvement Program (EIIP) (2000). Volume III: Chapter 17 - Asphalt Paving. Report prepared for the Area Source Committee of the Emission Inventory Improvement Committee, and for Charles Mann of the Air Pollution Prevention and Control Division, U.S. Environmental Protection Agency. 54 pages. <[http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii17\\_apr2001.pdf](http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii17_apr2001.pdf)>
- 9) KVB . 1978. Control of Hydrocarbon Emissions from Stationary Sources in the California South Coast Air Basin. Section 2, page 88.
- 10) Lutes, C.C., R.J. Thomas, and R. Burnette. 1994. Final Report - Evaluation of Emissions from Paving Asphalts. Report prepared for the United States Environmental Protection Agency, Office of Air Quality Planning and Standards EPA-600/R-94-135. Research Triangle Park, North Carolina. 207 pages.
- 11) Sonoma Technology, Inc. 2003. Central California Ozone Study, Attachment C: Asphalt Paving and Roofing. 27 pages. <[http://www.arb.ca.gov/ei/areasrc/ccosmeth/att\\_c\\_asphalt.doc](http://www.arb.ca.gov/ei/areasrc/ccosmeth/att_c_asphalt.doc)>
- 12) State of California Department of Transportation, Division of Maintenance. 2008. 2007 State of the Pavement. 34 pages. <[http://www.dot.ca.gov/hq/maint/2007\\_SOP\\_8\\_7\\_08.pdf](http://www.dot.ca.gov/hq/maint/2007_SOP_8_7_08.pdf)>

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- 13) State of California Department of Transportation. 2008. Analysis of Cost Differential Between Asphalt Containing Crumb Rubber and conventional Asphalt for 2007 Public Resources Code Section 42703. Report prepared for the State of California Business, Transportation and Housing Agency. 17 pages.  
<<http://www.dot.ca.gov/hq/oppd/rescons/ab338/Analysis-of-Cost-Differential-Btwn-AC-w-Crumb-Rubber-&-Conventional-AC-2007-Data-FINAL.pdf>>
- 14) State of California Department Of Transportation, Division of Transportation System Information. 2009. 2008 Californian Public Road Data. 86 pages.  
<<http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary/hpmspdf/2008PRD.pdf>>

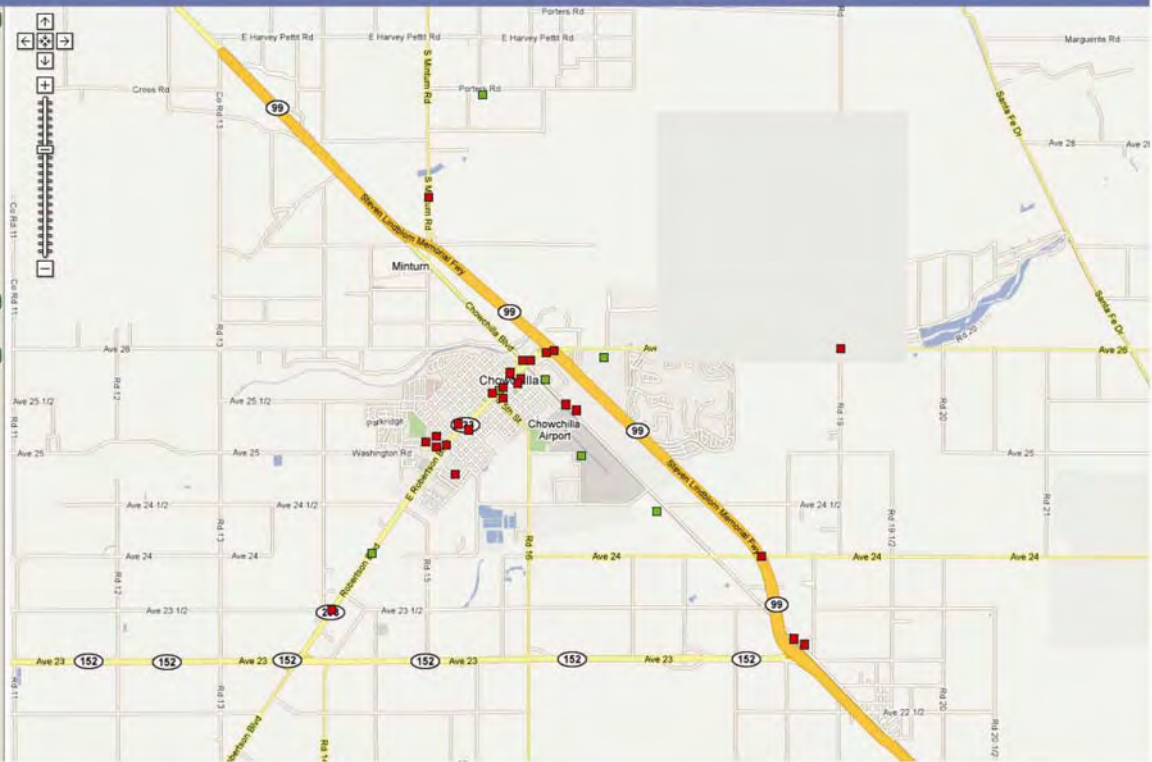
**Appendix VIII-A**  
**Hazardous Facilities and Hazardous Cleanup Locations**

# GEOTRACKER

- LAYERS**
- Leaking Underground Tank (LUST) Cleanup Sites
  - Other Cleanup Sites
  - Land Disposal Sites
  - Military Sites
  - Permitted Underground Storage Tank (UST) Facilities
  - Monitoring Wells
  - DTSC Cleanup Sites
  - DTSC Haz Waste Permit

**MAP SIZE**  
1600x1200

- OPTIONS**
- Site List - EXPORT TO EXCEL



GEOTRACKER ID	SITE NAME	CLEANUP STATUS	ADDRESS	CITY	LATITUDE
SL0603935695	ULTRAMAR, FORMER BEACON BULK PLANT NO.13646	OPEN - REMEDIATION	373 S. CHOWCHILLA BLVD.	CHOWCHILLA	37.1236
SLT5FR044359	CHOWCHILLA CLEANERS	OPEN - SITE ASSESSMENT	143 N 4TH ST	CHOWCHILLA	37.1222
SLT5FR644418	SAN JOAQUIN VALLEY ENERGY PARTNERS	OPEN - SITE ASSESSMENT	24772 RD. 16	CHOWCHILLA	37.1052
SLT5FS115111	TENNECO - MADERA ALMOND	COMPLETED - CASE CLOSED	20875 AVENUE 24	CHOWCHILLA	37.1266
SLT5FS761044	J R SIMPLOT - CHOWCHILLA	COMPLETED - CASE CLOSED	24148 ROBERTSON BLVD.	CHOWCHILLA	37.0993
SLT5FT204495	CHOWCHILLA MUN. AIRPORT	OPEN - SITE ASSESSMENT	1200 AIRPARK DR	CHOWCHILLA	37.113
SLT5FR791038	HAYWORTH FARMS	COMPLETED - CASE CLOSED	10439 AVENUE 25-1/2	CHOWCHILLA	37.1211
T0603900016	CHOWCHILLA WATER DISTRICT SHOP	COMPLETED - CASE CLOSED	321 CHOWCHILLA BLVD S	CHOWCHILLA	37.1202142
T0603900024	HOLLISTER TRUCKING	COMPLETED - CASE CLOSED	128 CHOWCHILLA BLVD	CHOWCHILLA	37.1256741
T0603900041	R.E. THARP, INC.	COMPLETED - CASE CLOSED	23500 ROBERTSON BLVD	CHOWCHILLA	37.0907916
T0603900066	TEXACO BUILDING	OPEN - INACTIVE	347 CHOWCHILLA BLVD S	CHOWCHILLA	37.1191042
T0603900072	CIRCLE K #3606	COMPLETED - CASE CLOSED	1104 ROBERTSON BLVD	CHOWCHILLA	37.1163622
T0603900077	PISTORESI CHEVROLET	OPEN - SITE ASSESSMENT	442 ROBERTSON BLVD	CHOWCHILLA	37.1211662
T0603900078	EXXON MINI MART	OPEN - REMEDIATION	130 ROBERTSON E	CHOWCHILLA	37.1257021
T0603900079	CHILD TRUCK LINES	COMPLETED - CASE CLOSED	16505 AVE 24-1/2	CHOWCHILLA	37.0862369
T0603900082	ASH SLOUGH VINEYARDS	COMPLETED - CASE CLOSED	27450 RD 19	CHOWCHILLA	37.1273805
T0603900084	ANDERSON CLAYTON	COMPLETED - CASE CLOSED	24772 RD 16	CHOWCHILLA	37.1143353
T0603900089	CHOWCHILLA MILL	COMPLETED - CASE CLOSED	25184 RD 16	CHOWCHILLA	37.1098073
T0603900095	JIFFY MART	OPEN - SITE ASSESSMENT	1505 ROBERTSON BLVD	CHOWCHILLA	37.1139193
T0603900102	BEACON STATION #366	COMPLETED - CASE CLOSED	107 ROBERTSON BLVD	CHOWCHILLA	37.1234031
T0603900105	CHOWCHILLA TIRE & WHEEL	OPEN - SITE ASSESSMENT	247 ROBERTSON BLVD W	CHOWCHILLA	37.1267411
T0603900111	MARSH'S SHELL	COMPLETED - CASE CLOSED	48 ROBERTSON BLVD	CHOWCHILLA	37.1235361
T0603900114	CASTLE WAREHOUSE & DIST.	COMPLETED - CASE CLOSED	16505 AVE 24 1/2	CHOWCHILLA	37.0862369
T0603900124	POST TRUCKING	COMPLETED - CASE CLOSED	18448 AVE 24	CHOWCHILLA	37.0982667
T0603900126	AQUINO'S TEXACO	COMPLETED - CASE CLOSED	125 CHOWCHILLA BLVD S	CHOWCHILLA	37.1143353
T0603900129	AQUINOS EXXON	OPEN - SITE ASSESSMENT	441 ROBERTSON BLVD W	CHOWCHILLA	37.1211662
T0603900147	BACCHUS FARMS	COMPLETED - CASE CLOSED	17085 AVE 26	CHOWCHILLA	37.1270431
T0603900154	CHOWCHILLA CITY AIRPORT	COMPLETED - CASE CLOSED	16487 AVENUE 25	CHOWCHILLA	37.1143353
T0603900158	CHOWCHILLA CHEVRON	COMPLETED - CASE CLOSED	440 ROBERTSON BLVD	CHOWCHILLA	37.1211662
T0603900173	CHOWCHILLA CITY POLICE & FIRE	COMPLETED - CASE CLOSED	122 TRINITY AVE	CHOWCHILLA	37.1225401
T0603900178	S & K MINI MART	COMPLETED - CASE CLOSED	1104 ROBERTSON BLVD	CHOWCHILLA	37.1163622
T0603983878	MINTURN PROPERTY	COMPLETED - CASE CLOSED	27600 ROAD 15	CHOWCHILLA	37.148599
T0603900114	CASTLE WAREHOUSE & DIST.	COMPLETED - CASE CLOSED	16505 AVE 24 1/2	CHOWCHILLA	37.0862369
T0603900124	POST TRUCKING	COMPLETED - CASE CLOSED	18448 AVE 24	CHOWCHILLA	37.0982667
T0603900125	DE BENEDITTO FARMS	COMPLETED - CASE CLOSED	26808 RD 23	CHOWCHILLA	37.1269551
T0603900126	AQUINO'S TEXACO	COMPLETED - CASE CLOSED	125 CHOWCHILLA BLVD S	CHOWCHILLA	37.1143353
T0603900129	AQUINOS EXXON	OPEN - SITE ASSESSMENT	441 ROBERTSON BLVD W	CHOWCHILLA	37.1211662
T0603900147	BACCHUS FARMS	COMPLETED - CASE CLOSED	17085 AVE 26	CHOWCHILLA	37.1270431
T0603900154	CHOWCHILLA CITY AIRPORT	COMPLETED - CASE CLOSED	16487 AVENUE 25	CHOWCHILLA	37.1143353
T0603900158	CHOWCHILLA CHEVRON	COMPLETED - CASE CLOSED	440 ROBERTSON BLVD	CHOWCHILLA	37.1211662
T0603900173	CHOWCHILLA CITY POLICE & FIRE	COMPLETED - CASE CLOSED	122 TRINITY AVE	CHOWCHILLA	37.1225401
T0603900178	S & K MINI MART	COMPLETED - CASE CLOSED	1104 ROBERTSON BLVD	CHOWCHILLA	37.1163622
T0603983878	MINTURN PROPERTY	COMPLETED - CASE CLOSED	27600 ROAD 15	CHOWCHILLA	37.148599