SACRAMENTO REGIONAL

8-HOUR OZONE ATTAINMENT AND

REASONABLE FURTHER PROGRESS PLAN

APPENDIX C

PROPOSED CONTROL MEASURES

December 19, 2008

El Dorado County Air Quality Management District
Marcella McTaggart, Air Pollution Control Officer
2850 Fairlane Court, Bldg. C
Placerville, CA 95667-4100
(530) 621-6662
http://www.co.el-dorado.ca.us/emd/apcd

Feather River Air Quality Management District
David Valler, Jr., Air Pollution Control Officer
938 14th Street
Marysville, CA 95901-4149
(530) 634-7659
http://www.fraqmd.org

Placer County Air Pollution Control District
Tom Christofk, Air Pollution Control Officer
3091 County Center Drive, Suite 240
Auburn, CA 95603
(530) 745-2330
http://www.placer.ca.gov/Departments/Air.aspx

Sacramento Metropolitan Air Quality Management District
Larry Greene, Air Pollution Control Officer
777 12th Street, Third Floor
Sacramento, CA 95814-1908
(916) 874-4800
http://www.airquality.org

Yolo-Solano Air Quality Management District
Mat Ehrhardt, Air Pollution Control Officer
1947 Galileo Court, Suite 103
Davis, CA 95618
(530) 757-3650
http://www.ysaqmd.org

SACRAMENTO REGIONAL

8-HOUR OZONE ATTAINMENT AND

REASONABLE FURTHER PROGRESS PLAN

APPENDIX C

PROPOSED CONTROL MEASURES

This appendix to the Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan contains more detailed descriptions of the potential control strategies being considered for future emission reductions, which will help the region meet the federal Clean Air Act requirements for the 1997 8-hour ozone standard.

Appendix C: Proposed Control Measures

Appendix C contains a summary table of emission reductions by control measure and a summary table of emission reductions by air district. This appendix also includes more detailed information on the individual proposed control measures. The non-regulatory control measures are listed first and include various regional measures (on-road and off-road mobile incentive programs, and an emerging/voluntary urban forest development program). These are followed by the regulatory control measures, which include indirect source rules and a variety of stationary and area-wide source control measures. The stationary and area-wide source measures include write-ups for individual air districts in the Sacramento nonattainment area. The final section includes a description of further study measures. Information on transportation control measures is included in Appendix D.

Stationary and Area-wide Source Control Measures

VOC Control Measures

NOx Control Measures

Further Study Measures

Summary Table of Emission Reductions by Control Measure

Measure Name	Emission Reductions (TPD)	
	2018	
	VOC	NO_x
Non-regulatory Measures		
Regional Mobile Incentive Program – On-road	**0.060**	**0.910**
Regional Mobile Incentive Program – Off-road	**0.005**	**0.013**
Spare The Air Program	**0.059**	**0.046**
SACOG Transportation Control Measures	**tbd**	**tbd**
Urban Forest Development Program	**0 - 0.18**	**-**
Total Non-regulatory Measures	**0.12**	**0.97**
Regulatory Measures		
Indirect Source Rule – Construction Mitigation	**-**	**0.136**
Indirect Source Rule – Operational ISR	**0–0.04**	**0-0.13**
Stationary and Area-wide Source Measures		
Architectural Coating		
SMAQMD-442	0.913	-
EDCAQMD-215	0.186	-
FRAQMD-3.15	0.004	-
PCAPCD-218	0.201	-
YSAQMD-2.14	0.214	-
Total Architectural Coating	**1.52**	
Automotive Refinishing		
SMAQMD-459	0.113	-
FRAQMD-3.19	0.001	-
PCAPCD-234	0.045	-
YSAQMD-2.26	0.058	-
Total Automotive Refinishing	**0.22**	
Degreasing/Solvent Cleaning		
SMAQMD-454/466	0.593	-
EDCAQMD-225/235	0.076	-
FRAQMD-3.14	0.001	-
YSAQMD-2.24/2.31	0.762	-
Total Degreasing/Solvent Cleaning	**1.43**	
Graphic Arts		
YSAQMD-2.29	---	-
Total Graphic Arts	**---**	
Miscellaneous Metal Parts and Products		
EDCAQMD-246	0.002	-
PCAPCD-CM3	0.014	-

Measure Name	Emission Reductions (TPD) 2018	
	VOC	NO_x
Total Miscellaneous Metal Parts and Products	**0.02**	
Natural Gas Production and Processing		
SMAQMD-461	0.116	-
Total Natural Gas Production and Processing	**0.12**	-
Asphalt Concrete		
SMAQMD-471	-	0.132
PCAPCD-CM1	-	0.036
Total Asphalt Concrete		**0.17**
Boilers, Steam Gen. and Process Heaters		
YSAQMD-2.27	-	0.288
Total Boilers, Steam Gen. and Process Heaters		**0.29**
IC Engines		
SMAQMD-412	-	0.013
FRAQMD-3.22	-	0.004
YSAQMD-2.32	-	0.118
Total IC Engines		**0.14**
Large Water Heaters and Small Boilers		
SMAQMD-414	-	1.117
EDCAQMD-239	-	0.003
FRAQMD-3.23	-	0.000
PCAPCD-CM2	-	0.030
YSAQMD-2.37	-	0.240
Total Large Water Heaters and Small Boilers		**1.39**
Total Stationary and Area Source Measures	**3.30**	**1.98**
Total Regulatory Measures	**3.30**	**2.12**
Total Reductions	**3.42**	**3.09**

tbd = to be determined

Summary Table of Emission Reductions by Air District

Air District Control Measure Name (Rule No.)	Emission Reductions (TPD)	
	2018	
	VOC	NOx
Stationary and Area Source Measures		
Sacramento Metropolitan AQMD		
Architectural Coating (SMAQMD-442)	0.913	-
Automotive Refinishing (SMAQMD-459)	0.113	-
Degreasing/Solvent Cleaning (SMAQMD-454/466)	0.593	-
Natural Gas Production and Processing (SMAQMD-461)	0.116	-
Asphalt Concrete (SMAQMD-471)	-	0.132
IC Engines (SMAQMD-412)	-	0.013
Large Water Heaters and Small Boilers (SMAQMD-414)	-	1.117
Total Sacramento Metropolitan AQMD	**1.74**	**1.26**
El Dorado County AQMD		
Architectural Coating (EDCAQMD-215)	0.186	-
Degreasing/Solvent Cleaning (EDCAQMD-225/235)	0.076	-
Misc. Metal Parts and Products (EDCAQMD-246)	0.002	-
Large Water Heaters and Small Boilers (EDCAQMD-239)	-	0.003
Total El Dorado County AQMD	**0.26**	**0.00**
Feather River AQMD		
Architectural Coating (FRAQMD-3.15)	0.004	-
Automotive Refinishing (FRAQMD-3.19)	0.001	-
Degreasing/Solvent Cleaning (FRAQMD-3.14)	0.001	-
IC Engines (FRAQMD-3.22)	-	0.004
Large Water Heaters and Small Boilers (FRAQMD-3.23)	-	0.000
Total Feather River AQMD	**0.01**	**0.00**
Placer County APCD		
Architectural Coating (PCAPCD-218)	0.201	-
Automotive Refinishing (PCAPCD-234)	0.045	-
Misc. Metal Parts and Products (PCAPCD-CM3)	0.014	-
Asphalt Concrete (PCAPCD-CM1)	-	0.036
Large Water Heaters and Small Boilers (PCAPCD-CM2)	-	0.030
Total Placer County APCD	**0.26**	**0.07**
Yolo-Solano AQMD		
Architectural Coating (YSAQMD-2.14)	0.214	-
Automotive Refinishing (YSAQMD-2.26)	0.058	-
Degreasing/Solvent Cleaning (YSAQMD-2.24/2.31)	0.762	-
Graphic Arts (YSAQMD-2.29)	---	-
Boilers, Steam Gen. & Process Heaters (YSAQMD-2.27)	-	0.288
IC Engines (YSAQMD-2.32)	-	0.118
Large Water Heaters and Small Boilers (YSAQMD-2.37)	-	0.240
Total Yolo-Solano AQMD	**1.03**	**0.65**
Total Stationary and Area-wide Source Measures	**3.30**	**1.98**

Summary Table of Emission Reductions for Adopted New Local Control Measures

New Local Control Measures Adopted by End of 2008	Emission Reductions (TPD)	
	2018	
Control Measures (Air District-Rule No.)	**VOC**	**NO_x**
Automotive Refinishing (YSAQMD-2.26)	0.058	--
Degreasing/Solvent Cleaning (SMAQMD-454/466)	0.593	--
Degreasing/Solvent Cleaning (YSAQMD-2.24/2.31)	0.762	--
Miscellaneous Metal Parts and Products (PCAPCD-CM3)	0.014	--
Total Adopted New Local Measures	**1.43**	**--**

Non-regulatory Control Measures

CONTROL MEASURE NUMBER: Regional Mobile Measures

Control Measure Title: All Mobile Source Incentive Programs
Evaluation Date: July 29, 2008

Control Measure Description

Mobile sources such as trucks, automobiles, trains, boats, construction and farm equipment are by far the largest sources of ozone precursors in the Sacramento nonattainment area. Included under this major source category are all non-stationary sources from lawn mowers to jumbo jets. The air districts do not have authority to directly regulate mobile source emissions through emission standards; however, the air district incentive programs (and indirect source rules) may complement state and federal regulatory efforts in reducing mobile source emissions. These regional mobile source incentive measures are implemented in all or parts of the Sacramento nonattainment area by the air districts.

The estimated emission reductions from these proposed regional mobile incentive measures are summarized for all mobile source incentive programs and disaggregated by reductions for the on-road mobile and off-road mobile control measures.

Because many of the incentive measures in the categories below target the same vehicles or engines, it is difficult to predict in advance what portion of the benefits should be assigned to each of the individual strategies. Therefore, the benefits from the collection of measures have been estimated, and all or any portion of the measures may be implemented to achieve those benefits. Some measures noted may likewise not be implemented if cost effective reductions are not available. However, for purposes of establishing motor vehicle emission budgets in each of the milestone years for transportation conformity, an explicit commitment is made to the reductions associated with the on-road mobile source incentive program.

The incentive program measures noted below rely on funding provided according to existing laws and policies. The funding sources for 2008-2018 include SECAT program ($38.4M), local district Department of Motor Vehicle fees ($13.0M), and local district revenues for Mowdown ($0.35M).

Individual Measure Descriptions

Implement a variety of incentive programs for on-road vehicles and off-road equipment. The programs include:

ONMS-LD-1 (ONMS-LD-2). Light Duty Early Retirement - Implement an incentive based light-duty vehicle early retirement program. The program is focused on accelerating retirement of non-OBD-II vehicles.

ONMS-HD-1 (ONMS-HD-5). SECAT-Like Program - The measure implements an incentive program for NOx reduction in heavy-duty vehicles similar to that created by the Sacramento Emergency Clean Air Transportation (SECAT) program.

SMAQMD OFMS-SI-1. Zero Emission Lawn and Garden Incentive (Residential) - This measure implements a year-round continuous incentive program for the replacement of residential spark ignited gasoline-powered mowers with electric or zero emission alternatives in 2008-2018.

SMAQMD OFMS-HD-1. Off-road CI Incentive Program - This measure implements an incentive program for NOx reductions through aftertreatment retrofits, engine replacement and fleet modernization in off-road heavy-duty compression ignition (CI) equipment.

Control Measure Funding and Sources

There are a number of funding sources available to the Sacramento region for reducing emissions. These funding sources include the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer), the Sacramento Emergency Clean Air and Transportation Program (SECAT) and the Goods Movement Emission Reduction Program (GMERP). The California Air Resources Board (CARB) develops guidelines and provides the funding for the Moyer and GMERP Programs[1]. The guidelines for the SECAT Program are developed by the Sacramento Air District (District) and approved by the boards of both the District and the Sacramento Area Council of Governments (SACOG). The funding for the SECAT Program is provided by SACOG from federal transportation funds. The district also collects fees on vehicles registered in Sacramento County. Two dollars of that fee is used to fund local match for the Moyer Program and for funding school bus projects. The funding for the Electric Lawnmower Exchange Program (Mow Down Air Pollution) comes from fines collected from sources cited for permit violations. The table below summarizes these funding sources from 2008 to 2018.

Description	Funding Sources
ONMS-LD-1	AB923 - $1,000,000 annually ('09-'14) SECAT - $3,200,000 annually ('08-'14); $4,000,000 annually ('15-'18)
ONMS-HD-1	
OFMS-SI-1	DMV, AB923 – $1,000,000 annually ('08-'14) District revenues for Mowdown - $50,000 annually ('08-'14)
OFMS-HD-1	

Targeted EIC Categories and Planning Inventory

The emissions reductions and percentages were also broken out for the on-road and off-road segments. On-road segments in EIC codes 710, 722, and 723. Off-road segments include EIC codes 860 and 870. The impact on various part of the EIC categories differ based on difference between old and new vehicle emissions rates. Evaporative EIC categories will have different percent effectiveness than exhaust categories.

[1] We have assumed that the ARB will take credit for all Moyer and GMERP emission reductions so no District Moyer or GMERP funding or emissions were included.

EIC Code	EIC Description	Nonattainment Planning Inventory							
		2011		2014		2017		2018	
		NOx (tpd)	ROG (tpd)	NOx (tpd)	ROG (tpd)	NOx (tpd)	ROG (tpd)	NOx (tpd)	ROG (tpd)
710	LIGHT DUTY PASSENGER (LDA)	7.93	12.24	5.89	9.44	4.49	7.73	4.16	7.27
722	LIGHT DUTY TRUCKS - 1 (LDT1)	3.37	4.50	2.64	3.69	2.02	3.07	1.82	2.89
723	LIGHT DUTY TRUCKS - 2 (LDT2)	7.14	7.08	5.74	6.38	4.65	5.86	4.36	5.72
744	MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV)	8.51	0.20	6.55	0.19	5.01	0.17	4.60	0.16
746	HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV)	34.28	2.86	25.77	2.29	19.38	1.86	17.77	1.73
860	OFF-ROAD EQUIPMENT	21.43	10.17	18.53	8.94	15.28	7.98	14.33	7.74
870	AGRICULTURAL EQUIPMENT	9.05	1.82	7.35	1.41	5.81	1.09	5.33	0.99
	Total	**91.71**	**38.86**	**72.47**	**32.34**	**56.65**	**27.75**	**52.36**	**26.49**

Sacramento NAA Inventory with ARB's Private Truck and Off-Road Fleet Rules

The targeted inventory baselines have been adjusted to reflect the impact of ARB's On-road Private Truck and Off-Road Fleet Rules. Based on ARB's State Implementation Plan Chapter 5 "Proposed New SIP Measures" reduction percentages were estimated using an average percentage reduction from the South Coast and the San Joaquin Valley estimates and then applying these estimates to the targeted inventory. These reductions where assumed to be achieved through the new ARB regulations which included both Moyer and GMERP incentive funding.

EIC Code	EIC Description	Nonattainment Planning Inventory (Adjusted)							
		2011		2014		2017		2018	
		NOx (tpd)	ROG (tpd)	NOx (tpd)	ROG (tpd)	NOx (tpd)	ROG (tpd)	NOx (tpd)	ROG (tpd)
710	LIGHT DUTY PASSENGER (LDA)	7.93	12.24	5.89	9.44	4.49	7.73	4.16	7.27
722	LIGHT DUTY TRUCKS - 1 (LDT1)	3.37	4.50	2.64	3.69	2.02	3.07	1.82	2.89
723	LIGHT DUTY TRUCKS - 2 (LDT2)	7.14	7.08	5.74	6.38	4.65	5.86	4.36	5.72
744	MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV)	7.22	0.16	4.03	0.09	3.16	0.09	2.93	0.09
746	HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV)	29.09	2.25	15.84	1.14	12.24	1.03	11.34	1.00
860	OFF-ROAD EQUIPMENT	21.04	10.06	16.98	8.49	13.13	7.52	11.96	7.28
870	AGRICULTURAL EQUIPMENT	9.05	1.82	7.35	1.41	5.81	1.09	5.33	0.99
	Total	**84.83**	**38.10**	**58.46**	**30.65**	**45.50**	**26.39**	**41.91**	**25.23**

Emission Reductions

The emission reductions are based on a variety of actions taken for all on- and off-road applications. The table below provides aggregate emission reductions and percentages for all milestone years and the compliance year 2018.

Total

Year	NOx		ROG	
	Tpd	%	Tpd	%
2011	0.940	1.11%	0.192	0.50%
2014	0.926	1.58%	0.192	0.63%
2017	0.931	2.05%	0.086	0.33%
2018	0.923	2.20%	0.066	0.26%

On-road Measures

Year	NOx		ROG	
	Tpd	%	Tpd	%
2011	0.726	1.33%	0.157	0.60%
2014	0.821	2.41%	0.151	0.73%
2017	0.900	3.39%	0.074	0.42%
2018	0.910	3.70%	0.060	0.36%

Off-road Measures

Year	NOx		ROG	
	Tpd	%	Tpd	%
2011	0.214	0.71%	0.035	0.29%
2014	0.105	0.43%	0.041	0.41%
2017	0.031	0.17%	0.012	0.14%
2018	0.013	0.07%	0.005	0.06%

Needed Resources and Authority:

Potential Implementing Agency	Agency Type	Authority Origin
Air Districts	Regional	All Air Districts: California Health and Safety Code 44299.50-44299.55 SMAQMD Only: California Health and Safety Code 41014, 41062, 41081, 41082, Other Air Districts: California Health and Safety Code: 44220 et. seq.

References:

ONMS-LD-1:
TIAX. “Revised Scrappage Memo.” Memo to SMAQMD staff. May 2005.

Bureau of Automotive Repair Website: www.smogcheck.ca.gov.

Bay Area Air Quality Management District Website: www.baaqmd.gov

Bay Area Air Quality Management District Vehicle Buy Back Program Annual Report, July 1, 2004

Consumer Assistance Program (CAP) Background Information Fact Sheet (http://www.breatheeasier.ca.gov/be_capbackground.pdf)

Consumer Assistance Program (CAP) retirement application (http://smogcheck.ca.gov/ftp/pdfforms/cap_app.pdf)

Vanessa Mongeon, Vehicle Buy Back program manger, BAAQMD.

ONMS-HD-1:
"Currently Verified Technologies", California Air Resources Board, http://www.arb.ca.gov/diesel/verdev/verifiedtechnologies/cvt.htm, accessed on 6 July 2006.

Johnson-Matthey EGRT Data Sheet, accessed at http://ect.jmcatalysts.com/pdf/EGRT.pdf on 7 July 2006.

Cleaire website, accessed at http://www.cleaire.com/ on 7 July 2006.

Appendix C: Cost Effectiveness Methodology, Public Fleet Rule, ARB.

Bureau of Economic, Analysis, US Department of Commerce. http://www.bea.gov/bea/an/0797fr/table3.htm.

"SECAT Fast Track Request 6/28/06" (e-mail), Mike Neuenberg, 28 June 2006.

SCRT System Diesel Retrofit Emissions Control Solutions, Johnson Matthey website, accessed 17 July 2007, www.jmcatalysts.com

"Proposed New SIP Measures – Descriptions" Chapter 5, 2007 State Implementation Plan, CARB, April 26, 2007 -- http://www.arb.ca.gov/planning/sip/2007sip/2007sip.htm

"The Carl Moyer Guidelines, Proposed 2008 Revisions ", adopted March 27, 2008 -- http://www.arb.ca.gov/msprog/moyer/2008guideline_updates.htm

OFMS-HD-1:
"Currently Verified Technologies", California Air Resources Board, http://www.arb.ca.gov/diesel/verdev/verifiedtechnologies/cvt.htm, accessed on 6 July 2006.

US EPA letter, 3 December 2004, http://enginecontrolsystems.com/pdf/verif_letter-ecs2.pdf, accessed on 10 July 2006.

Bureau of Economic, Analysis, US Department of Commerce. http://www.bea.gov/bea/an/0797fr/table3.htm.

Electronic communication, Richard Carlson, 19 July 2006.

"Off-road Construction Equipment Diesel Emission Reduction Technologies, Tier 1-4 Implementation Schedule"
TIAX. Presentation to CAPCOA Workshop, July 2004.

"Public Workshop to Discuss Diesel Off-Road Equipment Measure", California Air Resources Board presentation, 24 January 2006.

CARB's mail-out # 99-32, Appendix B.

“Rulemaking to Consider the Final Adoption of a Proposed Regulation For In-Use Off-road Diesel Vehicles”, CARB April 6, 2007 – http://www.arb.ca.gov/regact/2007/ordiesl07/ordiesl07.htm

“Proposed New SIP Measures – Descriptions” Chapter 5, 2007 State Implementation Plan, CARB, April 26, 2007 -- http://www.arb.ca.gov/planning/sip/2007sip/2007sip.htm

OFMS-SI-1:

“Report to the Board on the Potential Electrification Programs for Small Off-Road Engines”, ARB Staff Report, 2 April 2004.

Lifetime considerations. Charlene McGhee, SMAQMD. (Mow Down Air Pollution Control Studies through 2007)

Control Measure Number: **SMAQMD-1**

Control Measure Title: **Urban Forest Air Quality Development Program**

Control Measure Summary

The regional urban forest is populated by 7 million trees from over 100 different species. Each of these tree species can be categorized as low, medium, and high biogenic volatile organic compound (BVOC) emitting trees. Currently, 61% of the trees are considered as low emitting trees, 28% as medium emitting trees, and 11% as high emitting trees. This control measure proposes a targeted urban forest management program to reduce total urban forest BVOC emissions[1] by favoring the planting of low emitting trees rather than medium and high emitting trees in the next 10 years[2]

Through a combination of community education and governmental policy change over the next 10 years, this control measure calls for a minimum 390,000 low emitting trees to be planted that otherwise would have been medium or high emitting trees. This tree planting strategy change will reduce BVOC emissions by up to 0.84 tpd. The total estimated project cost is $1.71 million. Although the duration of the project is 10 years, the actual benefit will last many years. To be conservative we assume a 25 years planning period and the cost effectiveness of the BVOC reduction is $1,291 per ton or $0.65 per pound.

Control Measure Description

Our region, which includes the Sacramento Federal Ozone Nonattainment Area, has succeeded in creating a renowned urban forest. Our forest evolved over many years, with each generation of our community adding trees that met the needs of their day. In earlier years, urban trees were planted for comfort cooling and public health benefits. More recently, the Sacramento Municipal Utility District (SMUD) has invested millions of dollars in the strategic planting of an energy-saving urban forest. Today we have a pressing need to improve the purity of the region's air. While our urban trees make a major contribution to air quality, they were not planted with this in mind and so do not do as much as they could.

We enjoy the benefits of 7 million trees in the urban areas of our region. These trees shade between 12% and 14% of our urban area (McPherson 1998 and STF UFORE 2007). The variety of threats that urban trees confront (mortality, diseases, and natural disasters) reduces their average life to 40 years. Consequently, just to maintain our current canopy level, the region will collectively need to plant 1.75 million replacement trees over the next 10 years. To optimize the benefits of these trees for air quality, care must be taken to select trees that will not only grow well in Sacramento's climate but that will also emit low levels of BVOCs.

[1] BVOC emissions from trees largely consist of isoprene, monoterpenes, and methlybutenol (MBO) However a host of other compounds are emitted in smaller quantities, referred to here as other VOCs (OVOCs). No MBO emissions were assumed since they only occur only with a few species of pine not used. The approach are similar to that used by the California Air Resources Board to account for OVOCs (Klaus Scott, Emission Inventory Analysis Section, personal communication, 7/28/2006), which is to estimate OVOCs as 30% of the total emissions of isoprene + monoterpenes + MBO. More information in the Phase 1a report (Simpson 2007)

[2] STF is currently working on providing tree lists for each emitter category for different jurisdictions and will be provided by SIP submittal date to EPA.

Historically, the trees planted in our region have been 61% low-emitting and 39% high/medium-emitting trees (Simpson 2007). This traditional tree selection, defined as the 'current mix,' determines the emission profile for the current urban forest. By emphasizing low-emitter planting without considering the additional urban growth in the next 10 years, this control measure will at minimum change the future mix to be 66% low-emitting and 34% high/medium-emitting trees. To achieve this change, the control measure proposes an education program for community and landscape industry leaders in conjunction with local government policy changes. The planting assumptions are spelled out in the References of this measure (McPherson 1998, Simpson 2006, Simpson 2007).

Four groups within our region--local governments, community groups, property owners, and developers, either by themselves or through their landscapers—plant almost all trees. Local governments plant trees directly on land they control, such as parks or streets. Through the ordinances and policies that they create, local government also influence the planting of a great many more trees. The development community plants a large number of trees for this reason. Six tree non-profits in our region are major tree planters and a large number of community service groups occasionally host tree-planting projects. Private property owners, apart from any activities of the not-for-profits or local governments, are significant tree planters.

One of the requirements of a SIP control measure is that the emission reductions be verified. This requirement presents a special challenge for a tree measure. Tree planting is broadly dispersed and undertaken by a large number of individuals and organizations. There are few reporting mechanisms and almost no tracking requirements. It is not possible today to predict who specifically will plant the millions of trees we will need or where they will be planted. It is infeasible to strictly account for each tree planted and then to verify the planting and survival of a statistically valid number of individual trees. These difficulties in quantification have historically kept trees out of air quality attainment plans.

In September 2004, USEPA issued guidance giving states the opportunity to include a small number of projects that do not have the same high level of certainty as traditional control measures (USEPA 2004). Tree planting measure is specifically included as an option under this policy. The policy guidance is clear that these non-traditional, voluntary measure, or emerging measures, as they have become known, still require verification and tracking with best information systems available. This is consistent with EPA policy[1] for incorporating emerging and voluntary measures in a SIP but limiting the amount of emission reductions allowed due to the uncertainty and untested nature of the control mechanisms. For total emerging and voluntary measures, EPA has adopted a presumptive limit[2,3] of 6 percent of the total amount of emission reductions necessary to demonstrate attainment. For this region, the 6% level limits this measure to 0.18 tpd of VOC reductions. A detailed calculation of claimable emission reductions is described in Appendix 9.

To meet the verification requirement, the Urban Forest Air Quality Development Program will use a system of field surveys to measure actual planting activity, tree survival and growth. This survey system is named the Urban Forest Effects model (UFORE) and was developed by the US Forest Service. When this survey system is employed, sample plots are established

[1] "Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP)" (OAQPS, EPA, September 2004).
[2] Ibid., p. 9.
[3] The limit is presumptive in that the USEPA believes it may approve measure into a SIP in excess of the presumptive 6 percent where a clear and convincing justification is made by the State for a higher limit.

throughout the urban forest and detailed information is collected that can be used to characterize the entire forest. Periodic re-sampling at milestone years will track urban forest changes during the life of the project and demonstrate that low emitting trees are planted at a higher rate. In addition to the UFORE system, the Urban Forest Air Quality Program will ask participating jurisdictions and retailers to keep a comprehensive database of any tree planting or tree sales through 2018. This will aid in quantifying and verifying planting efforts in the region and supplement the UFORE survey results. A more detailed description of the UFORE system and how the tree database will aid if jurisdictions meet planting goals is presented in Appendices 4, 5 and 6 of this measure.

At least one and perhaps several agencies and organizations will be responsible for the timely completion of the activities of the control measure. In this measure, local governments will formally guarantee by resolution the tree species composition changes needed to complete this measure.

Emissions estimating and validation

To calculate emissions reductions, forest canopy emissions were estimated in two ways. The first estimate is derived from the business-as-usual (BAU) scenario. In the BAU scenario, we assumed that the current urban forest—its species and size distribution of trees--would be maintained and planted between now and 2018. The second estimate is the control measure scenario (CMS). To create the CMS, we changed the mix of tree species planted to favor lower emitting trees over higher emitting trees and recalculated emissions. The emission reduction claim of the control measure is the difference between these two scenarios.

The reduction calculation requires much more detail, beginning with the business-as-usual scenario. We had to contend with a variety of issues. The existing forest continues to grow and expand. Trees are planted and die. Smaller trees have different effects than larger trees. Each species of tree has a different effect on air quality. The urbanized area of the region continues to expand into undeveloped areas. During this transformation, pre-development trees are often replaced with very different urban trees. At first, the canopy cover of urbanizing areas often drops as land is cleared for development but soon young trees grow to create a much greater cover.

To address these issues, the Sacramento Urban Forest Ecosystem Study (McPherson, 1998) and the Benefit Cost Analysis of Modesto's Municipal Urban Forest (McPherson et al, 1999) were used to characterize current regional urban forest. These studies conclude that the regional canopy is 14% in developed areas and 5% in undeveloped areas slated for development. Tree species, size, age and health distributions documented in these studies were applied to the Sacramento region's canopy coverage figures to characterize the current urban forest. To estimate the business-as-usual canopy of 2018, the same ratios were applied to the future forest. As the community expands, as trees are planted and as they grow, the BAU scenario assumes that emitter category distribution of the urban forest remains constant.

Calculating the actual BVOC emissions of the current and projected urban forests is not straightforward. Of the hundreds of species of trees that exist in the Sacramento region, only handfuls have had their emissions measured. Biogenic VOC emissions are species-specific, and strongly dependent on the amount of leaf mass and environmental conditions such as available sunlight. Field sampling has found large variation in BVOC emissions for a particular species of tree from region-to-region, day-to-day and even hour-to-hour. To simplify the calculation and create a manageable data set for analysis, the 100+ tree species present in the

Sacramento regional urban forest were consolidated into eleven categories or families that have reasonably well-known emission profiles. Total emissions were then calculated considering the number and size of these trees today and in 2018 (Simpson, McPherson, 2007).

The CMS was created using the same base studies and assumptions used in the BAU scenario with one key difference. Since there are 7 million trees in the urban forest (61% low emitters, 28% medium, and 11% high emitters), approximately 1.75 million trees will be planted to replace trees that die. The BAU scenario assumes that replacements trees will follow the current mix profile. The initial study (Simpson 2007) of the control measure estimated that 1.75 million trees will be needed to be replaced over the next 10 years to maintain the current tree canopy cover due to the natural death of trees, tree diseases, or natural disasters. Preliminary photochemical modeling indicated that a total of 12tpd of VOC emissions was needed to demonstrate attainment in 2018. This established the limit of claimable reductions of 0.84tpd [1] Therefore it was determined that the minimum number of trees needed to be diverted from the number of 1.75 million replacement trees would be 390,000. Any future trees planted in the region using the CMS tree species profile will secure the emission reductions claimed in this control measure.

In addition to tree replacement, new trees will be planted in the new developed areas to maintain the region's traditional urban tree canopy cover in the urban area; these may include both suburbs and in-fills. However, there is a degree of uncertainty on the number of additional trees that will be planted in the Sacramento Region for the next 10 years, so the total number of trees in 2018 will be variable (n_{2018}). These figures are summarized in Table 2.

[1] EPA has a presumptive limit of 6% of the total amount of emission reduction necessary to achieve the planning requirement for attainment demonstration purposes. The 0.84 was based on preliminary modeling results. Final modeling and claimable reduction calculation details are provided in Appendix 9.

Table 1: 2018 Business-as-usual forest populations

2018 Business-as-usual forest canopy

Tree to maintain target urban tree canopy

Units: millions	Low emitting trees	Medium Emitting trees	High emitting trees	Total Trees
(1) 2008 trees remaining in 2018	3.20	1.47	0.58	5.25
(2) Replacement Trees	1.07	0.48	0.20	1.75
(3) New Trees	$0.61(n_{2018}-7)$	$0.28(n_{2018}-7)$	$0.11(n_{2018}-7)$	$N_{2018}-7$
(4) Resulting Total	$0.61n_{2018}$	$0.28n_{2018}$	$0.11n_{2018}$	n_{2018}

Table 2: Control measure results anticipated in 2018[1]

2018 Control Measure Scenario

Trees to maintain target urban tree canopy

Units: millions	Low emitting trees	Medium Emitting trees	High emitting trees	Total Trees
(1) 2008 trees remaining in 2018	3.20 (61%)	1.47 (28%)	0.58 (11%)	5.25 (100%)
(2) Replacement Trees	1.45 (83%)	0.21 (12%)	0.09 (5%)	1.75 (100%)
(3) New Trees	$(n_{2018}-7)\times 83\%$ (83%)	$(n_{2018}-7)\times 12\%$ (12%)	$(n_{2018}-7)\times 5\%$ (5%)	$N_{2018}-7$
(4) Resulting Total	$0.83n_{2018}-1.16$	$0.12n_{2018}+0.84$	$0.05n_{2018}+0.32$	n_{2018}
(5) Emission category, all 2018 trees	$\frac{0.83n_{2018}-1.16}{n_{2018}}\times 100\%$	$\frac{0.12n_{2018}+0.84}{n_{2018}}\times 100\%$	$\frac{0.05n_{2018}+0.32}{n_{2018}}\times 100\%$	100%

For discussion purposes, these trees are moved from high and medium emitter category to a low emitter category and are defined as 'diverted trees[2].' Table 3 summarizes this change.

[1] n_{2018} is the total number of trees in the Sacramento Region in 2018.

[2] Diverted Trees are a subset of Replacement Trees. Trees that are moved from high and medium emitter category to a low emitter category.

Table 3: Comparison of tree planting results in different scenarios

Units: millions	Low emitting trees	Medium Emitting trees	High emitting trees	Total Trees
BAU tree plantings (Minimum # of trees)	1.07	0.48	0.20	1.75
CMS tree plantings (Minimum # of trees)	1.45	0.21	0.09	1.75
Diverted trees	0.39	-0.28	-0.11	0.00

The emission reduction claim of this control measure is entirely the result of the lowered emission rates of 390,000 diverted trees. By 2018, the urban forest control measure is expected to reduce BVOC emissions by at least 0.84 tpd.

Table 4: Summary of emission reduction estimation

Emission Reduction Estimate

Units: millions	Low emitting trees	Medium Emitting trees	High emitting trees	Total Trees
Business As Usual (BAU)	$0.61n_{2018}$	$0.28n_{2018}$	$0.11n_{2018}$	n_{2018}
Control Measure Scenario (CMS)	$n_{2018,low\_emitter}$	$n_{2018,medium\_emitter}$	$n_{2018,high\_emitter}$	n_{2018}
Difference in number of trees between BAU and CMS	$\Delta_{low\_emitter}=0.61n_{2018}-n_{2018,low\ emitter}$	$\Delta_{medium\_emitter}=0.28n_{2018}-n_{2018,medium\_emitter}$	$\Delta_{high\_emitter}=0.11n_{2018}-n_{2018,high\_emitter}$	
Emission factor[1] (grams/tree/day)	0.24	1.32	4.44	
Emission changes (grams/day)	$\Delta E_1=0.24\times\Delta_{low\_emitter}$	$\Delta E_2=1.32\times\Delta_{medium\_emitter}$	$\Delta E_3=4.44\times\Delta_{high\_emitter}$	$\Delta E_1+\Delta E_2+\Delta E_3$

Again, the actual number of trees in 2018 is assumed to be n_{2018}. Emission per tree per day is the product of emission rate, leaf weight, and hours of emission per day. Conservative values assumed for the emission rates are 1, 6, and 19 for low, medium, high emitters respectively. These emission rates are the averages of the trees from the analysis performed by Simpson and McPherson 2006 and 2007. Low emitters are defined at 1 or less, medium 1-10, and high is anything over 10. The unit of the emission rate is micrograms per gram leaf per hour. The leaf

[1] Emission rates of 1,6, and 19µg per gram dry leaf weight per hour for low, medium, and high emitters respectively were conservative estimates which used a weighted average based on the species present from the 2007 UFORE study, emissions for the species in the region, and a study by Benjamin 1995, Benjamin 1997, . These emission rates are then multiplied by the estimated 40kg of dry leaf weight and 6 hours per day of emissions.

weight[1] is assumed to be on average 40 kg per tree and the hour of emission per day is 6 hours.

The net benefit of a tree moved to a lower emission category can be represented with the following equation:

$$\text{Emission Change}\left[\frac{\text{tons}}{\text{day}\cdot\text{tree}}\right]$$

$$= \text{Emission Change}\left[\frac{\text{grams}}{\text{day}\cdot\text{tree}}\right]\times\frac{1}{907{,}185}\left[\frac{\text{tons}}{\text{grams}}\right]$$

$$= \sum_{\substack{\text{i=low emitter,}\\ \text{medium emitter,}\\ \text{high emitter}}} \text{Emission Change}_i\left[\frac{\text{grams}}{\text{day}\cdot\text{tree}}\right]\times\frac{1}{907{,}185}\left[\frac{\text{tons}}{\text{grams}}\right]$$

$$= \sum_{\substack{\text{i=low emitter,}\\ \text{medium emitter,}\\ \text{high emitter}}} \left[\left(\#\text{ of trees in BAU}_i - \#\text{ of trees in CMS}_i\right)\times\text{Emission Factor}_i\left[\frac{\text{grams}}{\text{tree}\cdot\text{day}}\right]\right]\times\frac{1}{907{,}185}\left[\frac{\text{tons}}{\text{grams}}\right]$$

Table 4 is a representation of the modeling effort used to calculate the benefits of this control measure. It is presented as an aid to understanding the key changes that will be created by this control measure. The actual analysis supports the conclusions which also takes into account the air temperature relationships to BVOC performed by Jim Simpson and Greg McPherson of the US Forest Service Center for Urban Forest Research (CUFR). For a detailed explanation of the development of these claims, please refer to Simpson and McPherson 2006 and 2007.

[1] Leaf weight is used rather than the typical Leaf area index (LAI) used for emission from vegetation. The flux of a BVOC (µg hr^{-1} m^{-2} [land surface area]) from a vegetative canopy is often expressed as a function of its emission factor (µg g^{-1} [dry leaf weight] hr^{-1}) and foliar density (g [dry leaf weight] m^{-2} [land surface area]. Alternatively, foliar density can be replaced with the product of species specific leaf weight (SLW, g [dry leaf weight] m^{-2} leaf area) and LAI (m^{-2} leaf area/ m^{-2} land area) in the flux equation, as done in the Biogenic Emission Inventory GIS (BEIGIS) model developed by the California Air Resources Board.

Table 5: Planning Emission Inventory and Emission Reductions

	2002	2007	2018
Planning emission inventory (tpd) for BAU Case	69	75	83
Planning emission inventory (tpd) for CMS Case	69	75	82
Emission Reduction (tpd)	0.00	0.00	0.84[1]

Table 5 is the planning emission inventory and the emission reductions benefits from the tree program. The Business-As-Usual case would yield a VOC inventory of 83tpd, while the Control Measure Scenario with the emission reductions of 0.84tpd from the tree program will result in 82tpd of VOC. Although it may seem as though BVOC emissions has increased from 2002 to 2018, the increase in emissions is due to the natural growth of the urban forest and the appropriate comparison is between the planning inventory between the BAU case and the CMS case.

Other Air Quality Benefits

It is noteworthy that the benefits of trees planted under this control measure will not cease after the completion of the project. Trees will continue to grow and with each year create larger emission reductions. Also of note, this analysis only examines one aspect of trees, BVOC emissions, because the emissions are quantifiable by the most current science. Trees affect air chemistry in many direct and indirect ways: pollutant absorption, temperature reduction, carbon sequestration, and particle scrubbing. These are significant benefits of the urban forest. Unfortunately, scientific understanding of these tree effects is not sufficient to include them in the air quality attainment plan at this time. As the science evolves, we can look forward to trees playing an increasingly vital part of our region's air quality attainment plans. The current estimation of the NOx (Nitrogen Oxides) air quality benefits is 0.048 tpd, Ozone absorption is 0.2tpd, and Particulate Matter[2] (PM) emission reduction is 0.24 tpd, which does not currently include avoided evaporative emissions from cooling vehicles. Until the scientific understanding of the NOx, direct Ozone absorption and PM affects of trees becomes more complete, this control measure is only taking the BVOC reduction claim.

[1] This control measure is considered as an emerging and voluntary measure. The USEPA set a percent limitation of 6% for the emerging and voluntary measure emission reduction claims. Therefore, the maximum emissions reduction claim of the urban forest measure is 0.18 tpd. Appendix 9 shows the detailed calculation for the percentage limitation of this control measure. The range for emission reductions for this control measure is 0-0.18 tpd. Because the measure requires commitments that have not been secured the minimum benefit is 0 if no jurisdictions commit.

[2] Particulate Matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

Adoption year:

2009. This control measure relies on commitments from local jurisdictions. SMAQMD is working with the STF to identify the jurisdictions in the region that are interested in making this commitment and to secure their approval. The final plan will identify the jurisdictions and the adoption schedule. Currently STF anticipates several counties and cities in the region will adopt an air quality friendly tree list which should help the region achieve emission reductions from the tree measure. The minimum emission benefits are set at 0 if no jurisdictions approve a formal commitment as required by EPA guidance.

Implementation year:

Planting began in 2008 and will continue through 2018. The urban forest tree compositions and profile are presented in the Appendix 1 of this control measure as reference.

Cost Effectiveness

Based only on BVOC reductions, the cost effectiveness of the measure is $1,291 per ton or $0.65 per pound. The derivation of this value is explained in Appendix 2.

Authority

This project will rely on the general police power of cities and counties to adopt policies and ordinances that are not in conflict with general laws and that are for the protection of the general welfare (Cal. Const. art X1, section 7.) Under this measure, each jurisdiction will create a list of preferred low emitting trees and commit to a total number of trees by resolution and encourage tree planting by developers or municipalities to trees on that list to be diverted to the low emitting category. The sum of all diverted trees by all jurisdictions will total more than 390,000. A sample report and resolution are included in Appendix 3.

Funding

The Sacramento Tree Foundation (STF) will be the lead organization responsible for accomplishing the goals of this control measure. STF has been in the tree business for 26 years and has an annual budget of $2.7 million. The Sacramento Tree Foundation receives its funding from membership, partner agencies, grants and stipends, and private donations. STF efforts have grown steadily over the years and there is every expectation that it will continue to grow in the foreseeable future. STF intends to seek grant funding to complete this project but will use existing resources from its operations if no additional funding can be secured. The estimated budget for the project is $1.71 million during the next 10 years, about $171,000 per year. In STF current operations, they dedicate $475,000 per year to various education projects, $85,000 per year to advocacy and $700,000 per year to tree planting. A letter from STF to commit the necessary funds and resources from its operations can be found in Appendix 6.

Implementation

To achieve the objectives of this control measure, STF will develop an education program for community organizations, local governments, tree not-for-profits, landscape industry professionals and retail tree distributors. The education program will continue for the life of the control measure and will result in a reduction in the planting rate of medium and high emitting trees.

District's Role – Oversight Agency

The Sacramento Metropolitan Air Quality Management District will oversee and review milestone reports, emission reduction calculations, conclusions and recommendations set forth by the Sacramento Tree Foundation to ensure that the tree program is making progress and will meet its emission reductions targets. STF will report to SMAQMD as information are collected and analyzed. SMAQMD is currently working to make available a program evaluation document that describes the administrative details associated with the process and informational requirements the district will use to assess the success of the control measure. The program evaluation document will be included in the final Sacramento Regional 8-hour Ozone Attainment and Reasonable Further Progress Plan.

Verification and Tracking

There will be two methods used to demonstrate that this control measure has been successfully completed. The primary effort will utilize the urban forest assessment tool developed by the US Forest Service known as UFORE. This tool will follow changes in the forest population and will allow changes in emissions to be calculated. Additional steps will be taken to verify the results of the UFORE analysis. The most significant of these steps will be to use high-resolution aerial images to verify regional forest canopy coverage.

In conjunction with the education program, the STF will collect both historical and current planting and sales information from a variety of sources in the region. These will demonstrate that relative planting species distributions have changed from the pre-project species distributions, that the 390,000 diverted trees have been planted and that the BVOC reductions needed have been reached. The number of diverted trees will be calculated by applying the ratios of pre- and post-project planting rates of the three emission categories to the actual number of trees planted.

Although the measure only commits to achieve reductions by the attainment year, 2018, to monitor progress the STF established reasonable planting rates. To monitor progress and validate the emission reductions, the STF will conduct a UFORE analysis supplemented with the Tree Counting analysis for every milestone year and the attainment year, 2018. The results from the UFORE analysis in conjunction with methods used in CUFR's Phase 1a report will be used to compare with emission reduction estimates. The details of the verification and tracking are described in Appendices 4, 5 and 6.

Enforcement

Local governments electing to participate in this measure will adopt binding commitments to reach planting goals within their jurisdictions and to specify a tree list that contains preponderance of low emitting trees. Field surveys will substantiate the accomplishments within the jurisdiction of participating agencies and the region as a whole. STF will notify jurisdictions if they are not meeting milestone targets. Jurisdictions are then responsible to committing to potentially take corrective actions, and use additional resources to reach their goals.

Remedying Emission Credit Shortfall

Because of the uncertainties associated with implementation and validation of this urban forest measure, if this strategy falls short of its emission reduction target, the reductions will be backstopped and replaced by the other strategies that provide reductions surplus to those required to demonstrate attainment.

References:

Benjamin, Michael, Low-Emitting Urban Forests: A Taxonomic Methodology for Assigning Isoprene and Monoterpene Emission Rates, September 1995

Benjamin, Michael, Estimating the Ozone-Forming Potential of Urban Trees and Shrubs, Oct 1997

California Air Resources Board, Methods to Find the Cost-Effectiveness of Funding Air Quality Projects, May 2005

California Air Resources Board, California Almanac of Emissions and Air Quality-2006 Edition, pg 479.

McPherson, Greg, Structure and Sustainability of Sacramento's Urban Forest, Journal of Arboriculture, July 1998.

Mendes, Celso and Reed, Daniel, Monitoring Large Systems via Statistical Sampling, University of Illinois, September, 2002.

Sacramento Shade Program by the Sacramento Municipal Utility District.
http://www.smud.org/residential/saving/trees/index.html

Sacramento Tree Foundation, UFORE Field Collection Packet, June 2007.

Sacramento Tree Foundation, UFORE Random Plot Definitions,
ftp://69.62.222.149/RandomPlot.kml , June 2007.

Simpson, Jim and McPherson, Greg, Air Quality Effects of a Regional Urban Tree Planting Program for use in an Urban Forestry-based SIP Measure. Center for Urban Forest Research, PSW, USDA Forest Service, October 2006.
ftp://69.62.222.149/UFFCA Phase1A AQ Report SMAQMD,final,10-12-06.pdf

Simpson, Jim and McPherson, Greg, Preliminary evaluation of potential air quality benefits of trees within SIP guidelines: Revisions to Phase 1. Center for Urban Forest Research, PSW, USDA Forest Service, May 2007.
ftp://69.62.222.149/2007-009Phase1aPrelimEval.pdf

US Environmental Protection Agency, Incorporating Emerging and Voluntary Measure in a State Implementation Plan (SIP), September 2004

US Forest Service UFORE Project. http://www.ufore.org/ , 2000

UFORE Report for Atlanta, Georgia, US Forest Service, http://www.fs.fed.us/ne/syracuse/Data/State/data_GA_atl_ufore.htm, 1997.

UFORE Report for Brooklyn, New York, US Forest Service, ftp://69.62.222.149/BrooklynUFOREReport,gtrne290.pdf, September, 2000.

UFORE Report for Houston, Texas, US Forest Service, ftp://69.62.222.149/HoustonTFSReport.pdf, September, 2005.

Appendix 1: Forest Composition and Tree Profile

This table presents the minimum number of trees and tree compositions expected in the urban forest for the business as usual and control measure scenarios. The determination of growth, death, and expansion of the urban forest is a very complicated science. This table does not represent a SIP commitment. It should only be used as a guide for planning purposes. We assume that a quarter of the trees in the current forest will be removed due to mortality and/or other reasons. The numbers for the interim years are linearly interpolated between 2007 and 2018.

Program Year	**Year**	**Business-As-Usual Minimum Tree Planting**			**Control Measure Program Minimum Tree Planting**		
Units: million		Low-E	Medium-E	High-E	Low-E	Medium-E	High-E
0	2007	4.27	1.96	0.77	4.27	1.96	0.77
1	**2008**	**4.27**	**1.96**	**0.77**	**4.31**	**1.93**	**0.76**
2	2009	4.27	1.96	0.77	4.34	1.91	0.75
3	2010	4.27	1.96	0.77	4.38	1.88	0.74
4	**2011**	**4.27**	**1.96**	**0.77**	**4.41**	**1.86**	**0.73**
5	2012	4.27	1.96	0.77	4.45	1.83	0.72
6	2013	4.27	1.96	0.77	4.48	1.81	0.71
7	**2014**	**4.27**	**1.96**	**0.77**	**4.52**	**1.78**	**0.70**
8	2015	4.27	1.96	0.77	4.55	1.76	0.69
9	2016	4.27	1.96	0.77	4.59	1.73	0.68
10	**2017**	**4.27**	**1.96**	**0.77**	**4.62**	**1.71**	**0.67**
11	2018	4.27	1.96	0.77	4.66	1.68	0.67

Program Year	**Year**	**Business-As-Usual Minimum Tree Planting**			**Control Measure Program Minimum Tree Planting**		
Units:%		Low-E	Medium-E	High-E	Low-E	Medium-E	High-E
0	2007	61.0	28.0	11.0	61.0	28.0	11.0
1	**2008**	**61.0**	**28.0**	**11.0**	**61.5**	**27.6**	**10.9**
2	2009	61.0	28.0	11.0	62.0	27.3	10.7
3	2010	61.0	28.0	11.0	62.5	26.9	10.6
4	**2011**	**61.0**	**28.0**	**11.0**	**63.0**	**26.5**	**10.5**
5	2012	61.0	28.0	11.0	63.5	26.2	10.3
6	2013	61.0	28.0	11.0	64.0	25.8	10.2
7	**2014**	**61.0**	**28.0**	**11.0**	**64.5**	**25.5**	**10.0**
8	2015	61.0	28.0	11.0	65.0	25.1	9.9
9	2016	61.0	28.0	11.0	65.5	24.7	9.8
10	**2017**	**61.0**	**28.0**	**11.0**	**66.0**	**24.4**	**9.6**
11	2018	61.0	28.0	11.0	66.5	24.0	9.5

Appendix 2: Cost Effectiveness Estimates

As living organisms, the air quality effects of trees are always changing. Trees grow, air temperature varies, sunlight changes, and soil moisture fluctuates, leaves come and go with the seasons. Three quantities are necessary to calculate the cost effectiveness of a tree SIP measure. This Appendix examines the derivation of values for annual emissions reduction, project cost and life of the improvements. These values are then used in the standard CARB mobile source equation to determine the cost effectiveness of the measure.

The following table presents four cases for consideration. In each case, controlling parameters for cost effectiveness are varied within a range of values deemed reasonable for this control measure. Case 2 has been selected as the most reasonable.

Table 2.1 Cost Effectiveness Scenarios

Cost Effectiveness Scenarios						
Case		1	2	3	4	
Year of Evaluation		2018	2018	2028	2028	
Conditions		Control Measure, BVOC Only	Control Measure, Criteria pollutants	Control Measure, BVOC Only, Additional growth	Control Measure, Criteria pollutants, Additional growth	
Pollutants						
	BVOC	0.84	0.84	1.29	1.29	
	NOx		0.048		0.144	
	Particulates		0.244		0.728	
	Total	0.84	1.13	1.29	2.16	tons/day
Annualizing factor		37%	37%	37%	37%	
Pollutant reduction		113	153	174	292	tons/year
Annual pollutant reduction		226755	305580	348231	583625	lbs/year
Project recovery period		25	25	25	25	years
Discount rate		7%	7%	7%	7%	
Cost Recovery Factor		0.086	0.086	0.086	0.086	
Project Cost, unadjusted		$ 1,706,000	$ 1,706,000	$ 1,706,000	$ 1,706,000	
Cost Effectiveness		$ 1,291	$ 958	$ 841	$ 502	$/ton-yr
Cost Effectiveness		$ 0.65	$ 0.48	$ 0.42	$ 0.25	$/lb-yr

Emissions Inventory for Cost Effectiveness

Emissions reductions, shown as Pollutants in the table, were developed by the Center for Urban Forest Research (Simpson and McPherson 2006, 2007) and are described in detail in the body of the control measure. These represent the peak values obtained during a year. To determine the cost effectiveness of the measure, we had to decide what pollutants to include in the total reductions.

This control measure makes claims for BVOC reductions but the measure will also reduce NOx and particulate matter. Table 2.1 presents the full BVOC reduction estimated both with and without the addition of the other criteria pollutants.

Annualizing Emissions Reductions

The cost effectiveness is based on the annual emission reduction. For a typical control measure, this is the daily emission reduction multiplied by the number of days of operation during a year. This straightforward approach does not properly characterize this control measure. Biogenic emission reductions are not the same all year. The reductions are related to photosynthesis, leaf area and ambient temperature. The reductions from this control measure peak during the summer ozone season and fall to near zero during the winter because many trees lose their leaves during the winter and due to higher temperatures during the summer ozone season the emission benefits are the greatest during this time. If we calculate the cost effectiveness using the strict annual sum, the effect of trees during summer ozone season is lost. On the other hand, if we apply the peak summer reduction across the entire year, the cost effectiveness is dramatically over-stated when compared to other measures.

The following chart is adapted from the California Almanac of Emissions and Air Quality. It represents the changes in statewide biogenic emissions during a typical year.

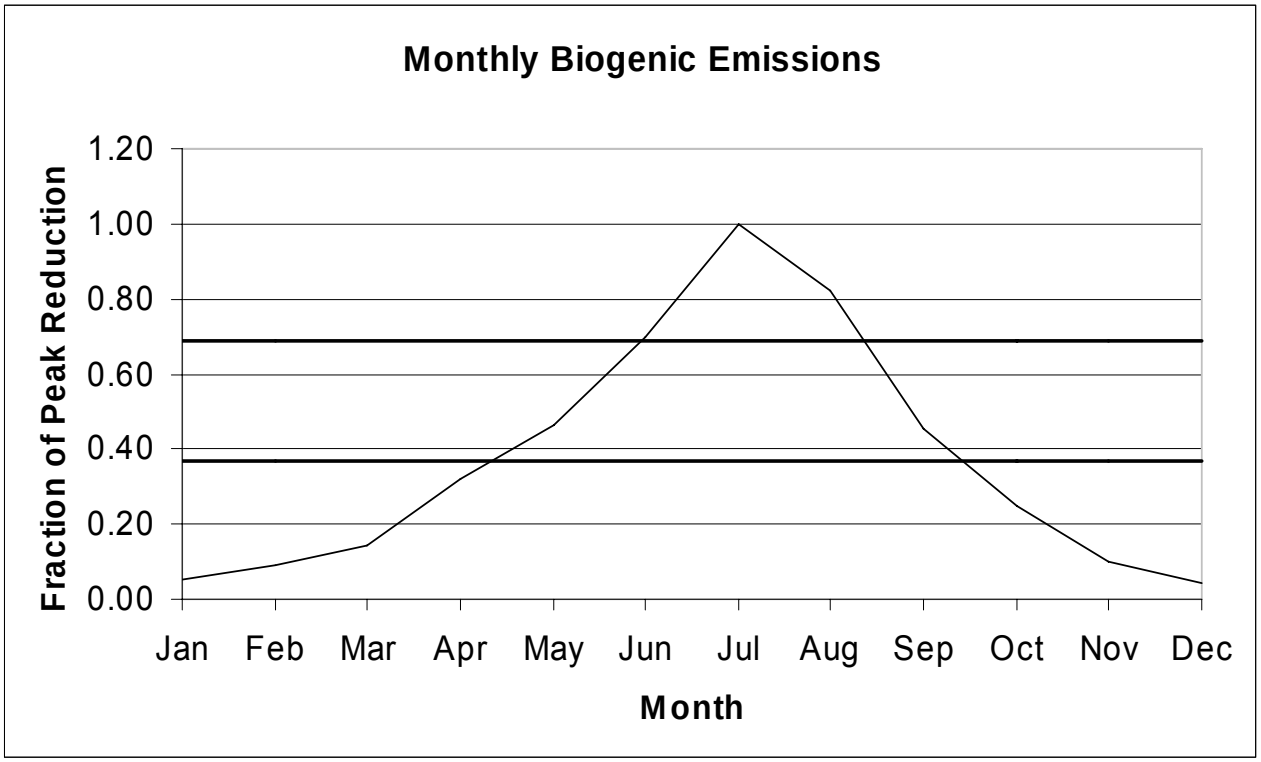


Figure 2.1 Monthly Biogenic Emissions

To determine the cost effectiveness of a variable reduction, we assumed that emission reduction was proportional to emission generation as presented in this chart. From this, the average annual reduction would be 37% of the peak value. To incorporate the significance of ozone season reductions, we also examined the average May through September reduction, which is 69% of the peak value. We decided that the most accurate comparison was to use the lower 37% figure to annualize the peak reductions. This percentage appears in the Cost Effectiveness Scenarios table as the Annualizing Factor. The annual tonnage used for

comparison purposes is the peak daily tonnage reduction multiplied by the annualizing factor and multiplied by 365.

Project Cost

Several aspects of the project cost are summarized in the following table.

Project Cost				Total Cost
Community Group Outreach				
Program implementation		$ 10,000	per year	$ 110,000
Government Directed Planting				
Program implementation		$ 21,000	per year	$ 231,000
Tree Seller Outreach				
Program implementation		$ 35,000	per year	$ 385,000
Landscape Industy Outreach				
Program implementation		$ 50,000	per year	$ 550,000
Program management		$ 25,000	per year	$ 275,000
Education materials		$ 10,000	per year	$ 110,000
Field Survey		$ 15,000	per survey	$ 45,000
Total				**$ 1,706,000**

Table 2.2 Project cost

Table 2.2 estimates both the direct cost of the control measure. We assume that tree planting is not a project cost because this control measure is not committing to plant additional trees to expand the urban forest. Also, planting low emitters does not cost more than medium or high emitters. The total expenditures necessary to complete this control measure are estimated to be $1.71 million. These costs include local government costs required to update current ordinances to specify low-emitting trees, the cost to secure commitments from tree retail sales outlets to emphasize the sale of low emitting trees, field survey inspections, an extensive community and landscape industry education program as well as general program management.

Cost Effectiveness Calculation

The formula provided by the California Air Resources Board for emission reduction cost effectiveness (CARB 2005) is:

$$\text{Cost Effectiveness} = \frac{(\text{CRF} \times \text{Funding}_{\text{Present Value}})(\$)}{\Delta(\text{ROG} + \text{NOx} + \text{PM10})(\text{lb/year})} = \$/\text{lb}$$

CRF, the capital recovery factor, is used to annualize the cost of a long-term project. Longer lived projects have lower recovery factors. The capital recovery factor is calculated with this equation:

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

$$CRF = \frac{7\%(1+7\%)^{25}}{(1+7\%)^{25} - 1}$$

$$CRF = 0.089$$

where i is the discount rate and n is project life.

For this control measure, the discount rate, i, is 7% and improvement life, n, is the 25-year average tree life. The resulting value is $1,291 per ton or $0.65 per pound, assuming that NOx and PM10 reductions are 0.

Appendix 3: Sample Report and Resolution for Local Governments

November 2008

ADOPT REGIONAL AIR QUALITY CONTROL MEASURE THAT INCLUDES URBAN FORESTS TO ATTAIN AIR QUALITY GOALS

ISSUE:
The regional air quality board has included trees in the State Implementation Plan control measure to improve air quality. The City/County of _____ is requested to adopt measures recommended by the Sacramento Tree Foundation to contribute to the overall improvement of the region's air quality. By managing the number and types of trees planted in our jurisdiction, we can reduce the formation of ozone and improve air quality. Minimum participation includes adopting a best tree list for our jurisdiction and agreeing to numerical tree planting goals.

RECOMMENDATION:
Approve a resolution adopting the preferred air quality control measures that include planting an agreed upon number and type of trees and utilizing a tree list to guide species composition and diversity.

DISCUSSION:
Our region is remarkably well suited to capture the benefits trees provide. Our hot summers and cool winters enable us to maximize the benefits of shade trees through energy savings, air quality improvement, storm water runoff retention, and community enhancement.
In 2006, City/County of _____ passed the resolution to adopt the regional Greenprint, a four decade program of incremental investments in our community trees, that will double the regional tree canopy and result in more livable communities through the best urban forest.
One key objective of the Greenprint is to reduce the costs and increase the benefits of tree ownership by strategically placing trees that are well-suited to our climate, soil and site conditions in locations where they can best reduce energy consumption, shade infrastructure, and improve water quality.
Our region has the challenge of unhealthful levels of ozone pollution. The U.S. Forest Service Center of Urban Forest Research (CUFR) and Sacramento Tree Foundation (Tree Foundation) conducted a study about the effects of trees on ozone air pollution and found that urban forestry can be an important part of our air quality attainment strategy. This study was sponsored by the regional Air Quality Districts and funded with the grant from Sacramento Area Council of Governments (SACOG) and California Department of Transportation (CalTrans).
The scientific community generally agrees that trees improve air quality. It has been measured that some trees - because of leaf canopy size, pollen, amount of time leaves are present on the trees and levels of biogenic volatile organic compounds (BVOC's) - provide more benefits than others. The net effect depends on the species, location and ultimate size of the trees chosen. For this reason, our jurisdiction can encourage the planting of the best suited trees for our climate combined with the best air quality characteristics to improve local and regional air quality.
In several important ways, air quality attainment plans are predictive. In adopting the plans, the air districts, and by extension the member jurisdictions, must estimate the air quality improvement steps that will be taken in the future. These estimates are then used to predict air quality progress. In areas where continued air quality improvement has been difficult, the

estimates tend to evolve into goals and in situations with severe air quality, may evolve into mandates.

To know the net effect of the new trees on regional air quality, accurate estimates of number and type of trees planted in our jurisdiction must be known. Our jurisdiction is being asked to commit to the best tree profiles and a minimum number of trees that will be planted in the jurisdiction on both public and private property during the next decade. It is important to note that the best trees commitment includes both public and private tree planting. As this commitment will become part of a federally mandated regional air quality attainment plan, regional partners agreeing to the ratio are expected to be successful.

To prepare for this planting program, council / board authorization is requested to participate with our regional partners and adopt the list of tree species that will grow well in our jurisdiction and be the most capable of air quality improvement. This list will serve as our recommended tree list to be used by staff for making decisions on species selection where trees within the City/County are specified.

Staff and the Tree Foundation have estimated that the managed planting of trees within the jurisdiction over the next ten years will allow us to meet the air quality control measure target. The best trees list may be amended as appropriate over time to include new species and research that enhances our choices for planting the best trees.

Limited exposure is present as is the case with other Council/Board decisions. After adoption, potential enforcement may be initiated by citizens and or/EPA if project goals are not met pursuant to the Clean Air Act (42USCA Section 7413 and 7604).

As we have the numbers of trees to plant (February 09?):

The Council/Board has adopted the regional Greenprint Initiative to double the regional tree canopy over the next four decades. The regional goal to meet this effort is to plant 5 million trees by 2025, increasing in our regional canopy from about 12% to 25%. The 2009 Tree Foundation study reveals that our jurisdiction has the capacity to plant ___ trees. Staff has concluded that the Council/Board can confidently commit to the planting of ___ trees (__ % of capacity) in our jurisdiction. Of the trees planted by the fall of 2018 the species composition will meet the list of best trees for air quality control measure compliance.

ENVIRONMENTAL CONSIDERATIONS:

Action in adopting this resolution is exempt from CEQA as it does not specifically result in a project. This decision will be re-visited at such time as a project as defined by CEQA is considered.

RECOMMENDATION APPROVED BY:

Executive _____

Title _____

Key Staff:_____

DRAFT SAMPLE RESOLUTION FOR AIR QUALITY CONTROL MEASURE

RESOLUTION NO. _____
ADOPTED BY _____

On Date of _____

RESOLUTION SUPPORTING LOCAL COMPONENT OF THE REGIONAL URBAN FOREST TO ATTAIN REGIONAL STATE IMPLEMENTATION PLAN AIR QUALITY CONTROL MEASURES GOALS

WHEREAS, the City/County of _____ recognizes the importance of tree canopies and their contributions to clean air and water, stormwater runoff reduction, energy conservation, improved public health, and increased property values; and

WHEREAS, the City/County of _____ have adopted the regional Greenprint initiative to optimize the tree canopy and benefits of trees in our region; and

WHEREAS, current science concludes that our enhanced urban forest will improve both local and regional air quality; and

WHEREAS, the species composition and number of trees planted during the coming years will determine the net air quality improvement our region can expect; and

WHEREAS, a select group of tree species are best suited to the climate and soils of our jurisdiction; and

WHEREAS, a list has been created of the best trees for our climate and air quality for both public and private trees that will be planted in our jurisdiction; and

WHEREAS, we recognize that by participating in the regional urban forest control measure through the fall of 2018 to attain air quality goals that we are expected to succeed and potential enforcement can be initiated by citizens and or/EPA if project goals are not met pursuant to the Clean Air Act (42USCA Section 7413 and 7604).

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL/BOARD OF THE CITY/COUNTY OF:

The Council/Board hereby authorizes the City Manager/County Executive to create a policy to regulate the planting of an agreed upon number of trees of certain species composition and use the preferred list of best trees suitable for climate and air quality to require specific tree planting associated with permitted projects on both public and private properties within our jurisdiction; and,

Hereby authorizes the City Manager/County Executive to implement the best tree list where appropriate within the operations of the jurisdiction; and,

Hereby expects all persons planting trees within the jurisdiction to choose an appropriate tree from this best tree list; and,

Hereby commits that the trees be planted within the jurisdiction prior to the fall of 2018 will be in accordance with the Urban Forest Air Quality Control Measure as part of our region's federal air quality attainment plans. (; and,)

As the numbers of trees to plant by jurisdiction after February 09 –
Hereby commits that ___ trees will be planted in within the jurisdiction by 2025 to meet the Greenprint goal of doubling the regional tree canopy.

Passed and Adopted by the Council/Board of the City/County of _____ at a regular meeting thereof held on the _____ by the following roll call votes:

_____

Presiding Officer

ATTEST:

_____
Clerk

Agenda Notice:

Item #_____ - Local Component of the Regional Urban Forest Project to Attain Air Quality Conformity
Authorize creation and implementation of a recommended list of tree species

Appendix 4: Verification and Tracking

This control measure proposes to gradually change the percentages of the different tree species that make up the urban forest of the Sacramento region. Consequently, to gauge the success of the control measure, an inventory of the urban forest needs to be created and maintained. Changes in the tree inventory over time will demonstrate the success of this control measure.

It is also important to track current conditions of the urban forest. To create this SIP measure, we based emissions calculations on the best information that we have today. This information is several years old and, in some cases, was derived for an urban forest of our neighboring region. To assure decision-makers that the estimates are reliable, an updated canopy inventory must be created.

Counting tree plantings is a tempting short cut to estimating change in a forest canopy, but necessary to quantify jurisdictional efforts and private owner planting behaviors. Therefore counting trees will be used as a supplement to the UFORE Survey System to verify the order of magnitude of tree planting efforts. Unfortunately, planting rates are only one aspect of canopy change. Survival, maintenance and growth are also key factors that can often out-weigh the impact of young tree planting.

The urban forest has many parameters that need to be tracked. On a per tree basis, it is important to know tree species, size, location, and health. This information is used to predict the future growth rate, survival, and leaf area of the tree. By accumulating this information for all trees in the forest, the species distribution and average age, size, health, and total leaf area can be determined. This composite information can then be used to determine the air quality, energy reduction, water purification, and real estate value effects of the forest. This information needs to be regularly updated to understand how the forest is changing as a result of this measure.

UFORE Survey System

By current estimate, there are 7 million trees in the region's urban forest. Measuring each of these trees would be a monumental undertaking. Recognizing this impracticality, the US Forest Service has developed an information system that accurately assesses an urban forest by sampling a limited number of locations throughout the forest. The system is named the Urban Forest Effects model (UFORE).

UFORE is a forest-modeling and inventory suite that allows users to calculate urban forest data, including estimates of the ecosystem services and emissions. The results are based on the tree and site information collected from 300 field survey plots selected randomly throughout the region. Each field survey plot is 1/10 acre in size. A detailed, structured data collection protocol is used to ensure the field information can be statistically employed to determine the make-up of the entire forest from this relatively small sample. UFORE calculates species and age distribution of the urban forest and also estimates the monetized benefits of the forest. The species and forest structure information are used to calculate emissions changes. The additional information that UFORE produces will be used to calculate costs and benefits of maintaining the urban forest. UFORE is currently in use and has produced satisfactory peer-reviewed results in several communities in North America including Atlanta, Baltimore, Boston, Calgary, Houston, Jersey City, New York City, Philadelphia, Syracuse, and Toronto. Links to online reports for Atlanta, New York City and Houston are listed in the References of this control measure.

The survey area of the assessment is the urbanized area of each of the cities and counties in the non-attainment area with the addition of the respective spheres of influence. The spheres

are included to allow changes to be tracked as urbanization grows. Sample plots are assigned within this large area using a random generator supplied by the US Forest Service. It is critical to the accuracy of the results that the plot assignment be completely random. Any thoughtful relocation of the plots will invalidate the results of the assessment.

This randomness can be unsettling. The first UFORE assessment has been started and the plots have been located. Many plots are located in places that intuitively make sense, like front yards, parks and golf courses. Other plots have landed in areas that are very unlikely to have any trees ever, like freeways, runways or in Folsom Lake. Taken as a whole though, these plots average out the variety of land uses that comprise our region and will give an accurate assessment of the urban forest. A Keyhole Markup Language (KML) layer file is provided in the References so that reviewers can examine the plot locations using a geo-referenced imaging system, in this case, Google Earth.

It should be noted that UFORE algorithms used to estimate BVOC emissions are standard but estimates of biomass are based on leaf area and fresh weight to dry weight relationships may not be characteristic of trees in this region. Local tree biomass data will be used in conjunction with the UFORE survey system to provide the most accurate information and emission reduction calculations.

UFORE results compared to previous SUFES results

An initial UFORE study was conducted in 2007 to define the initial conditions of the region's urban forest. In comparison with the 1998 SUFES study, results are comparable. The SUFES (Sacramento Urban Forest Ecosystem Study) was the first attempt to understand and estimate the tree species distribution and canopy cover of the region. There are several minor differences between two studies but their results and conclusion are similar. The SUFES (1998) found that the urban area tree canopy cover was 13-15% and six million trees in the urban area of the Sacramento region. It also found that the leading two species are live oak and valley oak. These two species accounted for 8.2% and 7.2% of trees in the urban forest. The UFORE study (2007) found that tree canopy was 12.1% and seven million trees in the region, while valley oak (10%) and live oak (6.7%) were the leading species in the Sacramento urban forest.

Field Surveys

The Sacramento Tree Foundation (STF), working with the tree organizations throughout the region, will lead the regional UFORE assessment. Seventy-five volunteers have been recruited from the six-county region. Each volunteer has undergone five hours of training before starting field survey work. The training covers each of more than 40 parameters that are recorded at every plot during tree species identification and the plot assessment process.

The volunteers are organized into three member teams and then each team is assigned approximately 10 plots located close to each other. Teams find the plot locations using a combination of aerial photographs and GPS coordinates. Teams complete their plot assessments over four weeks. All information is recorded on field data sheets that are collected by the STF.

Each plot measures 1/10 acre. A map of the UFORE study area is included in Appendix 10. Teams collect six separate types of information from each plot, including square footage of each ground cover type, buildings, impervious surfaces, shade, shrubs and the location information of reference objects so that re-sampling can be completed accurately. A drawing is created of

each plot. Following this, each tree on the plot is located, measured and 10 data points of information are collected about the size, species, health, and leaf area.

Teams spend an average of 2 hours per plot measuring, drawing and recording the data. To complete a plot assessment, the team will first locate the center of the plot. The center is marked and then a scale drawing is made. The actual land use category of the site is recorded. Next the ground cover areas are drawn to scale. The angle and distance to reference objects are recorded on the drawing. Each tree on the site is then carefully located on the drawing. The next step is to record the various tree parameters on a tree data sheet. A separate tree data sheet is filled out for each tree. Once all the tree information is obtained, the areas of shade canopy are also recorded on the plot drawing. Finally, the actual areas of each classification are calculated and recorded on the data sheets. Field data sheets are presented in Appendices 5, 6 and 7.

The plot drawings are necessary so that the results can be verified. To ensure the accuracy of the field collection data, a limited number of re-surveys are conducted by trained staff from STF. Each team will have at least one plot inspected. If the re-inspection finds that errors have been made, all of the team's work will be re-inspected. Sample plot data collection forms are included with this proposal.

As the plot survey information is returned to the STF, it is first reviewed for completeness and cross-checked to catch errors that may have been made. The data is then imported to an electronic database. Once all plot information has been entered, the data is presented to the US Forest Service who analyzes the information and creates the statistical report on forest composition and monetized benefits. The results will then be returned to the STF and used to calculate BVOC changes.

The STF completed the initial 300 plot survey during summer 2007. The entire survey will be repeated on the same 300 plots in 2011, 2014 and 2017. The data from subsequent surveys will be compared with earlier surveys to monitor progress of this control measure. The Sacramento Tree Foundation will report on progress and post the report on its Sacramento Tree Foundation website and air district websites. Information will be available to the public during milestone years and attainment year.

This control measure proposes additional information collection and analysis as a cross check of the UFORE results. Historical and future sales data from tree retailers and tree wholesalers will be collected. Local governments and tree planting groups will also be asked to report as much information as possible about historical and future tree species and planting locations.

STF will use this information to calculate changes in tree planting activities. Historical species and planting activities will establish the Business-as-usual case for each entity. As new data arrives, the calculations will be repeated based on the new information. A difference should slowly accumulate that demonstrates the successful implementation of the control measure education program.

County and State level agricultural agencies will also be polled for information. Individual property owners will be encouraged to record their tree planting activities on a website developed to encourage participation in the regional planting goal. While this expanded net of information collection is extensive, it will never, as a voluntary, convenience sample, have the statistical accuracy needed to demonstrate performance of the control measure. It will, however, be a meaningful way to double-check the accuracy of the field survey effort and should alert reviewers to problems with the effort in time to correct them prior to 2018.

As a final step of data collection, high-resolution satellite imagery will also be employed to ensure the accuracy of the field sample information. The science of aerial tree sampling is rapidly evolving. It may be possible during the life of this control measure to replace some components of data collection with aerial survey image processing.

Tree Counting

In addition to using UFORE as a tool to measure the change in the tree canopy, tree counting will be used to support and verify the results we obtain from the UFORE Survey Studies. Realizing that planting rates are only one aspect of tree canopy change, tree counting can support quantifying regional efforts. It will also aid participating jurisdictions in measuring and verifying their implementation strategies and planting activities through 2018.

Jurisdictions will keep an extensive database of their tree plantings which will include information such as the number of trees, species, location, age, and whether or not it is a new or a replacement tree.

Data collected from the tree retailers and nurseries in the region will provide information about private owner tree planting behaviors, such as the number of trees planted by private owners and if a shift from historical planting rates occurred.

The information collected from jurisdictions, and retailers will be used to supplement the UFORE study, verifying tree planting rates and order of magnitudes of the tree species changes. Figure A-4a shows a sample flow chart to track planting efforts by participating jurisdictions and private owners. The control measure recognizes that there is uncertainty whether or not trees sold by the retailers were actually planted within the region or whether or not the trees were even sold by the retailers in the region, but since it is used only to verifying orders of magnitude to supplement the UFORE study, the assumption is that all of these trees will be planted within the region. Attempts will be made to verify and collect information from private owner tree plantings by providing avenues to register the tree purchase with the Sacramento Tree Foundation.

Data Collection Budget

The budget for monitoring activity and for all remaining project management is $320,000 over the project life.

Application of Collected Information

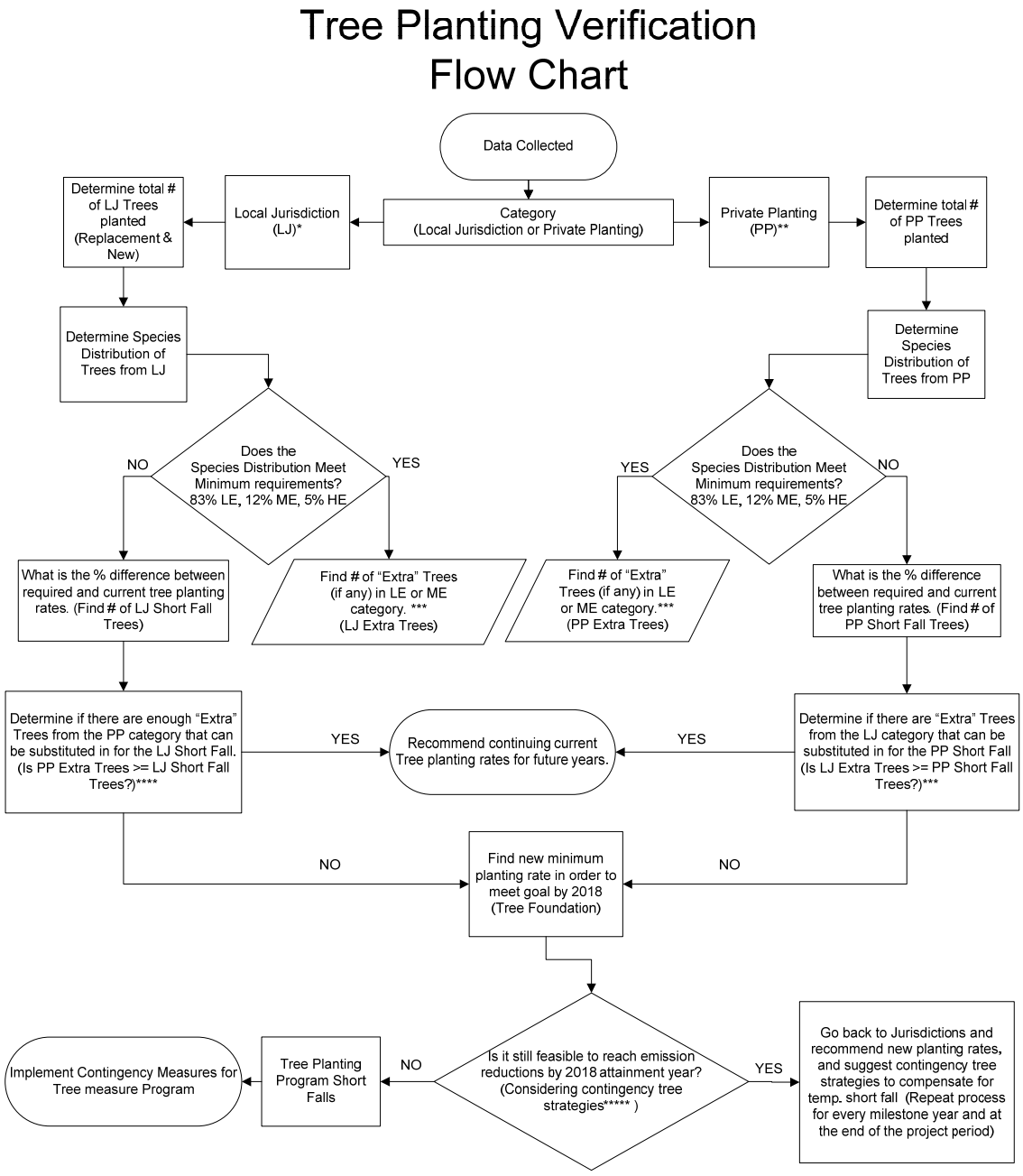
The information collected during the UFORE effort will be used to create a profile of the urban forest. This snapshot will reveal the region's canopy cover percentage, the number, size, and types of trees that make up the urban forest. This forest composition information will be analyzed using the models that were the basis of this control measure (Simpson & McPherson, 2006 and 2007). The models will yield an emission profile for this snapshot of the forest.

Over the years, trees will be planted and removed. Mostly low emitting trees will be planted but some medium and high emitting trees will also be planted. If the control measure is being successfully implemented, each iteration of the UFORE analysis will show that low emitting trees are becoming a higher percentage of the forest population. Gridded emission inventory modeling of the air basin using the updated tree species information will at first show a slight change in BVOC emissions. With each new canopy assessment, a larger difference between the current forest and the unaltered forest will appear. This difference will be the measure of the success of the control measure.

Potential Issues

It usually takes time for the UFORE tracking system to make intuitive sense to reviewers, given the small sampling frequency of the survey. The area of the plots totals 30 acres and the urbanized area of the region totals more than 300,000 acres. This means that only 1/10,000 of the region is being sampled. Fortunately, in random sample statistical analysis, the error bounds of the result are a function of the deviation of the samples and the number of samples taken and not dependent on the size of population (Mendes 2002). For the UFORE analysis, the sampling fraction of 300 plots will provide an uncertainty in the results of 7.5% with a 99% confidence. This accuracy changes very little for a broad range of sampling fractions as shown on the following chart.

Figure A-4a Tree Planting Verification Flow Chart



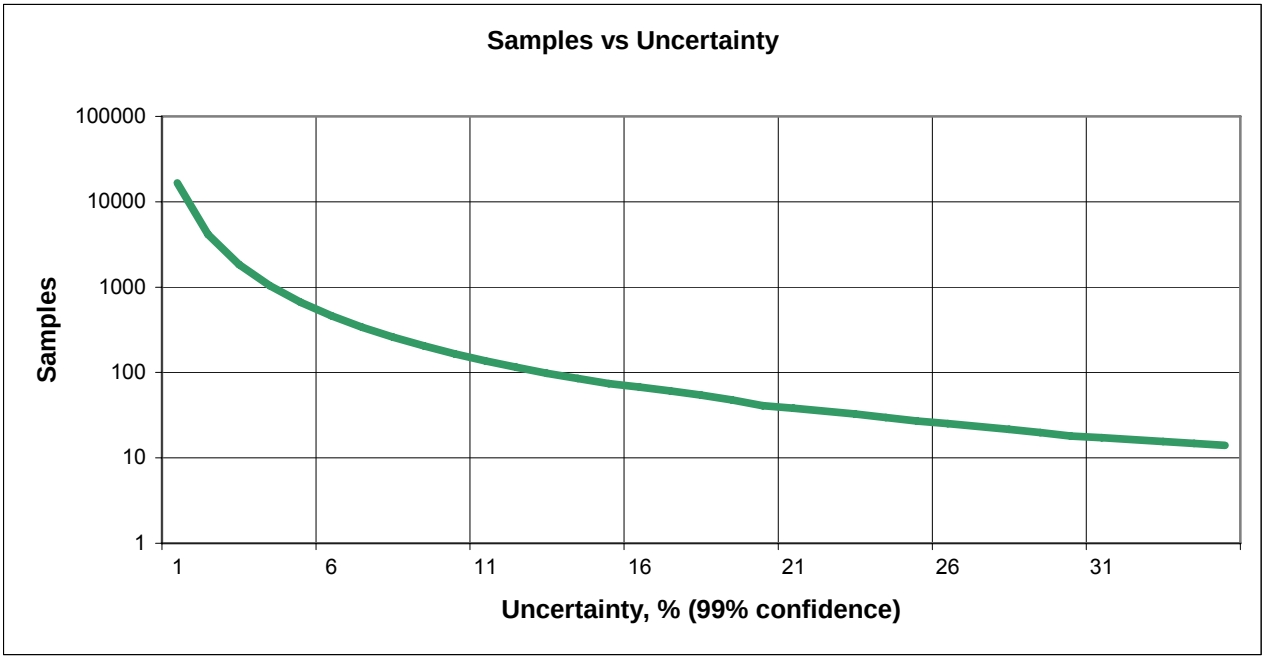
* Local Jurisdictions Trees may include trees from Green print , trees planted in new developments, and other planting efforts.

**Private Planting may include trees from retailers and nursery information in the area

***Any # of Trees over min requirement in that category is considered to be "Extra" Tree for that category. Calculated by subtracting Min Requirement Rate for each category from Current Rate for each Category.

****Only a lower or equal BVOC tree can be used to substitute in and counted as an extra tree. For example, HE can not act as a substitute for a ME or a LE, but LE can be a substituted in for a ME or HE, and ME can only act as a substitute for a HE.

***** Suggested Contingency Tree Strategies can be found in Appendix 7.



This system will only produce this accuracy for the entire urban forest, taken as a whole. The results for smaller stratifications, or sub-areas within the larger sample area, can be extracted from the data, but the accuracy will be lower as there will be fewer plots in the subdivision. A sample size of 30 will produce results of 24% uncertainty, 100 samples yield 13% accuracy. From the data collected, stratified results will be used to inform each participating local governmental jurisdiction of its progress in reaching the canopy goals it has adopted.

A second concern is typically raised about the accuracy of the field measurements. We intend to minimize these errors through volunteer training and re-surveying a sample of each team's work. The large number of people involved in the study also tends to reduce magnitude of systematic measurement errors. When a judgment is required, in the case of leaf area for example, a range of estimates always results. Each estimator will have a bias, sometimes higher and sometimes lower, than the actual value. Since many estimators are involved, the bias is averaged out of the final result. This is a practical application of the Law of Large Numbers.

Tree species identification is difficult. As correct tree species identification is critical to the results of the study, teams are encouraged to collect leaf samples from any unknown trees for review by urban foresters. Tree datasheets will be amended based on the decision of the forester.

The final major concern that needs to be addressed arises from use of defined, long-term reference plots. There are reasonable concerns that non-random changes will occur in reference plots because of the presence of the sampling teams and the public information that is distributed. In other words, property owners may decide to plant or maintain trees just because they realize that their land is part of a reference plot. This activity would not be random and so the plot would no longer represent the entire region. We plan to examine this possibility during re-sampling. Testing will be completed to determine if new random plots need to be created or if the original plots continue to accurately reflect the regional value.

Appendix 5: Tree Survey Sheet

Tree Information Sheet

Plot ID #_____

1. Tree Number ☐
(Each tree has own number, start at North and move clockwise; please number each one on drawing)

2. Tree Species ☐

3. Direction from Plot Center ☐ degrees

4. Distance from Plot Center ☐ feet

5. Circumference @ 4.5 ft. (use tape)

Trunk#1	inches @	ft.
Trunk#2	inches @	ft.
Trunk#3	inches @	ft.
Trunk#4	inches @	ft.
Trunk#5	inches @	ft.

6. Tree Height (protractor angle) ☐ degrees

7. Height to your eyes ☐ feet ☐ inches
7.a. Distance from tree to you ☐ feet ☐ inches

8. Protractor angle to live top ☐
(**only** if dead branches form top of canopy)
(maintain same distance and direction as tree height)

9. Ground to first branch (estimate) ☐ feet

10. Crown width (use rope)

North-South	feet	inches
East-West	feet	inches

11. % Missing (circle a percentage)

Trunk-north end: 0 10 20 30 40 50 60 70 80 90 100%
Trunk-south end: 0 10 20 30 40 50 60 70 80 90 100%
Trunk-east end: 0 10 20 30 40 50 60 70 80 90 100 %
Trunk-west end: 0 10 20 30 40 50 60 70 80 90 100 %

12. % Dieback (circle a percentage)

Trunk-north end: 0 10 20 30 40 50 60 70 80 90 100%
Trunk-south end: 0 10 20 30 40 50 60 70 80 90 100%
Trunk-east end: 0 10 20 30 40 50 60 70 80 90 100 %
Trunk-west end: 0 10 20 30 40 50 60 70 80 90 100 %

13. # squares impervious material under tree (use drawing) ☐

14. # squares shrub under tree (use drawing) ☐

15. Crown Light Exposure (1-5 sides) ☐

16. Closest building distance and location (use drawing)

____ feet	_____degrees
____ feet	_____degrees
____ feet	_____degrees

Appendix 6: Funding Agreement Letter

SACRAMENTO TREE FOUNDATION

12 November 2008

Mr. Larry Greene
Air Pollution Control Officer/Executive Director
Sacramento Metropolitan Air Quality Management District
777 12th Street, 3rd Floor
Sacramento, CA 95814-1908

Dear Mr. Greene,

Please accept this letter as a statement of commitment by the Sacramento Tree Foundation to achieve the 'urban forest for clean air' control measure submitted as part of the Air District's air quality attainment State Implementation Plan (SIP).

In summary, the control measure increases the percentage of lower Biogenic Volatile Organic Compound (BVOC) emitting trees in the region by influencing the tree selection choices of the majority of tree planters. This outcome will be achieved through a number of coordinated efforts that can be grouped into three categories: community education, local government action, and strategic tree planting.

The Sacramento Tree Foundation will commit the necessary funds and resources to influence our partner cities and counties and local tree suppliers to reach the control measure species composition goals. The estimated budget range for this project is up to $1.71 million during the next 10 years, or about $171,000 per year. In our current operations, we dedicate $420,000 per year to various education projects and $880,000 per year to planting trees. The Tree Foundation's urban forest efforts and influence have expanded steadily over the years, and we have every expectation that they will continue to grow with the implementation of our Greenprint Initiative. Encompassing the Air District's airshed, Greenprint is a regional initiative dedicated to building the best regional urban forest in the nation. We will seek funding support for this SIP control measure, and if necessary, re-focus our current funding efforts to ensure its completion.

The Sacramento Tree Foundation has an annual budget of almost $3 million which has allowed us to develop a staff of 33 professionals dedicated to advancing the Sacramento region's urban forest. We also lead the hard work of thousands of volunteers each year.

During 26 years of urban forest enhancement we have fostered good relationships with local governments and communities in our region. Our work has included partnerships with many grantors, including the Sacramento Metropolitan Air Quality Management District. In the 1990s we led the planting of over one million trees in Sacramento County.

With this letter I commit the resources and goodwill of the Sacramento Tree Foundation to implement this urban forest SIP control measure. We look forward to partnering with you and your staff to clean the air in the Sacramento Region.

Sincerely,

Ray Tretheway
Executive Director

191 Lathrop Way, Suite D Sacramento, CA 95815
(916) 924-TREE | Fax (916) 924-3803 | www.sactree.com
Our Mission:
To build the best urban forest for the Sacramento region

Appendix 7: Contingency Tree Measure Strategies

This control measure proposes, in a general sense, that participating groups can plant hundreds of thousands of trees during a few short years as a result improved community education and strategic changes to the policies of local governments. If a participating group is falling behind on its tree planting commitments, there are many additional tools and practices from the urban forest community that can be implemented to assist in reaching the goals. A sampling of tools includes:

Tree planting contests with quality prizes for the most successful groups:

- Individuals
- Neighborhoods
- Business districts
- Organization

Sponsor tree plantings in communities and on public land:

- Parks, roadways and near building
- Homes of seniors
- Tree removal mitigation planting

Free or reduced cost trees:

- Partner with electric utilities for planting free energy saving trees: SMUD and now PG&E
- Offer rebate coupons for purchasing low emitting trees

Reduce cost of tree establishment:

- Offer utility rebates for tree planting based on reducing long-term water consumption
- Host tree planting, pruning and maintenance clinics to improve canopy health

Reduce demand for medium and high emitting trees:

- Work with the landscape design industry to change specifications
- Communicate with residents about the better trees

Restrict the availability of medium and high emitting trees:

- Work with local tree suppliers to reduce or eliminate stocking of medium and high emitting trees
- Work with the county agricultural commissioner to quarantine very high emitting species
- Seek State action to prohibit the sale of selected very high emitting tree species within the geographic area

Appendix 8: Field Data Sheet

Section 1: Site and Team Info[1]

Location[2]

Group[6]:

Plot ID[3]

Year[7] Date:[8]

Field Land Use 1[4]

FLU1 (Squares)[9]

Field Land Use 2[5]

FLU2 (Squares)[10]

Section 2: Plot/Contact Information[11]

Address:[12]

Phone:[14]

Resident:[13]

Notes:[15]

Section 3: GPS Coordinates / Photograph[16]

GPS X:[17]

GPS Z:[19]

GPS Y:[18]

Photo ID #:[20]

Section 4: Reference Object Designation (skip if there are 3 trees/plot)

ID[21]	Description[22]	Direction from center (angle)[23]	Distance from center (feet)[24]	Notes and Comments[25]
1				
2				

Section 5: Ground Covers (show abbreviations on drawing; count squares)[26]

Building (B)[27]	Concrete (C)[28]	Asphalt (A)[29]	(OI) Other Impervious[30]	Maintained Grass (MG)[31]	Unmaintained Grass (UG)[32]	Water (W)[33]
Duff & Mulch (M)[34]	Bare Soil (BS)[35]	Seedlings (S)[36]	Herbs & Ivy (HI)[37]	Agricultural Crops (AC)[38]	Pervious Rock (PR)[39]	Shrub (SH)[40]

Section 6: Summary of Plot Areas (in Squares from drawing)[41]

Tree Cover[42] ☐ Shrub Area[43] ☐ Plantable Space[44] ☐

Below is a description of each of the terms used on the Field Data Collection sheet.

[1] Site and Team Info: This section of the data describes where the plot site is located, how to find it again later and who did the site review.

[2] Location: The general area of the plot

[3] Plot ID: The identification number assigned to the plot

[4] Field Land Use 1: This is the land use that exists on the plot. It doesn't always agree with the government database and so needs to be corrected in the field.

Land Use Types
Residential
Multi-Family Residential
Commercial/Industrial
Park
Cemetery
Golf Course

Land Use Types
Agriculture
Vacant
Institutional
Transportation
Utility
Water/Wetland

[5] Field Land Use 2: If the plot falls on two substantially different land uses, indicate the second class of land use. An example is when plot falls on a house next to a supermarket. This is rarely a substantial issue. You should not count a backyard garden as agricultural or the road in front of a home as transportation.

[6] Group: Your group number.

[7] Year: the year of the field survey

[8] Date: the date the field survey is completed

[9] FLU1 (Squares): In this box, record the Field Land Use 1 area in squares on the plot drawing

[10] FLU2 (Squares): In this box, record the Field Land Use 2 area in squares on the plot drawing

[11] Plot/Contact Information: This is the contact information for the plot owner

[12] Address: the address of the plot, if available

[13] Resident: the name of the person/s living on the plot

[14] Phone: the phone number of the resident

[15] Notes: general information about the plot location, owner or resident

[16] GPS Coordinates / Photograph: this section has the precise location of the center point of the plot.

[17] GPS X: this is the GPS longitude of the plot location. The units are decimal degrees

[18] GPS Y: this is the GPS latitude of the plot location. The units are decimal degrees

[19] GPS Z: this is the altitude of the plot. The units are feet.

[20] Photo ID #: If you take a picture of the site, enter the file name of the picture here.

[21] ID: the number of the reference item. Also show on plot drawing.

[22] Description: the name of the object, like “fire hydrant.”

[23] Direction from center: this is the direction in degrees from the plot center. Use the markings on the center marker to figure out the angle. 0 degrees is North, 90 degrees is East.

[24] Distance from center: this is the distance from the center of the plot to the nearest edge of the reference object

[25] Note and Comments: anything noteworthy about the reference item.

[26] Ground Covers (in squares): this section is used to describe all of the different ground covers that are on the plot. From the plot drawing that you make, roughly count the number of squares of each type. Enter the number in the adjacent box to the cover type. Put an “R” for “Remainder” in the box of the most extensive cover. For example, if a plot falls in an asphalt parking lot, enter R under Asphalt and then the number of squares in each of the other types present. The abbreviations for the cover types are shown in parentheses with each type.

[27] Building (B): this is for any structure. Only count the floor area of the building. Don’t include any awnings or gables or the like.

[28] Concrete (C): The standard material for sidewalks, curbs and gutters, the concrete designation also includes the colored, stamped driveways and walkways that are becoming more common.

[29] Asphalt (A): this is for any tar covered surface except roofs. Roads, parking lots, most basketball courts fit here.

[30] Other Impervious (OI): Any surface that doesn’t allow water penetration. An example of this is brick.

[31] Maintained Grass (MG): grass that is mowed, lawns. Include here lawns that need mowing.

[32] Unmaintained Grass (UG): natural grass areas. These could be natural areas of native grasses or pastures that don’t normally get mowed and irrigated

[33] Water (W): Any area of water including fountains, ponds, lakes and streams

[34] Duff & Mulch (M): any ground cover composed of decaying plant materials

[35] Bare Soil (BS): soil that has few or no plants growing in it.

[36] Seedlings (S): areas with small trees too numerous to count.

[37] Herbs & Ivy (HI): any low growing ground cover that can’t easily be distinguished as individual plants

[38] Agricultural Crops (AC): Crops grown on commercial farms. This doesn’t include backyard gardens

[39] Pervious Rock (PR): gravel, cobbles, boulders that generally allow water to reach the ground beneath rather than forcing it to run off the site

[40] Shrub (SH): leafy plant that does not count as a tree. Do not double count for ground cover under the shrub.

[41] Summary of Plot Areas (in Squares): this section is used to give an overall summary of the key coverage areas on the site. The units are squares taken from the plot drawing.

[42] Tree Cover: the total area in squares that is beneath all the trees on the plot. Take this number from the drawing and record in squares. Also include the shade canopy from branches that come from trees outside of the plot

[43] Shrub Area: the total area in squares that is generally occupied by shrubs. Take this number from the drawing and record in squares.

[44] Plantable Space: a rough approximation of the number of squares that could have a tree planted in them. Don't assume that construction work will be done to create a planting area.

Appendix 9: 6% Cap Calculations for Tree Measure Emission Reductions

The methodology for calculating the estimated maximum limit on emission reductions from the Urban Forest Air Quality Development Program for the Sacramento region is summarized below. This is consistent with EPA policy[1] for incorporating emerging and voluntary measures in a SIP that limits the amount of emission reductions allowed due to the uncertainty and untested nature of the control mechanisms. For total emerging and voluntary measures, EPA has a presumptive limit[2] of 6 percent of the total amount of emission reduction necessary to achieve the planning requirement for attainment demonstration purposes.

Methodology to Calculate VOC Reduction Limit for Tree Measure

Figure A9-1 contains the 2018 ozone/emission reduction graph for the peak ozone design value site at Cool in the Sacramento region. This diagram shows the pattern of ozone responses to varying combinations in domain-wide VOC and NOx emission reductions. The air quality modeling analysis for 2018 shows that attainment can be reached with different percent combinations of VOC and NOx control. Assuming the combination of percent reductions from only new VOC and NOx control measures adopted by the end of 2008, the 1997 federal 8-hour ozone standard could be attained by reducing 2018 modeled emissions by about 3.3% VOC and 12.5% NOx (shown as Point B on Figure A9-1) This emission reduction target represents the attainment shortfall).

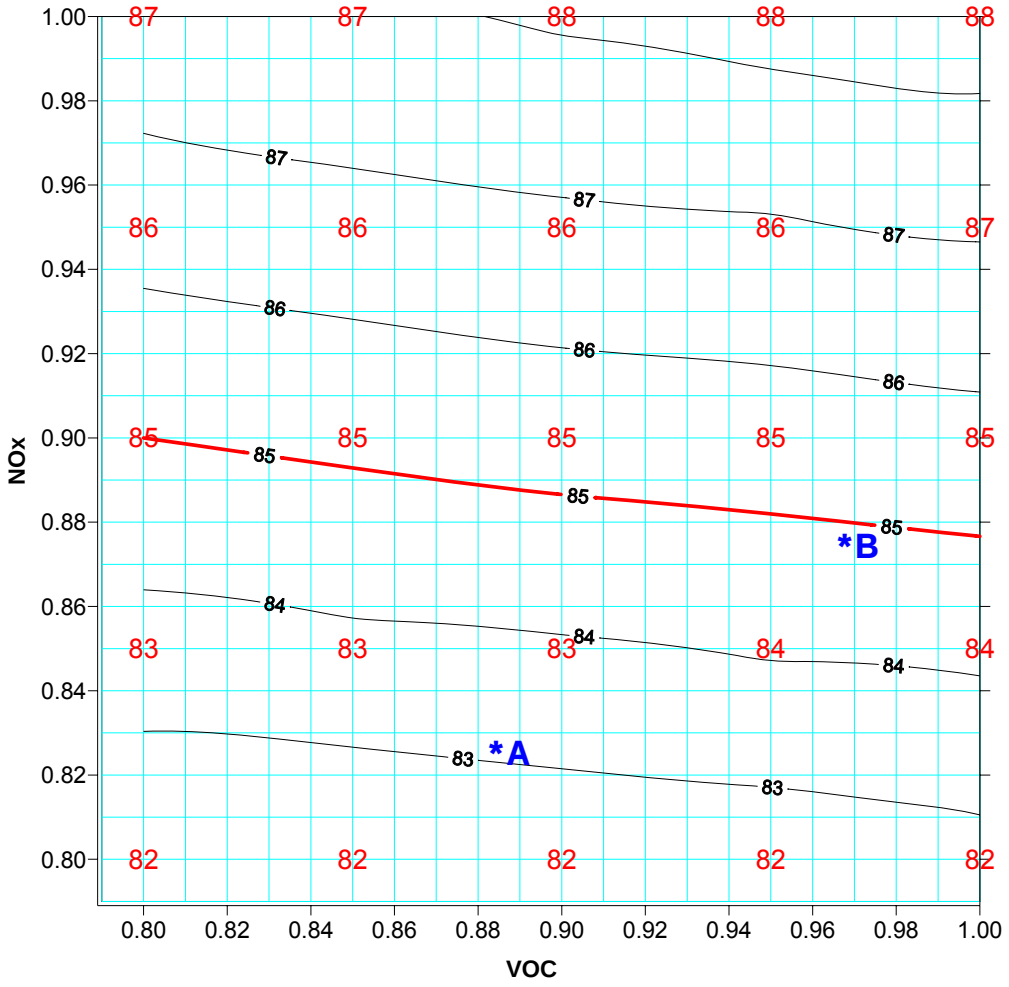
The cap on eligible emission reductions from emerging and voluntary measures is 6 percent of the VOC attainment shortfall. Since the 6 percent cap applies to all emerging and voluntary measures, the maximum reduction limit available for the Tree Measure needs to subtract out any reductions from other emerging or voluntary measures, such as "Spare The Air" Program[3].

Six Percent Reduction Calculations

The 2002 base year emission level (planning inventory) of the Sacramento Federal Ozone Nonattainment Area is 160 tpd of VOC and 196 tpd of NOx. Without any new emission control measures, the 2018 emission inventory is forecasted to be 121 tpd of VOC and 104 tpd of NOx. Based on the 2018 attainment shortfall analysis, 3.3% of the VOC and 12.5% of NOx emissions must be reduced to achieve the attainment standards. This means that VOC emissions must be reduced to 117 tpd and NOx emissions must be reduced to 91 tpd. The attainment shortfall for VOC is 4 tpd and NOx is 13 tpd. The Urban Forest for Clean Air Demonstration Program claims BVOC reductions only. By applying the 6 percent cap on the VOC shortfall, this measure and the Spare The Air Program have a limit of 0.24 tpd of VOC emission reductions. Since the Spare The Air Program will claim 0.06 tpd of VOC emission reduction credit, the tree program is capped at 0.18 tpd of BVOC reduction as an emerging and voluntary measure.

[1] "Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP)" (OAQPS, EPA, September 2004).
[2] Ibid., p. 9.
[3] Spare The Air Program (TCM-ONMS-ED-1) is a voluntary measure to inform and encourage the public to reduce vehicle trips, especially during forecasted high ozone days.

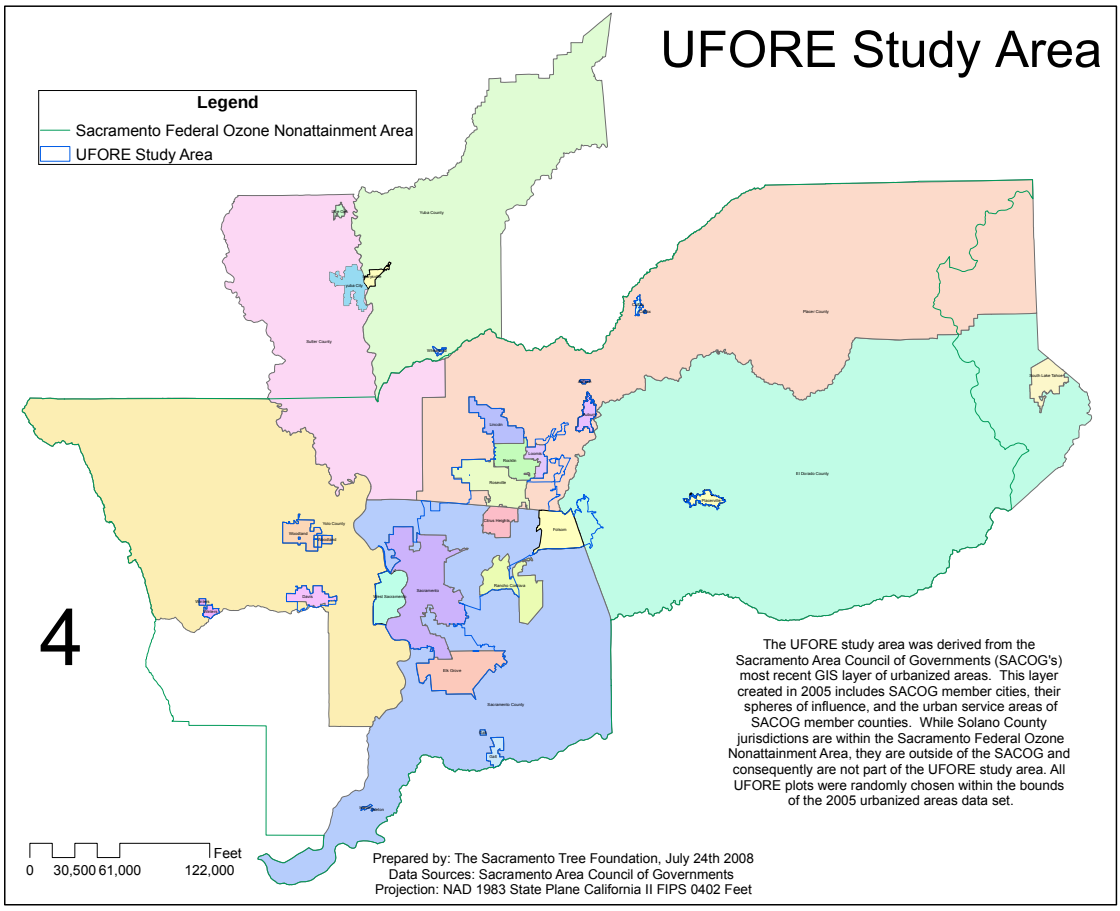
Figure A9-1
Ozone/Emission Reduction Graph
2018 Cool Peak Ozone Design Value Site



1. X and Y Axes: fractional emission reductions of VOC and NOx.
2. Whole (Red) Numbers: predicted ozone design value concentrations (truncated) based on modeling results for fractional VOC and NOx reductions at 5% increments.
3. Horizontal Contour Lines: District interpolated whole ppb ozone contour lines based on 5% increment modeled ozone values rounded to the tenth of a ppb.
4. Point A designates the 2018 emission reductions (11.6% VOC and 17.3% NOx) from all new local, regional, state and federal control measure committals, and provides for attainment.
5. Point B designates the 2018 emission reductions (3.3% VOC and 12.5% NOx) from only the new local, regional, state and federal control measures adopted by the end of 2008. These levels represent percent emission reduction targets for attainment (just below 85 ppb).

Using the combination of emission reduction levels from only new control measures adopted by the end of 2008, attainment of the 1997 federal 8-hour ozone standard (84 ppb) could be achieved by reducing 2018 modeled VOC and NOx emissions by about 3.3% for VOC and 12.5% for NOx (Point B). Since ozone design values are truncated to the whole ppb, ozone design values between 84 to <85 ppb are truncated to 84 ppb.

Appendix 10: UFORE Study Area



Regulatory Control Measures

Indirect Source Rules

CONTROL MEASURE NUMBER: IS-1

Control Measure Title: Construction Mitigation Rule

Date: May 22, 2008

Control Measure Description

New land use and development projects are indirect sources of air pollutant emissions from construction equipment, worker and vendor vehicle trips, and construction materials (e.g., adhesives, sealants, and architectural coatings). Based on California storm water permit data (2004-2006) there are, on average, 245 new land use projects occurring in the Sacramento Federal Non-Attainment Area (SFNA) each year. Depending upon the size and type, the timeline for a construction project can vary from a few months to years.

This control measure will reduce NOx emissions from equipment associated with the construction phase of new land use projects. This control measure will not address operational emissions generated by the projects, which will be addressed by control measure IS-2. San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) Rule 9510, Indirect Source Review, contains requirements for the mitigation of emissions from the construction of development projects. The requirements that are being considered for the control measure are based on the construction requirements of SJVUAPCD Rule 9510, which specifies that all applicable projects mitigate their NOx emissions by 20% less than the statewide average emission rates either by using cleaner construction equipment or modifying the construction equipment (through retrofits, replacements, or post-combustion controls), or by paying a fee that will be used by the districts to obtain emission reductions. During the rule development process, staff will explore integration of this rule with CARB's offroad engine rule to ensure that the 20% requirement is feasible and cost effective through 2018 and beyond.

The proposed control measure commits to a framework that includes quantification of emissions before and after mitigation measures are applied, establishes appropriate levels to define who is subject to the rule and emission reduction requirements for affected sources. The proposed emission reduction requirements will include a fee option to achieve offsite reductions when onsite reductions are unavailable. The proposed control measure will be evaluated for adoption by districts noted in the following tables.

Emission Inventory

The SFNA planning emission inventory is presented below for the category associated with construction equipment emissions of NOx. The emissions already account for California Air Resources Board State Implementation Plan measures.

District	EIC Code	EIC Description	NOx Emission Inventory (tpd)
			2018
SMAQMD	860-887	CONSTRUCTION AND MINING EQUIPMENT	4.6081
PCAPCD	860-887	CONSTRUCTION AND MINING EQUIPMENT	0.9172
FRAQMD	860-887	CONSTRUCTION AND MINING EQUIPMENT	0.0722
		TOTAL	**5.5975**

Emission Reductions

Total NOx emissions from all phases of construction and all other associated emissions will be estimated using URBEMIS 2007, version 9.2 or another construction emission estimation model that the Air Pollution Control Officer deems appropriate. Emission reductions for this measure have been calculated assuming that new construction projects will be required to reduce total construction-related emissions of NOx by 20% below the statewide averages (as required by SJVUAPCD Rule 9510). Applicants will be able to reduce these emissions through either onsite or offsite mitigation. Onsite mitigation will consist of applicants replacing or retrofitting older, higher-emitting construction equipment. Offsite mitigation will allow applicants to pay a fee based on the cost effectiveness of the Carl Moyer, SECAT, or other approved program. The District will secure mitigation for those applicants by funding emission reduction projects elsewhere, following the guidelines of the approved funding program.

Construction projects will be required to comply with this rule if they equal or exceed any of the following thresholds (based on SJVUAPCD Rule 9510):

- 50 residential units;
- 2,000 sq. feet of commercial space;
- 25,000 sq. feet of light industrial space;
- 100,000 sq. feet of heavy industrial space;
- 20,000 sq. feet of medical office space;
- 39,000 sq. feet of general office space;
- 9,000 sq. feet of educational space;
- 10,000 sq. feet of government space;
- 20,000 sq. feet of recreational space; or
- 9,000 sq. feet of space not identified above

In order to estimate potential future emission reductions, District staff used the State Water Resources Control Board storm water permit data and the default assumptions built into the construction emissions model URBEMIS. The storm water data provided the acres and type (residential, commercial, industrial) for all projects occurring in the SFNA over two acres. In order to condense this data, projects were categorized by their size and averaged over a three-year period (2004 through 2006). Because the storm

water database does not give project specifics beyond the type and size, all projects labeled residential were assumed to be entirely residential and other projects not labeled residential were assumed to be entirely commercial.

Defaults from URBEMIS including average residential and commercial density, the type and amount of construction equipment used for different sized projects, and the construction phase timelines were used to estimate calendar year 2008 emissions for the projects obtained from the storm water database. The NOx emissions from all applicable project groups were totaled and reductions were assumed to be 20% of this total with an 80% compliance rate. The reductions were compared to the 2008 SFNA emission inventory to derive a percent reduction that could be applied to the 2018 inventory.

Annual NOx emission reductions are summarized below for the districts planning to adopt this control measure in the SFNA.

District	2018 (tpd)
SMAQMD	0.0905
PCAPCD	0.0462
TOTAL	**0.1367**

There are no emission reductions estimated for the portion of FRAQMD in the SFNA because there were no new land use projects shown for 2004 to 2006 in the California storm water database for this area. It is assumed that new construction will occur and, therefore this control measure will achieve ozone precursor emission reductions from those future projects in the FRAQMD.

SMAQMD
Adoption year: 2010
Implementation year: 2011

PCAPCD
Adoption year: 2013
Implementation year: 2014

FRAQMD
Adoption year: 2013
Implementation year: 2014

Cost Effectiveness

It is anticipated that developers will not choose to perform onsite mitigation when the cost for doing so would exceed the cost of paying mitigation fees. Therefore, the upper bound of cost effectiveness for this measure is based on the mitigation fees. The fees have been estimated based on the current Carl Moyer program cost effectiveness of $16,000 per ton of NOx reduced.

Authority

The districts are authorized to adopt and implement regulations to reduce or mitigate emissions from indirect and areawide sources of air pollution by Health and Safety Code Section 40716. In addition, SMAQMD is specifically authorized to adopt regulations to limit or mitigate the impact on air quality of indirect or areawide sources by Health and Safety Code Section 41013.

Implementation

This control measure will be implemented by SMAQMD, PCAPCD, and FRAQMD.

References

CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (RF#980), February 28, 2007

SJVUAPCD "Rule 9510, Indirect Source Review (ISR)." Adopted December 15, 2005

SJVUAPCD "Final Draft Staff Report – Rule 9510, Indirect Source Review (ISR), Rule 3180, Administrative Fees for Indirect Source Review." December 15, 2005

State Water Resources Control Board "Statewide Construction Storm Water Database Active Notice of Intents (NOIs)." http://www.swrcb.ca.gov/stormwtr/databases.html.

URBEMIS 2007, Version 9.2, July 2007.

CONTROL MEASURE NUMBER: IS-2

Control Measure Title: Operational Indirect Source Rule (ISR)

Date: June 10, 2008

Control Measure Description

This control measure will reduce emissions generated during the operational phase of indirect sources. An indirect source is defined as any facility, building, structure or installation, or combination thereof, which generates or attracts mobile source activity that results in emissions of any pollutant for which there is a state ambient air quality standard. The rule will require indirect sources to mitigate a portion of their emissions through a combination of on-site mitigation measures and, if onsite measures are insufficient, a contribution to an off-site mitigation fund that will invest in emission reduction projects.

On-site mitigation could include strategies that reduce vehicle trips or vehicle miles traveled (VMT). Other on-site mitigation measures could be considered, such as improved energy efficiency resulting in fewer power plant emissions or reductions in on-site combustion emissions. Off-site mitigation fees will be calculated based on the amount of required emission reductions that can not be achieved through on-site measures. This control measure will integrate with SACOG's Blueprint Metropolitan Transportation Plan[17] and look for synergistic opportunities from AB 32 (Nunez) – California Global Warming Solutions Act of 2006[18] and SB 375 (Steinberg) – legislation to reduce greenhouse gases through land-use planning[19].

The proposed control measure commits to a framework that includes quantification of emissions before and after mitigation measures are applied, establishes appropriate levels to define who is subject to the rule and emission reduction requirements for affected sources. The proposed emission reduction requirements will include a fee option to achieve offsite reductions when onsite reductions are insufficient. The proposed control measure will be evaluated for adoption by districts noted in the following tables.

The District will develop guidelines that describe the quantification methodology used to evaluate the emission reductions from proposed off-site mitigation projects. The guidelines will be made available for public review through a public notice in a newspaper of general circulation, followed by District Board adoption (including responses to comments), and a request for CARB/EPA approval. The District will

[17] Metropolitan Transportation Plan for 2035 (MTP2035), approved by SACOG Board of Directors March 20, 2008
[18] California Health and Safety Code, Section 38500-38599.
[19] Signed by Governor 9-30-08, and amends California Government Code and Division 13 of the Public Resources Code.

evaluate and select off-site mitigation projects for funding with ISR revenue through a public process and ultimately District Board approval.

Emissions impacts of indirect sources are commonly modeled with the URBEMIS emissions model. URBEMIS calculates emissions based on trip generation rates for user specified land uses along with EMFAC mobile emission factors. URBEMIS also calculates area source emissions from sources such as on-site natural gas combustion, landscaping, and consumer products.

SACOG is currently developing a new modeling tool that integrates the iPLACES parcel-level land use scenario planning tool with the SACMET travel model. The new model will provide the ability to evaluate regional changes in vehicle trips and VMT based on proposed land uses.

Emission Inventory – 2018

The Operational ISR will apply to residential and non-residential development projects that generate indirect emissions from on-road mobile sources such as passenger cars, light trucks, and motorcycles. The table below presents the summer planning inventory for categories expected to be affected by the rule (note: other inventory categories may be affected to the extent that the rule affects them, or as part of selected mitigation strategies).

District	EIC Code	EIC Description	2018 Inventory* (tpd)	
			NOx	ROG
SMAQMD	710	LDA	2.53	4.90
	722	LDT1	0.76	1.32
	723	LDT2	2.60	3.75
	724	MDV	1.74	1.92
	732	LHDT1	2.08	0.99
	733	LHDT2	0.90	0.26
	734	MHDV	3.39	0.44
	736	HHDV	6.76	0.65
	750	Motorcycle	0.40	1.57
	762	Urban Bus	0.42	0.03
	770	School Bus	0.41	0.03
	780	Motor Home	0.17	0.02
	010-045-0110-0000	Electric Utilities – Natural Gas Turbine	0.709	0.191
	610-610-0110-0000	Residential Fuel Combustion – Natural Gas Cooking	0.082	0.004
	610-608-0110-0000	Residential Fuel Combustion – Natural Gas Water Heating	1.585	0.079
		SMAQMD Total	**24.54**	**16.15**

District	EIC Code	EIC Description	2018 Inventory* (tpd)	
			NOx	ROG
PCAPCD	710	LDA	0.53	0.93
	722	LDT1	0.34	0.54
	723	LDT2	0.59	0.80
	724	MDV	0.38	0.41
	732	LHDT1	0.63	0.17
	733	LHDT2	0.25	0.05
	734	MHDV	0.53	0.06
	736	HHDV	6.48	0.52
	750	Motorcycle	0.20	0.74
	762	Urban Bus	0.11	0.01
	770	School Bus	0.11	0.01
	780	Motor Home	0.07	0.01
	010-045-0110-0000	Electric Utilities – Natural Gas Turbine	0.089	0.007
	610-610-0110-0000	Residential Fuel Combustion – Natural Gas Cooking	0.029	0.001
	610-608-0110-0000	Residential Fuel Combustion – Natural Gas Water Heating	0.263	0.013
		PCAPCD Total	**10.60**	**4.27**

** all on-road emissions are based on EMFAC2007 with Feb. 08 SACOG activity data. Area source emissions are based on ARB CEFS_O3SIP data.*

Emission Reductions

In 2006, the existing California Environmental Quality Act mitigation program achieved 0.033 TPD of NOx and 0.035 TPD of ROG in the Sacramento district. These reductions represent 0.061% and 0.115% of the Sacramento 2005 affected NOx and ROG inventory, respectively.

The South Coast AQMD 2007 Air Quality Management Plan proposes an indirect source rule (2007EGM-01) with a commitment to achieve 1.0 TPD and 0.5 TPD of NOx and ROG, respectively, in 2020. This represents 0.17% of the ROG inventory and 0.36% of the NOx inventory. The San Joaquin Valley Unified APCD 2007 ozone plan includes a commitment to achieve 0.2 TPD reduction in on-road NOx in 2017 from their existing indirect source rule which represents 0.12% of the NOx inventory. (Note: South Coast inventory is based on ARB CEFS_O3SIP data. San Joaquin inventory is based on 2007 Ozone Plan Appendix B.)

Sufficient data is not currently available to precisely quantify expected reductions. For example, the integrated iPlaces land use model and SACMET travel model expected to be used for emission reduction quantification is not yet available in final form. However, based on the ranges of reductions discussed above as applied to the affected inventory for SMAQMD and PCAPCD in 2018 results in the following expected emission reduction range:

	2018 Reduction (tpd)	
District	**NOx**	**ROG**
SMAQMD	0 - 0.09	0 - 0.03
PCAPCD	0 - 0.04	0 - 0.01
Total	0 – 0.13	0 – 0.04

Emission reductions from this rule will result from a combination of on-site mitigation implemented by project proponents and off-site mitigation projects. Depending on the type of mitigation strategies funded through the off-site mitigation program, emission reductions could apply to mobile, stationary, or area-wide source inventory categories.

SMAQMD
Adoption year: 2012
Implementation year: 2014

PCAPCD
Adoption year: 2014
Implementation year: 2016

Cost Effectiveness

The cost effectiveness of this rule is dependent on the type of on-site mitigation implemented by a developer, and whether or not the off-site mitigation fee option is chosen for some or all of the required emission reductions. Some on-site mitigation may result in a cost savings.

Authority and Resources

The districts are authorized to adopt and implement regulations to reduce or mitigate emissions from indirect and area-wide sources of air pollution by Health and Safety Code Section 40716. In addition, SMAQMD is specifically authorized to adopt indirect or area-wide source regulations by Health and Safety Code Section 41013.

Districts are authorized to recover costs associated with regulation of area-wide and indirect sources by Health and Safety Code Section 42311(g).

Implementation

This control measure will be implemented by SMAQMD and PCAPCD.

Stationary and Area-wide Source Control Measures

VOC
Control Measures

Architectural Coatings

Control Measure Number: SMAQMD - 442

Control Measure Title: Architectural Coatings

Date: May 8, 2008

Control Measure Description

This control measure regulates the volatile organic compound (VOC) content in coatings applied to stationary structures and their appurtenances (e.g., general use flats, general use non-flats, and specialty coatings such as industrial maintenance coatings, lacquers, floor coatings, roof coatings, stains, etc.). The strategy also regulates the sale of coatings within the district by prohibiting manufacturers and suppliers of coatings from selling coatings that do not comply with the strategy.

The SMAQMD's architectural coating rule (Rule 442) was originally adopted in 1978 and has been amended seven times with the most recent amendment occurring in May 2001. The amendment in May 2001 adopted CARB's 2000 SCM for this category. On October 25, 2007, CARB adopted a new SCM for Architectural Coatings that established lower VOC limits for some coating categories.

The table below shows a comparison between the VOC limits in the current Rule 442 and the new SCM; coating categories that do not have lower VOC limits are not included.

Category	SMAQMD Rule 442 (g/l)	CARB SCM (g/l)
Flat Coating	100	50
Nonflat Coating	150	100
Nonflat-High Gloss	250	150
Antenna Coating	530	250
Antifouling Coaings	400	250
Bituminous Roof Coatings	300	50
Clear Wood Coatings:		275
Clear Brushing Lacquer	550	
Lacquers (including lacquer sanding sealers)	550	
Sanding Sealers (other than lacquer sanding sealers)	350	
Varnishes	350	
Concrete/Masonry Sealer (was Waterproofing Concrete/Masonry Sealer	400	100
Reactive Penetrating Sealer	400	350
Dry Fog Coatings	400	150
Fire Retardant Coatings:		350
Clear	650	
Opaque	350	
Floor Coatings	250	100
Flow Coatings	420	250
Mastic Texture Coatings	300	100
Primers, Sealers, and Undercoaters	200	100
Quick Dry Enamels	250	150
Quick Dry Primers, Sealers, Undercoaters	200	100
Roof Coatings	250	50
Rust Preventative Coatings	400	250
Specialty Primers, Sealers, Undercoaters	350	100
Temperature-Indicator Safety Coating	550	420
Traffic Marking Coatings	150	100

Emission Inventory –2018

EIC Code	EIC Description	ROG Planning Inventory Tons/day 2018
520-520-9100-0000	Oil-Based (Organic Solvent Based) Coatings (Unspecified)	0.0850
520-520-9105-0000	Oil-Based Primers, Sealers, And Undercoaters	0.1614
520-520-9106-0000	Oil-Based Quick Dry Primers, Sealers, And Undercoaters	0.0958
520-520-9108-0000	Oil-Based Specialty Primer, Sealer, And Undercoaters	0.0050
520-520-9109-0000	Oil-Based Bituminous Roof Primer	0.0160
520-520-9113-0000	Oil-Based Waterproofing Sealers	0.0744
520-520-9118-0000	Oil-Based Waterproofing Concrete/Masonry Sealers	0.0525
520-520-9122-0000	Oil-Based Faux Finishing	0.0016
520-520-9124-0000	Oil-Based Mastic Texture	0.0232
520-520-9126-0000	Oil-Based Rust Preventative	0.0370
520-520-9131-0000	Oil-Based Stains - Clear/Semitransparent	0.2948
520-520-9136-0000	Oil-Based Stains – Opaque	0.0278
520-520-9141-0000	Oil-Based Varnish - Clear/Semitransparent	0.1957
520-520-9153-0000	Oil-Based Quick Dry Enamel Coatings	0.0672
520-520-9157-0000	Oil-Based Lacquers (Unspecified)	0.0727
520-520-9159-0000	Oil-Based Flat Coatings	0.0026
520-520-9160-0000	Oil-Based Nonflat - Low Gloss/Medium Gloss	0.1081
520-520-9161-0000	Oil-Based High Gloss Nonflat Coatings	0.1171
520-520-9164-0000	Oil-Based Bituminous Coatings	0.2206

EIC Code	EIC Description	ROG Planning Inventory Tons/day
		2018
520-520-9165-0000	Oil-Based Concrete Curing Compounds	0.0042
520-520-9166-0000	Oil-Based Dry Fog Coatings	0.0437
520-520-9169-0000	Oil-Based Floor Coatings	0.0121
520-520-9170-0000	Oil-Based Form Release Coatings	0.0310
520-520-9172-0000	Oil-Based Industrial Maintenance Coatings	0.4144
520-520-9173-0000	Oil-Based Metallic Pigmented Coatings	0.1410
520-520-9174-0000	Oil-Based Roof Coatings	0.0107
520-520-9176-0000	Oil-Based Traffic Coatings	0.0383
520-520-9177-0000	Oil-Based Wood Preservatives	0.0348
520-520-9200-0000	Water-Based Coatings (Unspecified)	0.0112
520-520-9205-0000	Water-Based Primers, Sealers, And Undercoaters	0.1707
520-520-9206-0000	Water-Based Quick Dry Primers, Sealers, And Undercoaters	0.0135
520-520-9208-0000	Water-Based Specialty Primer, Sealer, And Undercoaters	0.0107
520-520-9209-0000	Water-Based Bituminous Roof Primer	0.0027
520-520-9213-0000	Water-Based Waterproofing Sealers	0.0098
520-520-9218-0000	Water-Based Waterproofing Concrete/Masonry Sealers	0.0141
520-520-9222-0000	Water-Based Faux Finishing	0.0094
520-520-9223-0000	Water-Based Form Release Compounds	0.0003
520-520-9224-0000	Water-Based Mastic Texture	0.0116
520-520-9226-0000	Water-Based Rust Preventative	0.0014
520-520-9231-0000	Water-Based Stains - Clear/Semitransparent	0.0167
520-520-9236-0000	Water-Based Stains - Opaque	0.0259
520-520-9241-0000	Water-Based Varnishes - Clear/Semitransparent	0.0261
520-520-9257-0000	Water-Based Lacquers (Unspecified)	0.0051
520-520-9259-0000	Water-Based Flat Coatings	0.6747
520-520-9260-0000	Water-Based Nonflat - Low Gloss/Medium Gloss	0.7753
520-520-9261-0000	Water-Based High Gloss Nonflat Coatings	0.0701
520-520-9264-0000	Water-Based Bituminous Coatings	0.0013
520-520-9265-0000	Water-Based Concrete Curing Compounds	0.0148
520-520-9266-0000	Water-Based Dry Fog Coatings	0.0126
520-520-9269-0000	Water-Based Floor Coatings	0.0325
520-520-9272-0000	Water-Based Industrial Maintenance Coatings	0.0326
520-520-9273-0000	Water-Based Metallic Pigmented Coatings	0.0033
520-520-9274-0000	Water-Based Roof Coatings	0.0185
520-520-9276-0000	Water-Based Traffic Coatings	0.117
520-520-9277-0000	Water-Based Wood Preservatives	0.0003
Total		**4.4709**

Emission Reductions

EIC Description	Adoption date	Implementation Date	ROG Emission Reduction Tons/day
			2018
Architectural Coating Categories	2010	2011, except Rust Preventative and Specialty Primer, Sealer, Undercoater in 2012	0.9138

Cost Effectiveness

The cost effectiveness calculations were based upon economic analyses conducted by the South Coast Air Quality Management District for amendments to Rule 1113. The specific economic analyses used are listed below:

- December 6, 2002 Amendments (based on vacated May 14, 1999 Amendments) (1998 economic data) – industrial maintenance coatings; rust preventative coatings; floor coatings; non-flats; primers, sealers, and undercoaters; quick-dry primers, sealers, and undercoaters; and quick-dry enamels.
- December 5, 2003 Amendments (2003 economic data) – clear wood finishes (including sanding sealers and varnish); roof coatings; stains; and waterproofing sealers (including concrete and masonry sealers). Range of cost effectiveness was $4,229 - $11,405/ton.
- June 9, 2006 Amendments (2006 economic data) – concrete-curing compounds; dry-fog coatings; and traffic coatings. Range of cost effectiveness was $4,882/ton.

It was assumed that the economic relationships between Sacramento and South Coast suppliers and users of architectural coatings do not differ significantly. Therefore, the estimated South Coast cost effectiveness values were assumed to be transferable to Sacramento.

The cost effectiveness values calculated from the December 6, 2002 and December 5, 2003 amendments were adjusted to 2006 dollars (from 1998 and 2003 dollars, respectively) using the Bureau of Labor Statistics' Consumer Price Index for West Urban consumers. The estimated overall cost effectiveness for this proposed measure is estimated to be $10,485/ton

Authority

Authority to implement this control measure by the SMAQMD is in accordance with California Health and Safety Code, Sections 40000, 40001, and 41010.

Implementation

The Sacramento Metropolitan Air Quality Management District is the implementing agency.

References

1. Sacramento Metropolitan Air Quality Management District, Rule 442 (Architectural Coatings). Amended May 24, 2001.
2. South Coast Air Quality Management District, Rule 1113 (Architectural Coatings). Amended June 9, 2006.
3. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). May 14, 1999.

4. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). December 6, 2002.
5. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). December 5, 2003.
6. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). June 9, 2006.
7. U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index 1996-2006.
8. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (RF#980), November 16, 2006
9. California Air Resources Board Suggested Control Measure for Architectural Coatings, October 25, 2007
10. Control Measure, SMAQMD - 442, November 28, 2006
11. Control Measure 442 Calculation Spreadsheet, SMAQMD, May 14, 2008

Control Measure Number: EDCAQMD - 215

Control Measure Title: Architectural Coatings

Date: May 12, 2008

Control Measure Description

This control measure regulates the volatile organic compound (VOC) content in coatings applied to stationary structures and their appurtenances (e.g., general use flats, general use non-flats, and specialty coatings such as industrial maintenance coatings, lacquers, floor coatings, roof coatings, stains, etc.). The strategy also regulates the sale of coatings within the district by prohibiting manufacturers and suppliers of coatings from selling coatings that do not comply with the strategy.

The existing Rule 215-Architectural Coatings was adopted on September 8, 1994 and subsequently amended on September 27, 1994. In 2000, the California Air Resources Board (CARB) adopted the Suggested Control Measures (SCM) for Architectural Coatings. This SCM established VOC limits that obtained about a 20% overall reduction for this category. On October 25, 2007, CARB adopted a new SCM for Architectural Coatings that established lower VOC limits for some coating categories.

The table below shows a comparison between the VOC limits in the current rule and the limits in the new SCM; coating categories that do not have lower VOC limits are not included.

Category	EDCAQMD Rule 215 (g/l)	CARB SCM (g/l)
Flat Coating	100	50
Specialty Flat	400	
Nonflat Coating	250	100
Nonflat-High Gloss	250	150
Antenna Coating	530	250
Antifouling Coaings	400	250
Bituminous Roof Coatings	300	50
Clear Wood Coatings:		275
Clear Brushing Lacquer	680	
Lacquers (including lacquer sanding sealers)	680	
Sanding Sealers (other than lacquer sanding sealers)	350	
Varnishes	350	
Concrete/Masonry Sealer (was Waterproofing Concrete/Masonry Sealer	400	100
Reactive Penetrating Sealer	400	350
Dry Fog Coatings	400	150
Fire Retardant Coatings:		350
Clear	650	
Opaque	350	
Floor Coatings	250	100
Flow Coatings	420	250
Industrial Maintenance		250
High temp	420	
Antigraffiti	340	
Mastic Texture Coatings	300	100
Multi-color	420	250
Pretreatment Wash Primers	675	420
Primers, Sealers, and Undercoaters	350	100
Quick Dry Enamels	400	150
Quick Dry Primers, Sealers, Undercoaters	350	100
Roof Coatings	300	50
Rust Preventative Coatings	420	250
Specialty Primers, Sealers, Undercoaters	350	100
Stains	350	250
Swimming Pool Repair and Maintenance	650	340
Temperature-Indicator Safety Coating	550	420
Traffic Marking Coatings	250	100
Water proofing Sealers	400	250

Emission Inventory –2018

EIC Code	EIC Description	ROG Planning Inventory Tons/day 2018
520-520-9100-0000	Oil-Based (Organic Solvent Based) Coatings (Unspecified)	0.0092
520-520-9105-0000	Oil-Based Primers, Sealers, And Undercoaters	0.0278
520-520-9106-0000	Oil-Based Quick Dry Primers, Sealers, And Undercoaters	0.0335
520-520-9108-0000	Oil-Based Specialty Primer, Sealer, And Undercoaters	0.0005
520-520-9109-0000	Oil-Based Bituminous Roof Primer	0.0016
520-520-9113-0000	Oil-Based Waterproofing Sealers	0.0089
520-520-9118-0000	Oil-Based Waterproofing Concrete/Masonry Sealers	0.0055
520-520-9122-0000	Oil-Based Faux Finishing	0.0002
520-520-9124-0000	Oil-Based Mastic Texture	0.0024
520-520-9126-0000	Oil-Based Rust Preventative	0.0039

EIC Code	EIC Description	ROG Planning Inventory Tons/day
		2018
520-520-9131-0000	Oil-Based Stains - Clear/Semitransparent	0.0402
520-520-9136-0000	Oil-Based Stains – Opaque	0.0045
520-520-9141-0000	Oil-Based Varnish - Clear/Semitransparent	0.0205
520-520-9153-0000	Oil-Based Quick Dry Enamel Coatings	0.0133
520-520-9157-0000	Oil-Based Lacquers (Unspecified)	0.0129
520-520-9159-0000	Oil-Based Flat Coatings	0.0003
520-520-9160-0000	Oil-Based Nonflat - Low Gloss/Medium Gloss	0.0119
520-520-9161-0000	Oil-Based High Gloss Nonflat Coatings	0.0123
520-520-9164-0000	Oil-Based Bituminous Coatings	0.0231
520-520-9165-0000	Oil-Based Concrete Curing Compounds	0.0005
520-520-9166-0000	Oil-Based Dry Fog Coatings	0.0046
520-520-9169-0000	Oil-Based Floor Coatings	0.0013
520-520-9170-0000	Oil-Based Form Release Coatings	0.0033
520-520-9172-0000	Oil-Based Industrial Maintenance Coatings	0.0719
520-520-9173-0000	Oil-Based Metallic Pigmented Coatings	0.0148
520-520-9174-0000	Oil-Based Roof Coatings	0.0012
520-520-9176-0000	Oil-Based Traffic Coatings	0.004
520-520-9177-0000	Oil-Based Wood Preservatives	0.0037
520-520-9200-0000	Water-Based Coatings (Unspecified)	0.0012
520-520-9205-0000	Water-Based Primers, Sealers, And Undercoaters	0.0182
520-520-9206-0000	Water-Based Quick Dry Primers, Sealers, And Undercoaters	0.0014
520-520-9208-0000	Water-Based Specialty Primer, Sealer, And Undercoaters	0.0011
520-520-9209-0000	Water-Based Bituminous Roof Primer	0.0003
520-520-9213-0000	Water-Based Waterproofing Sealers	0.0014
520-520-9218-0000	Water-Based Waterproofing Concrete/Masonry Sealers	0.0015
520-520-9222-0000	Water-Based Faux Finishing	0.001
520-520-9223-0000	Water-Based Form Release Compounds	0
520-520-9224-0000	Water-Based Mastic Texture	0.0012
520-520-9226-0000	Water-Based Rust Preventative	0.0002
520-520-9231-0000	Water-Based Stains - Clear/Semitransparent	0.0021
520-520-9236-0000	Water-Based Stains - Opaque	0.0028
520-520-9241-0000	Water-Based Varnishes - Clear/Semitransparent	0.0027
520-520-9257-0000	Water-Based Lacquers (Unspecified)	0.0005
520-520-9259-0000	Water-Based Flat Coatings	0.0895
520-520-9260-0000	Water-Based Nonflat - Low Gloss/Medium Gloss	0.0937
520-520-9261-0000	Water-Based High Gloss Nonflat Coatings	0.0074
520-520-9264-0000	Water-Based Bituminous Coatings	0.0001
520-520-9265-0000	Water-Based Concrete Curing Compounds	0.0016
520-520-9266-0000	Water-Based Dry Fog Coatings	0.0013
520-520-9269-0000	Water-Based Floor Coatings	0.0034
520-520-9272-0000	Water-Based Industrial Maintenance Coatings	0.0037
520-520-9273-0000	Water-Based Metallic Pigmented Coatings	0.0003
520-520-9274-0000	Water-Based Roof Coatings	0.0019
520-520-9276-0000	Water-Based Traffic Coatings	0.0123
520-520-9277-0000	Water-Based Wood Preservatives	0
Total		**0.5886**

Emission Reductions

EIC Description	Adoption date	Implementation Date	ROG Emission Reduction Tons/day 2018
Architectural Coating Categories	2013	2015	0.1862

Cost Effectiveness

The proposed VOC limits from the SCM are already in place in a number of air districts. When the SCM was adopted, the cost effectiveness was determined to be an average of $3.20 per pound ($6400 per ton) of ROG reduced. The proposed SCM VOC limits were identified by SCAQMD and are already in place in there. Based on the 1999 Socioeconomic impact assessment used in the socioeconomic analysis for the Rule 1113 amendments, the cost effectiveness was estimated to be $8.50 per pound ($16,996 per ton) of ROG reduced. These cost-effectiveness estimates will be used as representative of the economic relationships of suppliers and users within El Dorado County.

Authority

The above control measure will be implemented by amendment to the existing Rule 215 Architectural Coatings. The El Dorado Air Quality Management District has the authority to propose rules and regulations to the District Board for adoption under HSC 40001.

Implementation

The implementation of this proposed control measure does not involve any other agency other than the El Dorado County Air Quality Management District.

References

1. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (RF#980 November 16, 2006)
2. California ARB Staff Report for the Proposed Suggested Control Measure for Architectural Coating, Released June 6, 2000
3. South Coast AQMD Staff Report for Proposed Amended Rule 1113-Architectural Coating, dated December 6, 2002
4. South Coast AQMD Preliminary Draft Staff Report for Proposed Amended Rule 1113-Architectural Coating, dated April 1, 2001
5. Control Measure 215 Calculation Spreadsheet, SMAQMD, May 15, 2008
6. Control Measure EDCAQMD - 215, January 30, 2007
7. California Air Resources Board Suggested Control Measure for Architectural Coatings, October 25, 2007

Control Measure Number: FRAQMD - 3.15

Control Measure Title: Architectural Coatings

Date: May 20, 2008

Control Measure Description

This control measure regulates the volatile organic compound (VOC) content in coatings applied to stationary structures and their appurtenances (e.g., general use flats, general use non-flats, and specialty coatings such as industrial maintenance coatings, lacquers, floor coatings, roof coatings, stains, etc.). The strategy also regulates the sale of coatings within the district by prohibiting manufacturers and suppliers of coatings from selling coatings that do not comply with the strategy.

The existing Rule 3.15-Architectural Coatings was adopted in June, 1991 and subsequently amended on May 6, 1996 and November 13, 2002. The amendment in November 2002 adopted CARB's 2000 SCM for this category. On October 25, 2007, CARB adopted a new SCM for Architectural Coatings that established lower VOC limits for some coating categories.

The table below shows a comparison between the VOC limits in the current Rule 3.15 and the new SCM; coating categories that do not have lower VOC limits are not included.

Category	FRAQMD Rule 3.15 (g/l)	CARB SCM (g/l)
Flat Coating	100	50
Nonflat Coating	150	100
Nonflat-High Gloss	250	150
Antenna Coating	530	250
Antifouling Coaings	400	250
Bituminous Roof Coatings	300	50
Clear Wood Coatings:		275
Clear Brushing Lacquer	680	
Lacquers (including lacquer sanding sealers)	550	
Sanding Sealers (other than lacquer sanding sealers)	350	
Varnishes	350	
Concrete/Masonry Sealer (was Waterproofing Concrete/Masonry Sealer	400	100
Reactive Penetrating Sealer	400	350
Dry Fog Coatings	400	150
Fire Retardant Coatings:		350
Clear	650	
Opaque	350	
Floor Coatings	250	100
Flow Coatings	420	250
Mastic Texture Coatings	300	100
Primers, Sealers, and Undercoaters	200	100
Quick Dry Enamels	250	150
Quick Dry Primers, Sealers, Undercoaters	200	100
Roof Coatings	250	50
Rust Preventative Coatings	400	250
Specialty Primers, Sealers, Undercoaters	350	100
Temperature-Indicator Safety Coating	550	420
Traffic Marking Coatings	150	100

Emission Inventory – 2018

EIC Code	EIC Description	ROG Planning Inventory Tons/day 2018
520-520-9100-0000	Oil-Based (Organic Solvent Based) Coatings (Unspecified)	0.0004
520-520-9105-0000	Oil-Based Primers, Sealers, And Undercoaters	0.0008
520-520-9106-0000	Oil-Based Quick Dry Primers, Sealers, And Undercoaters	0.0005
520-520-9108-0000	Oil-Based Specialty Primer, Sealer, And Undercoaters	0
520-520-9109-0000	Oil-Based Bituminous Roof Primer	0.0001
520-520-9113-0000	Oil-Based Waterproofing Sealers	0.0004
520-520-9118-0000	Oil-Based Waterproofing Concrete/Masonry Sealers	0.0003
520-520-9122-0000	Oil-Based Faux Finishing	0
520-520-9124-0000	Oil-Based Mastic Texture	0.0001
520-520-9126-0000	Oil-Based Rust Preventative	0.0002
520-520-9131-0000	Oil-Based Stains - Clear/Semitransparent	0.0013
520-520-9136-0000	Oil-Based Stains – Opaque	0.0001
520-520-9141-0000	Oil-Based Varnish - Clear/Semitransparent	0.0009
520-520-9153-0000	Oil-Based Quick Dry Enamel Coatings	0.0003
520-520-9157-0000	Oil-Based Lacquers (Unspecified)	0.0004
520-520-9159-0000	Oil-Based Flat Coatings	0
520-520-9160-0000	Oil-Based Nonflat - Low Gloss/Medium Gloss	0.0005
520-520-9161-0000	Oil-Based High Gloss Nonflat Coatings	0.0006
520-520-9164-0000	Oil-Based Bituminous Coatings	0.001
520-520-9165-0000	Oil-Based Concrete Curing Compounds	0

EIC Code	EIC Description	ROG Planning Inventory Tons/day
		2018
520-520-9166-0000	Oil-Based Dry Fog Coatings	0.0002
520-520-9169-0000	Oil-Based Floor Coatings	0.0001
520-520-9170-0000	Oil-Based Form Release Coatings	0.0002
520-520-9172-0000	Oil-Based Industrial Maintenance Coatings	0.0016
520-520-9173-0000	Oil-Based Metallic Pigmented Coatings	0.0007
520-520-9174-0000	Oil-Based Roof Coatings	0.0001
520-520-9176-0000	Oil-Based Traffic Coatings	0.0002
520-520-9177-0000	Oil-Based Wood Preservatives	0.0002
520-520-9200-0000	Water-Based Coatings (Unspecified)	0.0001
520-520-9205-0000	Water-Based Primers, Sealers, And Undercoaters	0.0008
520-520-9206-0000	Water-Based Quick Dry Primers, Sealers, And Undercoaters	0.0001
520-520-9208-0000	Water-Based Specialty Primer, Sealer, And Undercoaters	0
520-520-9209-0000	Water-Based Bituminous Roof Primer	0
520-520-9213-0000	Water-Based Waterproofing Sealers	0
520-520-9218-0000	Water-Based Waterproofing Concrete/Masonry Sealers	0.0001
520-520-9222-0000	Water-Based Faux Finishing	0
520-520-9223-0000	Water-Based Form Release Compounds	0
520-520-9224-0000	Water-Based Mastic Texture	0.0001
520-520-9226-0000	Water-Based Rust Preventative	0
520-520-9231-0000	Water-Based Stains - Clear/Semitransparent	0.0001
520-520-9236-0000	Water-Based Stains - Opaque	0.0001
520-520-9241-0000	Water-Based Varnishes - Clear/Semitransparent	0.0001
520-520-9257-0000	Water-Based Lacquers (Unspecified)	0
520-520-9259-0000	Water-Based Flat Coatings	0.0028
520-520-9260-0000	Water-Based Nonflat - Low Gloss/Medium Gloss	0.0036
520-520-9261-0000	Water-Based High Gloss Nonflat Coatings	0.0003
520-520-9264-0000	Water-Based Bituminous Coatings	0
520-520-9265-0000	Water-Based Concrete Curing Compounds	0.0001
520-520-9266-0000	Water-Based Dry Fog Coatings	0.0001
520-520-9269-0000	Water-Based Floor Coatings	0.0002
520-520-9272-0000	Water-Based Industrial Maintenance Coatings	0.0001
520-520-9273-0000	Water-Based Metallic Pigmented Coatings	0
520-520-9274-0000	Water-Based Roof Coatings	0.0001
520-520-9276-0000	Water-Based Traffic Coatings	0.0005
520-520-9277-0000	Water-Based Wood Preservatives	0
Total		**0.0205**

Emission Reductions

EIC Description	Adoption date	Implementation Date	ROG Emission Reduction Tons/day
			2018
Architectural Coating Categories	<2012	<2012, except Rust Preventative and Specialty Primer, Sealer, Undercoater in 2012	0.0044

Cost Effectiveness

The cost effectiveness calculations were based upon economic analyses conducted by the South Coast Air Quality Management District for amendments to Rule 1113. The specific economic analyses used are listed below:

- December 6, 2002 Amendments (based on vacated May 14, 1999 Amendments) (1998 economic data) – industrial maintenance coatings; rust preventative coatings; floor coatings; non-flats; primers, sealers, and undercoaters; quick-dry primers, sealers, and undercoaters; and quick-dry enamels.
- December 5, 2003 Amendments (2003 economic data) – clear wood finishes (including sanding sealers and varnish); roof coatings; stains; and waterproofing sealers (including concrete and masonry sealers). Range of cost effectiveness was $4,229 - $11,405/ton.
- June 9, 2006 Amendments (2006 economic data) – concrete-curing compounds; dry-fog coatings; and traffic coatings. Range of cost effectiveness was $4,882/ton.

It was assumed that the economic relationships between Sacramento and South Coast suppliers and users of architectural coatings do not differ significantly. Therefore, the estimated South Coast cost effectiveness values were assumed to be transferable to Sacramento.

The cost effectiveness values calculated from the December 6, 2002 and December 5, 2003 amendments were adjusted to 2006 dollars (from 1998 and 2003 dollars, respectively) using the Bureau of Labor Statistics' Consumer Price Index for West Urban consumers. The estimated overall cost effectiveness for this proposed measure is $10,133/ton

Authority

Authority to implement this control measure by the FRAQMD is in accordance with California Health and Safety Code, Sections 40000, 40001, and 41010.

Implementation

The FRAQMD is the implementing agency.

References

1. South Coast Air Quality Management District, Rule 1113 (Architectural Coatings). Amended June 9, 2006.
2. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). May 14, 1999.
3. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). December 6, 2002.
4. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). December 5, 2003.
5. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). June 9, 2006.
6. U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index 1996-2006.

7. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (RF#980), November 16, 2006
8. Control Measure 3.15 calculation spreadsheet, SMAQMD, May 19, 2008
9. Control Measure, FRAQMD 3.15, dated February 1, 2007
10. California Air Resources Board Suggested Control Measure for Architectural Coatings, October 25, 2007

Control Measure Number: PCAPCD - 218

Control Measure Title: Architectural Coating

Date: May 20, 2008

Control Measure Description

This control measure regulates the volatile organic compound (VOC) content in coatings applied to stationary structures and their appurtenances (e.g., general use flats, general use non-flats, and specialty coatings such as industrial maintenance coatings, lacquers, floor coatings, roof coatings, stains, etc.). The strategy also regulates the sale of coatings within the district by prohibiting manufacturers and suppliers of coatings from selling coatings that do not comply with the strategy.

The PCAPCD's architectural coating rule (Rule 218) was originally adopted in 1983 and has been amended several times with the most recent amendment occurring in December 2001. The amendment in December 2001 adopted CARB's 2000 SCM for this category. On October 25, 2007, CARB adopted a new SCM for Architectural Coatings that established lower VOC limits for some coating categories.

The table below shows a comparison between the VOC limits in the current Rule 218 and the new SCM; coating categories that do not have lower VOC limits are not included.

Category	PCAPCD Rule 218 (g/l)	CARB SCM (g/l)
Flat Coating	100	50
Nonflat Coating	150	100
Nonflat-High Gloss	250	150
Antenna Coating	530	250
Antifouling Coaings	400	250
Bituminous Roof Coatings	300	50
Clear Wood Coatings:		275
Clear Brushing Lacquer	550	
Lacquers (including lacquer sanding sealers)	550	
Sanding Sealers (other than lacquer sanding sealers)	350	
Varnishes	350	
Concrete/Masonry Sealer (was Waterproofing Concrete/Masonry Sealer	400	100
Reactive Penetrating Sealer	400	350
Dry Fog Coatings	400	150
Fire Retardant Coatings:		350
Clear	650	
Opaque	350	
Floor Coatings	250	100
Flow Coatings	420	250
Mastic Texture Coatings	300	100
Primers, Sealers, and Undercoaters	200	100
Quick Dry Enamels	250	150
Quick Dry Primers, Sealers, Undercoaters	200	100
Roof Coatings	250	50
Rust Preventative Coatings	400	250
Specialty Primers, Sealers, Undercoaters	350	100
Temperature-Indicator Safety Coating	550	420
Traffic Marking Coatings	150	100

Emission Inventory – 2018

EIC Code	EIC Description	ROG Planning Inventory Tons/day 2018
520-520-9100-0000	Oil-Based (Organic Solvent Based) Coatings (Unspecified)	0.0192
520-520-9105-0000	Oil-Based Primers, Sealers, And Undercoaters	0.0364
520-520-9106-0000	Oil-Based Quick Dry Primers, Sealers, And Undercoaters	0.0216
520-520-9108-0000	Oil-Based Specialty Primer, Sealer, And Undercoaters	0.0012
520-520-9109-0000	Oil-Based Bituminous Roof Primer	0.0037
520-520-9113-0000	Oil-Based Waterproofing Sealers	0.0167
520-520-9118-0000	Oil-Based Waterproofing Concrete/Masonry Sealers	0.012
520-520-9122-0000	Oil-Based Faux Finishing	0.0004
520-520-9124-0000	Oil-Based Mastic Texture	0.0052
520-520-9126-0000	Oil-Based Rust Preventative	0.0084
520-520-9131-0000	Oil-Based Stains - Clear/Semitransparent	0.0667
520-520-9136-0000	Oil-Based Stains – Opaque	0.0063
520-520-9141-0000	Oil-Based Varnish - Clear/Semitransparent	0.0442
520-520-9153-0000	Oil-Based Quick Dry Enamel Coatings	0.0152
520-520-9157-0000	Oil-Based Lacquers (Unspecified)	0.0164
520-520-9159-0000	Oil-Based Flat Coatings	0.0007
520-520-9160-0000	Oil-Based Nonflat - Low Gloss/Medium Gloss	0.0245
520-520-9161-0000	Oil-Based High Gloss Nonflat Coatings	0.0265
520-520-9164-0000	Oil-Based Bituminous Coatings	0.0498
520-520-9165-0000	Oil-Based Concrete Curing Compounds	0.001

EIC Code	EIC Description	ROG Planning Inventory Tons/day
		2018
520-520-9166-0000	Oil-Based Dry Fog Coatings	0.01
520-520-9169-0000	Oil-Based Floor Coatings	0.0028
520-520-9170-0000	Oil-Based Form Release Coatings	0.0071
520-520-9172-0000	Oil-Based Industrial Maintenance Coatings	0.0847
520-520-9173-0000	Oil-Based Metallic Pigmented Coatings	0.0319
520-520-9174-0000	Oil-Based Roof Coatings	0.0024
520-520-9176-0000	Oil-Based Traffic Coatings	0.0086
520-520-9177-0000	Oil-Based Wood Preservatives	0.0079
520-520-9200-0000	Water-Based Coatings (Unspecified)	0.0025
520-520-9205-0000	Water-Based Primers, Sealers, And Undercoaters	0.0385
520-520-9206-0000	Water-Based Quick Dry Primers, Sealers, And Undercoaters	0.0031
520-520-9208-0000	Water-Based Specialty Primer, Sealer, And Undercoaters	0.0024
520-520-9209-0000	Water-Based Bituminous Roof Primer	0.0007
520-520-9213-0000	Water-Based Waterproofing Sealers	0.0022
520-520-9218-0000	Water-Based Waterproofing Concrete/Masonry Sealers	0.0032
520-520-9222-0000	Water-Based Faux Finishing	0.0021
520-520-9223-0000	Water-Based Form Release Compounds	0.0001
520-520-9224-0000	Water-Based Mastic Texture	0.0026
520-520-9226-0000	Water-Based Rust Preventative	0.0003
520-520-9231-0000	Water-Based Stains - Clear/Semitransparent	0.0038
520-520-9236-0000	Water-Based Stains - Opaque	0.0058
520-520-9241-0000	Water-Based Varnishes - Clear/Semitransparent	0.0059
520-520-9257-0000	Water-Based Lacquers (Unspecified)	0.0011
520-520-9259-0000	Water-Based Flat Coatings	0.1312
520-520-9260-0000	Water-Based Nonflat - Low Gloss/Medium Gloss	0.1752
520-520-9261-0000	Water-Based High Gloss Nonflat Coatings	0.0159
520-520-9264-0000	Water-Based Bituminous Coatings	0.0003
520-520-9265-0000	Water-Based Concrete Curing Compounds	0.0033
520-520-9266-0000	Water-Based Dry Fog Coatings	0.0029
520-520-9269-0000	Water-Based Floor Coatings	0.0074
520-520-9272-0000	Water-Based Industrial Maintenance Coatings	0.0068
520-520-9273-0000	Water-Based Metallic Pigmented Coatings	0.0008
520-520-9274-0000	Water-Based Roof Coatings	0.0042
520-520-9276-0000	Water-Based Traffic Coatings	0.0265
520-520-9277-0000	Water-Based Wood Preservatives	0.0001
Total		**0.9804**

Emission Reductions

EIC Description	Adoption date	Implementation Date	ROG Emission Reduction Tons/day
			2018
Architectural Coating Categories	2012	2013	0.2014

Cost Effectiveness

The cost effectiveness calculations were based upon economic analyses conducted by the South Coast Air Quality Management District for amendments to Rule 1113. The specific economic analyses used are listed below:

- December 6, 2002 Amendments (based on vacated May 14, 1999 Amendments) (1998 economic data) – industrial maintenance coatings; rust preventative coatings;

floor coatings; non-flats; primers, sealers, and undercoaters; quick-dry primers, sealers, and undercoaters; and quick-dry enamels.

- December 5, 2003 Amendments (2003 economic data) – clear wood finishes (including sanding sealers and varnish); roof coatings; stains; and waterproofing sealers (including concrete and masonry sealers). Range of cost effectiveness was $4,229 - $11,405/ton.
- June 9, 2006 Amendments (2006 economic data) – concrete-curing compounds; dry-fog coatings; and traffic coatings. Range of cost effectiveness was $4,882/ton.

It was assumed that the economic relationships between Placer and South Coast suppliers and users of architectural coatings do not differ significantly. Therefore, the estimated South Coast cost effectiveness values were assumed to be transferable to Sacramento.

The cost effectiveness values calculated from the December 6, 2002 and December 5, 2003 amendments were adjusted to 2006 dollars (from 1998 and 2003 dollars, respectively) using the Bureau of Labor Statistics' Consumer Price Index for West Urban consumers. The estimated overall cost effectiveness for this proposed measure is $10,119/ton.

Authority

Authority to implement this control measure by the PCAPCD is in accordance with California Health and Safety Code, Sections 40000, 40001, and 41010.

Implementation

The PCAPCD is the implementing agency.

References

1. South Coast AQMD Staff Report for Proposed Amended Rule 1113 - Architectural Coating, dated December6, 2002.
2. South Coast AQMD Preliminary Draft Staff Report for Proposed Amended Rule 1113 – Architectural Coating, dated August 15, 2003
3. Sacramento Metropolitan AQMD Staff Report for Rule 442 – Architectural Coating, Dated April 21st, 2001
4. ARB Forecasted Emissions by Summary Category Ozone SIP Planning Projections v1.06 RF #980. November 16, 2006.
5. Control Measure 218 calculation spreadsheet, SMAQMD, May 20, 2008
6. Control Measure, PCAPCD 218, February 5, 2007
7. California Air Resources Board Suggested Control Measure for Architectural Coatings, October 25, 2007

Control Measure Number: YSAQMD – 2.14

Control Measure Title: Architectural Coatings

Date: February 2, 2007

Control Measure Description

This control measure regulates the volatile organic compound (VOC) content in coatings applied to stationary structures and their appurtenances (e.g., general use flats, general use non-flats, and specialty coatings such as industrial maintenance coatings, lacquers, floor coatings, roof coatings, stains, etc.). The strategy also regulates the sale of coatings within the district by prohibiting manufacturers and suppliers of coatings from selling coatings that do not comply with the strategy.

The YSAQMD's architectural coating rule (Rule 2.14) was originally adopted in 1979 and with the most recent amendment occurring in November 2001. The amendment in November 2001 adopted CARB's 2000 SCM for this category. On October 25, 2007, CARB adopted a new SCM for Architectural Coatings that established lower VOC limits for some coating categories.

The table below shows a comparison between the VOC limits in the current Rule 2.14 and the new SCM; coating categories that do not have lower VOC limits are not included.

Category	YSAQMD Rule 2.14 (g/l)	CARB SCM (g/l)
Flat Coating	100	50
Nonflat Coating	150	100
Nonflat-High Gloss	250	150
Antenna Coating	530	250
Antifouling Coaings	400	250
Bituminous Roof Coatings	300	50
Clear Wood Coatings:		275
Clear Brushing Lacquer	550	
Lacquers (including lacquer sanding sealers)	550	
Sanding Sealers (other than lacquer sanding sealers)	350	
Varnishes	350	
Concrete/Masonry Sealer (was Waterproofing Concrete/Masonry Sealer	400	100
Reactive Penetrating Sealer	400	350
Dry Fog Coatings	400	150
Fire Retardant Coatings:		350
Clear	650	
Opaque	350	
Floor Coatings	250	100
Flow Coatings	420	250
Mastic Texture Coatings	300	100
Primers, Sealers, and Undercoaters	200	100
Quick Dry Enamels	250	150
Quick Dry Primers, Sealers, Undercoaters	200	100
Roof Coatings	250	50
Rust Preventative Coatings	400	250
Specialty Primers, Sealers, Undercoaters	350	100
Temperature-Indicator Safety Coating	550	420
Traffic Marking Coatings	150	100

Emission Inventory – 2018

EIC Code	EIC Description	ROG Planning Inventory Tons/day 2018
520-520-9100-0000	Oil-Based (Organic Solvent Based) Coatings (Unspecified)	0.0201
520-520-9105-0000	Oil-Based Primers, Sealers, And Undercoaters	0.0382
520-520-9106-0000	Oil-Based Quick Dry Primers, Sealers, And Undercoaters	0.0226
520-520-9108-0000	Oil-Based Specialty Primer, Sealer, And Undercoaters	0.0012
520-520-9109-0000	Oil-Based Bituminous Roof Primer	0.0037
520-520-9113-0000	Oil-Based Waterproofing Sealers	0.0176
520-520-9118-0000	Oil-Based Waterproofing Concrete/Masonry Sealers	0.0123
520-520-9122-0000	Oil-Based Faux Finishing	0.0004
520-520-9124-0000	Oil-Based Mastic Texture	0.0054
520-520-9126-0000	Oil-Based Rust Preventative	0.0088
520-520-9131-0000	Oil-Based Stains - Clear/Semitransparent	0.0696
520-520-9136-0000	Oil-Based Stains – Opaque	0.0066
520-520-9141-0000	Oil-Based Varnish - Clear/Semitransparent	0.0463
520-520-9153-0000	Oil-Based Quick Dry Enamel Coatings	0.0159
520-520-9157-0000	Oil-Based Lacquers (Unspecified)	0.0172
520-520-9159-0000	Oil-Based Flat Coatings	0.0006
520-520-9160-0000	Oil-Based Nonflat - Low Gloss/Medium Gloss	0.0256
520-520-9161-0000	Oil-Based High Gloss Nonflat Coatings	0.0276
520-520-9164-0000	Oil-Based Bituminous Coatings	0.0521
520-520-9165-0000	Oil-Based Concrete Curing Compounds	0.0011
520-520-9166-0000	Oil-Based Dry Fog Coatings	0.0103

520-520-9169-0000	Oil-Based Floor Coatings	0.0029
520-520-9170-0000	Oil-Based Form Release Coatings	0.0073
520-520-9172-0000	Oil-Based Industrial Maintenance Coatings	0.1067
520-520-9173-0000	Oil-Based Metallic Pigmented Coatings	0.0333
520-520-9174-0000	Oil-Based Roof Coatings	0.0025
520-520-9176-0000	Oil-Based Traffic Coatings	0.0091
520-520-9177-0000	Oil-Based Wood Preservatives	0.0083
520-520-9200-0000	Water-Based Coatings (Unspecified)	0.0026
520-520-9205-0000	Water-Based Primers, Sealers, And Undercoaters	0.0403
520-520-9206-0000	Water-Based Quick Dry Primers, Sealers, And Undercoaters	0.0031
520-520-9208-0000	Water-Based Specialty Primer, Sealer, And Undercoaters	0.0025
520-520-9209-0000	Water-Based Bituminous Roof Primer	0.0006
520-520-9213-0000	Water-Based Waterproofing Sealers	0.0023
520-520-9218-0000	Water-Based Waterproofing Concrete/Masonry Sealers	0.0033
520-520-9222-0000	Water-Based Faux Finishing	0.0022
520-520-9223-0000	Water-Based Form Release Compounds	0
520-520-9224-0000	Water-Based Mastic Texture	0.0028
520-520-9226-0000	Water-Based Rust Preventative	0.0003
520-520-9231-0000	Water-Based Stains - Clear/Semitransparent	0.0039
520-520-9236-0000	Water-Based Stains - Opaque	0.0061
520-520-9241-0000	Water-Based Varnishes - Clear/Semitransparent	0.0062
520-520-9257-0000	Water-Based Lacquers (Unspecified)	0.0012
520-520-9259-0000	Water-Based Flat Coatings	0.1538
520-520-9260-0000	Water-Based Nonflat - Low Gloss/Medium Gloss	0.1832
520-520-9261-0000	Water-Based High Gloss Nonflat Coatings	0.0166
520-520-9264-0000	Water-Based Bituminous Coatings	0.0003
520-520-9265-0000	Water-Based Concrete Curing Compounds	0.0035
520-520-9266-0000	Water-Based Dry Fog Coatings	0.003
520-520-9269-0000	Water-Based Floor Coatings	0.0077
520-520-9272-0000	Water-Based Industrial Maintenance Coatings	0.0087
520-520-9273-0000	Water-Based Metallic Pigmented Coatings	0.0008
520-520-9274-0000	Water-Based Roof Coatings	0.0044
520-520-9276-0000	Water-Based Traffic Coatings	0.0276
520-520-9277-0000	Water-Based Wood Preservatives	0
Total		**1.0603**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	ROG Emission Reduction Tons/day
			2018
Architectural Coating Categories	2010	2012	0.2144

Cost Effectiveness

The cost effectiveness calculations were based upon economic analyses conducted by the South Coast Air Quality Management District for amendments to Rule 1113. The specific economic analyses used are listed below:

- December 6, 2002 Amendments (based on vacated May 14, 1999 Amendments) (1998 economic data) – industrial maintenance coatings; rust preventative coatings; floor coatings; non-flats; primers, sealers, and undercoaters; quick-dry primers, sealers, and undercoaters; and quick-dry enamels.
- December 5, 2003 Amendments (2003 economic data) – clear wood finishes (including sanding sealers and varnish); roof coatings; stains; and waterproofing

sealers (including concrete and masonry sealers). Range of cost effectiveness was $4,229 - $11,405/ton.

- June 9, 2006 Amendments (2006 economic data) – concrete-curing compounds; dry-fog coatings; and traffic coatings. Range of cost effectiveness was $4,882/ton.

It was assumed that the economic relationships between Yolo/Solano and South Coast suppliers and users of architectural coatings do not differ significantly. Therefore, the estimated South Coast cost effectiveness values were assumed to be transferable to Sacramento.

The cost effectiveness values calculated from the December 6, 2002 and December 5, 2003 amendments were adjusted to 2006 dollars (from 1998 and 2003 dollars, respectively) using the Bureau of Labor Statistics' Consumer Price Index for West Urban consumers. The estimated overall cost effectiveness for this proposed measure is $10,387/ton.

Authority

Authority to implement this control measure by the YSAQMD is in accordance with California Health and Safety Code, Sections 40000, 40001, and 41010.

Implementation

The YSAQMD is the implementing agency.

References

1. Yolo-Solano Air Quality Management District, Rule 2.14, Architectural Coatings; November 14, 2001.
2. California Environmental Protection Agency – Air Resources Board, Suggested Control Measure for Architectural Coatings, June 22, 2000.
3. South Coast Air Quality Management District, Rule 1113, Architectural Coatings; June 9, 2006.
4. California Environmental Protection Agency – Air Resources Board, Forecasted Emissions by Summary Category Ozone SIP Planning Projections - V1.06 RF#980; Date Of Last Update: November 16, 2006.
5. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). May 14, 1999.
6. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). December 6, 2002.
7. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). December 5, 2003.
8. South Coast Air Quality Management District, Staff Report for Proposed Amended Rule 1113 (Architectural Coatings). June 9, 2006.
9. U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index 1996-2006.

10. Control Measure, YSAQMD – 2.14, February 2, 2007
11. California Air Resources Board Suggested Control Measure for Architectural Coatings, October 25, 2007
12. Control Measure 2.14 Calculation Spreadsheet, SMAQMD, May 20, 2008

Automotive Refinishing

Control Measure Number: SMAQMD - 459

Control Measure Title: Automotive Coatings

Date: December 8, 2006

Control Measure Description

Automotive refinishing coatings are used on motor vehicles and other mobile equipment, primarily by auto body repair and paint shops and automotive dealerships. VOC emissions from the surface coating operations result from the evaporation of the organic solvents used in the coatings. These emissions occur in a number of places during the operation, including surface preparation and cleanup, application of the coating, drying of the parts, and cleanup of the application equipment.

On October 20, 2005, CARB adopted a Suggested Control Measure (SCM) for automotive coatings. The SCM would introduce several significant changes into SMAQMD Rule 459, Automotive, Truck, and Heavy Equipment Refinishing Operations, such as:

- Consolidation of limits for Group I and Group II vehicles
- Consolidation of the precoats, primers, primer sealers, and primer surfacers categories
- Deletion of the multi-stage topcoats category, and replacement with separate limits for color coats and clear coats
- Elimination of the specialty coatings category, with specific limits for each type of coating, and a general limit applicable to all other coatings.
- Lower VOC limits for most coating categories.

The proposed control measure will evaluate the information from CARB's SCM and propose amendments to Rule 459.

Emission Inventory – 2018

EIC Code	EIC Description	VOC Planning Inventory (tpd)
		2018
230-218-9000-0000	Automobile Refinish Coatings, Unspecified	0.861
510-500-9021-0000	Aerosol Coatings, Auto Body Primers	0.0077
510-500-9082-0000	Aerosol Coatings, Auto Bumper and Trim Coatings	0.0068
510-500-9083-0000	Aerosol Coatings, Exact Match Engine Enamel	0.0065
510-500-9084-0000	Aerosol Coatings, Exact Match Automotive Coatings	0.0117
510-506-6558-0000	Consumer Products, Automotive Undercoating, Aerosol	0.0243
510-506-6559-0000	Consumer Products, Automotive Undercoating, Non-Aerosol	0.0018
Total		**0.9198**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	VOC Emission Reduction (tpd)
			2018
Automotive Refinishing	2010	2011	0.1130

Cost Effectiveness

CARB estimated the overall, statewide cost effectiveness of the SCM to be $1.43 per pound of VOC reduced. However, this takes into account reductions in districts with a wide range of stringency in their existing rules. Statewide, CARB estimated a 65% reduction in emissions from automotive refinish coatings. Based on our existing rule limits, District staff has estimated that within the SMAQMD, only a 16.4% reduction in VOC emissions will occur if the SCM is adopted in place of current limits. A large portion of the costs for compliance is based on retrofitting existing facilities to be compatible with water-borne coatings. Compliance costs for the SMAQMD will be similar to the statewide estimates, but the emission reductions in SMAQMD are expected to be lower than the statewide average by a factor of 3.96. Therefore, the cost effectiveness for the measure in the SMAQMD is estimated to be 3.96 times higher than the statewide average, or $5.66 per pound ($11,326 per ton) of VOC reduced.

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the SMAQMD through Rule 459.

References

1. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (Rf#980), November 16, 2006
2. Control Measure, SMAQMD - 459, December 8, 2006
3. CARB, Staff Report for the Proposed Suggested Control Measure for Automotive Coatings, October 2005.

Control Measure Number: FRAQMD - 3.19

Control Measure Title: Vehicle and Mobile Equipment Coating Operations

Date: February 2, 2007

Control Measure Description

Automotive refinishing coatings are used on motor vehicles and other mobile equipment, primarily by auto body repair and paint shops and automotive dealerships. VOC emissions from the surface coating operations result from the evaporation of the organic solvents used in the coatings. These emissions occur in a number of places during the operation, including surface preparation and cleanup, application of the coating, drying of the parts, and cleanup of the application equipment.

On October 20, 2005, CARB adopted a Suggested Control Measure (SCM) for automotive coatings. The SCM would introduce several significant changes into FRAQMD Rule 3.19, Vehicle and Motor Equipment Coating Operations, such as:

- Consolidation of limits for Group I and Group II vehicles
- Consolidation of the primers, primer sealers, and primer surfacer categories
- Deletion of the multi-stage topcoats category, and replacement with separate limits for color coats and clear coats
- Elimination of the specialty coatings category, with specific limits for each type of coating, and a general limit applicable to all other coatings.
- Lower VOC limits for most coating categories.

The proposed control measure will evaluate the information from CARB's SCM and propose amendments to Rule 3.19.

Emission Inventory – 2018

The population growth rate in South Sutter is purely based on the current Sutter County population growth rate projected by SACOG. The potential growth of proposed South Sutter Specific Plan (now called Sutter Pointe Specific Plan) is not factored in.

		VOC Planning Inventory (tpd)
EIC Code	**EIC Description**	**2018**
230-218-9000-0000	Automobile Refinish Coatings, Unspecified	0.0035
Total		**0.0035**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	VOC Emission Reduction (tpd)
			2018
Automotive Refinishing	2016	2017	0.0008

Cost Effectiveness

The cost effectiveness is expected to range between $5,560 and $77,300 per ton of ROG reduced.

Authority

The Feather River Air Quality Management District has the authority to propose rules and regulations to the District Board for adoption under HSC 40001.

Implementation

The implementation of this control measure does not involve any other agency other than the Feather River Air Quality Management District.

References

1. El Dorado County AQMD Rule 230, Adopted September 27, 1994.
2. Feather River AQMD Rule 3.19, Adopted August 6, 1998.
3. Placer County APCD Rule 234, Revised April 9, 1998.
4. Sacramento Metro AQMD Rule 459, Revised October 2, 1997.
5. Yolo-Solano AQMD Rule 2.26, Revised August 13, 1997.
6. Draft Staff Report, Rule 459, SMAQMD, August 2001.
7. Rule adoption files, Rule 459, SMAQMD.
8. California Air Resources Board, Staff Report for The Proposed Suggested Control Measures Automotive Coatings, October 2005
9. California ARB Forecasted Emissions by Summary Category, Ozone SIP Sacramento NAA Projections (v1.06_RF980) www.arb.ca.gov/app/emsinv/03sip/fcemssumcat_03v1.06.php. November 16, 2006
10. Control Measure, FRAQMD – 3.19, February 2, 2007

Control Measure Number: PCAPCD - 234

Control Measure Title: Automotive Refinishing Operations

Date: February 5, 2007

Control Measure Description

Automotive refinishing coatings are used on motor vehicles and other mobile equipment, primarily by auto body repair and paint shops and automotive dealerships. VOC emissions from the surface coating operations result from the evaporation of the organic solvents used in the coatings. These emissions occur in a number of places during the operation, including surface preparation and cleanup, application of the coating, drying of the parts, and cleanup of the application equipment.

On October 20, 2005, CARB adopted a Suggested Control Measure (SCM) for automotive coatings. The SCM would introduce several significant changes into PCAPCD Rule 234, such as:

- Consolidation of limits for Group I and Group II vehicles
- Consolidation of the precoats, primers, primer sealers, and primer surfacers categories
- Deletion of the multi-stage topcoats category, and replacement with separate limits for color coats and clear coats
- Elimination of the specialty coatings category, with specific limits for each type of coating, and a general limit applicable to all other coatings.
- Lower VOC limits for most coating categories.

The proposed control measure will evaluate the information from CARB's SCM and propose amendments to Rule 234.

Emission Inventory – 2018

EIC Code	EIC Description	VOC Planning Inventory (tpd) 2018
230-218-9000-0000	Automobile Refinish Coatings, Unspecified	0.1836

Emission Reductions

EIC Description	Adoption Date	Implementation date	VOC Emission Reduction (tpd) 2018
Automobile Refinish Coatings	2015	2017	0.045

Cost Effectiveness

CARB estimated the overall, statewide cost effectiveness of the SCM to be $1.43 per pound of VOC reduced. The annual cost for this measure is approximately $57,229/yr.

Authority

California Health and Safety Code, Sections 40000, 40001, and 40702

Implementation

This control measure will be implemented by the PCAPCD through Rule 234.

References

1. El Dorado County AQMD Rule 230, Adopted September 27, 1994.
2. Feather River AQMD Rule 3.19, Adopted August 6, 1998.
3. Placer County APCD Rule 234, Revised April 9, 1998.
4. Sacramento Metro AQMD Rule 459, Revised October 2, 1997.
5. Yolo-Solano AQMD Rule 2.26, Revised August 13, 1997.
6. Draft Staff Report, Rule 459, SMAQMD, August 2001.
7. Rule adoption files, Rule 459, SMAQMD.
8. Staff Report for the Proposed Suggested Control Measure for Automotive Coating, CARB, October 2005.
9. “ARB Forecasted Emissions by Summary Category Ozone SIP Planning Projections v1.06 RF #980”. November 16, 2006.
10. Control Measure, PCAPCD 234, February 5, 2007

Control Measure Number: YSAQMD – 2.26

Control Measure Title: Automotive Refinishing

Date: February 5, 2007

Control Measure Description

Automotive refinishing coatings are used on motor vehicles and other mobile equipment, primarily by auto body repair and paint shops and automotive dealerships. VOC emissions from the surface coating operations result from the evaporation of the organic solvents used in the coatings. These emissions occur in a number of places during the operation, including surface preparation and cleanup, application of the coating, drying of the parts, and cleanup of the application equipment.

On October 20, 2005, CARB adopted a Suggested Control Measure (SCM) for automotive coatings. The SCM would introduce several significant changes into YSAQMD Rule 2.26, Motor Vehicle and Mobile Equipment Coating Operation:

- Consolidation of limits for Group I and Group II vehicles
- Consolidation of the precoats, primers, primer sealers, and primer surfacers categories
- Deletion of the multi-stage topcoats category, and replacement with separate limits for color coats and clear coats
- Elimination of the specialty coatings category, with specific limits for each type of coating, and a general limit applicable to all other coatings.
- Lower VOC limits for most coating categories.

The proposed control measure will evaluate the information from CARB's SCM and propose amendments to Rule 2.26.

Emission Inventory –2018

EIC Code	EIC Description	VOC Planning Inventory (tpd)
		2018
230-218-9000-0000	Coatings	0.0907
230-218-9050-0000	Topcoats	0.0809
230-240-8300-0000	Thinning and Cleanup Solvents	0.0169
Total		**0.1885**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	VOC Emission Reduction (tpd)
			2018
Automotive Refinishing	2008	2009-2010	0.0581

Cost Effectiveness

The SCM staff report calculates that the annualized cost to for facilities with a single booth with no heater and an annual revenue less than $1 million, to be $1,648 (Page C-5). The cost includes upgrades to existing air moving/heating equipment, the purchasing of new application equipment, and worker training. This cost has been annualized over 15 years for major non-recurring costs, over 5 years for all other costs, and then adjusted for capitol cost recovery. The SCM estimates the recurring costs of equipment operation and maintenance, and the increased coating costs, to be $533 per year. Therefore, the total annual cost to facilities is estimated to be $2,181. Adjusting for inflation in 2008, the annual cost becomes $2,344.58. Currently there are 80 permitted sources that will be affected by this proposed control measure. The annual ROG emission reductions have been calculated using the emission inventory estimates over a 5 day per week and 52 weeks per year operational schedule.

Year	2018
Lifetime Cost Effectiveness ($/ton)	
ROG	$11,643

Total Cost: $2,637,647 over 15 years (2008)

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the YSAQMD.

References

1. California Environmental Protection Agency – Air Resources Board, Staff Report for the Proposed Suggested Control Measure for Automotive Coatings; October 2005.
2. Forecasted Emissions by Summary Category Ozone SIP Planning Projections - v1.06 RF#980; Date of Last Update: November 16, 2006.
3. Yolo-Solano Air Quality Management District, Rule 2.26, Motor Vehicle and Mobile Equipment Coating Operation; August 13, 1997.

Degreasing/ Solvent Cleaning

Control Measure Number: SMAQMD - 454/466

Control Measure Title: Degreasing/Solvent Cleaning

Date: December 8, 2006

Control Measure Description

Degreasing and solvent cleaning operations are performed by many commercial and industrial facilities. Solvents are used for surface preparation for further processing and cleaning after manufacturing. Degreasing is widely used by automotive repair and maintenance facilities and by electric apparatus and electronic component manufacturing or repair, construction trades, printing shops, metal parts and products, can coating, and other types of commercial and manufacturing facilities. Solvents are also used by coating operations for cleaning of coating application equipment such as spray guns and brushes.

This measure will consider lowering VOC content limits in several SMAQMD rules. Staff will consider lower limits that have been implemented by the South Coast district. Any of the following SMAQMD rules may be affected by this proposed control measure if lower limits are feasible and cost effective in Sacramento:

Cold Cleaning/Degreasing

- Rule 454, Degreasing Operations

Handwiping

- Rule 464, Organic Chemicals Manufacturing Operations
- Rule 465, Polyester Resin Operations
- Rule 466, Solvent Cleaning

Thinning/cleanup solvents

- Rule 450, Graphic Arts Operations
- Rule 451, Surface Coating Of Miscellaneous Metal Parts And Products
- Rule 452, Can Coating
- Rule 456, Aerospace Assembly And Component Coating Operations
- Rule 463, Wood Products Coatings

Emission Inventory – 2018

EIC Code	EIC Description	ROG Planning Inventory (Tons/day)
		2018
220-204-0500-0000	Cold Cleaning – Petroleum Naptha	0.5219
220-204-3022-0000	Cold Cleaning – Alcohols (Unspecified)	0.0156
220-204-3083-0000	Cold Cleaning – Chlorofluorocarbons (Unspecified)	0.0035
220-204-3176-0000	Cold Cleaning – Glycol Ethers (Unspecified)	0.001
220-204-3202-0000	Cold Cleaning – Isopropanol	0.0011
220-204-3204-0000	Cold Cleaning – Ketones (Unspecified)	0.0006
220-204-3333-0000	Cold Cleaning – Terpenes (Unspecified)	0.0081
220-204-3339-0000	Cold Cleaning – Toluene/Xylene	0.0005
220-204-8104-0000	Cold Cleaning – Degreasing Solvents – Pure (Unspecified)	0.0002
220-204-8106-0000	Cold Cleaning – Degreasing Solvents – Blends (Unspecified)	0.071
220-206-3083-0000	Vapor Degreaser – Chlorofluorocarbons (Unspecified)	0.0019
220-206-3107-0000	Vapor Degreaser – Dichlorofluoroethane (HCFC-141B)	0.0002
220-206-3301-0000	Vapor Degreaser – Perfluorocarbons (Unspecified)	0.0004
220-206-3346-0000	Vapor Degreaser – Trichloroethylene (TCE)	0.0022
220-208-0500-0000	Handwiping – Petroleum Naphtha	0.0824
220-208-3022-0000	Handwiping – Alcohols (Unspecified)	0.0373
220-208-3083-0000	Handwiping – Chlorofluorocarbons (Unspecified)	0.0004
220-208-3176-0000	Handwiping – Glycol Ethers (Unspecified)	0.0078
220-208-3204-0000	Handwiping – Ketones (Unspecified)	0.0283
220-208-3333-0000	Handwiping – Terpenes (Unspecified)	0.0002
220-208-3339-0000	Handwiping – Toluene/Xylene	0.0073
220-208-3346-0000	Handwiping – Trichloroethylene (TCE)	0.0007
220-208-8104-0000	Handwiping – Degreasing Solvents- Pure (Unspecified)	0.0054
220-208-8106-0000	Handwiping – Degreasing Solvents –Blends (Unspecified)	0.0172
230-216-8350-0000	Coatings – Preparation Solvents (Unspecified)	0.0035
230-240-8300-0000	Coatings – Thinning and Cleanup Solvents (Unspecified)	0.0042
230-240-8302-0000	Coatings – Thinning Solvents (Unspecified)	0.0007
230-240-8350-0000	Coatings – Cleanup Solvents (Unspecified)	0.0039
240-240-3202-0000	Printing – Thinning and Cleanup Solvents – Isopropanol	0.0479
240-240-3314-0000	Printing – Thinning and Cleanup Solvents – N-Propanol	0.0035
240-240-8302-0000	Printing – Thinning Solvents (Unspecified)	0.0028
240-995-8000-0000	Printing – Solvents (Unspecified)	0.8619
299-995-8000-0000	Coatings – Other Solvents (Unspecified)	0.0027
520-522-8300-0000	Architectural Coatings – Thinning and Cleanup Solvents	0.4651
Total		**2.2114**

Emission Reductions

EIC Description	Adoption date	Implementation Date	ROG Emission Reductions (Tons/day)
			2018
Degreasing/Solvent Cleaning Categories	2008	2010-2011	0.5937

Cost Effectiveness

The overall cost effectiveness estimates for this control measure by individual rule are shown in the table below.

Rule	Cost Effectiveness
450 – Graphic Arts Operations	$3.70 per lb. of VOC reduced
451 – Surface Coating of Misc. Metal Parts and Products	Cost savings
456 – Aerospace Assembly and Component Coating Operations	Cost savings
466 – Solvent Cleaning	$3.70 per lb. of VOC reduced
Other Degreasing/Solvent Rules	No additional costs

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the SMAQMD.

References

1. Sacramento Area Regional 2002 Milestone Report, Control Profiles Appendix, May 2003.
2. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (Rf#980), November 16, 2006.
3. Control Measure Calculation Spreadsheet, SMAQMD – 454/466, December 12, 2006.
4. SMAQMD Draft Staff Report on Amendments to Degreasing/Solvent Rules, March 28, 2008, posted on SMAQMD website under recently proposed rules and regulations: www.airquality.org/rules/

Control Measure Number: EDCAQMD – 225/235

Control Measure Title: Degreasing/Solvent Cleaning

Date: May 20, 2008

Control Measure Description

This control measure regulates the volatile organic compound (VOC) content in solvents used for degreasing and surface preparation in many commercial and industrial facilities. Solvents are used for surface preparation for further processing and cleaning after manufacturing. Degreasing is widely used by automotive repair and maintenance facilities and by other types of commercial and manufacturing facilities.

The existing Rule 225-Solvent Cleaning Operations was adopted on September 27, 1994 and Rule 235-Surface Preparation and Cleanup was adopted on June 27, 1995. Placer County Air Pollution Control District (PCAPCD) and Sacramento Metropolitan Air Quality Management District (SMAQMD) have revised their degreasing rules and their solvent cleaning rules in recent years to replace general solvent cleaning with aqueous cleaners or exempt solvent cleaners. This control measure would adopt similar measures in El Dorado County.

Emission Inventory –2018

EIC Code	EIC Description	ROG Planning Inventory Tons/day
		2018
220-204-0500-0000	COLD CLEANING-PETROLEUM NAPHTHA	0.0770
220-204-3022-0000	COLD CLEANING-ALCOHOLS (UNSPECIFIED)	0.0019
220-204-3083-0000	COLD CLEANING-CHLOROFLUOROCARBONS (UNSPECIFIED)	0.0002
220-204-3333-0000	COLD CLEANING-TERPENES (UNSPECIFIED)	0.0010
220-204-8106-0000	COLD CLEANING-DEGREASING SOLVENTS-BLENDS (UNSPECIFIED)	0.0076
Total Cold Cleaning		0.0877
220-208-0500-0000	WIPE-PETROLEUM NAPHTHA	0.0138
220-208-3022-0000	WIPE -ALCOHOLS (UNSPECIFIED)	0.0062
220-208-3176-0000	WIPE –GLYCOL ETHERS (UNSPECIFIED)	0.0010
220-208-3204-0000	WIPE - KETONES (UNSPECIFIED)	0.0041
220-208-3339-0000	WIPE –TOLUENE/XYLENE	0.0005
220-208-8104-0000	WIPE -DEGREASING SOLVENTS-PURE (UNSPECIFIED)	0.0005
220-208-8106-0000	WIPE -DEGREASING SOLVENTS-BLENDS (UNSPECIFIED)	0.0025
Total Wipe		0.0286
Total		**0.1163**

Emission Reductions

EIC Description	Adoption date	Implementation Date	ROG Emission Reduction Tons/day
			2018
Solvent Cleaning and Degreasing Categories	2013	2015	0.0764

Cost Effectiveness

The proposed VOC limits are already in place in a number of air districts. Based on the PCAPCD staff reports for their rules, the cost impact of changing from solvent based cleaners to aqueous based cleaners is minimal. These cost-effectiveness estimates will be used as representative of the economic relationships of suppliers and users within El Dorado County.

Authority

The above control measure will be implemented by amendment to the existing Rule 225 and Rule 235. The El Dorado Air Quality Management District has the authority to propose rules and regulations to the District Board for adoption under HSC 40001.

Implementation

The implementation of this proposed control measure does not involve any other agency other than the El Dorado County Air Quality Management District.

References

1. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (RF#980 November 16, 2006)
2. PCAPCD Staff Report for Proposed Amended Rule 240-Surface Cleaning and Degreasing, dated December 11, 2003
3. PCAPCD Staff Report for Proposed Amended Rule 216-Organic Solvent Cleaning and Degreasing Operations, dated December 11, 2003
4. Control Measure 215 Calculation Spreadsheet, SMAQMD, January 30, 2007
5. Control Measure EDCAQMD – 225, January 30, 2007
6. Control Measure EDCAQMD – 235, January 30, 2007

Control Measure Number: FRAQMD - 3.14

Control Measure Title: Solvent Degreasing

Date: February 2, 2007

Control Measure Description

Degreasing and solvent cleaning operations are performed by many commercial and industrial facilities. Solvents are used for surface preparation for further processing and cleaning after manufacturing. Degreasing is widely used by automotive repair and maintenance facilities and by electric apparatus and electronic component manufacturing or repair, construction trades, printing shops, metal parts and products, can coating, and other types of commercial and manufacturing facilities. Solvents are also used by coating operations for cleaning of coating application equipment such as spray guns and brushes.

The existing Rule 3.14- Solvent Degreasing was adopted in June 1991. Both Placer County Air Pollution Control District (PCAPCD) and Sacramento Metropolitan Air Quality Management District (SMAQMD) have revised their degreasing and surface preparation and cleanup rules in recent years to replace general solvent cleaning with aqueous cleaners or exempt solvent cleaners. This control measure will evaluate implementing similar limits in Sutter and Yuba Counties if they are feasible and cost effective.

Emission Inventory –2018

The population growth rate in South Sutter is purely based on the current Sutter County population growth rate projected by SACOG. The potential growth of proposed South Sutter Specific Plan (now called Sutter Pointe Specific Plan) is not factored in.

EIC Code	EIC Description	ROG Planning Inventory (Tons/day)
		2018
220-204-0500-0000	Cold Cleaning – Petroleum Naptha	0.0069
220-208-0500-0000	Handwiping – Petroleum Naphtha	0.0007
Total		**0.0076**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	ROG Emission reductions (Tons/day)
			2018
Degreasing/Solvent Cleaning	<2012	<2012	0.0006

Cost Effectiveness

Based on the Placer County Air Pollution Control District staff report for Rule 216-Organic Solvent Cleaning and Degreasing Operations, the cost impact of changing from solvent based cleaners to aqueous based cleaners is minimal.

Authority

The above control measure will be implemented by amendment to the existing Rule 3.14 Solvent Degreasing. The Feather River Air Quality Management District has the authority to propose rules and regulations to the District Board for adoption under HSC 40001.

Implementation

The implementation of this proposed control measure does not involve any other agency other than the Feather River Air Quality Management District.

References

1. California ARB Forecasted Emissions by Summary Category, Ozone SIP Sacramento NAA Projections (v1.06_RF980) www.arb.ca.gov/app/emsinv/03sip/fcemssumcat_03v1.06.php. November 16, 2006
2. Placer County Air Pollution Control District Staff Report for Rule 216, December 11, 2003
3. Control Measure, FRAQMD 3.14, February 2, 2007

Control Measure Number: YSAQMD – 2.24/2.31

Control Measure Title: General Surface Preparation/Cleanup and Degreasing

Date: February 5, 2007

Control Measure Description

Degreasing and solvent cleaning operations are performed by many commercial and industrial facilities. Solvents are used for surface preparation for further processing and cleaning after manufacturing. Degreasing is widely used by automotive repair and maintenance facilities and by electric apparatus and electronic component manufacturing or repair, construction trades, printing shops, metal parts and products, can coating, and other types of commercial and manufacturing facilities. Solvents are also used by coating operations for cleaning of coating application equipment such as spray guns and brushes.

The proposed control measure consists of the District revising the ROG limits of Rule 2.13[1] (Organic Solvents), Rule 2.24[2] (Solvent Cleaning Operations - Degreasing), and Rule 2.31[3] (Surface Preparation and Cleanup) to match the ROG limits currently feasible and required by South Coast AQMD's Rule 1122[4] (Solvent Degreasers) and Rule 1171[5] (Solvent Cleaning Operations). It is expected that most of the ROG-content limits will be reduced to 25 grams per liter (g/L).

Emission Inventory – 2018

EIC Code	EIC Description	ROG Planning Inventory (Tons/day)
		2018
22020405000000	0500-Petroleum Naphtha	0.4243
22020430220000	3022-Alcohols (Unspecified)	0.0089
22020430830000	3083-Chlorofluorocarbons (Unspecified)	0.0006
22020431760000	3176-Glycol Ethers (Unspecified)	0.0008
22020432040000	3204-Ketones (Unspecified)	0.0003
22020433330000	3333-Terpenes (Unspecified)	0.0035
22020481060000	8106-Degreasing Solvents - Blends (Unspecified)	0.0265
22020630830000	3083-Chlorofluorocarbons (Unspecified)	0.0005
22020633460000	3346-Trichloroethylene (Tce)	0.0004
22020805000000	0500-Petroleum Naphtha	0.0359
22020830220000	3022-Alcohols (Unspecified)	0.0193
22020830830000	3083-Chlorofluorocarbons (Unspecified)	0.0000
22020831760000	3176-Glycol Ethers (Unspecified)	0.0039
22020832040000	3204-Ketones (Unspecified)	0.0145
22020833390000	3339-Toluene/xylene	0.0035
22020833460000	3346-Trichloroethylene (Tce)	0.0004
22020881040000	8104-Degreasing Solvents - Pure (Unspecified	0.0029
22020881060000	8106-Degreasing Solvents - Blends (Unspecified)	0.0087
Total		**0.5549**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	ROG Emission Reduction (tpd)
			2018
Degreasing/Solvent Cleaning	2008	2009	0.762

Cost Effectiveness

The cost effectiveness for this control method varies depending on the type of cleaning being performed. Cost analysis was performed for each solvent cleaning application (e.g., electrical parts, architectural coatings application equipment). Switching to cleaners with lower VOC content would result in either cost decreases or increases, depending on the particular application. The costs are expected to range from a cost savings to $6.60/lb across the different applications. The overall cost effectiveness for this proposal is estimated at $2,398 per ton of VOC reduced.

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the YSAQMD.

References

1. Yolo-Solano Air Quality Management District, Rule 2.13, Organic Solvents; May 25, 1994.
2. …, Rule 2.24, Solvent Cleaning Operations (Degreasing); August 13, 1997.
3. …, Rule 2.31, Surface Preparation and Cleanup; August 13,1997.
4. South Coast Air Quality Management District, Rule 1122, Solvent Degreasers; October 1, 2004.
5. …, Rule 1171, Solvent Cleaning Operations; May 6, 2005.
6. California Environmental Protection Agency – Air Resources Board, Forecasted Emissions by Summary Category Ozone SIP Planning Projections - v1.06 RF#980; Date of Last Update: November 16, 2006.

Graphic Arts

Control Measure Number: YSAQMD – 2.29

Control Measure Title: Graphic Arts

Date: February 7, 2007

Control Measure Description

VOC emissions from graphic art operations result from the evaporation of organic solvents in the inks, fountain solutions, and solvents used in the various types of printing processes. These operations produce a wide variety of printed products that include books, magazines, newspapers, fliers, posters, and packaging materials. These various types of products require that facilities use very specific materials and printing methods. The different types of printing methods include lithography, flexography, gravure, and letterpress. Although the District's graphic arts rule (Rule 2.29) contains specific screen printing requirements, for the purposes of the SIP, the screen printing category will be grouped into the paper, fabric, and film coating category.

For certain lithographic and flexographic printing operations heatset inks are used. These viscous inks are cured using indirect hot air dryers that evaporate the ink solvents immediately after printing. In the Yolo-Solano AQMD, smaller heatset presses are equipped with electric hot air or UV light dryers. However, the larger heatset presses are equipped with natural gas fired dryers. Currently, only a single flexographic printing facility is permitted to use a Regenerative Thermal Oxidizer (RTO) to control the ROG emissions from its operation. Because no additional NOx controls are currently available for combustion devices being used as air pollution control equipment, NOx reductions associated with graphic arts operations will not be addressed in this control strategy.

The first proposed control measure in reducing the ROG emissions would be to lower the District's current rule exemption limit from 400 pounds per month to 60 pounds per month. The second proposed control measure is to revise the Districts' various cleaning solvent ROG limits to match the current Sacramento Metropolitan AQMD standards. The District's ROG emission exemption is contained in Rule 2.29, Graphic Arts Printing Operations, while the allowable solvent limits are contained in District Rule 2.31, Solvent Preparation and Cleanup.

Emission Inventory –2018

EIC Code	EIC Description	ROG Inventory for Control Measures (tpd)
		2018
24099580000000	Solvent	0.125

Emission Reductions

EIC Description	Adoption Date	Implementation Date	ROG Emission Reduction (tpd)
			2018
Solvent	2010	2012	Not available

Yolo Solano Air Quality Management District does not have enough data to quantify the emission reduction.

Cost Effectiveness

Because of the various types of solvents currently used in this wide source category and the unavailability of specific usage data, the District cannot perform a cost effectiveness calculation for this control measure. However, it is expected that because of the availability of the compliant products in the Sacramento Metropolitan Air Quality Management District, the added costs associated with purchasing and disposing of the ROG compliant materials will not greatly differ from the cost of the currently compliant ROG products.

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the YSAQMD.

References

1. California Environmental Protection Agency – Air Resources Board, Forecasted Emissions by Summary Category Ozone SIP Planning Projections - V1.06 RF#980; Date of Last Update: November 16, 2006.
2. Sacramento Metropolitan Air Quality Management District, Rule 450, Graphic Arts Operations; March 24, 2000.
3. Yolo-Solano Air Quality Management District, Rule 2.29, Graphic Arts Printing Operations; August 13, 1997.
4. Rule 2.31, Solvent Preparation and Cleanup; August 13, 1997.

Miscellaneous Metal Parts and Products

Control Measure Number: EDCAQMD - 246

Control Measure Title: Coatings of Miscellaneous Metal Parts

Date: May 20, 2008

Control Measure Description

This control measure regulates the volatile organic compound (VOC) content in coatings applied to metal parts and products. The control measure will have specific limits for coatings on metals which mirror the Control Techniques Guidelines (CTG).

Emission Inventory – 2018

EIC Code	EIC Description	ROG Planning Inventory Tons/day
		2018
230-230-9000-0000	METAL PARTS AND PRODUCTS COATINGS	0.0168
Total		**0.0168**

Emission Reductions

EIC Description	Adoption date	Implementation Date	ROG Emission Reduction Tons/day
			2018
Metal Parts Coating Categories	2009	2009	0.0027

Cost Effectiveness

The proposed VOC limits are already in place in a number of air districts. Based on wide availability of compliant coatings, the cost impact of changing to lower VOC coatings is minimal. These cost-effectiveness estimates will be used as representative of the economic relationships of suppliers and users within El Dorado County.

Authority

The above control measure will be implemented by adopting the new Rule 246 Surface Coating of Miscellaneous Parts and Products. The El Dorado Air Quality Management District has the authority to propose rules and regulations to the District Board for adoption under HSC 40001.

Implementation

The implementation of this proposed control measure does not involve any other agency other than the El Dorado County Air Quality Management District.

References

1. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (RF#980 November 16, 2006)
2. Control Measure EDCAQMD - 246, January 30, 2007

Control Measure Number: PCAPCD - CM3

Control Measure Title: Miscellaneous Metal Parts and Products

Date: February 5, 2007

Control Measure Description

This category is comprised of VOC emissions from the coating of miscellaneous metal parts and products including signs, storage and trash containers, door frames, window frames, panels, metal cabinets, caskets and various other metal coating operations. VOC emissions from the surface coating operations result from the evaporation of the organic solvents used in the coatings. These emissions occur in a number of places during the operation, including surface preparation and cleanup, application of the coating, drying of the parts, and cleanup of the application equipment. This control measure will only address the VOC emissions from the coating process. The surface preparation and cleanup VOC emissions are addressed under other measures.

Staff evaluated the miscellaneous metal parts and products VOC limits that are included in EPA's Control Technique Guideline for Metal Parts and Products.

Emission Inventory – 2018

EIC Code	EIC Description	VOC Planning Inventory (tpd)
		2018
230-230-9000-0000	Metal Parts And Products Coating	0.0405

Emission Reductions

EIC Description	Adoption Date	Implementation Date	VOC Emission Reductions (tpd)
			2018
Metal Parts And Products Coating	2009	2009	0.014

Cost Effectiveness

The cost effectiveness for this measure has not been determined. Other VOC rules within the nonattainment area have ranged in cost effectiveness from $110 - $8,330 per ton of VOC reduced.

Authority

The Placer County Air pollution Control District has the authority to propose rules and regulations to the District Board for adoption under HSC 40001.

Implementation

The implementation of this proposed control measure does not involve any other agency other than the Placer County Air pollution Control District.

References

1. California ARB Forecasted Emissions by Summary Category, Ozone SIP Sacramento NAA Projections (v1.06_RF980) www.arb.ca.gov/app/emsinv/03sip/fcemssumcat_03v1.06.php. November 16, 2006
2. CARB's Areawide Source Methodologies, Industrial Coatings, Updated February 1990; Reissued October 1997
3. Control Measure, PCAPCD CM3, February 5, 2007

Natural Gas Production and Processing

Control Measure Number: SMAQMD - 461

Control Measure Title: Natural Gas Production and Processing

Date: December 8, 2006

Control Measure Description

There are several natural gas production fields within Sacramento County. Fugitive emissions of VOC from natural gas production occur from equipment leaks in valves, pumps, compressors, pressure relief devices, flanges, and threaded connections at gas wells and associated transmission systems. The proposed control measure would establish inspection and repair requirements for leaking components or other requirements to achieve similar results.

Emission Inventory – 2018

EIC Code	EIC Description	VOC Planning Inventory (tpd) 2018
310-302-1600-0000	Oil and Gas Production Fugitive Losses - Valves	0.3279
310-304-1600-0000	Oil and Gas Production Fugitive Losses - Fittings	0.1348
310-306-1600-0000	Oil and Gas Production Fugitive Losses - Pumps	0.0005
310-308-1600-0000	Oil and Gas Production Fugitive Losses - Compressors	0.0014
Total		**0.4646**

Note: The inventory in the above table is based on the current CARB planning inventory. However, the District conducted a survey of natural gas producers in 2004 that produced an emission estimate of only 0.161 tons/day from fugitive components.

Emission Reductions

EIC Description	Adoption Date	Implementation Date	VOC Emission Reduction (tpd) 2018
Fugitive Emissions – Oil and Gas Production	2011	2012	0.116-0.334

Cost Effectiveness

The cost effectiveness of the leak detections and repair program was estimated by CARB in the 1993 RACT determination document at $3.70 per pound in 1989 dollars. Adjusted for inflation, this is equivalent to $11,900 per ton in 2006 dollars.

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the SMAQMD.

References

1. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (Rf#980), November 16, 2006
2. Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017, U.S. EPA, November 1995.
3. Determination of Reasonably Available Control Technology for the Control of Fugitive Emissions of Volatile Organic Compounds from Oil and Gas Production and Processing Facilities, Refineries, Chemical Plants, and Pipeline Transfer Stations, California Air Resources Board, December 1993.
4. Control Measure, SMAQMD – 461, December 8, 2006

NOx Control Measures

Asphalt Concrete

Control Measure Number: SMAQMD - 471

Control Measure Title: Asphaltic Concrete

Date: December 11, 2006

Control Measure Description

Asphaltic concrete, or hot-mix pavement material, is produced in both continuous and batch plants; some of the latter are portable. The process involves heating aggregate in a rotary dryer to approximately 300 °F and mixing it with melted asphalt cement refined from petroleum. This measure targets NOx emissions from the burners used to heat the dryer. NOx emissions also come from heaters used to melt asphalt cement, and from stationary internal combustion engines.

The control of dryer NOx emissions may be accomplished by controlling the burners used to heat the dryer. Nearly all plants in the Sacramento Metropolitan Air Quality Management District (SMAQMD) are fired with natural gas. The concentration of NOx discharged from uncontrolled burners is typically over 100 parts per million, volumetric dry (ppmvd) @ 3% O2, or about 0.016 pounds per ton. This measure will consider the use of low NOx burners and flue gas recirculation (FGR) to reduce these emissions. A similar control measure (Rule 4309 – Dryers, Dehydrators, and Ovens) was adopted by the San Joaquin Valley Unified APCD and applies to dryers at asphaltic concrete plants.

Emission Inventory –2018

EIC Code	EIC Description	NOx Inventory for Control Measure (tpd)
		2018
430-424-7006-0000	Asphaltic Concrete Production	0.2087

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reduction (tpd)
			2018
Asphaltic Concrete Production	2012	2014	0.1326

Cost Effectiveness

In the December 15, 2005 staff report for Rule 4309. San Joaquin district staff estimated the cost effectiveness of NOx controls for asphaltic concrete plants to range from $17,600 to $42,300 per ton of NOx reduced. Cost effectiveness in the SMAQMD is expected to be similar.

Authority

Authority to implement this control measure by the SMAQMD is in accordance with California Health and Safety Code, Sections 40000, 40001, and 41010.

Implementation

The Sacramento Metropolitan Air Quality Management District is the implementing agency.

References

1. CARB Ozone SIP Planning Inventory, Version 1.0, Sacramento NAA (Rf#980), November 16, 2006.
2. Control Measure, SMAQMD 471, September 14, 2006.
3. Best Available Control Technology Guidelines, Part D: BACT Guidelines for Non-Major Polluting Facilities. South Coast Air Quality Management District. October 20, 2000 (Revised July 9, 2004).
4. San Joaquin Valley Unified Air Pollution Control District. Final Draft Staff Report for Rule 4309 (Dryers, Dehydrators, and Ovens). December 15, 2005.
5. Economic Indicators. Chemical Engineering. May 2006.
6. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Control Cost Manual, Fourth Edition (EPA 450/3-90-006). U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. January 1990.
7. Emission Factor Documentation for AP-42 Section 11.1, Hot Mix Asphalt Plants. Final Report. RTI International. Prepare for: U.S. Environmental Protection Agency, Research Triangle Park, NC. February 2004.
8. Employer Costs for Employee Compensation -- March 2006, Table 9, All workers in private industry, installation, maintenance, and repair. June 21, 2006
9. Average Retail Price of Electricity by End-Use Sector. Energy Information Administration. Washington, D.C. Accessed August 16, 2006. Internet Address: http://www.eia.doe.gov/cneaf/electricity/epm/epmxlfile5_6_b.xls.
10. Natural Gas Prices. Energy Information Administration. Washington, D.C. Accessed August 16, 2006. Internet Address: http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SCA_m.htm.

Control Measure Number: PCAPCD - CM1

Control Measure Title: Asphalt Concrete Production

Date: February 5, 2007

Control Measure Description

Asphaltic concrete, or hot-mix pavement material, is produced in both continuous and batch plants; some of the latter are portable. The process involves heating aggregate in a rotary dryer to approximately 300 °F and mixing it with melted asphalt cement refined from petroleum. Most of the NOx emissions are from the burners used to heat the dryer, and those are the NOx emissions targeted by this control measure. Some ancillary NOx emissions come from heaters used to melt asphalt cement, and from stationary internal combustion engines.

The control of dryer NOx emissions may be accomplished by controlling the burners used to heat the dryer. All the plants in the Placer County are fired with natural gas. The concentration of NOx discharged from uncontrolled burners is typically over 100 parts per million, volumetric dry (ppmvd), or about 0.016 pounds per ton. Use of low NOx burners and flue gas recirculation (FGR) is able to reduce these emissions to as low as 30 ppmvd. There is little to no fuel penalty as a result of these controls, but a reduction in burner capacity of up to 20 percent may be required to avoid flame impingement on the inner surfaces of the dryer. This could result in lost production for plants when they are producing at close to their rated capacities. In order to control NOx emissions, plants must be retrofitted with low NOx burners and FGR.

Emission Inventory –2018

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
430-424-7006-0000	Asphaltic Concrete Production	0.0624

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reduction (tpd)
			2018
Asphaltic Concrete Production	2013	2014	0.0364

Cost Effectiveness

It is assumed that the equipment has a 20 year life, an interest rate of 3%, and the cost of running two plants in Placer County is $360,000. The estimated cost effectiveness is $5,675/ton of NOx reduced.

Authority

California Health and Safety Code, Sections 40000, 40001, and 40702

Implementation

The Placer County Air Pollution Control District is the implementing agency.

References

1. References are shown in footnotes.
2. Draft Final Sacramento Off-road Measures, Control Measure SN-59, Asphalt Concrete Production, Sacramento Metropolitan AQMD, October 14, 2003.
3. "ARB Forecasted Emissions by Summary Category Ozone SIP Planning Projections v1.06 RF #980". www.arb.ca.gov/app/emsinv/0#sip/fcemssumcat_0#v106.php. November 16, 2006.
4. Control Measure, PCAPCD CM1, February 7, 2007

Boilers, Steam Generators, and Process Heaters

Control Measure Number: YSAQMD – 2.27

Control Measure Title: Boilers, Steam Generators, and Process Heaters/Space Heaters

Date: February 6, 2007

Control Measure Description

Boilers and steam generators are used to provide hot water and steam for a variety of industrial and commercial applications. These applications include space heating, food processing, garment laundering, and equipment sterilization. Manufacturing operations use process heaters to heat materials or equipment during the manufacturing process. The equipment burners can be fired on solid, liquid or gaseous fuels. A unit's maximum input rating can be calculated from the fuel heat input value over an hour's time and is reported in British Thermal Units per hour (MMBTU/hr). Per regulatory convention, the emissions from these types of units are reported in parts per million (ppm) corrected to 3% oxygen (O_2).

The proposed control measure consists of the District amending Rule 2.27 (Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters) to incorporate a multi-tiered NOx emission limit.

Emission Inventory - 2018

EIC Code	EIC Description	NOx Planning Inventory (tpd)
		2018
5000501100000	Manufacturing and Industrial Boilers, Natural Gas Fuel	0.0302
5001001100000	Manufacturing and Industrial Boilers, Propane Fuel	0.0068
5099501100000	Manufacturing and Industrial Process Heaters, Natural Gas Fuel	0.8936
5200501100000	Manufacturing and Industrial Process Heaters, Distillate Oil Fuel	0.141
5201001100000	Manufacturing and Industrial Oven Heaters (Forced Drying Surface Coatings), Natural Gas Fuel	0.0217
6000501100000	Manufacturing and Industrial, Other, Natural Gas Fuel	0.1428
6001001100000	Manufacturing and Industrial, Other, LPG Fuel	0.0078
6099501100000	Food and Agricultural Process Boilers, Natural Gas Fuel	0.6945
31035601100000	Food and Agricultural Process Heaters, Natural Gas Fuel	0.0099
Total		**1.9483**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reduction Tons/day
			2018
Boilers	2010	2012	0.2883

Cost Effectiveness

From an analysis performed by the Sacramento Metropolitan AQMD in 2003[2], the cost for boiler retrofits will vary on the size, the type, and the age of an individual unit. It is expected that some of the older units that have reached the end of their service lives may be replaced instead of being retrofitted with low-NOx equipment or post-combustion controls. Based on this analysis, the cost of equipment modifications ranged from $12,664 - $23,359 per ton of NOx reduced. Adjusted for inflation, the expected cost in 2007 will be $13,934 - $25,718.

Total Cost: $17,924,227 - $33,061,593 over a 15 year equipment useful life (2007).

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the YSAQMD through Rule 2.27.

References

1. California Environmental Protection Agency – Air Resources Board, Forecasted Emissions by Summary Category Ozone SIP Planning Projections - v1.06 RF#980; Date of Last Update: November 16, 2006.
2. Sacramento Metropolitan Air Quality Management District, Final Draft – Sacramento Off-Road Measures: Boilers, Steam Generators, and Process Heaters/Space Heaters, October 14, 2003.

IC Engines

Control Measure Number: SMAQMD - 412

Control Measure Title: IC Engines

Date: December 7, 2006

Control Measure Description

Internal combustion (IC) engines are used at a wide variety of stationary sources including hospitals, farms, and natural gas fields. Approximately 93% of the engines currently permitted with the district are designated as emergency standby engines that only operate for maintenance and emergency purposes. These engines are in place to provide backup power or operate fire pumps while prime powered engines could be used continuously.

IC engines are typically classified by the method in which the fuel is ignited. Compression ignited engines are diesel fueled and are typically used as emergency standby engines and in agricultural operations. Spark ignited engines can use natural gas, propane, gasoline, or other fuels as source of energy. Typically, natural gas is used in prime powered spark ignited engines where most of the prime powered engines are used in the process of natural gas compression. Spark ignited engines can be further classified as rich or lean burn depending upon the amount of air that is mixed with the fuel before it is ignited.

The pollutants that are created during the combustion process that are of primary concern for the District are NOx, CO, and VOC. Some of the standard methods for controlling these pollutants from IC engines include selective and non-selective catalytic reduction, low emission combustion technologies, NOx absorbers, and engine replacement. Additionally, diesel particulate matter (PM), which has been identified as a carcinogen and an air toxic contaminant, is a large concern, but has primarily been addressed in the State's air toxic control measure for compression ignited engine PM.

The proposed control measure would establish emission standards for stationary engines.

This control measure will not be addressing engines used in agricultural processes. The California Air Resources Board (CARB) established new standards in the diesel engine particulate air toxic control measure (ATCM) for engines used in agricultural processes. CARB has stated that the anticipated method of compliance to meet their newly proposed standards is replacement with EPA certified Tier 3 or 4 engines. The proposed amendments to the ATCM will also require the replacement engine to maintain the NOx standards for that particular Tier engine. Therefore, additional local control measures would likely duplicate the state measure.

Emission Inventory –2018

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
010-040-0142-0000	IC Engines, Electric Utilities - Landfill Gas	0.1098
030-040-0100-0000	IC Engines, Oil and Gas Production – Gaseous Fuel (Unspecified)	0.0773
050-040-0110-0000	IC Engines, Mfg. and Industrial - Natural Gas	0.5616
050-040-0124-0000	IC Engines, Mfg. and Industrial – Propane	0
050-040-1200-0000	IC Engines, Mfg. and Industrial – Diesel	0.0443
052-042-0110-0000	IC Engines, Food and Ag Processing - Natural Gas	0.1119
052-042-1200-0000	IC Engines, Food and Ag Processing – Diesel	0.2313
060-040-0110-0000	IC Engines, Service and Commercial - Natural Gas	0.0114
060-040-1200-0000	IC Engines, Service and Commercial – Diesel	0.0179
099-040-1200-0000	IC Engines, Other – Diesel	0.3914
Total		**1.5569**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reduction (tpd)
			2018
IC Engines	2011	2013	0.0131

Cost Effectiveness

In estimating cost effectiveness, staff assumed that all spark ignited engines would either upgrade or install new non-selective catalytic reduction (NSCR) systems, which is the most cost effective option for meeting BARCT standards. Additionally, staff assumes that the method of compliance for prime power diesel engines is to electrify. Staff estimates that by electrifying this diesel engine there will be a cost savings of approximately $5,000 annually. For all other engines affected by this rule, including capital, testing, and operational costs, the total cost effectiveness of the control measure is approximately $11,500 per ton of NOx reduced.

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the SMAQMD.

References

1. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (Rf#980), November 16, 2006
2. CARB November 2001 Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines
3. Section 93115, Title 17 of the California Code of Regulations, Airborne Toxic Control Measure for Stationary Compression Ignition Engines
4. South Coast AQMD Rule 1110.2
5. San Joaquin Valley Unified APCD Rule 4702
6. Ventura County APCD Rule 74.9
7. Control Measure, SMAQMD 412, December 7, 2006

Control Measure Number: FRAQMD - 3.22

Control Measure Title: Stationary Internal Combustion Engines (Non-Agricultural)

Date: February 5, 2007

Control Measure Description

Internal combustion (IC) engines are in place at a wide variety of stationary sources. Use times range from a few hours a month for emergency standby engines to full-time for engines that are used as prime power. Standby engines tend to have small horsepower ratings (under 300) and may be in place to operate fire pumps or to provide backup power in case of an electrical outage, while engines that provide prime power are larger (often over 600 hp) and usage may be constant.

The most common fuel type for emergency standby engines is diesel, and for prime power engines, natural gas. Other fuels such as propane, gasoline, and landfill gas are also used occasionally, depending on the engine application. Many of the natural gas engines are in remote locations and used to compress natural gas from natural gas wells. These engines can be either lean burn or rich burn. The pollutants of primary concern that result from the combustion process are NOx and CO; however, recent rulemaking efforts at the statewide level have focused on diesel PM, which has been identified as a carcinogen and a toxic air contaminant. SOx and ROG also result from the combustion process.

The proposed control measure would establish emission standards for non-agricultural stationary IC engines.

EIC Emission Inventory:

The population growth rate in South Sutter is purely based on the current Sutter County population growth rate projected by SACOG. The potential growth of proposed South Sutter Specific Plan (now called Sutter Pointe Specific Plan) is not factored in.

Emission Inventory - 2018

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
060-995-1220-0000	Service and Commercial, Other, Distillate	0.002
099-995-0000-0000	Fuel Combustion (other)	0.018
Total		**0.020**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reductions (tpd)
			2018
IC Engines	2010	2011	0.0045

Cost Effectiveness

The cost effectiveness is estimated to be $11,500 per ton of NOx reduced.

Implementation

The Feather River Air Quality Management District proposes to implement this rule in 2011.

Authority

Feather River Air Quality Management District has the authority to regulating stationary internal combustion engines is within provisions of the California Health and Safety Code.

References

1. Placer County Air Pollution Control District Rule 242 Internal Combustion Engines
2. South Coast AQMD Rule 1110.2, Emissions from Gaseous and Liquid-Fueled Engines
3. San Joaquin 2002 and 2005 Rate of Progress Plan
4. Draft Final Sacramento Off-road Measures, Control Measure D-20, Cogeneration/IC Engines, Sacramento Metropolitan AQMD, October 14, 2003.
5. "ARB Forecasted Emissions by Summary Category Ozone SIP Planning Projections v1.06 RF #980". www.arb.ca.gov/app/emsinv/0#sip/fcemssumcat_0#v106.php. November 16, 2006.
6. Control Measure, FRAQMD 3.22, February 2, 2007

Control Measure Number: YSAQMD – 2.32

Control Measure Title: Stationary Internal Combustion (IC) Engines

Date: February 1, 2007

Control Measure Description

Internal combustion (IC) engines are used at a wide variety of stationary sources including hospitals, farms, and natural gas fields. IC engines are typically classified by the method in which the fuel is ignited. Compression ignited engines are diesel fueled and are typically used as emergency standby engines and in agricultural operations. Spark ignited engines can use natural gas, propane, gasoline, or other fuels as source of energy. Typically, natural gas is used in prime powered spark ignited engines where most of the prime powered engines are used in the process of natural gas compression. Spark ignited engines can be further classified as rich or lean burn depending upon the amount of air that is mixed with the fuel before it is ignited.

The pollutants that are created during the combustion process that are of primary concern for the District are NOx, CO, and VOC. Some of the standard methods for controlling these pollutants from IC engines include selective and non-selective catalytic reduction, low emission combustion technologies, NOx absorbers, and engine replacement. Additionally, diesel particulate matter (PM), which has been identified as a carcinogen and an air toxic contaminant, is a large concern, but has primarily been addressed in the State's air toxic control measure for compression ignited engine PM.

The proposed control measure benefits were calculated assuming changed applicability of Rule 2.32 (Stationary IC Engines) to incorporate the reduced NOx emission limits for the spark ignited rich burn and lean burn gaseous fired engines.

This control measure will not be addressing engines used in agricultural processes. The California Air Resources Board (CARB) established new standards in the diesel engine particulate air toxic control measure (ATCM) for engines used in agricultural processes. CARB has stated that the anticipated method of compliance to meet their newly proposed standards is replacement with EPA certified Tier 3 or 4 engines. The proposed amendments to the ATCM will also require the replacement engine to maintain the NOx standards for that particular Tier engine. Therefore, additional local control measures would likely duplicate the state measure.

Emission Inventory –2018

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
020-040-0110-0000	Cogeneration - Natural Gas	0.0092
030-040-0110-0000	Oil and Gas Production - Natural Gas	0.2318
Total		**0.241**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reduction (tpd)
			2018
IC Engines	2010	2011	0.1187

Cost Effectiveness

In estimating cost effectiveness, staff assumed that all spark ignited engines would either upgrade or install new non-selective catalytic reduction (NSCR) systems, which is the most cost effective option for meeting BARCT standards. Additionally, staff assumes that the method of compliance for prime power diesel engines is to electrify. Staff estimates that by electrifying this diesel engine there will be a cost savings of approximately $5,000 annually. For all other engines affected by this rule, including capital, testing, and operational costs, the total cost effectiveness of the control measure is approximately $11,500 per ton of NOx reduced.

Authority

The District is authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001, 40702, and 41010.

Implementation

This control measure will be implemented by the YSAQMD through Rule 2.32.

References

1. California Environmental Protection Agency – Air Resources Board, Forecasted Emissions by Summary Category Ozone SIP Planning Projections - v1.06 RF#980; Date of Last Update: November 16, 2006.

2. Determination of Reasonably Available Control Technology and Best Available Retrofit Technology for Stationary Spark-Ignited Internal Combustion Engines; November 2001.

Water Heaters

Control Measure Number: SMAQMD - 414

Control Measure Title: Water Heaters

Date: February 7, 2007

Control Measure Description

This control measure would evaluate low NOx emission standards for new boilers and water heaters within the heat input range of 75,000 to 1,000,000 Btu/hr. At the current time, Sacramento Metropolitan Air Quality Management District (SMAQMD) Rule 414 (Natural Gas-Fired Water Heaters) sets NOx emission standards for water heaters with rated capacities of less than 75,000 Btu/hr. Likewise, SMAQMD Rule 411 (NOx from Boilers, Process Heaters, and Steam Generators) sets NOx standards for boilers with a rated heat capacity of 1,000,000 Btu/hr and higher. This control measure addresses boilers and water heaters that fall between the heat capacity ranges of Rule 414 and Rule 411 (i.e., from 75,000 to 1,000,000 Btu/hr).

The heat input range addressed by this control measure generally applies to small commercial/industrial boilers and hot water heaters that predominantly burn natural gas and are used to heat water and generate steam. These units are used in a variety of applications, including in restaurants, retail stores, schools, hotels and office buildings. The smaller units in this heat input range (i.e., <300,000 Btu/hr) use the natural draft created by combustion of natural gas and air to transfer heat to the confined water and do not rely on fans or blowers to transport either air or combustion gases. These combustion units are known as “atmospheric” and are rather simple in their operation. The larger units in this heat input range (i.e., >300,000 Btu/hr) usually resemble small boilers because water circulates through a series of water tubes or water jackets close to the flow of hot gases and are heated as the gases flow around them. Burners on these units can be either atmospheric or forced draft.

Emission Inventory –2018

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
060-030-0110-0000	Service and Commercial Natural Gas Water Heating	0.3105
610-608-0110-0000	Residential Natural Gas Water Heating	1.5852
Total		**1.8957**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reductions (tpd)
			2018
Water Heaters	2009	2010-2012	1.1173

Cost Effectiveness

Cost effectiveness was estimated based upon economic analyses conducted by the SCAQMD for a similar measure.

It was assumed that the economic conditions for equipment dealers in Sacramento County do not differ significantly than the economic conditions for equipment dealers in the South Cost area; therefore, the estimated South Coast cost effectiveness values were assumed to be appropriate for Sacramento. SCAQMD Rule 1121 and 1146.2 amendments are not considered to be technology forcing and compliant heaters are already being manufactured and sold in the current consumer market.

Based on cost effectiveness information from the SCAQMD rules, the overall cost effectiveness for the proposed measure is estimated to be $9,903/ton.

Authority

Authority to implement this control measure by the SMAQMD is in accordance with California Health and Safety Code, Sections 40000, 40001, and 41010.

Implementation

The Sacramento Metropolitan Air Quality Management District is the implementing agency.

References

1. CARB Ozone SIP Planning Inventory, Version 1.04, Sacramento NAA (Rf#976), September 14, 2006.
2. Control Measure, SMAQMD 414, September 14, 2006.
3. Sacramento Metropolitan Air Quality Management District Rule 414 (Natural Gas-Fired Water Heaters).
4. Sacramento Metropolitan Air Quality Management District Rule 411 (NOx from Boilers, Process Heaters, and Steam Generators (Amended October 27, 2005).
5. South Coast Air Quality Management District Rule 1146.2 (Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters) (Amended May 5, 2006).
6. South Coast Air Quality Management District Rule 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters) (Amended September 3, 2004).
7. South Coast Air Quality Management District - Staff Report for Proposed Amended Rule 1146.2 (Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters), April 2006.
8. South Coast Air Quality Management District - Staff Report for Proposed Amended Rule 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters), November 1999.

Control Measure Number: EDCAQMD - 239

Control Measure Title: Natural Gas-Fired Water Heaters

Date: January 31, 2007

Control Measure Description

This control measure will evaluate low NOx limits for all new boilers and water heaters within a heat input range of less than 1,000,000 Btu/hr. At the current time, El Dorado County Air Quality Management District (EDCAQMD) Rule 239 (Natural Gas-Fired Water Heaters) sets NOx emission standards for water heaters with rated capacities of less than 75,000 Btu/hr.

The heat input range addressed by this control measure generally applies to small commercial/industrial boilers and hot water heaters that predominantly burn natural gas and are used to heat water and generate steam. These units are used in a variety of applications, including in restaurants, retail stores, schools, hotels and office buildings. The smaller units in this heat input range (i.e., <300,000 Btu/hr) use the natural draft created by combustion of natural gas and air to transfer heat to the confined water and do not rely on fans or blowers to transport either air or combustion gases. These combustion units are known as “atmospheric” and are rather simple in their operation. The larger units in this heat input range (i.e., >300,000 Btu/hr) usually resemble small boilers because water circulates through a series of water tubes or water jackets close to the flow of hot gases and are heated as the gases flow around them. Burners on these units can be either atmospheric or forced draft.

Emission Inventory –2018

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
060-995-0110-0000	Service and Commercial (Other)	0.011
610-608-0110-0000	Residential Natural Gas Water Heating	0.017
Total		**0.028**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reductions (tpd)
			2018
Water Heaters	2015	2016	0.0035

Cost Effectiveness

Based on the May 5, 2006 South Coast Air Quality Management District Staff Report for Rule 1146.2 Measures, the cost effectiveness ranges from $2400-$16,000/ton of NO_x reduced.

Authority

The above control measure will be implemented by amendment to the existing Rule 239 Natural Gas-Fired Residential Water Heaters. The El Dorado Air Quality Management District has the authority to propose rules and regulations to the District Board for adoption under HSC 40001.

Implementation

The implementation of this proposed control measure does not involve any other agency other than the El Dorado County Air Quality Management District.

References

1. California ARB Forecasted Emissions by Summary Category, Ozone SIP Sacramento NAA Projections (v1.06_RF980) www.arb.ca.gov/app/emsinv/03sip/fcemssumcat_03v1.06.php. November 16, 2006
2. South Coast Air Quality Management District Staff Report for Rule 1146.2, May 5, 2006
3. Control Measure, EDCAQMD 239, January 31, 2007

Control Measure Number: FRAQMD - 3.23

Control Measure Title: Large Water Heaters and Small Boilers

Date: February 5, 2007

Control Measure Description

This control measure will evaluate low NOx limits for all new boilers and water heaters within the heat input range of 75,000 to 1,000,000 Btu/hr. This category includes small commercial/industrial boilers and hot water heaters that predominately burn natural gas and are used to heat water and generate steam. These units are used to heat water or create steam for a variety of purposes. Users of these units include restaurants, retail stores, schools, hotels and office buildings. The smaller units in this size range (<300,000 Btu/hr) use the natural draft created by combustion of natural gas and air to transfer heat to the confined water and do not rely on fans or blowers to transport either air or combustion gases. These combustion units are known as "atmospheric" and are rather simple in their operation. Units with heat inputs larger than 300,000 Btu/hr usually resemble small boilers because water circulates through a series of water tubes or water jackets close to the flow of hot gases and are heated as the gases flow around them. Burners on these units can be either atmospheric or forced draft. Currently Sacramento, Yolo/Solano, and El Dorado all have rules for natural gas fired water heaters that apply to units with a heat input of less than 75,000 Btu/hr but do not have a rule for larger units in the size range for this measure.

Emission Inventory –2018

The population growth rate in south Sutter is purely based on the current Sutter County population growth rate projected by SACOG. The potential growth of proposed South Sutter Specific Plan (now called Sutter Pointe Specific Plan) is not factored in.

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
610-608-0110-0000	Residential Natural Gas Water Heating	0.0041

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reductions (tpd)
			2018
Water Heaters	2016	2017	0.0001

Cost Effectiveness

Cost effectiveness is expected to range between $9,000 and $21,308 per ton of NOx reduced.

Authority

Feather River Air Quality Management District has the authority to regulating stationary internal combustion engines is within provisions of the California Health and Safety Code.

References

1. Sonoma Technology Method Summary for Commercial Gas Fuel Usage and Emissions, September 16, 2002
2. California Energy Commission 2000 natural gas database by natural gas usage and number of accounts by county and SIC code.
3. Staff Report, Rule 1146.2, Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers, South Coast Air Quality Management District, January 9, 1998
4. Staff Report, Rule 74.11.1, Large Water Heaters and Small Boilers, Ventura County Air Pollution Control District, August 31, 1999
5. Staff Report, Rule 360, Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers, Santa Barbara County Air Pollution Control District, October 17, 2002.
6. California ARB Forecasted Emissions by Summary Category, Ozone SIP Sacramento NAA Projections (v1.06_RF980) www.arb.ca.gov/app/emsinv/03sip/fcemssumcat_03v1.06.php. November 16, 2006
7. Control Measure, FRAQMD 3.23, February 5, 2007

Control Measure Number: PCAPCD - CM2

Control Measure Title: Large Water Heaters and Small Boilers

Date: February 5, 2007

Control Measure Description

This control measure will evaluate low NOx limits for all new boilers and water heaters within the heat input range of 75,000 to 1,000,000 Btu/hr. This category includes small commercial/industrial boilers and hot water heaters that predominately burn natural gas and are used to heat water and generate steam. These units are used to heat water or create steam for a variety of purposes. Users of these units include restaurants, retail stores, schools, hotels and office buildings. The smaller units in this size range (<300,000 Btu/hr) use the natural draft created by combustion of natural gas and air to transfer heat to the confined water and do not rely on fans or blowers to transport either air or combustion gases. These combustion units are known as "atmospheric" and are rather simple in their operation. Units with heat inputs larger than 300,000 Btu/hr usually resemble small boilers because water circulates through a series of water tubes or water jackets close to the flow of hot gases and are heated as the gases flow around them. Burners on these units can be either atmospheric or forced draft. Currently Sacramento, Yolo/Solano, and El Dorado all have rules for natural gas fired water heaters that apply to units with a heat input of less than 75,000 Btu/hr but do not have a rule for larger units in the size range for this measure.

Emission Inventory –2018

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
060-995-0110-0000	Service and Commercial (Other)	0.7827
610-608-0110-0000	Residential Natural Gas Water Heating	0.2055
Total		**0.9882**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reductions (tpd)
			2018
Residential Natural Gas Water Heating	2015	2017	0.030

Cost Effectiveness

The estimated cost effectiveness of this measure is $2,300 - $21,309/ton of NOx reduced.

Authority

California Health and Safety Code, Sections 40000, 40001, and 40702

Implementation

The Placer County Air Pollution Control District is the implementing agency.

References

1. SMAQMD Method Summary for natural gas consumption by commercial gas combustion categories by Hao Quinn, November 12, 2002.
2. Sonoma Technology Method Summary for Commercial Gas Fuel Usage and Emissions, September 16, 2002
3. California Energy Commission 2000 natural gas database by natural gas usage and number of accounts by county and SIC code.
4. Database query of stationary fuel combustion and residential combustion from 7-15-03 CEFS forecast output (provided by Larry Hunsaker, CARB).
5. Communication with Ali Mohamad of the SMAQMD on July 24, 2003 to discuss SMAQMD staff report on Rule 411, Boiler NOx.
6. Communication with Hao Quinn of the SMAQMD on July 29, 2003 to determine estimated fuel use and number of sources for large water heaters and small boilers.
7. Staff Report, Rule 1146.2, Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers, South Coast Air Quality Management District, January 9, 1998
8. Staff Report, Rule 74.11.1, Large Water Heaters and Small Boilers, Ventura County Air Pollution Control District, August 31, 1999
9. Staff Report, Rule 360, Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers, Santa Barbara County Air Pollution Control District, October 17, 2002.
10. Staff Report, Rule 411, NOx from Boilers, Process Heaters and Steam Generators, Sacramento Metropolitan Air Pollution Control District, October 27, 2005.
11. CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (Rf#980), November 16, 2006.
12. Control Measure, PCAPCD CM2, February 5, 2007

Control Measure Number: YSAQMD – 2.37

Control Measure Title: Large Water Heaters and Small Boilers

Date: February 1, 2007

Control Measure Description

This control measure will evaluate low NOx limits for all new boilers and water heaters within the heat input range of 75,000 to 1,000,000 Btu/hr. At the current time, Yolo-Solano Air Quality Management District (YSAQMD) Rule 2.37 (Natural Gas Fired Residential Water Heaters) sets NOx emission standards for water heaters with rated capacities of less than 75,000 Btu/hr. This control measure addresses boilers and water heaters that fall between the heat capacity ranges of 75,000 to 1,000,000 Btu/hr.

The heat input range addressed by this control measure generally applies to small commercial/industrial boilers and hot water heaters that predominantly burn natural gas and are used to heat water and generate steam. These units are used in a variety of applications, including in restaurants, retail stores, schools, hotels and office buildings. The smaller units in this heat input range (i.e., <300,000 Btu/hr) use the natural draft created by combustion of natural gas and air to transfer heat to the confined water and do not rely on fans or blowers to transport either air or combustion gases. These combustion units are known as “atmospheric” and are rather simple in their operation. The larger units in this heat input range (i.e., >300,000 Btu/hr) usually resemble small boilers because water circulates through a series of water tubes or water jackets close to the flow of hot gases and are heated as the gases flow around them. Burners on these units can be either atmospheric or forced draft.

Emission Inventory –2018

The Yolo-Solano planning emission inventory for water heaters is presented below for NOx and VOC, although this control measure pertains to NOx emissions, only.

EIC Code	EIC Description	NOx Inventory for Control Measures (tpd)
		2018
052-005-0110-0000	Food and Agricultural Processing - Boilers	0.141
052-010-0110-0000	Food and Agricultural Processing - Process Heaters	0.0217
060-005-0110-0000	Service and Commercial - Boilers	0.1428
060-010-0110-0000	Service and Commercial - Process Heaters	0.0078
060-995-0110-0000	Service and Commercial - Other	0.6945
310-356-0110-0000	Oil and Gas Production - Natural Gas Production	0.0099
610-608-0110-0000	Residential Fuel Combustion - Fuel Combustion - Water Heating	0.2322
610-995-0110-0000	Residential Fuel Combustion - Other	0.0419
Total		**1.2918**

Emission Reductions

EIC Description	Adoption Date	Implementation Date	NOx Emission Reductions (tpd)
			2018
Water Heaters	2009	2010	0.2403

Cost Effectiveness

Cost effectiveness was estimated based upon economic analyses conducted by the SCAQMD for a similar measure.

It was assumed that the economic conditions for equipment dealers in the Yolo-Solano area do not differ significantly than the economic conditions for equipment dealers in the South Cost area; therefore, the estimated South Coast cost effectiveness values were assumed to be appropriate for Yolo-Solano. SCAQMD Rule 1121 and 1146.2 amendments are not considered to be technology forcing and compliant heaters are already being manufactured and sold in the current consumer market.

Based on cost effectiveness information from the SCAQMD rules, the overall cost effectiveness for the proposed measure is estimated to be $9,903/ton.

Authority

Authority to implement this control measure by the SMAQMD is in accordance with California Health and Safety Code, Sections 40000, 40001, and 41010.

Implementation

The Yolo-Solano Air Quality Management District is the implementing agency.

References

1. California Environmental Protection Agency – Air Resources Board, Forecasted Emissions by Summary Category Ozone SIP Planning Projections - v1.06 RF#980; Date of Last Update: November 16, 2006.
2. Yolo-Solano Air Quality Management District, Rule 2.37, Natural Gas-Fired Residential Water Heaters, November 9, 1994.
3. South Coast Air Quality Management District; Rule 1146.2, Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters, Mat 5, 2006.
4. Sacramento Metropolitan Air Quality Management District, Final Draft – Sacramento Off-Road Measures: Large Water Heaters and Small Boilers, October 14, 2003.

Further Study Measures

Further Study Measures

Further study measures are measures for which insufficient information was available during the development of the control strategy to allow the region to commit to them as control measures. The adoption of further study measures requires full evaluations of emission data, cost effectiveness, technological feasibility, and authority for implementation. If the evaluations show that the measures are viable control measures, they will be considered for adoption and implementation.

This section includes the description of six further study measures. These measures are evaluated qualitatively for environmental impacts in this State Implementation Plan and will be evaluated quantitatively for the actual emission benefits and feasibility in the future. These further study measures are: 1) Heat Island Mitigation, 2) Alternative Energy, 3) Energy efficiency, 4) Gasoline Transfer Phase I/II, 5) Lubricants, and 6) Episodic Controls.

Control Measure Number: Further Study – 1

Control Measure Title: Urban Heat Island

Control Measure Description:

The purpose of this control measure is to encourage activities that would lower ambient temperatures in urban areas. This control measure focuses on encouraging activities such as using lighter, more reflective surface materials and increased tree planting.

This further study measure will evaluate the potential to develop programs that promote the use of light colored roofing and pavement materials, solar roofing membranes, and increased tree planting. Also programs to promote use of more reflective pavement and tree planting could be a required element for new sources, or could be included as recommendations through the California Environmental Quality Act (CEQA) Air Quality Handbook. Sources such as builders, utilities, cities and local government agencies, and private citizens, etc. that promote the use of lighter colored materials and increased tree planting could be eligible for an emission credit. Emission credits could be issued based on types of surface materials used or numbers of trees per unit or area that meet or exceed a specified benchmark.

There are a variety of potential techniques that can be implemented to reduce urban temperatures and increase the albedo of roofs, pavements, and building surfaces. Most of these techniques can be implemented during the maintenance or modification of existing structures or during the building stages of new structures.

Emission Inventory - 2018

The air districts do not have sufficient information to calculate the inventory for this potential control measure at this time.

Emissions Reductions

The air districts are not able to calculate the potential emission reductions from this control measure because the emission inventory is unknown. The amount of emission reductions will be determined during implementation of this control measure.

Cost Effectiveness

The air districts do not have sufficient information to calculate the cost effectiveness of this control measure. The air districts will continue to monitor the progress made on a similar control measure for urban heat islands proposed in both the SJVUAPCD 2007 Ozone Plan and SCAQMD Final 2007 AQMP and determine at a later date if the control measure is feasible and cost effective.

Authority

The implementing agencies could include the air districts and local governments.

Recommendation

This control measure requires additional information and further study and is not recommended at this time. The air districts will continue to monitor the progress made on the control measure for urban heat islands proposed in SJVUAPCD and SCAQMD.

References

2007 Ozone Plan, Chapter 8: Innovative Strategies and Programs: 8.2.4, San Joaquin Valley Air Pollution Control District, April 30, 2007.

Final 2007 AQMP, Appendix IV-A: CM#2007MCS-03, South Coast Air Quality Management District, June 2007.

Control Measure Number: Further Study – 2

Control Measure Title: Alternative Energy

Control Measure Description:

The use of alternative energy sources either in transportation or stationary applications can reduce ozone precursors. This further study measure looks at reductions possible in the stationary sector of the Sacramento region. This source category includes facilities or operations that have VOC-containing byproducts that can be converted to electric energy by utilizing currently available technology or other byproducts such as biomass waste, from which energy could also be derived. The electricity produced may be used for internal facility needs or metered back and sold to utility companies.

This further study measure will evaluate potential opportunities to convert green waste, dairy manure, and other forms of biomass into usable energy for electricity generation. The converted fuel depending on the type could be used in fuel cells, internal combustion (IC) engines or mini-turbines.

The San Joaquin APCD proposed in their 2007 Ozone Plan a measure very similar to this one and has also committed to study this measure further.

Emission Inventory - 2018

There is no specific inventory attributable to this source category, since it can include any application for which there is technology that can produce energy without using fossil-based materials.

Emissions Reductions

The air districts do not have sufficient information to calculate the potential emission reductions from this control measure.

Cost Effectiveness

The air districts do not have sufficient information to calculate the cost effectiveness of this control measure. The air districts will continue to monitor the progress made on a similar control measure for alternative energy proposed in SJVUAPCD and determine at a later date if the control measure is feasible and cost effective.

Authority

The implementing agencies still need to be determined.

Recommendation

This control measure requires additional information and further studies and is not recommended at this time. The air districts will continue to monitor the progress made on the control measure for alternative energy proposed in the SJVUAPCD.

References

2007 Ozone Plan, Chapter 8: Innovative Strategies and Programs: 8.2.5, San Joaquin Valley Air Pollution Control District, April 30, 2007.

Control Measure Number: Further Study – 3

Control Measure Title: Energy Efficiency

Control Measure Description:

The purpose of this further study measure is to look at possible sources of emissions in the region that could reduce ozone precursors by reducing energy consumption.

This future study measure will evaluate energy efficiency projects and practices that have a demonstrable benefit to air quality, such as energy efficient water pumps, solar water heaters, reduced agricultural field passes, use of GPS in agricultural operations, and other conservation management practices that simultaneously reduce PM and ozone precursors. In addition, this further study measure will examine green certification of energy efficient homes, offices, and commercial and industrial facilities that utilized green building practices.

Emission Inventory - 2018

There is inadequate information to calculate the emission inventory from these projects at this time.

Emissions Reductions

There is inadequate information to calculate the potential emission reductions. The air districts will monitor the development of a similar control measure in the SCAQMD and SJVUAPCD and determine the potential emission reductions once more information becomes available.

Cost Effectiveness

The air districts do not have sufficient information to calculate the cost effectiveness of this control measure. The air districts will continue to monitor the progress made on a similar control measure for alternative energy proposed in SCAQMD and determine at a later date if the control measure is feasible and cost effective.

Authority

The implementing agencies could include the air districts and local governments.

Recommendation

This control measure requires additional information and further studies and is not recommended at this time. The air districts will continue to monitor the progress made on the control measure for energy efficiency proposed in the SCAQMD.

References

Final 2007 AQMP, Appendix IV-A: CM#2007MCS-03, South Coast Air Quality Management District, June 2007.

2007 Ozone Plan, Chapter 8: Innovative Strategies and Programs: 8.2.4, San Joaquin Valley Air Pollution Control District, April 30, 2007.

Control Measure Number: Further Study – 4

Control Measure Title: Gasoline Transfer Phase I/II

Control Measure Description

The purpose of this control measure is to reduce VOC and toxic emissions from gasoline dispensing facilities (GDFs) by improving implementation of the Enhanced Vapor Recovery (EVR) Regulation.

The EVR includes testing and certification procedures to improve the performance and specification of both Phase I and Phase II vapor recovery systems. The EVR for Phase I includes the improvements of the spill containment and cover, rotatable product and vapor adaptors, overfill prevention device, and pressure vacuum vent gauges. The EVR for Phase II includes, but is not limited to, the onboard refueling vapor recovery (ORVR) and the in-station diagnostic (ISD). The ORVR routes gasoline vapor displaced during vehicle fueling to the onboard canister on the vehicle. The ISD is designed to provide continuous real-time monitoring of vapor collection and containment efficiencies, alert the GDF operator when a failure mode is detected so that corrective action can be taken, shut down the dispensers if repairs are ignored and provide compliance records.

Currently, emissions from GDFs are regulated by the EVR regulation of the California Air Resources Board (CARB) and local air district rules.

This control measure will evaluate methods to improve the functions of the ISD. Some improvements may include providing earlier warning signal, changing both the warning and gross failure alerting ranges, disallowing the use of the reset button, or installing a “shut down” sensor or mechanism on the dispenser to stop fueling if the fuel filters are blocked and the fueling flow rate drops below the system certification standards.

In addition, this control measure will explore the option to require controls for mobile refuelers if a district rule has not established such requirements.

Emission Inventory

SMAQMD – 2002 Baseline Emission Inventory (Summer)

EIC Code	EIC Description	VOC/ROG (tpd)
330-374-1100-0000	FUEL DISPENSING TANKS - WORKING LOSSES	0.1404
330-376-1100-0000	FUEL DISPENSING TANKS - BREATHING LOSSES	0.1072
330-378-1100-0000	VEHICLE REFUELING - VAPOR DISPLACEMENT LOSSES	0.8888
330-380-1100-0000	VEHICLE REFUELING - SPILLAGE	0.1473
	Total	1.2837

PCAPCD – 2002 Baseline Emission Inventory (Summer)

EIC Code	EIC Description	VOC/ROG (tpd)
330-374-1100-0000	FUEL DISPENSING TANKS - WORKING LOSSES	0.0518
330-376-1100-0000	FUEL DISPENSING TANKS - BREATHING LOSSES	0.0251
330-378-1100-0000	VEHICLE REFUELING – VAPOR DISPLACEMENT LOSSES	0.21
330-380-1100-0000	VEHICLE REFUELING - SPILLAGE	0.035
Total		0.3219

YSAQMD – 2002 Baseline Emission Inventory (Summer)

EIC Code	EIC Description	VOC/ROG (tpd)
330-374-1100-0000	FUEL DISPENSING TANKS - WORKING LOSSES	0.2431
330-376-1100-0000	FUEL DISPENSING TANKS - BREATHING LOSSES	0.1657
330-378-1100-0000	VEHICLE REFUELING – VAPOR DISPLACEMENT LOSSES	1.3848
330-380-1100-0000	VEHICLE REFUELING - SPILLAGE	0.2293
Total		2.0229

Emission Reductions

There is inadequate information to calculate the potential emission reductions. The air districts will monitor the development of a similar control measure in SCAQMD and determine the potential emission reductions once more information becomes available.

Cost Effectiveness

The air districts will continue to monitor the progress made on the similar control measure proposed in SCAQMD and determine at a later date if the control measure is feasible and cost effective.

Authority

The air districts are authorized to adopt and amend rules and regulations by Health and Safety Code Sections 40001and 40702.

Recommendation

This control measure requires additional information and further studies, and is not recommended at this time. The air districts will continue to monitor the developments of the enhanced detection warnings by SCAQMD and determine the feasibility of this control measure once more information becomes available.

References

Final 2007 AQMP, Appendix IV-A: CM#2007FUG-02, South Coast Air Quality Management District, June 2007.

2007 Ozone Plan, Appendix I: Candidate Control Measures, S-PET-2. San Joaquin Valley Unified Air Pollution Control District, April 30, 2007.

CARB Ozone SIP Planning Inventory, Version 1.06, Sacramento NAA (Rf#980), August 26, 2008

Control Measure Number: Further Study – 5

Control Measure Title: Lubricants

Control Measure Description

The proposed control measure seeks to reduce VOC emissions from the use of lubricants that are utilized by a variety of different industries and new facility processes. Lubricants include product such as coolants in manufacturing processes, stamping fluids, vanishing oils, and cutting, forming, and honing oils, and are used by various companies in the region including, but not limited to machine shops, auto rebuilders, and auto part manufacturers. Many lubricants and their additives, such as rust and corrosive inhibitors, are at least 50 percent VOC solvents and are believed to emit a significant amount of VOCs. In addition, mineral spirits and kerosene used to dilute lubricants contain traces of benzene, toluene, and xylene, which are all classified as Hazardous Air Pollutants (HAPs) by the EPA and Toxic Air Contaminants (TACs) by the state of California.

Currently, there are no regulations or emission restrictions specifically concerned with industrial lubricants in place at the local, state or federal levels. However, South Coast proposed in their Final 2007 AQMP to refine the emission inventory for this category and seek alternatives to high-VOC lubricants. SCAQMD also proposes to develop rules to further seek emission reductions. This control measure proposes to look at further reducing source emissions by either placing an overall emission limit by source, or by limiting VOC content in lubricant formulations at the point of sale and/or use.

Emission Inventory -2018

The emission inventory for this source category is unknown because this source category does not have a specific Emission Inventory Code. Lubricants may be categorized under coating and/or solvent operations.

Emission Reductions

The air districts are not able to calculate the potential emission reductions from this control measure because the emission inventory is unknown.

Cost Effectiveness

The air districts do not have sufficient information to calculate the cost effectiveness of this control measure. The District will continue to monitor the progress made on a similar control measure for lubricants proposed in SCAQMD and determine at a later date if the control measure is feasible and cost effective.

Authority

The air districts have the authority to regulate VOC emissions from industrial coatings and solvent operations, under which industrial lubricants are categorized.

Recommendation

This control measure requires additional information and further studies and is not recommended at this time. The air districts will continue to monitor the progress made on the control measure for lubricants proposed in SCAQMD.

References

Final 2007 AQMP, Appendix IV-A: CM#2007CTS-01, South Coast Air Quality Management District, June 2007.

Control Measure Number: Further Study – 6

Control Measure Title: Episodic Controls (Combination of OFMS-8, OFMS13, OFMS16, OFMS19, OFMS20, OFMS21, OFMS24, OFMS42)

Control Measure Description:

There are various emission reduction strategies that could potentially be implemented on an episodic basis when meteorological conditions would normally result in ozone exceedances. This further study measure will evaluate the feasibility of banning or reducing the use of a variety of types of equipment on high ozone days such as construction equipment, pleasure craft or other recreational vehicles; and lawn and landscaping equipment. As part of this evaluation the potential emission reductions, cost effectiveness, technical feasibility and the authority to implement these measures would be analyzed.

SJVUAPCD has a similar control measure included in their Innovative Technologies section of their plan, but has not ascribed any specific emission reduction commitments to this innovative measure.

Emission Inventory - 2018

Each of these different approaches would affect a different inventory category or different categories.

Emissions Reductions

The air districts are not able to calculate the potential emission reductions from these potential control measures because the mechanisms for achieving the banning or reductions in use have not been identified.

Cost Effectiveness

The air districts do not have sufficient information to calculate the cost effectiveness of any of these potential control measures.

Authority

The implementing agencies would need to be determined for each of the potential control measures.

Recommendation

This control measure requires additional information and further studies and is not recommended at this time. The air districts will continue to monitor the progress made by SJVUAPCD on similar episodic controls that are included in their plan and determine at a later date if this control measure is feasible and cost effective.