

California Environmental Protection Agency  
 **Air Resources Board**

**TECHNICAL SUPPORT DOCUMENT  
FOR PROPOSED AMENDMENTS TO THE  
SUGGESTED CONTROL MEASURE FOR  
ARCHITECTURAL COATINGS**



**September 2007**



**State of California  
AIR RESOURCES BOARD**

**TECHNICAL SUPPORT DOCUMENT  
FOR PROPOSED AMENDMENTS TO THE  
SUGGESTED CONTROL MEASURE FOR  
ARCHITECTURAL COATINGS**

Public Meeting to Consider

**PROPOSED AMENDMENTS TO THE  
SUGGESTED CONTROL MEASURE FOR  
ARCHITECTURAL COATINGS**

To be considered by the Air Resources Board on October 25, 2007

California Environmental Protection Agency  
Headquarters Building  
1001 "I" Street  
Sacramento, California

This report has been prepared by the staff of the Air Resources Board. Publication does not signify that the contents reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.



**State of California  
AIR RESOURCES BOARD**

**TECHNICAL SUPPORT DOCUMENT  
FOR PROPOSED AMENDMENTS TO THE  
SUGGESTED CONTROL MEASURE FOR  
ARCHITECTURAL COATINGS**

**Prepared by:**

**Stationary Source Division  
Air Resources Board**

**Reviewed by:**

**Jim Nyarady, P.E., Manager, Strategy Evaluation Section  
Barbara Fry, Chief, Measures Assessment Branch  
Robert Barham, Ph.D., Assistant Chief, Stationary Source Division  
Robert Fletcher, P.E., Chief, Stationary Source Division**

**September 2007**

## **ACKNOWLEDGMENTS**

This report and the proposed amendments to the Suggested Control Measure for Architectural Coatings were developed by the following Air Resources Board staff:

Monique Spears Davis, P.E.  
Nancy Adams  
Janet Briones  
Nathan Champlin  
Christian Hurley  
Kyle Keene  
Stephanie Lee, Ph.D.  
Camille McCallion  
Lynna Negri  
Sarah Penfield  
Diane Kiyota, J.D.  
Reza Mahdavi, Ph.D.

We would like to extend our appreciation to the following stakeholders for facilitating discussion among industry and governmental representatives:

National Paint and Coatings Association (NPCA)  
Roof Coatings Manufacturers Association (RCMA)  
South Coast Air Quality Management District (SCAQMD)  
California Air Pollution Control Officers Association (CAPCOA)

We also would like to thank those coating manufacturers that met with ARB staff to share specific technical information regarding their products.

**Technical Support Document  
Proposed Amendments to the Suggested Control Measure for  
Architectural Coatings**

**TABLE OF CONTENTS**

**CHAPTER 1 - INTRODUCTION**

<b>Section</b>		<b>Page</b>
1.A.	Background	1-1
1.B.	Why Regulate Architectural Coatings?	1-1
1.C.	Air Quality Standards	1-4
1.D.	Architectural Coatings Regulatory History	1-5
1.E.	References	1-9

**CHAPTER 2 - EMISSIONS & REDUCTIONS**

<b>Section</b>		<b>Page</b>
2.A.	Estimated Emissions from Architectural Coatings	2-1
2.B.	Estimated Emission Reductions from the Proposed SCM	2-4
2.C.	Reactivity	2-8
2.D.	Weight Percent VOC	2-10
2.E.	Limit-to-Limit Reductions	2-12
2.F.	Atmospheric Availability	2-13
2.G.	References	2-14

**CHAPTER 3 – PROPOSED SUGGESTED CONTROL MEASURE**

<b>Section</b>		<b>Page</b>
3.A.	Introduction	3-1
3.B.	Major Proposed Changes	3-1
3.C.	Applicability	3-2
3.D.	Severability	3-2
3.E.	Exemptions	3-2
3.F.	Definitions	3-3
3.G.	Standards	3-4
3.H.	Container Labeling Requirements	3-9
3.I.	Reporting Requirements	3-12
3.J.	Compliance Provisions and Test Methods	3-13
3.K.	References	3-14

**CHAPTER 4 – PROCESS FOR DEVELOPING PROPOSED SCM**

<b>Section</b>		<b>Page</b>
4.A.	2005 Architectural Coatings Survey	4-1
4.B.	Informal Meetings With Districts, U.S. EPA, and Industry	4-1
4.C.	Formal Public Meetings	4-2
4.D.	Evaluation of Other Architectural Coating Rules	4-2
4.E.	Technology Assessment	4-11
4.F.	Laboratory and Field Testing	4-11
4.G.	Environmental Impact Analysis	4-12
4.H.	Economic Analysis	4-13
4.I.	References	4-13

# TABLE OF CONTENTS

Section		Page
	<b>CHAPTER 5 – TECHNICAL ASSESSMENT OF CATEGORIES</b>	
5.0.	Summary of Categories	5-1
5.1.	Aluminum Roof	5-5
5.2.	Basement Specialty Coatings	5-14
5.3.	Bituminous Roof Coating	5-18
5.4.	Bituminous Roof Primer	5-26
5.5.	Bond Breakers	5-29
5.6.	Concrete Curing Compounds	5-32
5.7.	Concrete/Masonry Sealers	5-37
5.8.	Driveway Sealers	5-48
5.9.	Dry Fog	5-51
5.10.	Faux Finishing	5-54
5.11.	Fire Resistive	5-60
5.12.	Flat	5-64
5.13.	Floor	5-70
5.14.	Form Release Compounds	5-74
5.15.	Graphic Arts	5-77
5.16.	High Temperature	5-79
5.17.	Industrial Maintenance	5-82
5.18.	Low Solids	5-93
5.19.	Magnesite Cement	5-95
5.20.	Mastic Texture	5-97
5.21.	Metallic Pigmented	5-100
5.22.	Multi-Color	5-105
5.23.	Nonflat	5-107
5.24.	Nonflat – High Gloss	5-116
5.25.	Pre-Treatment Wash Primers	5-123
5.26.	Primers, Sealers, and Undercoaters	5-125
5.27.	Reactive Penetrating Sealers	5-134
5.28.	Recycled Coatings	5-141
5.29.	Roof Coating	5-144
5.30.	Rust Preventative	5-151
5.31.	Shellacs	5-155
5.32.	Specialty Primers, Sealers, and Undercoaters	5-160
5.33.	Stains	5-166
5.34.	Stone Consolidants	5-175
5.35.	Swimming Pool Coatings	5-179
5.36.	Traffic Marking	5-184
5.37.	Tub and Tile Refinish	5-188
5.38.	Waterproofing Membranes	5-191
5.39.	Wood Coatings	5-195
5.40.	Wood Preservatives	5-212
5.41.	Zinc-Rich Primers	5-215
5.42.	References	5-221

# TABLE OF CONTENTS

<b>Section</b>	<b>Page</b>
<b>CHAPTER 6 – ENVIRONMENTAL IMPACTS</b>	
6.A. Background	6-1
6.B. Analysis of Reasonably Foreseeable Environmental Impacts of the Methods of Compliance	6-1
6.C. Reasonably Foreseeable Feasible Mitigation Measures	6-8
6.D. Alternatives to the Proposed SCM	6-8
6.E. Community Health and Environmental Justice	6-8
6.F. References	6-8
<b>CHAPTER 7 – ECONOMIC IMPACTS</b>	
<b>Section</b>	<b>Page</b>
7.A. Background	7-1
7.B. Summary of Economic Impacts	7-1
7.C. General Approach	7-3
7.D. Sources and Treatment of Cost Data	7-5
7.E. Annual Costs and the Cost-Effectiveness of the Proposed Limits	7-6
7.F. Economic Impacts on Businesses	7-9
7.G. Potential Impacts on California Consumers	7-15
7.H. Mitigation of Potential Impacts through Additional Regulatory Flexibility	7-16
7.I. References	7-16
<b>CHAPTER 8 – FUTURE ACTIVITIES</b>	
<b>Section</b>	<b>Page</b>
8.A. Architectural Coatings Survey	8-1
8.B. Technology Assessments for Proposed Limits	8-1
8.C. Reactivity-Based Limits	8-1
8.D. VOC Test Method Improvement	8-2
<b>APPENDIX A – Proposed Amendments to the Suggested Control Measure for Architectural Coatings</b>	
<b>APPENDIX B – 2000 Suggested Control Measure for Architectural Coatings</b>	
<b>APPENDIX C – Air Quality Standards and Nonattainment Areas</b>	
<b>APPENDIX D – Summary of Current VOC Limits</b>	
<b>APPENDIX E – Emission Reduction Calculation Methodology</b>	
<b>APPENDIX F – SCM Workshop Notices</b>	
<b>APPENDIX G – Economic Analysis Details</b>	

## LIST OF TABLES

<b>Table</b>		<b>Page</b>
Table 1-1	2007 Ozone SIP Commitments For VOC Emission Reductions From Architectural Coating Measures	1-5
Table 1-2	District Architectural Coatings Rules and Populations	1-6
Table 2-1	California Emission Inventory Data	2-1
Table 2-2	Summary Comparison Between 2001 and 2005 Surveys – Statewide Data	2-3
Table 2-3	VOC Emission Reductions By Product Category	2-5
Table 2-4	Comparison of Estimated Emission Reductions From the Proposed SCM and the 2007 Ozone SIP Commitments	2-7
Table 2-5	Complying Marketshare and Number of Complying Products	2-7
Table 2-6	Reactivity and Weight Percent VOC	2-11
Table 3-1	Proposed VOC Content Limits For Architectural Coatings	3-5
Table 3-2	Most Restrictive Limit Exceptions For Specialty Coatings	3-6
Table 4-1	Comparison Between National Rule and Proposed SCM	4-3
Table 4-2	Comparison Between South Coast Rule 1113 and Proposed SCM	4-9
Table 4-3	Test Data That Were Reviewed for the Proposed SCM	4-12
Table 5-1	Draft Proposed SCM VOC Limits	5-2
Table 5-2	SCM Categories That Have Been Removed from the VOC Limits Table	5-4
Tables 5.1-1 to 5.41-2	Survey Data, Complying Marketshare, and Emission Reductions are provided in the Chapter 5 writeup for each coating category	5-8 to 5-235
Table 5.7-1	Summary of Concrete/Masonry Sealer Subcategories	5-42
Table 5.7-4	Summary of AVES Coating Project - Waterproofing Sealers	5-44
Table 5.7-5	UMR Project – Waterproofing Concrete/Masonry Sealers That Were Tested	5-45
Table 5.33-2	Stains – Clear/Semitransparent: Solventborne & Waterborne Data	5-169
Table 7-1	Summary of Economic Impacts	7-3
Table 7-2	2007 Economic Impact Survey Respondents	7-5
Table 7-3	Cost-Effectiveness and Maximum Per-Gallon Cost Increases	7-8
Table 7-4	Cost-Effectiveness of Proposed Limits vs. Similar Control Programs	7-9
Table 7-5	Sales Volume for Compliant and Non-Compliant Coatings in Categories with a Change in VOC Limit (excluding the South Coast AQMD)	7-11
Table 7-6	Changes in Return on Owner’s Equity (ROEs) for Typical Businesses in Architectural Coatings Industry	7-12
Table C-1	Ambient Air Quality Standards for Ozone, PM10, and PM2.5	C-1
Table C-2	2006 State Nonattainment Areas for Ozone, PM10, and PM2.5	C-6
Table C-3	2007 Federal Ozone Nonattainment Areas	C-9

## LIST OF TABLES

<b>Table</b>		<b>Page</b>
Table C-4	2007 Ozone SIP Commitments For VOC Emission Reductions From Architectural Coating Measures	C-12
Table C-5	Comparison of Estimated Emission Reductions From the Proposed SCM and the 2007 Ozone SIP Commitments	C-13
Table D-1	Summary of Architectural Coating Rules and VOC Limits in California	D-1
Table G-1	Survey Data Inputs for Cost Calculations Outside of SCAQMD for Categories with Greater Than .01 TPD Emission Reduction	G-1
Table G-2	Non-Recurring and Recurring Cost from 2007 ARB Economic Impacts Survey	G-3
Table G-3	Raw Material Cost Differential Between Complying and Non-Complying Products	G-4
Table G-4	Calculated Annual Cost	G-5
Table G-5	Calculated Cost-Effectiveness and Cost Increase Per Gallon	G-6
Table G-6	Cost-Effectiveness of Proposed Limits Under Sensitivity Analysis	G-7

## LIST OF FIGURES

<b>Figure</b>		<b>Page</b>
Figure 2-1	Manufacturers' "Overcompliance" With 2000 SCM Limits	2-12
Figure 2-2	Growth of Coating Sales Diminish Actual Reductions	2-13
Figure 5.1-1	Aluminum Roof Coatings: Ozone Reductions From Using Less Reactive Solvents	5-12
Figure 5.1-2	Aromatic Hydrocarbon Solvent Usage vs. VOC Content	5-13
Figure 5.3-1	Bituminous Roof Coatings: Ozone Reductions From Using Less Reactive Solvents	5-25
Figure 5.24-1	Nonflat – Medium Gloss Coatings: Gloss Level vs. VOC	5-122
Figure C-1	2006 Area Designations for State Ambient Air Quality Standard for Ozone	C-3
Figure C-2	2006 Area Designations for State Ambient Air Quality Standard for PM <sub>10</sub>	C-4
Figure C-3	2006 Area Designations for State Ambient Air Quality Standard for PM <sub>2.5</sub>	C-5

## LIST OF ACRONYMS AND ABBREVIATIONS

---

AASHTO	American Association of State Highway and Transportation Officials
ACQ	Alkaline Copper Quaternary
APA	Administrative Procedure Act
APCD	Air Pollution Control District
APEO	Alkylphenol Ethoxylate
APP	Atactic Polypropylene

## LIST OF ACRONYMS AND ABBREVIATIONS

---

AQMD	Air Quality Management District
ARB, Board	Air Resources Board
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
BTU	British Thermal Unit
BUR	Built Up Roof
CAB	Cellulose Acetate Butyrate
Cal/EPA	California Environmental Protection Agency
CalTrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CAS#	Chemical Abstract Service number
CBA	Copper Boron Azole
CCA	Chromated Copper Arsenate
CCAA	California Clean Air Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIE	Comission Internationale de l'Eclairage or International Commission on Illumination
CIWMB	California Integrated Waste Management Board
CRF	Capital Recovery Factor
CRRC	Cool Roof Rating Council
DFT	Dry Film Thickness
DGS	Department of General Services
DNA	Deoxyribonucleic Acid
DTM	Direct To Metal
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EIR	Environmental Impact Report
EPP	Environmentally Preferable Purchasing
EPSA	Essential Public Service Agencies
g O <sup>3</sup> /g product	grams ozone per gram product
HC	Hydrocarbon
HPD	Hybrid Polymer Dispersion
IPE	Innovative Product Exemption
LADCO/MRPO	Lake Michigan Air Directors Consortium/ Midwest Regional Planning Organization
LADWP	Los Angeles Department of Water and Power
LEED	Leadership in Energy and Environmental Design
LEV	Low Emissions Vehicle
MBS	Modified Bitumen Systems
µg/m <sup>3</sup>	Microgram Per Cubic Meter
MIR	Maximum Incremental Reactivity
MPI	Master Painters Institute
MWD	Metropolitan Water District of Southern California
NAICS	North American Industry Classification System

## LIST OF ACRONYMS AND ABBREVIATIONS

---

NCHRP	National Cooperative Highway Research Program
NMP	N-methylpyrrolidone
NPCA	National Paint and Coatings Association
NPDES	National Pollution Discharge Elimination System
NOx	Nitrogen Oxides
NTS	National Technical Systems
OEHHA	Office of Environmental Health Hazard Assessment
OEM	Original Equipment Manufacturer
OFP	Ozone Formation Potential
OSB	Oriented Strand Board
OTC	Ozone Transport Commission
PACT	POTWs Assessing Coating Technology
PCBTF	Parachlorobenzotrifluoride
PD	Protected Data
PIA	Prison Industry Authority
PM	Particulate Matter
PM <sub>2.5</sub>	Particulate Matter that is 2.5 microns or less in diameter
PM <sub>10</sub>	Particulate Matter that is 10 microns or less in diameter
POTW	Publicly Owned Treatment Work
ppm	Parts Per Million
PSU	Primer, Sealer, and Undercoater
PUD	Polyurethane Dispersion
PVC	Polyvinyl Chloride
RCMA	Roof Coatings Manufacturers Association
ROE	Return on Owner's Equity
ROG	Reactive Organic Gas
RWQCB	Regional Water Quality Control Board
SABRC	State Agency Buy Recycled Campaign
SB	Solventborne
SBR	Styrene Butadiene Rubber
SBS	Styrene Butadiene Styrene
SCAP	Southern California Alliance of Publicly-Owned Treatment Works
SCAQMD	South Coast Air Quality Management District
SCM	Suggested Control Measure
SFRM	Spray-Applied Fire-Resistant Material
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SPF	Spray Polyurethane Foam
SPRI	Single Ply Roofing Industry
SPSU	Specialty Primer, Sealer, and Undercoater
STAPPA/ALAPCO	State and Territorial Air Pollution Program Administrators/ Association of Local Air Pollution Control Officials
SWA	Sales-Weighted Average
SWAMIR	Sales-Weighted Average Maximum Incremental Reactivity
SWRCB	State Water Resources Control Board

## **LIST OF ACRONYMS AND ABBREVIATIONS**

---

SWRI	Sealant Waterproofing and Restoration Institute
TAC	Technical Advisory Committee
TBA	Tertiary Butyl Alcohol
TBAc	Tertiary Butyl Acetate
TMPD-MIB	2,2,4-Trimethyl-1,3-Pentanediol Monoisobutyrate
tpd	Tons Per Day
UL	Underwriter's Laboratory
U.S. EPA	United States Environmental Protection Agency
USGBC	United States Green Building Council
UV	Ultraviolet
VAE	Vinyl Acetate Ethylene
VOC	Volatile Organic Compound
WB	Waterborne
WCMS	Waterproofing Concrete/Masonry Sealer
WPS	Waterproofing Sealer
WST	Waterproofing Sealers and Treatments