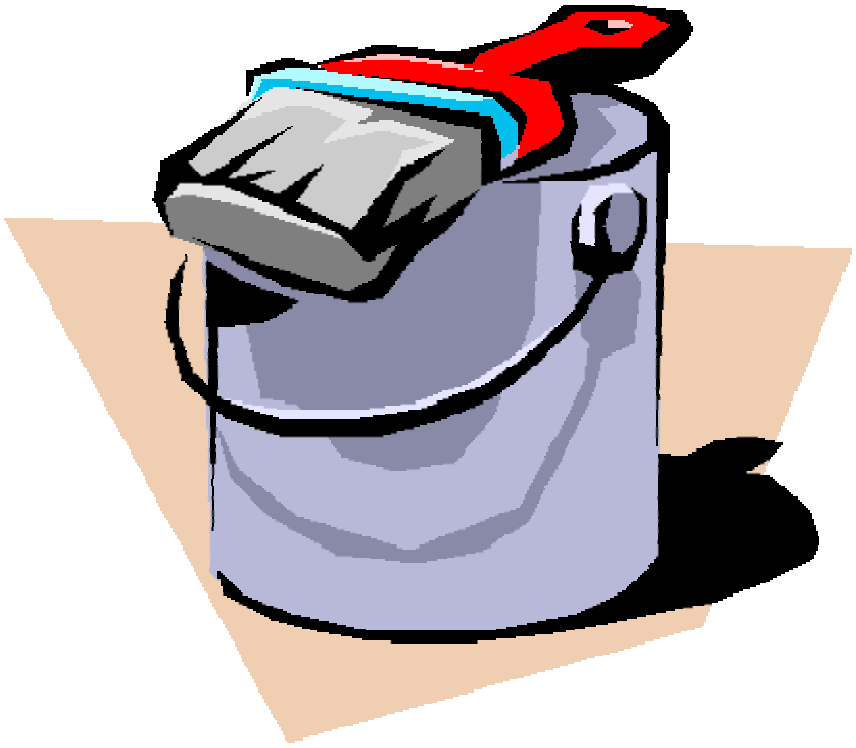
California Environmental Protection Agency

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

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State of California
AIR RESOURCES BOARD

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

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

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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^3/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
$\mu g/m^3$	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
$PM_{2.5}$	Particulate Matter that is 2.5 microns or less in diameter
PM_{10}	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

CHAPTER 1. INTRODUCTION

1.A. BACKGROUND

Architectural coatings are products that are applied to stationary structures and their accessories. They include house paints, stains, industrial maintenance coatings, traffic coatings, and many other products. When these coatings are applied, volatile organic compounds (VOCs) are emitted from the coatings and from solvents that are used for thinning and clean-up.

Control of VOC emissions from architectural coatings is primarily the responsibility of the local air pollution control and air quality management districts (APCD/AQMD or district). The Air Resources Board (ARB or Board) is responsible for serving as an oversight agency and providing assistance to the districts. One way that ARB provides assistance is by developing a Suggested Control Measure (SCM) for architectural coatings. The SCM serves as a model rule that can be used by districts throughout California. ARB approved a Suggested Control Measure (SCM) for architectural coatings in 1977 and, as technology advanced, amended it in 1985, 1989, and 2000. While ARB provides support to the districts by developing the SCM, the districts are ultimately responsible for adopting, implementing, and enforcing architectural coating rules in California.

Currently, 20 districts have architectural coating rules based on the SCM that the Board approved in 2000. In addition, the Ozone Transport Commission (OTC), which represents northeastern states, has developed a model rule for architectural coatings based primarily on the 2000 SCM. Environment Canada has also used the 2000 SCM as the basis for Canada's proposed architectural coatings regulation. The U.S. EPA is planning to update its national architectural coatings rule based on the OTC's version of the 2000 SCM.

The proposed SCM (see Appendix A) will update the current version of the SCM (see Appendix B). The proposed SCM lowers the VOC limits and improves definitions for many categories. Staff is also proposing the SCM to promote consistency and uniformity among district rules. This consistency makes it easier for manufacturers and painting contractors to comply with district rules. In this Technical Support Document, staff presents their rationale for the proposed updates to the 2000 SCM.

1.B. WHY REGULATE ARCHITECTURAL COATINGS?

Architectural coatings represent a significant source of VOC emissions throughout California. VOC emissions from architectural coatings can lead to the formation of ozone and particulate matter (PM), two of the most serious air pollutants in California. Ozone is a strong oxidizer that irritates the respiratory system, leading to a variety of adverse health effects. It also damages plant life

and property. Particulate matter less than 10 microns in diameter can be inhaled deep into the lungs. PM exposure has also been associated with a wide range of adverse health impacts, including hospitalization and premature death.

VOC emissions from architectural coatings use in California are estimated to be about 118 tons per day (tpd) on an annual average basis in 2004. This total includes almost 95 tpd emitted directly from coatings and more than 23 tpd from associated cleanup solvents, thinners, and additives. Total emissions from architectural coatings and associated materials represent almost 10% of the total VOC emissions from stationary and area sources, and almost 5% of all VOC emissions statewide. This 118 tpd is more than the combined VOC emissions from petroleum refining and marketing, and is comparable in size to the emissions from approximately 4.2 million passenger cars (ARB, 2005b; ARB, 2007).

California has extreme air quality problems that require unique strategies for meeting federal and State ambient air quality standards. In this section, we provide an overview of these air quality problems and the need for significant emission reductions from all sources of air pollution, including architectural coatings.

1.B.1. Ozone

In the presence of sunlight, VOCs and nitrogen oxides (NO_x) undergo a series of chemical reactions to form ozone. The rate of ozone generation is related closely to the concentration of VOCs in the atmosphere, the types of VOCs that are present, the availability of NO_x, and meteorological conditions (U.S. EPA, 1996; Seinfeld and Pandis, 1998). Ozone is a colorless gas with a pungent odor, and is the chief component of urban smog. It is one of the State's more persistent air quality problems. Air quality data has revealed that 93 percent of Californians, or 35 million people, live in areas designated as nonattainment for the federal 8-hour ozone standard (ARB, 2006a). In addition, California has six of the top ten areas in the United States with the highest levels of ozone (ARB, 2006b).

It is well documented that ozone adversely affects the respiratory functions of humans and animals. In some animal studies, changes to lung structure were observed with long-term exposure to ozone concentrations above ambient; these changes remained even after periods of exposure to clean air (U.S. EPA, 1996; U.S. EPA, 2006). Ozone is a strong irritant that can cause a number of adverse health effects. Human exposure studies show that 6.6- to 8-hour exposures to ozone at 0.08 ppm can induce acute reduction in lung function, airways inflammation, and symptoms of respiratory irritation such as cough and chest tightness, and increased asthma symptoms (ARB, 1997; ARB, 2000; U.S. EPA, 1996; U.S. EPA 2006). Ozone in sufficient doses can also increase the permeability of lung cells, rendering them more susceptible to toxins and

microorganisms. Other health effects that have been associated with ozone exposure include hospitalization for worsening of pre-existing heart and lung diseases, school absences, and premature death (ARB 2005).

Because the majority of ozone exposure occurs outdoors, the greatest risk is to people who are active outdoors during smoggy periods, such as children, athletes, and outdoor workers. Recent evidence also suggests that ozone may be linked to the onset of new asthma in very active children who reside in high ozone communities (McConnell 2002). Based on 2001 – 2003 data, ozone exposure is estimated to be a contributing factor to 630 premature deaths per year in California (ARB, 2005a).

Not only does ozone adversely affect human and animal health, but it also affects vegetation throughout most of California, resulting in reduced yield and quality in agricultural crops, disfiguration or unsatisfactory growth in ornamental vegetation, and damage and death to native plants. During the summer, ozone levels are often highest in the urban centers in Southern California, the San Joaquin Valley, and the Sacramento Valley. These are adjacent to the principal production areas in the State's multibillion-dollar agricultural industry (USDA, 2006). ARB studies indicate that ozone pollution damage to crops is estimated to cost agriculture over $500 million annually (ARB, 1987; ARB, 2006b).

1.B.2. Particulate Matter

VOC emissions from architectural coatings contribute to the formation of particulate matter (PM). PM is a complex mixture of tiny particles that consists of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. These particles vary greatly in size, shape, and chemical composition, and can be made up of many different materials such as metals, soot, soil, and dust. PM can be emitted directly from sources (e.g., diesel engine exhaust) or can be produced indirectly from sources emitting gases that are converted to PM by atmospheric processes. PM particles that are 10 microns or less in diameter are called "PM_{10}", while particles that are 2.5 microns or less in diameter are called "$PM_{2.5}$". PM, particularly $PM_{2.5}$, contributes significantly to regional haze and reduction of visibility in California. In addition, the acidic portion of PM (nitrates, sulfates) can harm crops, forests, aquatic environments, and other ecosystems (ARB, 2002).

Both PM_{10} and $PM_{2.5}$ can be inhaled deeply into the lungs. Extensive research indicates that exposure to PM is associated with increased risk of: hospitalization for worsening of chronic lung and heart diseases; emergency room and urgent care visits for asthma exacerbation; worsened asthma and bronchitis symptoms; and increased premature death, particularly in elderly people with pre-existing heart and lung disease. Certain populations, including the elderly, people with lung or heart disease, infants, children, and asthmatics, are at increased risk of experiencing adverse effects with exposure to PM. In children, several studies

have shown associations between chronic PM exposure and reduced lung function growth and increased school absenteeism. PM exposure can also lead to increased use of bronchodilator medications in asthmatic children (ARB, 2002).

1.C. AIR QUALITY STANDARDS

To protect California's population from the harmful effects of ozone and PM, the ARB and U.S. EPA have established air quality standards for these contaminants. Most of California's 35 districts are classified as "nonattainment", because they don't comply with State or federal air quality standards for ozone and PM. For nonattainment districts, clean air laws require districts to develop plans to describe how they will attain ambient air quality standards. Appendix C contains a detailed discussion of air quality standards and districts that have been designated as "nonattainment", because they exceed these standards. The California Clean Air Act requires nonattainment districts to prepare and submit plans for attaining and maintaining the State standards. The federal Clean Air Act requires districts to develop state implementation plans (SIPs) if they have not attained federal air quality standards. These SIPs include control measures that explain the districts' plans for adopting new or modified rules to achieve emission reductions.

In many of the nonattainment districts, substantial VOC emission reductions are needed to achieve and maintain air quality standards. Reductions are achieved by implementing rules that target sources of VOC emissions. The proposed SCM for architectural coatings is intended to assist districts by providing a model rule that will reduce VOC emissions and help them attain the ozone and PM standards.

The proposed SCM is primarily intended for the 20 districts that currently have a rule based on the 2000 SCM. In addition, the proposed SCM is intended for districts that may need to adopt a new architectural coating rule to achieve VOC emission reductions and meet air quality standards. The South Coast AQMD is not expected to adopt the proposed SCM because its architectural coatings Rule 1113 includes VOC limits that are, in most cases, at least as stringent as the proposed SCM. The 20 districts with an SCM based rule encompass about 53 percent of California's population, and the South Coast AQMD accounts for 44 percent. The remaining 3 percent of the State's population must comply with the U.S. EPA's national rule for architectural coatings.

Six districts in two federal ozone nonattainment areas included control measures for architectural coatings in their draft or final 2007 Ozone SIPs. These districts are:

- El Dorado AQMD[1]
- Feather River AQMD[1]
- Placer County APCD[1]
- Sacramento Metropolitan AQMD[1]
- San Joaquin Valley Unified APCD[2]
- Yolo-Solano AQMD[1]

1. The Sacramento Federal Ozone Nonattainment Area includes all of Sacramento and Yolo Counties, portions of Placer and El Dorado Counties, eastern Solano County and southern Sutter County.
2. San Joaquin Valley Unified APCD adopted its ozone SIP in April 2007

Table 1-1 lists the 2012 emission reduction commitments for architectural coatings for each of these districts. The numbers in this table represent the districts' goals for emission reductions from architectural coatings. The proposed SCM will help districts surpass these goals by achieving greater reductions than are listed in the districts' SIPs. Chapter 2 contains a discussion of VOC emissions and the expected emission reductions from the proposed SCM.

Table 1-1
2007 Ozone SIP Commitments For VOC Emission Reductions From Architectural Coating Measures

District	Implementation Year	2012 ROG Planning Inventory[2] (tpd)	Emission Reductions in 2012 (tpd)	% Reductions
El Dorado County AQMD[1]	2012	0.38	0.06	16%
Feather River AQMD	Pre-2012	0.02	0.003	15%
Placer County APCD[3]	2013	0.89	0.13	15%
Sacramento Metropolitan AQMD	2012	4.12	0.62	15%
San Joaquin Valley Unified APCD	2012	9.7	2.0	21%
Yolo-Solano County AQMD	2011	0.96	0.14	15%
TOTAL:		**16.1**	**2.95**	**18%**

1. El Dorado County had not yet adopted the 2000 SCM limits at the time that the draft 2007 SIP was developed. Therefore, their SIP Commitment value is actually larger, but for the purpose of this table we are only including the 2007 SCM commitment.
2. The 2012 ROG Planning Inventory is based on ARB's 2001 Architectural Coating Survey and does not reflect the data from ARB's 2005 Architectural Coating Survey that was used to develop the proposed SCM.
3. For Placer County, values represent the 2018 ROG Planning Inventory and the 2018 Emission Reductions.

1.D. ARCHITECTURAL COATINGS REGULATORY HISTORY

1.D.1. ARB's Suggested Control Measure (SCM)

Widespread regulation of emissions from architectural coatings in California began with the approval of the SCM for architectural coatings by the ARB in 1977. Subsequently, many of the districts adopted rules based on this SCM. ARB's SCM was amended in 1985, 1989, and 2000. Many districts adopted or amended their architectural coatings rules after these revisions to the SCM. Districts have also revised their rules independent of changes to the SCM.

Currently, 20 of California's 35 districts have an architectural coatings rule based on the 2000 SCM. The South Coast AQMD has its own architectural coatings rule, Rule 1113. These 20 districts, listed in Table 1-2, encompass about 53% of California's population and the South Coast AQMD accounts for 44%. Therefore, 97% of the State's population has an architectural coating rule that is more stringent than the U.S. EPA's National Architectural Coating Rule (See Section 1.D.4). Appendix D lists the current VOC limits for the 2000 SCM, South Coast AQMD Rule 1113, and the U.S. EPA National Rule.

Table 1-2
District Architectural Coatings Rules and Populations

	District	Architectural Coating Rule	% of State Population
1.	Antelope Valley AQMD	Rule 1113	0.9%
2.	Bay Area AQMD	Rule 8-3	18.8%
3.	Butte County AQMD	Rule 240	0.6%
4.	Colusa County	Rule 2-26	0.1%
5.	Feather River AQMD	Rule 3-15	0.4%
6.	Imperial County APCD	Rule 424	0.4%
7.	Kern County APCD	Rule 410.1	0.3%
8.	Mojave Desert AQMD	Rule 1113	1.2%
9.	Monterey Bay Unified	Rule 426	2.0%
10.	Northern Sonoma County APCD	Rule 485	0.5%
11.	Placer County APCD	Rule 218	0.8%
12.	Sacramento Metropolitan AQMD	Rule 442	3.7%
13.	San Diego County APCD	Rule 67.0	8.3%
14.	San Joaquin Valley Unified APCD	Rule 4601	9.8%
15.	San Luis Obispo County APCD	Rule 433	0.7%
16.	Santa Barbara County APCD	Rule 323	1.1%
17.	Shasta County AQMD	Rule 3-31	0.5%
18.	Tehama County	Rule 4:39	0.2%
19.	Ventura County APCD	Rule 74.2	2.2%
20.	Yolo-Solano AQMD	Rule 2.14	0.9%
			53%

ARB's 2000 SCM incorporated near-term VOC limits from the 1996 and 1999 amendments to SCAQMD's rule. When the ARB developed the 2000 amendments to the SCM, staff prepared a Program Environmental Impact Report (EIR) to ensure that California Environmental Quality Act (CEQA) requirements would be met when districts adopted or revised their architectural coatings rules. Districts referenced the Program EIR in their CEQA documentation and no lawsuits were filed to protest any of the rules that are based on the 2000 SCM. VOC emissions for architectural coatings were approximately 100 TPD in 1996 and they declined to 95 TPD in 2004, excluding emissions from thinning solvents, cleanup solvents, or additives. This decline occurred despite an increase in California's population from 32 million in 1996 to 36.5 million in 2004 (DOF, 2006). During that same time period, California housing units increased from 12 million in 1996 to 13 million in 2004
(U.S. Census, 1999; 2006).

1.D.2. South Coast Air Quality Management District's (SCAQMD) Rule 1113

The South Coast AQMD amended its rule in November 1996 to lower the VOC limits for several coating categories, including flats and lacquers, as well as to add an averaging provision. The South Coast AQMD also increased the VOC limits for other coating categories and reinstated higher VOC limits. These amendments implemented Phase I of the District's plan for reducing VOC emissions from architectural coatings.

The South Coast AQMD amended its rule again in May 1999 to implement Phase II of the District's plan for reducing VOC emissions from architectural coatings, and to readopt limits negated in 1990. These amendments lowered VOC limits for many categories and significantly amended the averaging provision. Several industry groups filed lawsuits challenging the 1999 amendments based on various legal challenges. These lawsuits were consolidated into one matter before the court and South Coast AQMD prevailed in the district court. The ruling was appealed on June 24, 2002, and the Court of Appeal of the State of California Fourth Appellate District, Division Three, reversed the lower court's decision stating that the 1999 amendments were not properly adopted. It directed the district court to issue a rule of mandate to the AQMD to vacate the 1999 amendments (SCAQMD, 2002).

The South Coast AQMD has amended its rule five times since ARB adopted its 2000 SCM. The July 2001 amendment added a category for clear brushing lacquers at a VOC limit of 680 g/l in response to industry's argument that formulating a brushing lacquer at a lower VOC content was not technically feasible at that time. The VOC content of brushing lacquers was required to be reduced to 275 g/l by January 1, 2005 (SCAQMD, 2001). The December 2002 amendments re-adopted most of the 1999 amendments that were vacated in 2002. South Coast AQMD clarified the language to reflect the original intent and to address some ARB and U.S. EPA issues (SCAQMD, 2002). The December 2003 amendments implemented Phase III of the District's plan to reduce VOC emissions from architectural coatings. These amendments lowered the VOC limits of varnishes and sanding sealers, roof coatings, waterproofing sealers, and exterior stains, and set a phase-out date for the small container exemption for clear wood finishes. It also expanded the scope of the Averaging Compliance Option to include categories whose VOC limits were changing (SCAQMD, 2003). The July 2004 amendments clarified the recordkeeping requirements of the Averaging Compliance Option to address U.S. EPA concerns (SCAQMD, 2004). The last amendment in June 2006 clarified the definitions of several coating categories, exempted Tert-Butyl Acetate (TBAC) for use in industrial maintenance coatings, lowered the VOC limits for concrete curing compounds, dry-fog coatings, and traffic coatings, and set interim limits for nonflat high gloss, quick dry enamels, and specialty primer/sealer/undercoaters (SCAQMD, 2006).

The National Paint and Coatings Association (NPCA) sued South Coast AQMD in January 2004 asking for a writ of mandate to vacate the 2003 amendments to their rule. They alleged that the South Coast AQMD's rulemaking "was in excess of its authority", violated CEQA, and failed to adequately consider the socio-economic impacts. This matter was moved from Orange County Superior Court to the United States District Court-Central District of California and back to the State court early in 2004. NPCA was granted a motion in December 2004 to consolidate this case with a previous case challenging the technical feasibility and CEQA compliance of South Coast AQMD's 2002 amendments. The State court granted South Coast AQMD's motion to dismiss the CEQA claims in 2005. In 2006, the Ninth Circuit court returned the case to the U.S. District Court. The district court denied the writ of mandate in May 2007 stating that South Coast AQMD provided sufficient evidence that the limits were attainable and that they adequately considered the socio-economic impacts of the amendments (USDC-CDC, 2007).

1.D.3. Other States' Rules

In October 2000, the State and Territorial Air Pollution Program Administrators/ Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) issued a model rule identical to ARB's 2000 SCM. The adoption of this rule was recommended for all states or local districts with the caveat that certain local conditions may not warrant the adoption of some of the SCM limits (STAPPA/ALAPCO, 2000).

The Ozone Transport Commission (OTC) adopted the STAPPA/ALAPCO model rule as its model rule in 2002 with some modifications. They set the VOC limit effective dates for January 1, 2005 to provide sufficient lead time for manufacturers. They also implemented a 340 g/l limit for industrial maintenance coatings rather than the 250 g/l, citing the need for a higher limit due to possible performance issues in the northeast, and modified the sell-through provision to allow for unlimited sell-through. They also created separate categories for conversion varnishes, concrete surface retarders, thermoplastic rubber and mastic coatings, calcimine recoaters, nuclear coatings, and impacted immersion coatings, with limits identical to those in the U.S. EPA National Rule, and exempted the latter four categories from the Most Restrictive VOC Limits provision (OTC, 2002). They intend to modify their model rule as appropriate for their local conditions based on the limits in this proposed SCM (OTC, 2007). Lake Michigan Air Directors Consortium/Midwest Regional Planning Organization (LADCO/MRPO) plans to adopt OTC's model rule in 2007, which would incorporate changes from this current SCM (LADCO/MRPO, 2006; OTC, 2007).

1.D.4. U.S. EPA's National Architectural Coatings Rule

In the 1990 Clean Air Act Amendments, the U.S. Congress enacted section 183(e), which established a new regulatory program for controlling VOC

emissions from consumer and commercial products. Section 183(e) directs the U.S. EPA Administrator to determine the ozone-forming potential of these products, and to prioritize the need for regulation of these products. Architectural coatings were in the first group of products to be regulated.

The U.S. EPA proposed a draft rule in June 1996 that established specific VOC limits for various categories of architectural coatings. The national architectural coatings rule was finalized in September 1998. The National Rule went into effect throughout the country, including all California districts, on September 13, 1999.

The National Rule contains over 20 categories that are not typically included in district rules. Almost all of the VOC limits listed in the National Rule are less stringent than those of the 2000 SCM. In addition, for many of the categories that are in both the district rules and the National Rule, the National Rule has definitions that differ significantly from those of the district rules. The applicable VOC limits in the National Rule are listed in Appendix D and are compared to the proposed SCM in Chapter 4.

The U.S. EPA is planning to update its national architectural coatings rule in 2007. The limits proposed in that update are expected to reflect those limits found in the 2002 OTC model rule (Page, 2007).

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CHAPTER 2. EMISSIONS & REDUCTIONS

2.A. ESTIMATED EMISSIONS FROM ARCHITECTURAL COATINGS

VOC emissions from the use of architectural coatings in California are estimated to be about 118 tons per day (tpd) on an annual average basis in 2004. Of this total, the South Coast AQMD accounts for 52 tons per day. The statewide total includes almost 95 tpd emitted directly from coatings and about 23 tpd from associated cleanup solvents, thinners, and additives. As shown in Table 2-1, total emissions from architectural coatings and associated materials represent almost 10 percent of the total VOC emissions from stationary and area sources, and almost 5 percent of all VOC emissions statewide. The VOC emissions from architectural coatings are more than the combined VOC emissions from petroleum refining and marketing, and are comparable to the emissions from approximately 5 million passenger cars. Detailed emissions data for individual coating categories are provided in Chapter 5.

Table 2-1
California Emission Inventory Data

Category	2004 VOC Emissions (tons/day, annual average)
Stationary Sources	
Fuel Combustion	45
Waste Disposal	22
Cleaning and Surface Coatings	222
Petroleum Production and Marketing	
Oil and Gas Production	49
Petroleum Refining	22
Petroleum Marketing	84
Industrial Processes	61
Area-Wide Sources	
Consumer Products	253
Architectural Coatings & Related Process Solvent	**118**
Pesticides/Fertilizers	55
Asphalt Paving/Roofing	32
Residential Fuel Combustion	56
Farming Operations	118
Fires	1
Managed Burning and Disposal	78
Cooking	6
Mobile Sources	1,299
Total – All Sources	**2,521**

Note:
Emissions data for architectural coatings are from the ARB 2005 Architectural Coating Survey (ARB, 2006). The remaining data are from ARB Almanac 2005 Table 2-1 and Table 2-2, which do not reflect the results from the ARB 2005 Architectural Coating Survey (ARB, 2005).

Emissions from architectural coatings are estimated from surveys of architectural coatings sales in California. ARB has conducted eight surveys over the past

30 years which collected sales and emissions data for coatings sold in California in 1975, 1980, 1984, 1988, 1990, 1996, 2000, and 2004.

In 2005, ARB conducted a survey to collect data on architectural coatings sold during calendar year 2004 (ARB, 2006). Almost 900 survey packages were mailed to companies that potentially sold architectural coating products in California. In some cases, multiple survey packages were sent to a company to ensure that all of the appropriate divisions and subsidiaries were informed of the survey requirements. We received responses from 57 percent of the mailouts, either survey data or a form to explain why they were not submitting data. Reasons for not submitting data included:

- They did not have any sales of architectural coatings in California during 2004;
- They did not manufacture architectural coatings; or
- Their sales were to be reported by another company.

Data were submitted for approximately 30 percent of the surveys that were mailed out. To ensure that these data were representative of the California market, ARB staff compared the sales from our survey to nationwide census data. Since California represents 12 percent of the nationwide population, we assumed that California shipments were approximately equal to 12 percent of the nationwide sales for architectural coatings and we found that our survey total is actually greater than the estimate based on census data. Therefore, staff believes the survey captures virtually all of the California sales of architectural coatings.

In many cases, parent companies submitted data for multiple divisions or for subsidiaries. When compiling our summary list of companies, we consolidated all submittals under one company name. In summary, a total of 197 companies submitted data. This represents an increase when compared to the previous five ARB surveys (conducted in 2001, 1998, 1993, 1989, 1985), that had an average of 156 companies responding with data. Approximately 11 percent of the companies on the mailing list had their surveys returned as undeliverable because they had changed their mailing addresses, changed company names, or had gone out of business. Thirty-two percent (32%) did not send in data or an explanation for their nonsubmittal. Draft survey data were compiled in a report that was made available for public review in September 2006.

Table 2-2 compares the ARB survey results for architectural coatings sold in 2000 and 2004. The sales volume for architectural coatings increased from more than 98 million gallons in 2000, to more than 110 million gallons in 2004. However, the total VOC emissions for architectural coatings decreased from 110 to 95 tpd from 2000 to 2004, due to implementation of rules with lower VOC limits. These emissions quantities do not include emissions from thinning solvents, cleanup solvents, or additives. The survey data indicate that architectural coatings in California are continuing to shift toward waterborne

products. From 2000 to 2004, the percent of total sales volume attributed to waterborne coatings increased from 83 to 88 percent. During this same time period, the architectural coating emissions per capita and the average amount of VOCs per gallon of coating decreased more than 20 percent. These declines occurred despite the fact that California's population increased 7 percent and housing units increased 5 percent from 2000 to 2004.

Table 2-2
Summary Comparison Between 2001 and 2005 Surveys – Statewide Data

	2001 Survey (2000 Sales, including quarts)	2005 Survey (2004 Sales, including quarts)	Percent Change
COATING SALES VOLUME DATA			
Total Sales Volume Reported (gallons)	**98,455,172**	**110,407,721**	**12%**
Waterborne Coating Sales Volume	81,548,961	97,354,686	19%
Solventborne Coating Sales Volume	16,906,211	13,053,035	-23%
Percent Waterborne Sales	83%	88%	
Percent Solventborne Sales	17%	12%	
Coating Sales Volume Per Capita (gals per person)	2.9	3.1	
EMISSIONS DATA – COATINGS ONLY			
Total Coating Emissions (tons/day)	**110**	**95**	**-14%**
Waterborne Coating Emissions	45.5	45.7	0%
Solventborne Coating Emissions	64.2	49.0	-24%
Percent Waterborne Emissions	41%	48%	
Percent Solventborne Emissions	59%	52%	
Emissions per capita (lbs VOC emitted per person)	2.4	1.9	
Emission Factor - Coatings Only (lb VOC/gal)	**0.81**	**0.63**	**-23%**
Waterborne Coating Emission Factor	0.41	0.34	-16%
Solventborne Coating Emission Factor	2.77	2.74	-1%
EMISSIONS DATA – COATINGS, SOLVENTS & ADDITIVES			
Grand Total Emissions (tons/day)	**128**	**118**	**-8%**
Waterborne Coating Emissions	45.5	45.7	0%
Solventborne Coating Emissions	64.2	49.0	-24%
Thinning/Cleanup/Additive Emissions	18.5	23.6	27%
Percent Waterborne Emissions	35%	39%	
Percent Solventborne Emissions	50%	41%	
Percent Thinning/Cleanup/Additive Emissions	14%	20%	
Emissions per capita (lbs VOC emitted per person)	2.8	2.4	
Emission Factor with Thinning/Cleanup/Additives (lb VOC/gal coating)	**1.0**	**0.8**	**-18%**

Notes:

1. For the 2001 Survey, VOC emissions totals included emissions from:
   a) thinning solvents added to solventborne coatings; and
   b) cleanup solvents used for solventborne coatings only.
2. For the 2005 Survey, VOC emissions totals included emissions from:
   a) thinning solvents added to solventborne coatings;
   b) cleanup solvents used for both solventborne and waterborne coatings; and
   c) additives in waterborne coatings.
3. CA Population in 2000 = 34,099,000 (DOF, 2006); CA Housing Units in 2000 = 12,244,704 (U.S. Census, 2006)
4. CA Population in 2004 = 36,506,000 (DOF, 2006); CA Housing Units in 2004 = 12,807,257 (U.S. Census, 2006)
5. Emissions data are on an "Annual Average" basis.

Between 2000 and 2004, California's population climbed 7 percent and housing units increased 5 percent, which averages out to an annual growth rate of 1 to 2 percent per year. However, it appears that the growth rate in population lags behind the growth in architectural coating sales, both in California and nationwide. From 2000 to 2004, California's coating sales increased 12 percent, an average growth rate of 3 percent per year. Also, from 2000 to 2004, nationwide sales of architectural coatings increased 24 percent, an average growth rate of 6 percent per year (U.S. Census, 2005). This is similar to the difference in growth rates that occurred between 1996 and 2000, prior to implementation of the current VOC limits. From 1996 to 2000, California's population increased 5 percent while California's coating sales increased 13 percent. These trends seem to indicate that the growth in population and housing can be significantly less than the actual growth in coating sales.

2.B. ESTIMATED EMISSION REDUCTIONS FROM THE PROPOSED SCM

Because the proposed SCM is intended for districts outside of the South Coast AQMD, the estimated emission reductions exclude the South Coast AQMD. In addition, emission reductions are only calculated for large containers, because small containers (one liter or less) are exempt from the proposed VOC limits. In 2004, these small containers only represented three percent of architectural coating sales volume in California.

The baseline for determining emission reductions is the 2004 data from ARB's survey. For architectural coatings, the 95 tpd of statewide VOC emissions are apportioned to districts based on population. Districts outside of the South Coast AQMD represent 56 percent of the State's population which equates to 53 tpd of VOC emissions, including small containers. This does not include VOC emissions from cleanup solvents, thinners, or additives.

As shown in Table 2-3, the proposed SCM is expected to achieve 15.2 tpd in VOC emission reductions outside of the South Coast AQMD. This represents a 28 percent overall emission reduction. Table 2 only lists categories for which staff is proposing lower VOC limits. Although there are emission reductions from 19 categories, 95 percent of the emission reductions are from nine categories, which account for 80 percent of the emissions. These nine categories are highlighted in boldface in Table 2-3.

Table 2-3
VOC Emission Reductions By Product Category
(Large containers only, excluding the South Coast AQMD)

Coating Category	Existing VOC Limit (g/l)	Proposed VOC Limit (g/l)	Emissions in 2004 (excluding SCAQMD)[1] (tons/day)	Emission Reductions (excluding SCAQMD)[2] (tons/day)
Aluminum Roof	500	400	1.10	0.19
Basement Specialty Coating	400	400	0.01	0.00
Bituminous Roof	300	50	0.23	0.17
Bituminous Roof Primer	350	350	0.13	0.00
Bond Breakers	350	350	0.09	0.00
Concrete Curing Compounds	350	350	0.25	0.00
Concrete/Masonry Sealer	**250-400 [3]**	**100**	**1.12**	**0.54**
Driveway Sealer	100	50	0.02	0.00
Dry Fog	**400**	**150**	**0.46**	**0.31**
Faux Finishing	350	350	0.11	0.00
Fire Resistive	350	350	0.01	0.00
Flat	**100**	**50**	**7.59**	**3.12**
Floor	250	100	0.39	0.07
Form Release Compounds	250	250	0.45	0.00
Graphic Arts	500	500	0.00	0.00
High Temperature	420	420	0.02	0.00
Industrial Maintenance	250	250	2.34	0.00
Low Solids	120	120	0.02	0.00
Magnesite Cement	450	450	0.05	0.00
Mastic Texture	300	100	0.29	0.10
Metallic Pigmented	500	500	0.05	0.00
Multi-Color	250	250	0.00	0.00
Nonflat - High Gloss	**250**	**150**	**3.00**	**0.91**
Nonflat	**150**	**100**	**10.42[4]**	**2.77[4]**
Pre-Treatment Wash Primer	420	420	0.00	0.00
Primer, Sealer, and Undercoater	**200**	**100**	**3.98**	**1.12**
Reactive Penetrating Sealer	250-400 [3]	350	0.01	0.00
Recycled	250	250	0.00	0.00
Roof	250	50	0.22	0.07
Rust Preventative	**400**	**250**	**3.44**	**1.57**
Shellacs – Clear	730	730	0.14	0.00
Shellacs – Opaque	550	550	0.44	0.00
Specialty Primer, Sealer, and Undercoater	**350**	**100**	**3.40**	**2.62**
Stains	250	250	2.14	0.00
Stone Consolidant	100-400 [3]	450	0.00	0.00
Swimming Pool	340	340	0.03	0.00
Traffic Marking	150	100	0.93	0.09
Tub and Tile Refinish	100-250 [3]	420	0.00	0.00
Waterproofing Membranes	250-400 [3]	250	0.65	0.09
Wood Coatings	**250-680 [3]**	**275**	**3.52**	**1.41**
Wood Preservatives	350	350	0.32	0.00

Table 2-3
VOC Emission Reductions By Product Category
(Large containers only, excluding the South Coast AQMD)

Coating Category	Existing VOC Limit (g/l)	Proposed VOC Limit (g/l)	Emissions in 2004 (excluding SCAQMD)[1] (tons/day)	Emission Reductions (excluding SCAQMD)[2] (tons/day)
Zinc-Rich Primer	500	340	0.04	0.01
Total			**47.4**	**15.2**

Notes:
1. This table does not include emissions for the South Coast AQMD, which represents 44% of California's population. It also does not include emissions from small containers or emissions from thinning, cleanup, or additives.
2. This table does not include emission reductions for the South Coast AQMD, which represents 44% of California's population.
3. This is a proposed new category that includes coatings from various categories in the 2000 SCM. The "Existing VOC Limit" for this category represents the range of VOC limits for the coatings that were combined into this new category.
4. Upon the effective date of this rule, the Fire Retardant coating categories are eliminated and coatings with fire retardant properties will be subject to the VOC limit of their primary category (e.g., Flat, Nonflat, etc.). For the purposes of estimating emission reductions, it was assumed that Fire Retardant would be classified as Nonflat with a VOC limit of 100 g/l.
5. Boldface indicates the nine categories that account for 95 percent of the VOC emission reductions.

The emissions reductions in Table 2-3 are based on annual average data from 2004. Appendix E contains a detailed explanation of the methodology that was used to calculate emissions and emission reductions. To predict future emission reductions after the proposed SCM is implemented, ARB and district staff will "grow" the emission reductions by using established growth factors that depend on the demographic data for a given district. In addition, the reductions will be adjusted to represent average summer emissions, rather than annual average emissions. The emissions data used in ozone attainment plans (or SIPs) are usually presented as average summer emissions, since the peak ozone season in California is typically the summer. Also, the estimated emissions on an average summer day are greater than on an average annual day because more painting is done in May through October than the rest of the year, due to weather conditions. Annual average daily emissions spread out these higher summer emissions evenly throughout the year.

As shown in Table 2-3, ARB staff expects the proposed SCM to achieve about 15 tpd of emission reductions for districts outside of the South Coast AQMD. In Chapter 1, staff summarized the emission reduction goals for six districts that have SIP commitments related to architectural coatings. ARB staff has determined that the expected reductions from the proposed SCM will exceed the quantity needed by these six districts. As shown in Table 1-1, the districts have established a goal of achieving about 3 tpd of emission reductions in 2012. ARB staff estimates that the proposed SCM would achieve more than 4 tpd for these six districts, based on 2004 data. Table 2-4 illustrates the approach used to estimate emission reductions for the districts.

As shown in Table 2-4, staff estimated reductions for individual districts by using district population percentages. Each district is assigned a portion of the statewide emissions (95 tpd), based on their population percentage. ARB staff

then used information from district SIPs to determine their percentage reduction goals. For the non-SCAQMD portion of the State, which represents 56 percent of the population, total emission reductions are expected to be 15.2 tpd. ARB staff apportioned this 15.2 tpd to the districts, based on population, and found that the emission reductions from the SCM are estimated to be about 4.4 tpd for the six districts with SIP commitments and about 10.8 tpd from the remaining non-SCAQMD districts.

Table 2-4
Comparison of Estimated Emission Reductions From the Proposed SCM and the 2007 Ozone SIP Commitments

	[A]	[B] =[A]*[95 tpd]	[C]	[D] = [B]*[C]	[E] = [A]/[56%]	[F] =[E]*[15.2 tpd]
Districts with SIP Commitments	**% of CA Population[2]**	**Emission Inventory (TPD in 2004)[3]**	**SIP Commitment (%)**	**SIP Commitment (TPD in 2004)**	**% of Total SCM Reductions**	**Reductions From SCM (TPD in 2004)**
El Dorado (part)[1]	0.50%	0.48	16%	0.08	0.89%	0.14
Feather River	0.40%	0.38	15%	0.06	0.71%	0.11
Placer County	0.80%	0.76	15%	0.11	1.43%	0.22
Sacramento Metro	3.70%	3.52	15%	0.53	6.61%	1.00
San Joaquin	9.80%	9.31	21%	1.96	17.50%	2.66
Yolo-Solano	0.90%	0.86	15%	0.13	1.61%	0.24
TOTAL:	**16.1%**	**15.3**		**2.9**		**4.4**

1. El Dorado County had not yet adopted the 2000 SCM limits at the time that the draft 2007 SIP was developed. Therefore, their SIP Commitment value includes reductions from the 2000 SCM and the proposed 2007 SCM.
2. The "% of CA Population" may not represent the entire district population. For some districts in the Sacramento Nonattainment Area, only a portion of the district population is included for SIP planning purposes.
3. Emission Inventory data are based on data from ARB's 2005 Architectural Coating Survey. These data are for coatings only and do not include emissions from thinning solvents, cleanup solvents, or additives. Statewide emissions are 95 tpd, including the South Coast AQMD.

In addition to estimating emission reductions, ARB staff also used 2004 sales data to determine the portion of the market that complies with the VOC limits in the proposed SCM. Table 2-5 lists the complying marketshare, which represents the percentage of the 2004 sales volume that complies with the proposed VOC limits. The table also lists the number of complying products. Table 2-5 only includes coating categories whose VOC limit would decrease with the proposed SCM. Complying marketshares for all categories are provided in Chapter 5.

Table 2-5
Complying Marketshare and Number of Complying Products

Coating Category	Existing VOC Limit (g/l)	Proposed VOC Limit (g/l)	Complying Marketshare	# of Complying Products
Aluminum Roof	500	400	31%	13
Bituminous Roof	300	50	90%	35
Concrete/Masonry Sealer	250-400 [1]	100	41%	133
Driveway Sealer	100	50	100%	38
Dry Fog	400	150	42%	27
Flat	100	50	7%	358

Table 2-5
Complying Marketshare and Number of Complying Products

Coating Category	Existing VOC Limit (g/l)	Proposed VOC Limit (g/l)	Complying Marketshare	# of Complying Products
Floor	250	100	85%	168
Mastic Texture	300	100	79%	40
Nonflat - High Gloss	250	150	28%	94
Nonflat	150	100	28%	958
Primers, Sealers, and Undercoaters	200	100	36%	310
Reactive Penetrating Sealer	250-400	350	93%	20
Roof	250	50	83%	112
Rust Preventative	400	250	3%	52
Specialty Primers, Sealers, and Undercoaters	350	100	22%	25
Traffic Marking	150	100	74%	158
Waterproofing Membranes	250-400 [1]	250	68%	24
Wood Coatings	250-680 [1]	275	50%	307
Zinc-Rich Primer	500	340	54%	30

1. This is a proposed new category that includes coatings from various categories in the 2000 SCM. The "Existing VOC Limit" for this category represents the range of VOC limits for the coatings that were combined into this new category.

2.C. REACTIVITY

Traditionally, VOC limits for coatings have been based on the total VOC content in the coating, regardless of the chemical composition of the VOCs. Although a few compounds are excluded from the VOC content because they are designated as "exempt compounds", all other VOCs are treated equally when determining the VOC content of a coating. Mass-based VOC limits have been successfully used for many years to achieve VOC emission reductions.

However, VOCs don't necessarily behave the same when they are emitted into the atmosphere. Since VOCs have differing molecular structures, they may form ozone through varying chemical reactions at varying rates. This characteristic is called reactivity. A relative reactivity scale (the maximum incremental reactivity scale) was developed by Dr. William Carter to rank VOCs based on their tendency to form ozone (Carter, 1994). Each VOC in this scale is assigned an "ozone formation potential" value based on smog chamber studies or by comparison with similar VOCs. Such a relative reactivity scale is used in the ARB's existing Low Emissions Vehicle (LEV) program. This regulation first used the MIR scale to determine the ozone forming potential of vehicle exhaust by utilizing reactivity adjustment factors. By making a reactivity adjustment to the emissions, an alternatively fueled vehicle is able to emit more mass emissions, as long as they are less reactive than those from a gasoline fueled vehicle. ARB's Reformulated Gasoline program also uses the MIR scale to allow tradeoffs between various emission processes on a reactivity-adjusted basis.

In 2000, ARB staff used reactivity to develop the statewide aerosol coatings regulation, which includes reactivity-based limits instead of mass-based limits.

This reactivity-based approach was implemented because ARB staff determined that aerosol coatings had achieved the maximum reductions technically feasible with a mass-based approach. This approach was supported by the aerosol coatings industry and the regulation is being implemented and enforced by ARB staff. Since aerosol coatings are subject to a statewide ARB regulation, all of the aerosol coatings in California must comply with the same limits and the same requirements. For architectural coatings, this is not the case. Local air districts are responsible for controlling VOC emissions from architectural coatings, and three different sets of VOC limits apply in California, depending on which district has jurisdiction.

When the Board approved the SCM in 2000, they directed staff to investigate the use of a reactivity-based approach for architectural coatings. ARB staff has conducted detailed analyses to explore the potential for including reactivity-based limits in the SCM. Staff has published reports on reactivity analyses using the 2000 survey data and the 2004 survey data (ARB, 2005; ARB, 2007).

In the Summer of 2006, ARB staff met with the districts and the U.S. EPA to discuss a potential reactivity-based approach. Since districts are responsible for architectural coatings rules, district personnel would be responsible for enforcing reactivity-based limits. Districts expressed concerns that implementation of a reactivity-based rule would require additional resources for enforcement. If district personnel wanted to determine the reactivity of a product for enforcement purposes, they would need to obtain detailed chemical formulation data to identify all of the volatile ingredients contained in the product. They would then need to identify the appropriate maximum incremental reactivity (MIR) value for each of these ingredients, so they could calculate the overall reactivity for the product. District personnel would also need to develop a system for updating MIR values to accommodate changes that result from research studies. Verifying compliance with a mass-based limit requires fewer resources, because it only involves a relatively simple measurement of total VOCs. Many districts do not have the resources to enforce a reactivity-based architectural coatings rule.

The South Coast AQMD staff in particular commented that they did not support reactivity-based architectural coating limits at this time, citing the increased resources and their belief that more research needs to be done. They also commented that reactivity-based limits are premature at this time. They believe that such limits should only be explored for achieving ozone reductions beyond their mass-based limits, which in some cases are more stringent than those in the proposed SCM (SCAQMD, 2006).

Only some industry representatives have been supportive of a reactivity-based approach. ARB staff met with industry groups in the Spring and Fall of 2006 to discuss reactivity. In addition, ARB conducted several meetings with individual coating manufacturers and raw material suppliers to discuss their concerns. No

consensus regarding reactivity-based limits could be achieved among coating manufacturers.

Another option that ARB staff considered was a rule that contained mass-based VOC limits, but included a flexibility option based on reactivity. In Spring 2007, the National Paint and Coatings Association (NPCA) suggested that an Innovative Product Exemption (IPE) for reactivity be included in the SCM. ARB's consumer products regulation contains an IPE for mass-based VOC limits, but this regulation is implemented and enforced by ARB staff. If an IPE flexibility provision were included in an architectural coating rule, district personnel would be responsible for implementation and enforcement.

NPCA proposed language for an IPE exemption in July 2007. Under the NPCA proposal, coating manufacturers could sell products that exceed mass-based VOC limits, if the products had a lower reactivity than a representative product that complied with the mass-based VOC limit. For each product submitted for an exemption, district personnel would need to determine the reactivity of the noncompliant product, identify a representative compliant product, and compare the reactivity of the two products. District personnel would also need to develop enforceable conditions for each exemption (e.g., laboratory test methods, reporting requirements, etc.). The U.S. EPA expressed concerns about how a reactivity-based IPE provision would be enforced, and about potential complications that could result from case-by-case, reactivity-based limits that might be adopted by one air district and not a neighboring district.

ARB staff concluded that many districts have insufficient resources to implement and enforce reactivity-based limits or the IPE provision, and that the U.S. EPA had concerns regarding the implementation and enforcement of the IPE provision. Based upon the lack of district resources, U.S. EPA's response, and the lack of industry consensus, staff decided to propose mass-based VOC limits. The proposed mass-based limits provide significant emission reductions and will be easier for the districts to implement and enforce. In addition, the districts have existing variance rules that can provide flexibility for coating manufacturers.

Even though staff is not proposing a reactivity-based approach at this time, the staff recognizes that reactivity-based regulations for this category may play a role in the future. Consequently, ARB staff will continue to work with industry, districts, and other stakeholders to explore a reactivity-based approach for architectural coatings.

2.D. WEIGHT PERCENT VOC

Architectural coatings are regulated on the basis of VOC content in units of grams per liter, less water and exempt compounds. For aerosol coatings, products are regulated on the basis of reactivity in units of grams ozone per gram product, with a maximum limit of 2.7 grams ozone per gram product. For

consumer products, items are regulated on the basis of percent VOC by weight, with a maximum of 85 percent. In the 2000 SCM, VOC limits for architectural coatings ranged from 100 g/l to 730 g/l which may seem relatively high when compared to a reactivity-based limit or a VOC limit that is expressed in weight percent. In reality, architectural coatings generally have a lower reactivity than aerosol coatings and a lower VOC weight percent than consumer products, but this may not be apparent based on the way VOC content is expressed. Therefore, ARB staff analyzed the sales-weighted average maximum incremental reactivity (SWAMIR) and the VOC weight percent for architectural coatings. These data are summarized in Table 2-6 and detailed data are provided in the survey report and the reactivity analysis report (ARB, 2006; ARB, 2007). This table only includes categories with lower proposed VOC limits. For the categories that have the highest sales volumes (Flat; Nonflat; and Primers, Sealers, and Undercoaters), the weight percent VOC is currently four percent or less.

Table 2-6
Reactivity and Weight Percent VOC

Coating Category	Existing Reactivity/ SWAMIR (g ozone/ g coating)	Existing VOC Weight Percent[1]	Existing VOC Limit (g/l)	Proposed VOC Limit (g/l)
Aluminum Roof	N/A [2]	N/A [2]	500	400
Bituminous Roof	0.08	2	300	50
Concrete/Masonry Sealer [3]	0.20-0.40	9-12	250-400	100
Driveway Sealer	0.00	0.2	100	50
Dry Fog	0.29	13	400	150
Flat	0.06	2	100	50
Floor	0.37	13	250	100
Mastic Texture	0.09	5	300	100
Nonflat - High Gloss	0.15	6	250	150
Nonflat	0.10	4	150	100
Primers, Sealers, and Undercoaters	0.12	4	200	100
Reactive Penetrating Sealer	0.20-0.40	9-12	250-400	350
Roof	0.06	2	250	50
Rust Preventative	0.54	30	400	250
Specialty Primers, Sealers, and Undercoaters	0.36	19	350	100
Traffic Marking	0.11	4	150	100
Waterproofing Membranes [3]	0.20-0.40	9-12	250-400	250
Wood Coatings [3]	0.31-1.49	26-74	250-680	275
Zinc-Rich Primer	N/A [2]	N/A [2]	500	340

1. These are Sales-Weighted Average Weight Percents based on the 2005 Architectural Coatings Survey (ARB, 2006).
2. N/A: This is a proposed new category. Therefore, reactivity and VOC weight percent were not provided in the survey report or reactivity analysis report.
3. This is a proposed new category that includes coatings from various categories in the 2000 SCM. The "Existing Reactivity" and "Existing VOC Limit" for this category represent a range of the data for the categories that were combined into this new category.

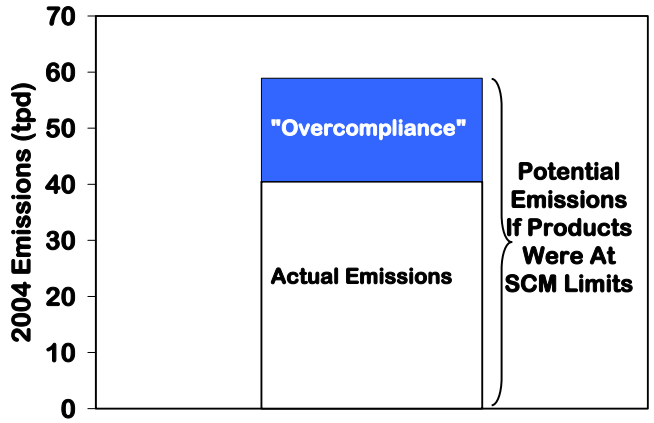
2.E. LIMIT-TO-LIMIT REDUCTIONS

To estimate emission reductions, ARB staff evaluates each product reported in the architectural coatings survey. For each product, we determine the current VOC emissions, as reported in the survey, and then we calculate the expected future VOC emissions at the new VOC limit in the proposed SCM. For the purposes of estimating emission reductions, it is assumed that all manufacturers will reformulate their products to be equal to the new VOC limit. However, in reality, many manufacturers actually reformulate their products below VOC limits to ensure compliance.

After 20 districts adopted rules based on the 2000 SCM, many manufacturers reformulated their coatings to be below the current VOC limits. Consequently, there was a certain amount of "overcompliance" and this was documented when ARB conducted the architectural coating survey. Since ARB's emission inventory is based on the results of the architectural coating survey, the "overcompliance" eventually gets incorporated into the emission inventory, but it is not necessarily documented in SCM staff reports. Many coating manufacturers requested that ARB include some documentation of their "overcompliance" while developing the proposed SCM.

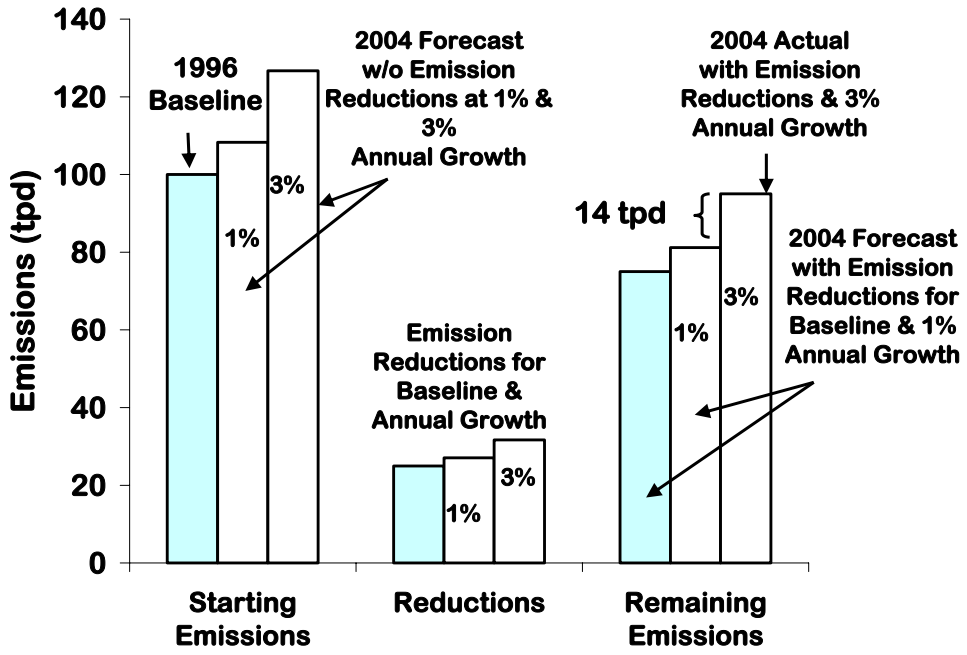
For the 2000 SCM, the following categories were targeted for emission reductions: Flat, Industrial Maintenance, Lacquers, Multi-Color, Nonflat-Low Gloss and Medium Gloss, Primer, Sealer, Undercoater, Quick Dry Enamel, Quick Dry PSU, Stains, and Traffic. Based on the ARB survey, the 2004 VOC emissions from these categories were approximately 41 tpd. If all of the products in these categories had VOC contents that were equal to the SCM limit, estimated emissions would have been 59 tpd. The difference of 18 tpd represents "overcompliance" by manufacturers (see Figure 2-1). This is a maximum estimate of "overcompliance", because there were products that were already below the 2000 SCM limits as far back as 1996.

Figure 2-1
Manufacturers' "Overcompliance" with 2000 SCM Limits



By 2004, the 2000 SCM was designed to achieve an emission reduction of 10 tpd, based on 1996 emissions data. Also by 2004, South Coast AQMD Rule 1113 was designed to reduce emissions approximately 16 tpd. However, reductions were overwhelmed by sales growth. Traditionally, it is assumed that the growth in architectural coating sales is closely tied to housing units and population, which grow about one percent each year. However, the actual sales growth for architectural coatings was higher than expected for both California and the U.S.. From 1996 to 2004, architectural coating sales increased an average of three percent a year for both California and nationwide. Thus, it was expected that the SCM and Rule 1113 would cause coating emissions to decline to 80 tpd in 2004, but they only declined to 95 tpd, due to higher than predicted sales growth, as shown in Figure 2-2.

Figure 2-2
Growth of Coating Sales Diminish Actual Reductions
(1996 – 2004)



2.F. ATMOSPHERIC AVAILABILITY

The NPCA has requested that ARB consider the atmospheric availability and fate of VOCs from architectural coatings stipulating that some VOCs may be retained in the coating and substrate. ARB staff has considered the available research.

A study was done on the emissions of 2,2,4-trimethyl-1,3-pentanediol monoisobutyrate (TMPD-MIB) from two modified latex paints (flat and semi-gloss) applied to gypsum board, aluminum, and concrete (a type used in China). The latex paint was modified to remove the small amount of glycols or glycol

ethers and no primer was used in the study. Air measurements were taken up to 15 months after application (Lin and Corsi, 2007). The coating applied on aluminum had greater emissions in the first 100 hours than those coatings applied to gypsum and concrete. The emissions from coatings applied to gypsum and concrete were significantly lower than the emissions from coatings on aluminum. This indicates that the type of substrate has an effect on emissions. Emissions decreased considerably for the coatings on gypsum board and concrete after the first 100 hours. Low, but measurable, emissions remained relatively constant for the remainder of the sampling period. The TMPD-MIB emissions from the wet film up to the first 100 hours were small compared to the integrated long-term emissions from the dry film (Lin and Corsi, 2007).

One coating sample on aluminum was analyzed for approximately eleven months. About 80 percent of the TMPD-MIB was emitted during this period. When coatings were applied on gypsum board, flat coatings had greater TMPD-MIB emissions than semi-gloss coatings. However, when coatings were applied on concrete, semi-gloss coatings had greater TMPD-MIB emissions than flat coatings.

Several coating samples on gypsum board were sacrificed at 3, 8, and 15 months to determine the amount of TMPD-MIB left in the paint film and substrate. At three months, about 73 percent of the TMPD-MIB in the semi-gloss and 72 percent in the flat remained in the samples. At eight months, these numbers declined to 51 percent in the semi-gloss and 24-26 percent in the flat samples. At 15 months, only 17 percent of the TMPD-MIB remained in the flat paint samples while 45 percent remained in the semi-gloss samples.

The above study shows that some TMPD-MIB remains in the paint and substrate after the paint film dries. However, the amount that remains is dependent on gloss level and substrate. Due to the preliminary nature of this information, more research is needed before ARB considers adjusting its emissions inventory to reflect the amount of TMPD-MIB retained in the paint and substrate.

2.G. REFERENCES

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United States Census Bureau. "Current Industrial Reports, MA325, Paint and Allied Products: 2004," Table 1. September, 2005. (U.S. Census, 2005)

United States Census Bureau. "Annual Estimates of Housing Units for the United States and States: April 1, 2000 to July 1, 2005 (HU-EST2005-01)". August 21, 2006. (U.S. Census, 2006)

CHAPTER 3. PROPOSED SUGGESTED CONTROL MEASURE

3.A. INTRODUCTION

In this chapter, we provide a plain English discussion of the staff's proposed suggested control measure (SCM) for architectural coatings, which is contained in Appendix A. The proposed SCM is an update of the SCM that the Board approved in 2000. Where applicable, we discuss where the proposed SCM's provisions differ from those of the 2000 SCM. For comparison purposes, the 2000 SCM is contained in Appendix B.

Control of emissions from architectural coatings is primarily the responsibility of the local air pollution control districts and air quality management districts, collectively referred to as districts. The proposed SCM is not an ARB regulation. It is a model rule that districts can follow when adopting and amending their local architectural coatings rules. If districts adopt the VOC limits in the proposed SCM, district personnel are responsible for enforcing those limits.

The proposed SCM controls VOC emissions by establishing limits on the VOC content of various architectural coating categories. These VOC limits are expressed in grams of VOC per liter of coating, less water and exempt compounds. To establish the limits in the proposed SCM, ARB staff conducted a detailed assessment of each coating category to determine the maximum emission reductions that are technically feasible and cost-effective. In general, manufacturers will comply with the VOC limits by reformulating their products to replace some of the VOC solvent with water or exempt compounds. Manufacturers may also modify their formulations by increasing the amount of resin and pigment solids contained in the coatings. However, many manufacturers already have large volumes of complying products, and no reformulation is required.

3.B. MAJOR PROPOSED CHANGES

Provided below is a summary of the major proposed changes between the 2000 SCM and the proposed SCM. Details of these changes are discussed in this chapter and Chapter 5.

- The proposed SCM deletes the following 15 categories from the table of VOC limits: Antenna; Antifouling; Clear Brushing Lacquer; Fire Retardant - Clear; Fire Retardant – Opaque; Flow; Lacquer; Quick Dry Enamel; Quick Dry Primer, Sealer, and Undercoater; Sanding Sealer; Swimming Pool Repair and Maintenance; Temperature Indicator Safety; Varnish; Waterproofing Concrete/Masonry Sealer; and Waterproofing Sealer.
- The proposed SCM adds the following ten categories to the table of VOC limits: Aluminum Roof; Basement Specialty Coating; Concrete/Masonry Sealer; Driveway Sealer; Reactive Penetrating Sealer; Stone Consolidant;

Tub and Tile Refinish; Waterproofing Membrane; Wood Coating; and Zinc-Rich Primer.

- The proposed SCM lowers VOC limits for 19 categories.
- In the proposed SCM, numerous definitions have been revised for clarification purposes or to make the definition more stringent. Definitions have also been revised to update referenced test methods and standards.
- The proposed SCM revises the provision for exceptions to the Most Restrictive VOC Limit.
- The proposed SCM deletes the Averaging Compliance Option that expired in January, 2005.
- The proposed SCM deletes all of the reporting requirements that were in the 2000 SCM, but it adds a reporting requirement to formalize the collection of architectural coating survey data.

3.C. APPLICABILITY

If adopted by the districts, the proposed SCM would apply to anyone who supplies, sells, offers for sale, or manufactures architectural coatings for use in those districts. It would also apply to anyone who applies or solicits the application of architectural coatings for use in those districts. Those who are subject to the SCM include, but are not limited to, the following:

- Manufacturers
- Distributors
- Retailers
- Importers
- Paint Contractors
- Construction Workers
- Maintenance Staff
- Public Works Personnel

3.D. SEVERABILITY

The Severability Section states that each provision of the proposed SCM is separate, in legal terms. If a judge determined that a particular section of the SCM was not valid, all of the other provisions of the SCM would still be in effect and enforceable. The Severability Section is a new addition to the SCM.

3.E. EXEMPTIONS

The Exemptions Section describes coatings that do not have to comply with the VOC limits and other requirements in the proposed SCM. In the previous version of the SCM, exemptions were included under the Applicability Section. For the proposed SCM, we've added a new Exemptions Section for clarification.

Since the SCM will become a district rule, it only applies to architectural coatings that are used within districts that have adopted the SCM. Architectural coatings that are manufactured in a district that has adopted the SCM are not subject to the SCM if they are sold and used in a district that has not adopted the SCM. If a district doesn't have a local rule, architectural coatings must comply with the U.S.

EPA's national rule for architectural coatings. Aerosol coatings are exempt from the proposed SCM, because they are not defined as architectural coatings, and are covered by the ARB's aerosol coatings regulation. Architectural coatings sold in small containers (one liter or less) are exempt from the VOC limits and most of the provisions of the proposed SCM. However, coatings in small containers are subject to the reporting requirements in Section 7 of the SCM. For example, manufacturers are required to provide survey data for small containers.

3.F. DEFINITIONS

To help clarify and enforce the proposed SCM, Section 4 of the proposed SCM provides new or revised definitions for terms that are not self-explanatory.

The following definitions are added for new product categories:

- Aluminum Roof
- Basement Specialty Coating
- Concrete/Masonry Sealer
- Driveway Sealer
- Reactive Penetrating Sealer
- Stone Consolidant
- Tub and Tile Refinish
- Waterproofing Membrane
- Wood Coatings
- Zinc-Rich Primer

For the Primers, Sealers, and Undercoaters category, the definition is revised for clarification purposes. Previously, separate definitions were listed for "Primer", "Sealer", and "Undercoater". For the proposed SCM, these separate definitions are combined under "Primer, Sealer, Undercoater" to be consistent with the table of VOC limits. In addition, the definition is modified to be more consistent with SCAQMD Rule 1113.

Some definitions are deleted, because the categories are no longer listed in the table of VOC limits. Categories were deleted because they were replaced by new categories or were unnecessary. Products from deleted categories are included in other categories in the proposed SCM. For example, the new Wood Coatings category will cover those products that were previously classified as Clear Brushing Lacquers; Lacquers; Sanding Sealers; and Varnishes. Definitions were deleted for the following categories:

- Antenna Coating
- Antifouling Coating
- Clear Brushing Lacquers
- Flow Coating
- Lacquer
- Quick Dry Enamel
- Quick Dry Primer, Sealer, and Undercoater
- Sanding Sealer
- Swimming Pool Repair and Maintenance
- Temperature Indicator Safety Coating
- Varnish
- Waterproofing Concrete/Masonry Sealer
- Waterproofing Sealer

In some cases, staff is proposing revised definitions for categories, either for clarification or to limit the types of products that qualify for inclusion in a category. Revised definitions are proposed for the following categories:

- Bituminous Roof Primer
- Concrete Curing Compound
- Faux Finishing Coating
- Fire-Resistive Coating
- Fire-Retardant Coating
- Floor Coating
- Graphic Arts
- Industrial Maintenance
- Low Solids Coating
- Metallic Pigment
- Multi-Color Coating
- Nonflat – High Gloss
- Primer, Sealer, Undercoater
- Recycled Coating
- Roof Coating
- Rust Preventative Coating
- Shellac
- Specialty Primer, Sealer, and Undercoater
- Stain
- Swimming Pool Coating

The proposed SCM has also added definitions for “VOC Actual” and “VOC Regulatory”. These terms were defined elsewhere in the previous version of the SCM and they were moved to the Definitions Section for clarification.

3.G. STANDARDS

The Standards Section of the proposed SCM differs significantly from the 2000 SCM. Changes are proposed for VOC limits, most restrictive limits requirements, and requirements for specified categories.

3.G.1. VOC Content Limits

As shown in Table 3-1 below, the proposed SCM (see Appendix A) will establish VOC content limits for more than 40 categories of architectural coatings. Items in boldface indicate VOC limits that are more stringent than the previous SCM. Compared to the 47 categories in the 2000 SCM, 15 categories were eliminated, ten were added, and the limits for 19 categories were lowered. Most of the proposed limits are consistent with the 2008 limits in SCAQMD’s Rule 1113. The proposed limits would become effective on January 1, 2010 for most of the categories. However, VOC limits for the following categories would not become effective until January 1, 2012: Rust Preventative and Specialty Primers, Sealers, and Undercoaters.

With the exception of the Low Solids category, the VOC limits are expressed in terms of VOC Regulatory, which is also referred to as “VOC, Less Water, Less Exempt Compounds” or “Coating VOC”. For the Low Solids category, the VOC limit is expressed in terms of VOC Actual, which is also referred to as “Material VOC”. In some cases, products in the Low Solids category are sold as concentrated solutions that need to be diluted prior to use. For those concentrated products, the VOC Actual value should be determined based on the manufacturer’s minimum recommendations for dilution.

Table 3-1
Proposed VOC Content Limits For Architectural Coatings

Limits are expressed as VOC Regulatory, thinned to the manufacturer's maximum recommendation, excluding any colorant added to tint bases. "Manufacturer's maximum recommendation" means the maximum recommendation for thinning that is indicated on the label or lid of the coating container.

Coating Category	Effective 1/1/2010	Effective 1/1/2012
Aluminum Roof	**400**	
Basement Specialty Coatings	400	
Bituminous Roof Coatings	**50**	
Bituminous Roof Primers	350	
Bond Breakers	350	
Concrete Curing Compounds	350	
Concrete/Masonry Sealers	**100**	
Driveway Sealers	**50**	
Dry Fog Coatings	**150**	
Faux Finishing Coatings	350	
Fire Resistive Coatings	350	
Flat Coatings	**50**	
Floor Coatings	**100**	
Form-Release Compounds	250	
Graphic Arts Coatings (Sign Paints)	500	
High Temperature Coatings	420	
Industrial Maintenance Coatings	250	
Low Solids Coatings[a]	120	
Magnesite Cement Coatings	450	
Mastic Texture Coatings	**100**	
Metallic Pigmented Coatings	500	
Multi-Color Coatings	250	
Nonflat Coatings	**100**	
Nonflat - High Gloss Coatings	**150**	
Pre-Treatment Wash Primers	420	
Primers, Sealers, and Undercoaters	**100**	
Reactive Penetrating Sealer	**350**	
Recycled Coatings	250	
Roof Coatings	**50**	
Rust Preventative Coatings		**250**
Shellacs: • Clear • Opaque	 730 550	
Specialty Primers, Sealers, and Undercoaters		**100**
Stains	250	
Stone Consolidant	450	
Swimming Pool Coatings	340	
Traffic Marking Coatings	**100**	
Tub and Tile Refinish	420	
Waterproofing Membranes	**250**	
Wood Coatings	**275**	
Wood Preservatives	350	
Zinc-Rich Primers	**340**	

a. Limit is expressed as VOC Actual.

The proposed table of VOC limits does not contain a listing for Fire Retardant coatings. ARB staff determined that coatings with fire retardant properties no longer required a special category with a higher VOC limit. Instead, these coatings will be covered by their primary categories. For example, if a product meets the definition for a Nonflat Coating and possesses fire retardant properties, it would be classified as a Nonflat coating and would need to comply with a 100 g/l VOC limit. Similarly, if a product meets the definition for Roof Coating and possesses fire retardant properties, it would be classified as a Roof Coating and would need to comply with a 50 g/l VOC limit.

3.G.2. Most Restrictive VOC Limit

If a coating is marketed for more than one coating category, the lowest, or most restrictive, VOC limit will apply. However, there are exceptions to the most restrictive limit requirement. The Most Restrictive Limit section of the proposed SCM was revised to include a table to clarify the situations where the most restrictive limit is not applicable. We've added a table to clarify the situations where the most restrictive limit is not required, as shown below in Table 3-2. For example, consider a coating that is marketed for use on concrete floors in industrial environments and is resistant to acids and other corrosive chemicals. This coating could be categorized as a Concrete/Masonry Sealer (VOC limit = 100 g/l) or an Industrial Maintenance Coating (VOC limit = 250 g/l). However, because the coating is designed to perform functions that require a higher VOC content for industrial environments, it meets the Industrial Maintenance Coating definition and should be classified as such. It is because of these types of situations that Industrial Maintenance is one of the categories that is exempt from the most restrictive limit requirement.

Table 3-2
Most Restrictive Limit Exceptions For Specialty Coatings

Coatings That Meet the Definitions in Section 4 of the SCM for This Category	Are Not Subject to the Most Restrictive VOC Limit Requirement When They Are Also Recommended for These Uses
Aluminum Roof Coatings	Bituminous Roof Primers; Bituminous Roof Coatings; Industrial Maintenance Coatings; or Roof Coatings
Basement Specialty Coatings	Concrete/Masonry Sealers; Floor Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Bituminous Roof Primers	Bituminous Roof; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Roof Coatings; or Specialty Primers, Sealers, and Undercoaters
Concrete Curing Compounds	Concrete/Masonry Sealers; Floor Coatings; Industrial Maintenance Coatings; or Primers, Sealers, and Undercoaters
Concrete/Masonry Sealers	Driveway Sealers
Faux Finishing Coatings	Primers, Sealers, and Undercoaters; Stains; or Wood Coatings
Fire Resistive Coatings	Industrial Maintenance; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Floor Coatings	Driveway Sealers

Table 3-2
Most Restrictive Limit Exceptions For Specialty Coatings

Coatings That Meet the Definitions in Section 4 of the SCM for This Category	Are Not Subject to the Most Restrictive VOC Limit Requirement When They Are Also Recommended for These Uses
Graphic Arts Coatings	Faux Finishing Coatings
High Temperature Coatings	Fire Resistive Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Rust Preventative Coatings; Specialty Primers, Sealers, and Undercoaters; or Zinc-Rich Primers
Industrial Maintenance Coatings	Concrete/Masonry Sealers; Floor Coatings; Mastic Texture Coatings; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Low Solids Coatings	All Categories in Table 1
Magnesite Cement Coatings	Concrete/Masonry Sealers or Floor Coatings
Metallic Pigmented Coatings	Aluminum Roof Coatings; Bituminous Roof Coatings; Bituminous Roof Primers; Faux Finishing Coatings; Fire Resistive Coatings; High Temperature Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Roof Coatings; Rust Preventative Coatings; Specialty Primers, Sealers, and Undercoaters; or Tub and Tile Refinish Coatings
Pre-Treatment Wash Primers	Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; or Rust Preventative Coatings
Reactive Penetrating Sealers	Concrete/Masonry Sealers; Floor Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Recycled Coatings	Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Rust Preventative Coatings	Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Shellacs	All Categories in Table 1
Stone Consolidants	Concrete/Masonry Sealers; Floor Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Reactive Penetrating Sealers; or Specialty Primers, Sealers, and Undercoaters
Swimming Pool Coatings	Concrete/Masonry Sealers; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Traffic Marking Coatings	Driveway Sealers
Tub and Tile Refinish Coatings	Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Waterproofing Membranes	Concrete/Masonry Sealers; Floor Coatings; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Wood Coatings	Floor Coatings; Primers, Sealers, and Undercoaters; Specialty Primers, Sealers, and Undercoaters; or Stains
Wood Preservatives	Primers, Sealers, and Undercoaters; Specialty Primers, Sealers, and Undercoaters; Stains; or Wood Coatings
Zinc-Rich Primers	Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Rust Preventative Coatings; or Specialty Primers, Sealers, and Undercoaters

3.G.3. Sell-Through of Coatings

Under the proposed SCM, an architectural coating listed in Table 3-1 and manufactured prior to the effective date of the VOC content limit for that coating category may be sold, supplied, or offered for sale for up to three years after the

effective date. This three-year time period is referred to as the "sell-through". The sell-through provision allows unlimited use of coatings manufactured prior to the effective dates of the proposed limits. It's important to note that coatings sold prior to the effective dates listed in Table 3-1 must comply with the VOC limits in effect at the time of manufacture. For example, if a Nonflat-High Gloss coating is manufactured in 2009, it would be subject to a VOC limit of 250 g/l.
If that coating complies with the 250 g/l limit, it could be sold until 2012 under the 3-year sell-through provision. However, if a Nonflat-High Gloss coating is manufactured in 2010, it must comply with the150 g/l limit.

No changes are being proposed for the sell-through provision.

3.G.4. Painting Practices

The Standards Section of the proposed SCM also specifies that coating containers and any VOC-containing products used for cleaning or thinning are to be closed when not in use. No changes are being proposed for the painting practices provision.

3.G.5. Thinning

If a user adds thinners or other additives to a coating, the coating must still meet the VOC limits in Table 3-1. In many cases, manufacturers have formulated coatings just below the VOC limit and the addition of any thinning solvent can make a coating non-compliant. No changes are being proposed for the thinning provision.

3.G.6. Coatings Not Listed in Table 3-1

If a coating does not meet any of the definitions for the categories listed in Table 3-1, that coating will be classified as Flat, Nonflat, or Nonflat-High Gloss, based on its gloss level, and the corresponding VOC content limit will apply.
No changes are being proposed for the coatings not listed provision.

3.G.7. Deleted Standards

The 2000 SCM contained a special provision for Industrial Maintenance Coatings. Under this provision, there was a petition process which could allow for the use of 340 g/l Industrial Maintenance Coatings in areas with persistent fog and cold temperatures. This petition process was eliminated because it was only used once and ARB staff determined that it was no longer necessary.

The 2000 SCM specifically prohibited the use of Rust Preventative Coatings for industrial use, unless they complied with the 250 g/l VOC limit for Industrial Maintenance Coatings. This provision was intended to limit the use of high-VOC Rust Preventative Coatings to their intended applications. Rust Preventative

Coatings were intended for application by homeowners and maintenance personnel in non-industrial settings, so the 2000 SCM included a high VOC limit of 400 g/l to allow for user-friendly, single-component products. The 2000 SCM did not intend to allow for the use of 400 g/l products in industrial areas where multi-component products could provide sufficient corrosion protection and meet a VOC limit of 250 g/l. In the proposed SCM, the VOC limit for Rust Preventative Coatings has been lowered from 400 g/l to 250 g/l. Since Rust Preventative and Industrial Maintenance Coatings have the same proposed VOC limit, it is no longer necessary to maintain the prohibition provision and it is proposed for elimination.

The 2000 SCM contained a special provision for Lacquers where a person could add VOC to a lacquer to avoid blushing of the finish, if certain conditions were met. In the proposed SCM, products that were formerly classified as Lacquers would be included in the new Wood Coatings category and the VOC limit was lowered from 550 g/l to 275 g/l. ARB staff has evaluated formulations and manufacturer information for Lacquers that comply with the proposed 275 g/l limit and staff has determined that the lacquer blushing provision is no longer necessary. Therefore, it has been proposed for elimination.

The 2000 SCM contained an averaging compliance option, which expired in 2005 and was administered by ARB staff. Based on staff's experience with the averaging program, we believe that many districts do not have sufficient resources to manage an averaging program. In addition, while averaging is a viable option for a small number of large businesses, it is difficult for small businesses to participate because they have fewer products. Therefore, ARB staff does not believe that it is appropriate or necessary to include an averaging program in the proposed SCM. ARB staff has worked extensively with stakeholders to develop categories and VOC limits that are technologically feasible, without the need for an averaging program.

3.H. CONTAINER LABELING REQUIREMENTS

The proposed SCM describes labeling requirements and specifies where information should be placed on coating containers. Many of the container labeling requirements in the proposed SCM are similar to those in the 2000 SCM. However, some revisions are proposed, as noted below. For details of all the container labeling requirements, please refer to section 6.1 of the proposed SCM.

3.H.1. Date Code

The proposed SCM continues the requirement for each manufacturer to label all coating containers with the date that the coating was manufactured or a code that represents the date of manufacture. No changes are being proposed for the date code labeling requirement.

3.H.2. Thinning Recommendations

The proposed SCM continues the requirement for each manufacturer to label all coating containers with the manufacturer's recommendations regarding the addition of thinning solvents. This requirement does not apply to the use of water as a thinner. No changes are being proposed for the thinning recommendations labeling requirement.

3.H.3. VOC Content

The proposed SCM requires each manufacturer to label all coating containers with the VOC content. If the manufacturer does not recommend thinning, the label must display the VOC content as supplied. If the manufacturer recommends thinning, the label must display the VOC content including the maximum amount of thinning solvent recommended by the manufacturer. If the coating is a multi-component product, the label must display the VOC content as mixed or catalyzed. VOC content can be based on formulation data or the results of laboratory analysis based on specified test methods. VOC content must be displayed in grams of VOC per liter of coating. The format of the VOC content labeling requirement has been changed for clarification purposes, but the requirements have not been changed in the proposed SCM.

3.H.4. Faux Finishing Coatings

The proposed SCM contains a new labeling requirement for Faux Finishing Coatings. Effective January 1, 2010, the labels of all Faux Finishing Coatings must display the statement "This product can only be sold or used as part of a Faux Finishing coating system".

3.H.5. Industrial Maintenance Coatings

The proposed SCM continues the requirement that all Industrial Maintenance Coating containers be labeled with the phrase "For industrial use only" or the phrase "For professional use only". The proposed SCM deletes the option of using the phrases "Not for residential use" or "Not intended for residential use". These options related to residential uses have been eliminated in the proposed SCM, because the SCM does not contain a provision against residential use. Industrial Maintenance coatings are not intended for use by typical homeowners, but there may be some residential settings that require an Industrial Maintenance coating.

3.H.6. Rust Preventative Coatings

The proposed SCM continues the requirement that all Rust Preventative Coating containers be labeled with the phrase "For Metal Substrates Only". However, if a

product meets the definition for Industrial Maintenance Coatings and it is used for corrosion prevention purposes, it is not required that the container be labeled with this phrase.

3.H.7. Specialty Primers, Sealers, and Undercoaters

The proposed SCM requires that all Specialty Primers, Sealers, and Undercoaters (SPSU) containers be labeled with one or more of the following descriptions: “For fire-damaged substrates”; “For smoke-damaged substrates”; or “For water-damaged substrates”. This is similar to the 2000 SCM, but the 2000 SCM also allowed the option of using the phrases “For blocking stains” and “For excessively chalky substrates”. These labeling options related to stain blocking and chalkiness have been eliminated, because the SPSU definition in the proposed SCM has been revised to eliminate criteria related to stain blocking and chalkiness.

3.H.8. Reactive Penetrating Sealers

The proposed SCM contains a new labeling requirement for the new Reactive Penetrating Sealer category. Effective January 1, 2010, the labels of all Reactive Penetrating Sealers must display the statement “Reactive Penetrating Sealer”.

3.H.9. Stone Consolidants

The proposed SCM contains a new labeling requirement for the new Stone Consolidant category. Effective January 1, 2010, the labels of all Stone Consolidants must display the statement “Stone Consolidant – For Professional Use Only”.

3.H.10. Nonflat – High Gloss Coatings

The proposed SCM continues the requirement that all Nonflat – High Gloss Coating containers be labeled with the phrase “High Gloss”. However, if a product meets the definition for Nonflat High Gloss and it is classified under another category (e.g., Rust Preventative, Wood Coating, etc.), it is not required that the container be labeled as “High Gloss”.

3.H.11. Wood Coatings

The proposed SCM contains a new labeling requirement for the new Wood Coating category. Effective January 1, 2010, the labels of all Wood Coatings must display the statement “For Wood Substrates Only”.

3.H.12. Zinc-Rich Primers

The proposed SCM contains a new labeling requirement for the new Zinc-Rich Primer category. Effective January 1, 2010, the labels of all Zinc-Rich Primers must display the statement “For Professional Use Only”.

3.H.13. Deleted Labeling Requirements

The 2000 SCM included labeling requirements for Clear Brushing Lacquers and Quick Dry Enamels. These requirements are deleted in the proposed SCM, because these categories have been proposed for deletion from the table of standards.

3.I. REPORTING REQUIREMENTS

The proposed SCM contains reporting requirements which are significantly different from those in the 2000 SCM.

3.I.1. Sales Data

The proposed SCM contains a new requirement to submit sales data. Although this is a new requirement in the SCM, it is intended to implement existing practices. Since 1975, ARB has conducted surveys to collect sales data for architectural coatings. Collection of these data is authorized in the California Health and Safety Code which requires submission of data to estimate emissions. Prior to conducting a survey, ARB staff works with industry representatives to identify appropriate time periods for submittal of survey data. While most manufacturers submit data promptly, some take more than a year to submit survey data. This delay in obtaining the survey data inhibits ARB’s efforts to analyze the data and provide it to the districts in a timely fashion. Several states in the Ozone Transport Commission have adopted rules that are based on the 2000 SCM, but they contain an added provision which requires submittal of survey data (DE, 2006; ME, 2006; NH, 2006; NJ, 2004; NY, 2007).
This provision appears to be an effective method of encouraging prompt submittal of survey data. Therefore, the proposed SCM includes a similar provision that is intended to expedite the collection of survey data for architectural coatings. Under this provision, survey data must be provided within 180 days. Failure to do so could result in the issuance of a Notice of Violation or a Notice to Comply from the air district.

3.I.2. Deleted Reporting Requirements

All of the reporting requirements that were contained in the 2000 SCM are proposed for elimination. The intent of these requirements was to track shifts in coating sales that were associated with the changes resulting from the 2000 SCM. ARB staff has reviewed the accumulated data and has incorporated this information when developing the proposed SCM. Staff believes that ARB’s

periodic architectural coating surveys are adequate for future tracking of coating sales. Therefore, it is no longer necessary to have annual reporting requirements.

Annual reports have been deleted for the following: Clear Brushing Lacquers; Rust Preventative Coatings; Specialty Primers, Sealers, and Undercoaters; Toxic Exempt Compounds (perchloroethylene and methylene chloride); Recycled Coatings; Bituminous Roof Coatings; and Bituminous Roof Primers.

3.J. COMPLIANCE PROVISIONS AND TEST METHODS

This section of the proposed SCM designates acceptable methods for determining compliance with the requirements contained in the SCM.

3.J.1. VOC Content

The proposed SCM designates acceptable methods for determining compliance with the requirements. The proposed SCM contains revisions to the section that describes how to determine VOC content. For clarification purposes, there is new text to explain that VOC content must reflect the amount of recommended thinning solvent. In addition, equations for calculating VOC contents have been moved to the Definitions Section of the SCM.

Traditionally, U.S. EPA Method 24 has been designated as the official way of verifying the VOC content for architectural coatings. ARB is currently funding a research project to develop an expanded test method that is intended to improve the accuracy for laboratory tests involving waterborne coatings, multi-component coatings, and others that may be difficult to analyze with Method 24. Since this research is not yet completed, it has not been included in the proposed SCM. However, it is ARB's intent that districts allow for the use of the expanded method under development, if the research data indicate that it is a valid alternative. The proposed SCM allows for the use of alternative test methods, but manufacturers must first obtain written approval from the district, ARB, and the U.S. EPA. If an alternative test method is approved, the results of the alternative method will govern, if there are discrepancies between the results of the alternative method and formulation data. Similarly, if there are discrepancies between VOC content based on formulation data and the results of a Method 24 test, Method 24 test results will prevail.

3.J.2. New Test Methods

The proposed SCM contains new test methods to verify compliance with proposed changes in the Definitions Section. New test methods have been added for Basement Specialty Coatings, Reactive Penetraing Sealers, Stone Consolidants, Tub and Tile Refinish Coatings, and Waterproofing Membranes.

3.J.3. Deleted Test Methods

In the proposed SCM, the test method has been deleted for determining drying times, because the Quick Dry categories have been proposed for elimination and there is no need to verify drying times for the other coating categories. In addition, the test method for determining surface chalkiness has been deleted, because chalkiness has been removed from the criteria in the Specialty Primer, Sealer, and Undercoater category.

3.K. REFERENCES

Delaware Administrative Code, Title 7, Section 1141, “Limiting Emissions of Volatile Organic Compounds From Consumer and Commercial Products, 1.0 Architectural and Industrial Maintenance Coatings”. (DE, 2006)

Code of Maine Rules, 06 096 Department of Environmental Protection, Chapter 151, “Architectural and Industrial Maintenance (AIM) Coatings”. (ME, 2006)

New Hampshire Code of Administrative Rules, Chapter Env-A 4200, “Architectural and Industrial Maintenance Coatings”. (NH, 2006)

New Jersey Administrative Code, Title 7, Chapter 27, Subchapter 23, “Prevention of Air Pollution from Architectural Coatings”. (NJ, 2004)

New York Codes Rules and Regulations, Title 6, Part 205, “Architectural and Industrial Maintenance (AIM) Coatings”. (NY, 2007)

CHAPTER 4. PROCESS FOR DEVELOPING PROPOSED SCM

In 2005, ARB staff initiated activities to develop the proposed SCM. These activities have included:

- Conducting a survey of architectural coatings;
- Meeting with district and U.S. EPA Region IX representatives;
- Hosting public workshops;
- Meeting with industry trade groups and individual manufacturers;
- Meeting with essential public services agencies;
- Evaluating the South Coast AQMD Rule 1113 and the U.S. EPA's National Architectural Coatings Rule;
- Conducting technology assessments of all the coating categories;
- Evaluating durability and performance research for several coating categories;
- Preparing an environmental impact analysis; and
- Conducting an economic impacts survey and preparing an economic analysis.

4.A. 2005 ARCHITECTURAL COATINGS SURVEY

In early 2005, ARB staff began working with manufacturers and industry groups to develop a new survey of architectural and industrial maintenance coatings sold in California. The last such ARB survey was undertaken in 2001 (ARB, 2003a) and surveyed sales and VOC contents of coatings sold in 2000. In April 2005, the ARB sent out the latest survey seeking 2004 sales data. The survey due date was September 1, 2005, but manufacturers submitted data as late as August 2006.

Data entry and quality assurance checking were completed in September 2006, and a draft survey report was posted for public review (ARB, 2006). Notifications were e-mailed or mailed to all survey respondents and other interested parties that were subscribers to the ARB Architectural Coatings ListServe. A discussion of the survey results is included in Chapter 5.

4.B. INFORMAL MEETINGS WITH DISTRICTS, U.S. EPA, AND INDUSTRY

In October 2006, ARB and district personnel established a District Working Group to discuss the update of the 2000 SCM. This working group also includes representatives from U.S. EPA Region IX. ARB had five conference calls with this group to discuss items including: district SIP commitments for emission reductions from architectural coatings; findings of the 2005 architectural coatings survey; the possibility of a reactivity-based approach; specific SCM language; the environmental impact analysis; and flexibility options for manufacturers to comply with the SCM. The U.S. EPA was involved in the meetings to keep them abreast of the SCM developments, and to increase the likelihood that the district rules

based on the SCM will be approvable as SIP revisions. In addition to meeting with the District Working Group, ARB staff participated in four meetings with California Air Pollution Control Officers Association (CAPCOA) committees.

Also in October 2006, ARB and coating industry representatives established an Industry Working Group, similar to the District Working Group. ARB had four conference calls with the Industry Working Group to discuss items including: revisions of coating category definitions; proposed VOC limits; the possibility of a reactivity-based approach; the use of tertiary Butyl Acetate (TBAc); and flexibility options for manufacturers to comply with the SCM.

In addition to the meetings with the Industry Working Group, ARB hosted meetings with industry trade groups. ARB also had meetings and conference calls with individual manufacturers about their particular concerns and to share data. About 40 such meetings with manufacturers or trade groups have occurred.

4.C. FORMAL PUBLIC MEETINGS

In developing the proposed SCM, ARB hosted three public workshops in Sacramento on December 12, 2006; March 13, 2007; and June 6, 2007. Participants included representatives from industry (coatings manufacturers, ingredient manufacturers, coatings contractors, user groups, and trade associations); local districts; the U.S. EPA; and other interested parties. The first workshop focused on general discussions regarding the SCM update, the project timeline, and the technical approach. At the second workshop, ARB staff presented draft VOC limits and draft revised definitions for several major coating categories. At the third workshop, ARB staff presented draft regulatory language for the SCM. Comments were submitted to ARB from manufacturers, trade associations, and other agencies. ARB's responses to those comments are contained in Chapter 5.

Staff posted draft SCM materials on ARB's Internet site and sent List Serve notices to over 900 subscribers to announce the availability of these materials. Posted items included: workshop announcements; draft SCM revisions; survey data; reactivity analysis data; workshop slide presentations; and lists with examples of compliant coating products. Copies of workshop announcements are contained in Appendix F.

4.D. EVALUATION OF OTHER ARCHITECTURAL COATING RULES

4.D.1. U.S. EPA National Architectural Coating Rule

On August 14, 1998, the U.S. EPA promulgated the final version of their National Volatile Organic Compound Emission Standards for Architectural Coatings (National Rule) (U.S. EPA, 1998a). The National Rule took effect on

September 13, 1999 and it was adopted in accordance with section 183(e) of the Federal Clean Air Act, which allows U.S. EPA to regulate manufacturers and importers to obtain VOC emission reductions. Section 183(e) does not give U.S. EPA the authority to regulate end users, so the National Rule only applies to manufacturers and importers of architectural coatings (U.S. EPA, 1998a; 1998b). ARB's SCM applies to a broader range of entities, including manufacturers, distributors, retailers, and users of architectural coatings.

The National Rule, section 59.410, specifically allows states or local governments to adopt more stringent emission limits for architectural coatings. The VOC limits in the 2000 SCM and the proposed SCM are equal to or more stringent than those in the National Rule, as shown in Table 4-1. In California, approximately 3% of the population lives in areas that are governed by the National Rule. The remainder of the population is subject to the 2000 SCM or South Coast AQMD Rule 1113.

The U.S. EPA is planning to update its national architectural coatings rule in 2007. The limits proposed in that update are expected to reflect those limits found in the 2002 OTC model rule (Page, 2007), which was based on the 2000 SCM, with some modifications. The 2000 SCM has become the model rule that is spreading across the country. Therefore, we must be aware that the limits we set in the proposed SCM may have similar impacts across the country.

Table 4-1
Comparison Between National Rule and Proposed SCM

EPA Category	EPA VOC Limit (g/l)	Potential Corresponding Categories in Proposed SCM	Proposed SCM VOC Limit (g/l)
Antenna Coatings	530	Industrial Maintenance	250
Anti-Fouling Coatings	450	Industrial Maintenance	250
Anti-Graffiti Coatings	600	Industrial Maintenance	250
Bituminous Coatings and Mastics	500	Bituminous Roof Coatings Bituminous Roof Primers Concrete/Masonry Sealers Driveway Sealers Industrial Maintenance Waterproofing Membranes	50 350 100 50 250 250
Bond Breakers	600	Bond Breakers	350
Calcimine Recoaters	475	Flat Specialty PSU	50 100
Chalkboard Resurfacers	450	Industrial Maintenance	250
Concrete Curing Compounds	350	Concrete Curing Compounds	350
Concrete Curing and Sealing Compounds	700	Concrete Curing Compounds Concrete/Masonry Sealers	350 100
Concrete Protective Coatings	400	Concrete/Masonry Sealers	100
Concrete Surface Retarders	780	Concrete Curing Compounds	350
Conversion Varnish	725	Wood Coatings	275
Dry Fog Coatings	400	Dry Fog Coatings	150
Extreme high durability coatings	800	Industrial Maintenance	250
Faux Finishing/Glazing	700	Faux Finishing Coatings	350

Table 4-1
Comparison Between National Rule and Proposed SCM

EPA Category	EPA VOC Limit (g/l)	Potential Corresponding Categories in Proposed SCM	Proposed SCM VOC Limit (g/l)
Fire-Retardant/Resistive Coatings:			
Clear	850	Fire Resistive [1]	350
Opaque	450	Fire Resistive [1]	350
Flat Coatings:			
Exterior	250	Flat	50
Interior	250	Flat	50
Floor Coatings	400	Floor Coatings	100
Flow Coatings	650	Industrial Maintenance	250
Form Release Compounds	450	Form Release Compounds	250
Graphic Arts Coatings (Sign Paints)	500	Graphic Arts Coatings (Sign Paints)	500
Heat Reactive Coatings	420	Industrial Maintenance	250
High Temperature Coatings	650	High Temperature Coatings	420
Impacted Immersion Coatings	780	Industrial Maintenance	250
Industrial Maintenance Coatings	450	Industrial Maintenance Tub and Tile Refinish	250 420
Lacquers (including lacquer sanding sealers)	680	Wood Coatings	275
Magnesite Cement Coatings	600	Magnesite Cement Coatings	450
Mastic Texture Coatings	300	Mastic Texture Coatings	100
Metallic Pigmented Coatings	500	Metallic Pigmented Coatings Aluminum Roof Zinc-Rich Primers	500 400 340
Multi-Colored Coatings	580	Multi-Color Coatings	250
Nonferrous Ornamental Metal Lacquers and Surface Protectants	870	Rust Preventative Nonflat – High Gloss Primers, Sealers, Undercoaters	250 150 100
Nonflat Coatings:			
Exterior	380	Nonflat Coatings	100
Interior	380	Nonflat Coatings	100
Nuclear Coatings	450	Industrial Maintenance	250
Pretreatment Wash Primers	780	Pretreatment Wash Primers	420
Primers and Undercoaters	350	Primers, Sealers, Undercoaters Specialty PSU	100 100
Quick-Dry Coatings:			
Enamels	450	Nonflat – High Gloss	150
Primers, Sealers, and Undercoaters	450	Primers, Sealers, Undercoaters Specialty PSU	100 100
Repair and Maintenance Thermoplastic	650	Industrial Maintenance	250
Roof Coatings	250	Roof Coatings	50
Rust Preventative Coatings	400	Rust Preventative Coatings	250
Sanding Sealers (other than lacquer sanding sealers)	550	Wood Coatings	275

Table 4-1
Comparison Between National Rule and Proposed SCM

EPA Category	EPA VOC Limit (g/l)	Potential Corresponding Categories in Proposed SCM	Proposed SCM VOC Limit (g/l)
Sealers (including interior clear wood sealers)	400	Primers, Sealers, Undercoaters Specialty PSU Wood Coatings Concrete/Masonry Sealers	100 100 275 100
Shellacs:		Shellacs:	
Clear	730	Clear	730
Opaque	550	Opaque	550
Stains:			
Clear and Semitransparent	550	Stains (Semitransparent) Wood Coatings (Clear Stains)	250 275
Opaque	350	Stains	250
Low Solids	120[2]	Low Solids	120[2]
Stain Controllers	720	Wood Coatings	275
Swimming Pool Coatings	600	Swimming Pool Coatings	340
Thermoplastic Rubber Coatings and Mastics	550	Roof Coatings	50
Traffic Marking Coatings	150	Traffic Marking Coatings	100
Varnishes	450	Wood Coatings	275
Waterproofing Sealers and Treatments	600	Concrete/Masonry Sealers Wood Coatings Basement Specialty Coating Driveway Sealers Waterproofing Membrane	100 275 400 50 250
Wood Preservatives:			
Below Ground Wood Preservatives	550	Wood Preservatives	350
Clear and Semitransparent	550	Wood Preservatives	350
Opaque	350	Wood Preservatives	350
Low Solids	120[2]	Low Solids	120[2]
Zone Marking Coatings	450	Traffic Marking Coatings	100

1. In the proposed SCM, the "Fire Resistive" category would be retained for those products that are certified in accordance with ASTM E119-07. However, the "Fire Retardant" category would be eliminated and coatings with fire retardant properties would fall under their primary categories (e.g., Flat, Nonflat, etc.)
2. Units are grams of VOC per liter of coating, including water and exempt compounds, thinned to the maximum thinning recommended by the manufacturer.

The National Rule contains flexibility provisions that are not in the proposed SCM: (1) an exceedance fee provision; (2) a tonnage exemption; and (3) a recycled coatings compliance option. For compliance with these provisions, manufacturers and importers must keep specified records and submit annual reports to the appropriate regional U.S. EPA office.

The exceedance fee provision allows manufacturers and importers to comply with the rule by paying a fee, in lieu of meeting the VOC content limits. The tonnage exemption allows manufacturers and importers to sell or distribute limited quantities of architectural coatings that do not comply with the VOC content limits and for which no exceedance fee is paid.

The recycled coatings compliance option allows calculation of an adjusted VOC content for coatings that contain a certain percentage of post-consumer coating. Containers of recycled architectural coatings must include labeling that shows the percentage, by volume, of post-consumer coating content.

ARB staff did not include an exceedance fee or tonnage exemption in the proposed SCM, because we need to maximize emission reductions, due to the severe air quality problems in California. The National Rule's recycled coating option was not included in the proposed SCM, because we believe having a Recycled Coatings category with a VOC limit of 250 g/l accomplishes the same goal of encouraging recycling without the need for an adjusted VOC content credit.

It is important to remember that the proposed SCM is intended for the non-SCAQMD portion of California. It is not intended to be a model for the entire United States. There are some VOC limits that may be inappropriate for other parts of the country. Because many parts of the country have significantly higher precipitation, both rain and snow, and significantly lower temperatures, architectural coating categories that are sensitive to application temperature may need to have higher VOC limits to allow for more solventborne products. Examples of such categories are: Bituminous Roof Coatings, Driveway Sealers, Roof, and Industrial Maintenance Coatings. Other categories that may need higher VOC limits would include coatings that are specific to different parts of the country, such as some categories that have already been identified in the OTC model rule, and coatings for historical renovation, including some clear wood floor coatings, such as conjugated tung oil varnishes.

4.D.2. South Coast AQMD Rule 1113

On November 8, 1996 and May 14, 1999, the South Coast AQMD revised Rule 1113, their architectural coating regulation (SCAQMD, 1996; 1999). These revisions of Rule 1113 contained interim VOC limits that were largely adopted in the 2000 SCM. Since that time, the South Coast AQMD has revised Rule 1113 in 2001, 2002, 2003, 2004, and 2006 (SCAQMD, 2001; 2002a; 2003; 2004; 2006b). While developing the proposed SCM, ARB staff considered the feasibility of proposing the Rule 1113 VOC limits that are scheduled to be fully implemented by 2008. In many cases, ARB staff determined that the final South Coast AQMD limits would be feasible for implementation beyond the South Coast AQMD. However, there are some categories for which staff determined that a higher VOC limit would be more appropriate at this time. The most significant of these categories are Aluminum Roof Coatings, Industrial Maintenance Coatings, Nonflat Coatings, Nonflat-High Gloss Coatings, Rust Preventative Coatings, and Exterior Stains. The primary reasons for having a higher limit in the proposed SCM include the following:

The Proposed SCM Needs to be Suitable for a Variety of Climates

Rule 1113 applies to coating activities that occur within the boundaries of the South Coast AQMD, which has a relatively mild, warm climate. This type of climate provides advantages for developing low-VOC coatings with acceptable performance and durability. However, in Northern California and other parts of the State, the climate can have far greater extremes of temperature and humidity. For these areas outside of the South Coast, coatings have to withstand harsher climates and it can be more difficult to develop low-VOC products. As South Coast AQMD staff has said in public meetings, some of the VOC limits in their rule, specifically for Nonflat and Nonflat-High Gloss Coatings, are not intended necessarily for areas outside of the South Coast AQMD (SCAQMD, 2006a). There are concerns with freeze/thaw stability and dirt pick up due to removal of VOCs to meet the lower limits. This concern also applies in varying degrees to Aluminum Roof Coatings, Industrial Maintenance Coatings, Rust Preventative Coatings, and Exterior Stains.

The Proposed SCM Does Not Contain an Averaging Provision

Rule 1113 contains an averaging provision, but the proposed SCM does not allow averaging. In the South Coast AQMD, coating manufacturers can sell products that exceed the VOC limits in Rule 1113, if they can demonstrate that emissions from the high-VOC products are being offset by emissions from ultra low-VOC products. These ultra low-VOC products must have VOC levels that are below the allowable limits. Participants in the averaging program must prepare detailed plans and reports to verify their emissions data. Management of an averaging program can require significant staff resources for detailed recordkeeping and auditing. All of the categories mentioned above can be averaged.

The 2000 SCM contained a temporary averaging provision, which expired in 2005 and was administered by ARB staff. When districts submitted their 2000 SCM rules to U.S. EPA for approval, U.S. EPA disapproved the averaging provision, primarily due to issues regarding recordkeeping. While administering the averaging program, ARB staff found that it was a viable option for a small number of large companies that have a wide variety of product lines. However, it was generally difficult for small businesses to take advantage of this flexibility provision because they had far fewer products available for averaging. ARB also found that management of the averaging program required significant staff resources, and most districts did not have the resources to manage and enforce such a program.

Based on ARB's experience with the averaging program, staff determined that it would be preferable to establish VOC limits that wouldn't require the need for an averaging program to allow for the sale of higher VOC products in limited instances. ARB staff has worked extensively with stakeholders to develop categories and VOC limits that are technologically feasible, without the need for

an averaging program. Therefore, ARB staff does not believe that it is appropriate or necessary to include an averaging program in the proposed SCM.

The Proposed SCM Does Not Contain a VOC Exemption for TBAc

Rule 1113 contains a limited VOC exemption for TBAc to allow for its use in Industrial Maintenance Coatings only. Under this exemption, manufacturers do not have to include TBAc when calculating the VOC content of Industrial Maintenance coatings. Because they've allowed for the use of TBAc as an exempt solvent, South Coast AQMD determined that it was technologically feasible to establish a VOC limit of 100 g/l for Industrial Maintenance Coatings. ARB staff has not yet proposed a similar exemption for TBAc, due to health concerns about toxicity identified by the Office of Environmental Health Hazard Assessment (OEHHA). Also, ARB staff found that essential public service agencies are having difficulty certifying products that can comply with the 100 g/l limit and meet their specifications for projects throughout the State, even with the TBAc exemption. Since the proposed SCM does not allow for the use of TBAc as an exempt solvent, staff determined that it was appropriate to retain the 250 g/l VOC limit for the Industrial Maintenance category.

The Proposed SCM Does Not Contain Small Business Exemptions

Rule 1113 contains small business exemptions for manufacturers of Lacquers; Flats; Nonflats; Primers, Sealers, and Undercoaters; Quick Dry Enamels; Waterproofing Concrete/Masonry Sealers; and Rust Preventative Coatings. For example, manufacturers of Flat coatings are exempt from the Rule 1113 VOC limits, if they meet designated small business criteria. For the other categories under these exemptions, manufacturers can have up to two additional years to comply with VOC limits, if they meet designated small business criteria. The proposed SCM does not contain any small business exemptions, because most districts do not have the resources to manage and enforce this type of flexibility option. In addition, ARB staff believes that this type of exemption can be inequitable because it excludes companies that don't meet the criteria for a small business, but have niche product lines with small sales volumes.

The Proposed SCM Does Not Contain an Exemption for High Elevations

Rule 1113 contains an exemption for all stains and lacquers that are used in areas with elevations of 4,000 feet or greater above sea level. Stains and lacquers that are used at these high elevations are exempt from VOC limits and all other requirements of Rule 1113. The proposed SCM does not include an exemption for high elevations.

The Proposed SCM Needs to Be Enforceable by Small Districts

Many of the flexibility provisions contained in Rule 1113 require considerable staff resources to implement and enforce. Significant staff time is often needed to gather data, perform analyses, compile reports, and conduct audits to validate the proper use of flexibility provisions. Many of California's air districts have limited staff available to enforce flexibility provisions in architectural coating rules.

Since these districts will need to enforce the proposed SCM, ARB staff has determined that the rule will be more effective with a limited use of flexibility provisions. Accordingly, the proposed SCM does not contain an averaging provision or the exemptions mentioned above, all of which require resources for recordkeeping and auditing. Larger air districts can provide added flexibility by using their existing variance rules, if they choose to do so.

Table 4-2 contains a comparison between South Coast AQMD's Rule 1113 and the proposed SCM VOC limits.

Table 4-2
Comparison Between South Coast Rule 1113 and Proposed SCM

South Coast Rule 1113 Category	Rule 1113 Ceiling Limit [1] (g/l)	Rule 1113 VOC Limit (g/l)	Potential Corresponding Categories in Proposed SCM	Proposed SCM VOC Limit (g/l)
Bond Breakers	350	350	Bond Breakers	350
Clear Wood Finishes	350	275	Wood Coatings	275
Varnish	350	275	Wood Coatings	275
Sanding Sealers	350	275	Wood Coatings	275
Lacquer	680	275	Wood Coatings	275
Clear Brushing Lacquer	680	275	Wood Coatings	275
Concrete-Curing Compounds	**350**	**100**	**Concrete Curing Compounds**	**350**
Concrete-Curing Compounds For Roadways and Bridges	350	350	Concrete Curing Compounds	350
Dry-Fog Coatings	400	150	Dry Fog Coatings	150
Fire-Proofing Exterior Coatings	450	350	Fire Resistive Coatings	350
Flats	250	50	Flat Coatings	50
Floor Coatings	**420**	**50**	**Floor Coatings**	**100**
Graphic Arts (Sign) Coatings	500	500	Graphic Arts Coatings (Sign Paints)	500
Industrial Maintenance Coatings	**420**	**100 [2]**	**Industrial Maintenance Coatings**	**250**
High Temperature IM Coatings	420	420	High Temperature Coatings	420
Zinc-Rich IM Primers	**420**	**100**	**Zinc-Rich Primers**	**340**
Japans/Faux Finishing Coatings	700	350	Faux Finishing Coatings	350
Low-Solids Coating	-	120 [3]	Low Solids Coatings	120 [3]
Magnesite Cement Coatings	600	450	Magnesite Cement Coatings	450
Mastic Coatings	**300**	**300**	**Mastic Texture Coatings**	**100**
Metallic Pigmented Coatings	500	500	Metallic Pigmented Coatings	500
Multi-Color Coatings	420	250	Multi-Color Coatings	250
Nonflat Coatings	**250**	**50**	**Nonflat Coatings**	**100**
Nonflat High Gloss	**250**	**50**	**Nonflat - High Gloss**	**150**
Pigmented Lacquer	680	275	Wood Coatings	275
Pre-Treatment Wash Primers	780	420	Pre-Treatment Wash Primers	420
Primers, Sealers, and Undercoaters	350	100	Primers, Sealers, and Undercoaters	100
Quick-Dry Enamels	**400**	**50**	**Nonflat - High Gloss**	**150**

Table 4-2
Comparison Between South Coast Rule 1113 and Proposed SCM

South Coast Rule 1113 Category	Rule 1113 Ceiling Limit [1] (g/l)	Rule 1113 VOC Limit (g/l)	Potential Corresponding Categories in Proposed SCM	Proposed SCM VOC Limit (g/l)
Quick-Dry Primers, Sealers, and Undercoaters	350	100	Primers, Sealers, and Undercoaters	100
Recycled Coatings	-	250	Recycled Coatings	250
Roof Coatings	300	50	Roof Coatings Bituminous Roof Coatings	50 50
Roof Coatings, Aluminum	**500**	**100**	**Aluminum Roof Coatings**	**400**
Roof Primers, Bituminous	350	350	Bituminous Roof Primers	350
Rust Preventative Coatings	**420**	**100**	**Rust Preventative Coatings**	**250**
Shellac			Shellacs	
Clear	730	730	Clear	730
Pigmented	550	550	Opaque	550
Specialty Primers	350	100	Specialty Primers, Sealers, and Undercoaters	100
Stains	**350**	**100**	**Stains**	**250**
Stains, Interior	250	250	Stains	250
Swimming Pool Coatings				
Repair	650	340	Swimming Pool Coatings	340
Other	340	340	Swimming Pool Coatings	340
Traffic Coatings	**250**	**100**	**Traffic Marking Coatings** **Driveway Sealers**	**100** **50**
Waterproofing Sealers	**400**	**100**	**Concrete/Masonry Sealers** **Wood Coatings** **Basement Specialty Coatings** **Waterproofing Membranes** **Reactive Penetrating Sealer**	**100** **275** **400** **250** **350**
Waterproofing Concrete/Masonry Sealers	**400**	**100**	**Concrete/Masonry Sealers** **Basement Specialty Coatings** **Waterproofing Membranes** **Reactive Penetrating Sealer** **Stone Consolidant**	**100** **400** **250** **350** **450**
Wood Preservatives				
Below-Ground	350	350	Wood Preservatives	350
Other	350	350	Wood Preservatives	350
Default	**-**	**250**	**Form-Release Compounds** **Stone Consolidant** **Tub and Tile Refinish** **Default**	**250** **450** **420** **50-150**

1. Ceiling Limit: The maximum allowable VOC content for coatings that are included in the Rule 1113 averaging program.
2. For Industrial Maintenance Coatings, Rule 1113 allows for the use of TBAc as an exempt solvent to help achieve the 100 g/l VOC limit.
3. Units are grams of VOC per liter of material (i.e., including water and exempt compounds).

Traditionally, architectural coating rules have contained an exemption for products sold in small containers ("one liter or less"). This exemption has served as a safety valve for small volume, niche applications that may need a higher

VOC product. Based on data from several ARB surveys, small containers have consistently accounted for a very small percentage of architectural coating sales. In 2004, small containers only accounted for three percent of the total sales volume, and less than half of those sales exceeded the VOC limits for large containers. Therefore, ARB staff does not believe that the small container exemption needs to be amended or deleted.

In December 2003, South Coast AQMD revised their small container exemption to eliminate the small container exemption for varnishes, sanding sealers, clear lacquers, and pigmented lacquers, effective July 1, 2006. In addition, the South Coast AQMD requires manufacturers to submit an annual report to document sales of products sold in small containers. The proposed SCM does not contain a requirement for annual reporting, because ARB already conducts periodic surveys that gather data on coating sales volumes. The proposed SCM also retains the small container exemption for wood coatings, because staff has found it to be an effective way of addressing niche applications and providing flexibility without a significant loss of emission reductions.

4.E. TECHNOLOGY ASSESSMENT

To ensure that the proposed SCM is technologically and commercially feasible, ARB staff conducted a technology assessment for all of the coating categories. Details of these assessments are provided in Chapter 5. Some of the sources of information utilized in the technology assessments included: the ARB 2005 survey data; manufacturers' product data sheets; Internet websites; books and trade magazines; technical reports; test results and specifications; U.S. EPA's Background Information Document (U.S. EPA, 1998a); discussions with manufacturers and users of coatings; and information from trade associations. Based on their technical analyses, staff has concluded that the overall performance of the reformulated products in each category will be similar to the performance of their higher VOC counterparts. To confirm this analysis, ARB staff will conduct technology reviews for the proposed VOC limits that are lower than current limits, prior to their effective dates.

4.F. LABORATORY AND FIELD TESTING

When evaluating technological feasibility for low-VOC coatings, ARB staff reviewed laboratory and field testing data that compared the performance characteristics for low- and high-VOC coatings. Table 4-3 summarizes the formal testing projects that were included in our evaluation. ARB staff also reviewed confidential test data provided by some coating manufacturers. In general, most of the data indicate that low-VOC coatings can perform comparably to high-VOC coatings. Detailed descriptions of testing results are contained in Chapter 5 for the applicable categories.

Table 4-3
Test Data That Were Reviewed for the Proposed SCM

Study Name	Project Sponsor	Study Conducted By	Report Date	Categories Studied
"Development and Demonstration of Zero- And Low-VOC Resin Technology For Advanced Control Measure Development"	SCAQMD	AVES	March 2001	Lacquers; Sanding Sealers; Stains; Varnishes; Waterproofing Sealers
"KTA-Tator Study"	SCAQMD	KTA-Tator	July 2002	Floor; Nonflat High Gloss; Primer, Sealer, Undercoater; Stains
"Testing Industrial Maintenance Coatings For Wastewater Environments"	Southern California Alliance of Publicly Owned Treatment Works (SCAP)	KTA-Tator	August 2003	Industrial Maintenance
"Phase II Assessment Study of Architectural Coatings"	SCAQMD/ ARB	National Technical Systems (NTS)	December 2003	Industrial Maintenance; Nonflat
"Essential Public Service Agency Technology Assessment"	Essential Public Service Agencies (EPSA)	Metropolitan Water District of Southern California (MWD)	December 2005	Industrial Maintenance
"Architectural & Industrial Maintenance Coatings Technology Assessment"	SCAQMD	University of Missouri, Rolla	May 2006	Industrial Maintenance; Lacquers; Nonflat; Nonflat – High Gloss; Primer, Sealer, Undercoater; Rust Preventative; Sanding Sealers; Stains; Varnishes; Waterproofing Concrete/Masonry Sealer

(ARB, 2003b; AVES, 2001; MWD, 2005; SCAP, 2003; SCAQMD, 2002b; UMR, 2006)

4.G. ENVIRONMENTAL IMPACT ANALYSIS

Both the California Environmental Quality Act (CEQA) and ARB policy require ARB to evaluate the potential adverse environmental impacts of proposed projects. For the 2000 SCM, staff prepared a formal environmental impact report (EIR), which is incorporated by reference herein (ARB, 2000). The EIR included an analysis of environmental impacts that could potentially result from the implementation of the 2000 SCM throughout California (excluding the South Coast AQMD). Staff investigated the potential for environmental impacts in six

main areas: air quality; water demand and quality; public services; transportation and circulation; solid and hazardous waste; and health hazards. The analysis concluded that implementing the 2000 SCM would have no significant adverse impacts, but would have a net air quality benefit.

For the proposed SCM, staff has addressed potential environmental impacts in Chapter 6. Staff believes that districts can use this information and the EIR from the 2000 SCM to support their environmental impact analyses when they adopt local rules based on the proposed SCM.

4.H. ECONOMIC ANALYSIS

Chapter 7 of the Staff Report discusses the economic impacts ARB anticipates from implementation of the proposed SCM. ARB staff quantified the economic impacts to the extent feasible, but economic impact analyses can be inherently imprecise by nature. Therefore, some projections are necessarily qualitative or semi-quantitative, based on general observations about the architectural coatings industry. The economic impacts analysis for the proposed SCM provides a general picture of the economic impacts that typical businesses might encounter, but staff recognizes that individual companies may experience impacts different than those projected in this analysis.

The staff evaluation included a cost-effectiveness analysis and a business impacts analysis. The cost-effectiveness analysis measured how cost-efficient the proposed SCM will be in reducing VOCs relative to other regulatory programs. The business impacts analysis evaluated the impacts on profitability, employment, and competitiveness to California businesses, consumers, and government agencies (ARB, 2007).

4.I. REFERENCES

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CHAPTER 5. TECHNICAL ASSESSMENT OF CATEGORIES

5.0. SUMMARY OF CATEGORIES

In this chapter, we provide a discussion of the architectural coatings categories included in the proposed SCM. This chapter contains descriptions of the coatings that are covered under each category, and the rationale for establishing a new VOC limit or retaining the existing VOC limit.

In most cases, the VOC limits in the proposed SCM are consistent with the South Coast AQMD's Rule 1113 VOC limits that will be in effect by 2008.
To allow time for district rule adoption and manufacturer reformulation, ARB is proposing an effective date of January 1, 2010 for most categories and January 1, 2012 for Rust Preventative and Specialty Primer, Sealer, and Undercoater.

The discussions of the proposed VOC limits for each of the coating categories explain why we believe that they are technologically and commercially feasible by the proposed effective date. Sources of information for the technology assessments included the following:

- Data from our comprehensive surveys of architectural coatings;
- Information from coating manufacturers and resin suppliers (brochures, product data sheets, product labels, and material safety data sheets);
- Results of durability and performance testing;
- Coating formulation and performance data from Internet websites; books and trade magazines; technical reports;
- Industry standards and specifications;
- Meetings with manufacturers and users of coatings;
- Information provided by trade associations;
- Discussions with other regulatory agencies (local air districts, U.S. EPA, the Ozone Transport Commission, other states, Environment Canada);
- 2000 SCM technical support documents (ARB, 2000, 2000a);
- South Coast AQMD staff reports from Rule 1113 amendments (South Coast AQMD, 1996, 1999, 2001, 2002a, 2003, 2004, 2006); and
- U.S. EPA's National Rule preamble and Background Information Document (U.S. EPA, 1998, 1998a).

Table 5-1 contains a summary of the proposed categories and VOC limits. Table 5-2 summarizes the categories that are proposed for elimination from the SCM VOC Limits table. See Chapter 2 for a table summarizing emission reductions.

Table 5-1:
Draft Proposed SCM VOC Limits

Coating Category	Current VOC Limit (g/l, less water)	Proposed VOC Limit (g/l, less water) Effective Date 1/1/2010	Effective Date 1/1/2012
Aluminum Roof Coatings [1]	500	400	
Antenna Coatings (Deleted effective 1/1/2010)	530	N/A	
Antifouling Coatings (Deleted effective 1/1/2010)	400	N/A	
Basement Specialty Coatings [2]	400	400	
Bituminous Roof Coatings	300	50	
Bituminous Roof Primers	350	350	
Bond Breakers	350	350	
Clear Wood Coatings (Deleted effective 1/1/2010) [3] • Clear Brushing Lacquers • Lacquers (including lacquer sanding sealers) • Sanding Sealers (other than lacquer sanding sealers) • Varnishes	 680 550 350 350	 N/A N/A N/A N/A	
Concrete Curing Compounds	350	350	
Concrete/Masonry Sealer [4]	250-400	100	
Driveway Sealer [5]	100	50	
Dry Fog Coatings	400	150	
Faux Finishing Coatings	350	350	
Fire Resistive Coatings	350	350	
Fire Retardant Coatings: (Deleted effective 1/1/2010) [6] • Clear • Opaque	 650 350	 N/A N/A	
Flat Coatings	100	50	
Floor Coatings	250	100	
Flow Coatings (Deleted effective 1/1/2010)	420	N/A	
Form-Release Compounds	250	250	
Graphic Arts Coatings (Sign Paints)	500	500	
High Temperature Coatings	420	420	
Industrial Maintenance Coatings	250	250	
Low Solids Coatings	120 [7]	120 [7]	
Magnesite Cement Coatings	450	450	
Mastic Texture Coatings	300	100	
Metallic Pigmented Coatings	500	500	
Multi-Color Coatings	250	250	
Nonflat Coatings	150	100	
Nonflat - High Gloss Coatings	250	150	
Pre-Treatment Wash Primer	420	420	
Primers, Sealers, and Undercoaters	200	100	
Quick Dry Enamels (Deleted effective 1/1/2010)	250	N/A	
Quick Dry Primers, Sealers, and Undercoaters (Deleted effective 1/1/2010)	200	N/A	
Reactive Penetrating Sealer[8]	250-400	350	
Recycled	250	250	
Roof	250	50	

Table 5-1:
Draft Proposed SCM VOC Limits

Coating Category	Current VOC Limit (g/l, less water)	Proposed VOC Limit (g/l, less water) Effective Date 1/1/2010	Proposed VOC Limit (g/l, less water) Effective Date 1/1/2012
Rust Preventative	400		250
Shellacs: • Clear • Opaque	 730 550	 730 550	
Specialty Primers, Sealers, and Undercoaters	350		100
Stains	250	250	
Stone Consolidant[9]	100-400	450	
Swimming Pool Coatings	340	340	
Swimming Pool Repair and Maintenance Coatings (Deleted effective 1/1/2010)	340	N/A	
Temperature Indicator Safety Coatings (Deleted effective 1/1/2010)	550	N/A	
Traffic Marking	150	100	
Tub and Tile Refinish [10]	100-250	420	
Waterproofing Membranes [11]	250-400	250	
Waterproofing Sealers (Deleted effective 1/1/2010)	250	N/A	
Waterproofing Concrete/Masonry Sealers (Deleted effective 1/1/2010)	400	N/A	
Wood Coatings [12]	250-680	275	
Wood Preservatives	350	350	
Zinc-Rich Primer [13]	500	340	

1. Aluminum Roof is a proposed new category that was formerly covered by Metallic Pigmented.
2. Basement Specialty Coatings is a proposed new category that was formerly covered by Waterproofing Sealer and Waterproofing Concrete/Masonry Sealer.
3. It is proposed that all Clear Wood Coatings be combined under the new “Wood Coatings” category, upon the effective date of this rule.
4. Concrete/Masonry Sealer is a proposed new category that was formerly covered by Waterproofing Sealer, Waterproofing Concrete/Masonry Sealer, and other categories. The “Existing VOC Limit” for this category represents the range of VOC limits for the coatings that were combined into this new category.
5. Driveway Sealer is a proposed new category that was formerly covered by the default VOC limits.
6. Upon the effective date of this rule, the Fire Retardant coating categories are eliminated and coatings with fire retardant properties will be subject to the VOC limit of their primary category (e.g., Flat, Nonflat, etc.)
7. The VOC Limit for Low Solids Coatings is expressed as “VOC, including water and exempt compounds” (i.e., Material VOC or VOC Actual).
8. Reactive Penetrating Sealer is a proposed new category that was formerly covered by Waterproofing Sealer and Waterproofing Concrete/Masonry Sealer.
9. Stone Consolidant is a proposed new category that was formerly covered by Waterproofing Concrete/Masonry Sealer and Other.
10. Tub and Tile Refinish is a proposed new category that was formerly coverd by the default VOC limits and Nonflat – High Gloss.
11. Waterproofing Membrane is a proposed new category that was formerly covered by Waterproofing Sealer and Waterproofing Concrete/Masonry Sealer.
12. Wood Coatings is a proposed new category that was formerly covered by Clear Brushing Lacquers, Lacquers, Sanding Sealers, Waterproofing Sealers, Varnishes, and other categories.
13. Zinc-Rich Primer is a proposed new category that was formerly covered by Metallic Pigmented.
14. N/A: Not applicable because category is being eliminated in the proposed SCM.

Provided below is a summary of the categories that are proposed for elimination from the SCM VOC Limits table.

Table 5-2:
SCM Categories That Have Been Removed from the VOC Limits Table

Category	Reason For Removal
Antenna	No products were reported in 2005 survey. Coatings used for antennas can be covered under other categories (e.g., Industrial Maintenance, Rust Preventative).
Antifouling	No products were reported in 2001 survey or 2005 survey. Antifouling coatings are primarily covered by marine coating rules.
Fire-Retardant – Clear Fire-Retardant - Opaque	The Fire Retardant categories are no longer needed. Products with Fire Retardant properties can comply with VOC limits in the Flat, Nonflat, and other applicable categories. Therefore, there is no need for separate categories to accommodate higher-VOC Fire Retardant coatings.
Flow	No products were reported in 2005 survey. Flow coatings can be covered under other categories (e.g., Industrial Maintenance).
Quick Dry Enamel	Category is no longer needed as these products fall under the Nonflat High Gloss category. During development of the 2000 SCM, ARB staff indicated that this category would be eliminated.
Quick Dry Primer, Sealer, Undercoater	Category is no longer needed as these products fall under the PSU and Specialty PSU categories. During development of the 2000 SCM, ARB staff indicated that this category would be eliminated.
Swimming Pool Repair and Maintenance Coatings	Will be covered under revised definition of Swimming Pool Coatings. During development of the 2000 SCM, ARB staff indicated that this category would be eliminated.
Temperature Indicator Safety	No products were reported in 2001 survey or 2005 survey. Coatings used for temperature indicator safety can be covered under other categories (e.g., Industrial Maintenance, High Temperature).
Waterproofing Concrete/Masonry Sealers	Most of the products that were formerly classified as Waterproofing Concrete/Masonry Sealers will be covered by the new Concrete/Masonry Sealer category. In addition, some products will be reclassified as Basement Specialty Coatings; Industrial Maintenance; Reactive Penetrating Sealer; Stone Consolidant; Wood Coatings; and Waterproofing Membranes.
Waterproofing Sealers	Most of the products that were formerly classified as Waterproofing Sealers will be covered by the new Concrete/Masonry Sealer category. In addition, some products will be reclassified as Basement Specialty Coatings; Industrial Maintenance; Reactive Penetrating Sealer; Wood Coatings; and Waterproofing Membranes.

The remainder of this chapter contains a writeup for each coating category that includes: a comparison of VOC limits from different architectural coating rules; the proposed category definition; major changes between the 2000 SCM and the proposed SCM; a description of product uses and formulations; survey data; the rationale for the proposed VOC limit; and a discussion of the issues associated with the proposed VOC limit. For each category, survey data is provided for solventborne products only, waterborne products only, and all products. Sales-weighted averages are based on the reported sales volumes for solventborne products, waterborne products, and all products, including small containers.

Lists of compliant products for many coating categories are provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm). Some lists also include noncompliant products for comparison purposes. These lists are intended to provide examples of coatings that would comply with the proposed VOC limits. The lists are not intended to serve as approved product lists and mention of any product or manufacturer does not indicate endorsement by ARB.

5.1. ALUMINUM ROOF

VOC Limit Table (g/l)

USEPA: 500 (under Metallic Pigmented)	Canada: 500 (under Metallic Pigmented)	OTC: 500 (under Metallic Pigmented)	SCAQMD: 100	SCM Proposed: 400

5.1.1. Category Definition

A coating labeled and formulated exclusively for application to roofs and containing at least 84 grams of elemental aluminum pigment per liter of coating (0.7 pounds per gallon). Pigment content shall be determined in accordance with SCAQMD Method 318-95.

5.1.2. Major Proposed Changes

- Aluminum Roof is a new category for coatings that were formerly covered by Metallic Pigmented.
- The proposed VOC Limit for Aluminum Roof coatings would decrease from 500 g/l to 400 g/l.

5.1.3. Coating Description

Aluminum Roof Coating is a new category that was formerly included in the Metallic Pigmented category. These coatings are primarily used as a topcoat for asphalt roof systems or metal roofs that need a reflective coating. They contain aluminum flakes for the reflection of solar radiation to reduce the surface temperature of the roof and the internal temperature of the structure. These aluminum pigments float to the surface of the coating during settling (a process known as "leafing") and they can reflect up to 60% of ultraviolet (UV) rays. They also aid in the inhibition of rust formation and alleviate corrosion of metal surfaces. Aluminum Roof coatings are also aesthetically pleasing. These coatings are not intended to prevent water penetration or stop leaks, repair seams, or repair blisters, but they can prevent moisture accumulation due to the inherent nature of bituminous resin water resistance (RCMA, 1997). In addition, most Aluminum Roof coatings are Underwriter's Laboratory (UL) Class A Fire Rated, which improves fire resistance and enhances building safety.

The Cool Roof Rating Council (CRRC) is an independent organization that established a rating system that accurately displays the radiative property data for the outmost layer of a roofing system (CRRC, 2007). As part of their testing, they determine the emissivity and reflectance of a roof coating which are used to determine if a roof coating can be termed a “cool roof”. The emittance or emissivity of a coating is a measure of the amount of thermal radiation (long-wave) given off by the coating divided by the amount of thermal radiation given off by a black body at the same temperature. A black body will emit the maximum amount of thermal radiation at a particular temperature. Reflectance is the amount of solar (short-wave) radiation that is not absorbed by the material. The CRRC will test and register Aluminum Roof coatings, but none are considered “Cool Roof” in the State of California, because they do not meet the Title 24 solar reflectance minimum of 70% or the thermal emmittance minimum of 75% (CEC, 2006). However, like Bituminous Roof coatings, they can contribute to the “overall envelope” of a cool building, set by Title 24 standards (CEC, 2005).

Aluminum Roof coatings are usually single component products that can be sprayed on, brushed, or roller applied. Typically, these coatings have a smooth texture with some degree of a glossy, metal luster. They are generally applied by contractors on flat, low-slope commercial buildings, but they can also be applied by homeowners or business owners. Even when these coatings are applied properly, aluminum particles naturally degrade and erode over time due to UV exposure and ponding water. This depreciates the coating reflectivity and may lead to the need for recoating every two to four years for maintenance purposes (Zielnik, 2006; Zielnik, 2006b). Aluminum Roof coatings also tend to be less elastic, and the surfaces can “alligator” due to thermal-mechanical stresses (Zielnik, 2006; Zielnik, 2006b). Therefore, Aluminum Roof coatings may not be recommended for roofs that require a low-maintenance coating with good weatherability, because they may require frequent recoating due to UV degradation and thermal-mechanical stresses.

Most of the reported Aluminum Roof coatings are composed of bituminous resins, but a few have alkyd, oleoresin or urethane/polyurethane resins. Some Aluminum Roof coatings contain fibers (asbestos or non-asbestos) that allow for cross-linking and interlocking to increase durability, longevity, and/or viscosity for application purposes. The use of asbestos fibers is declining due to the associated health risks. Aluminum Roof coatings are formulated to maximize the aluminum surface area that is exposed to solar radiation and optimize reflectivity. The use of aggressive thinning solvents in an Aluminum Roof coating may induce asphalt to bleed through the aluminum and/or inhibit proper aluminum leafing activity (RCMA, 1997). During curing and drying, a natural process occurs that is known as “tobacco juicing,” which results when a residue seeps out of the asphalt/coal contained in Aluminum Roof coatings. The residue is water soluble and washes away with the first rain of the season. However, if not properly washed away, it can cause peeling of Aluminum Roof coatings (ARMA, 1994).

Most of the reported Aluminum Roof coatings are solventborne products with relatively high VOC levels, but some waterborne formulations were also reported in ARB's survey. When comparing solventborne to waterborne products, the lowest VOC solventborne product generates almost four times the VOC emissions of the highest VOC waterborne product. Waterborne emulsions may be as effective as solventborne Aluminum Roof coatings if they are applied during favorable atmospheric conditions that allow for proper curing, such as temperatures above 40 degrees F and minimal moisture. Proceedings from the Fourth International Symposium on Roofing Technology in 1997 state that waterborne Aluminum Roof coatings applied to roofing membranes perform well, exhibiting good adhesion and reflectivity (FISRT, 1997).

However, waterborne Aluminum Roof coatings can have shelf life stability problems, because hydrogen gas can be formed when water and aluminum chemically react, particularly in hotter temperatures. When enclosed in a container, this reaction can produce a buildup of hydrogen gas that could explode upon opening. The shelf life for waterborne Aluminum Roof emulsions is typically shorter than the shelf life for solventborne coatings, due to this undesired chemical reaction which also presents a safety concern. On product data sheets, some companies state that these coatings should not be stored for more than six months at room temperature.

According to the California Department of Transportation (Caltrans), the most effective Aluminum Roof Coatings used by Caltrans have VOC contents from 200 g/l to 250 g/l. They use products with multi-component formulations applied by trained personnel, which helps minimize the potential for the formation of hydrogen gas during storage. These coatings require technical expertise to mix and apply properly and may not be suitable for use by the average contractor, business owner, or homeowner. Caltrans has not identified any acceptable products that could meet a 100 g/l VOC limit (Caltrans, 2007).

5.1.4. Substrates/Exposures

All Aluminum Roof coatings are applied to external roofing surfaces to provide solar reflective properties. These coatings can be applied to new roof systems that have cured for at least 30-90 days or they can be applied for maintenance of weathered systems. They are usually applied to asphalt and metal substrates, but can be applied to other bituminous surfaces (Built-Up Roofs and Modified Bituminous Systems), concrete, stone, masonry, and some properly prepared wood and shingled surfaces. Aluminum Roof coatings should not be installed on roofs that are damaged or cracked and susceptible to ponding water as it leads to adhesion failure and degradation of the aluminum. Application on improper surfaces can drastically shorten the lifetime and impair the reflective properties, resulting in more frequent re-application and higher energy costs.

Conditions pertaining to wetness and moisture can also lead to improper curing and adhesion failure. In addition, extreme cold weather inhibits aluminum leafing and hot temperatures above 110 degrees F may induce streaking and highlights (RCMA, 1997). For most applications, the temperature must be at least 5 degrees F above the dew point for best adhesion and cure. An advantage of solventborne Aluminum Roof coatings is that they can be applied in colder and wetter conditions, due to lower freezing temperatures and quicker cure times. However, temperatures that are too low can inhibit leafing. In some cases improper leafing can be resolved during aging over the summer months. The use of solventborne Aluminum Roof coatings is advantageous for areas such as Northern California, the Sierra Nevada area, and similar climates with colder and wetter conditions. Waterborne coatings are subject to freezing at temperatures below 40 degrees F and can improperly cure, due to excess moisture.

5.1.5. Survey Results

Table 5.1-1 summarizes our estimate of sales and VOC emissions from the Aluminum Roof Coating category, based on results from the ARB survey. In 2004, the sales volume for Aluminum Roof in California was almost 503,000 gallons which represents less than 0.5 percent of the total California sales volume for architectural coatings.

In 2004, VOC emissions from Aluminum Roof coatings were about 2 tpd, which represents 2 percent of the total emissions from architectural coatings. Solventborne coatings produce about 98 percent of the VOC emissions from this category, but they only account for 77 percent of the sales volume. According to the ARB Survey, roughly 3 tpd of VOCs are released from all coatings related to roofing, including emissions from Aluminum Roof, Bituminous Roof, Bituminous Roof Primer, and Roof coatings. Aluminum Roof coatings emit almost two-thirds of reported VOC emissions from all roofing-related products, but they only make up 15 percent of the total sales volume of these products.

Table 5.1-1: Survey Data
Aluminum Roof

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	55	387,675	77%	0%	100%	0%	0%	437	1.93
WB	6	115,318	23%	0%	100%	0%	0%	65	0.03
Total	**61**	**502,993**	**100%**	**0%**	**100%**	**0%**	**0%**	**352**	**1.96**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.1-2 contains complying marketshare data for the Aluminum Roof category, based on results from the ARB survey. This table shows that

31 percent of the sales volume for Aluminum Roof coatings complies with the proposed VOC limit of 400 g/l. The expected VOC emission reductions for this proposed limit are 0.18 tpd. If this SCM were to propose a VOC limit of 100 g/l for this category, approximately 15% of the reported sales volume would be compliant, but there would only be two compliant products.

Table 5.1-2: Complying Marketshare & Emission Reductions Aluminum Roof

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
400	13	31%	0.18

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

A listing of Aluminum Roof manufacturers and products that comply with the proposed VOC limit is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm). Of the 12 companies that reported sales in this category, four offered Aluminum Roof coatings that comply with the proposed limit. One of these four companies is considered a small business because they employ less than 250 employees.

5.1.6. Manufacturer and Industry Issues

Some manufacturers and industry representatives have expressed concerns about certain aspects of the proposed SCM regarding VOC limits, definitions, and other technical issues. Below are key issues that have been brought to our attention during our interactions with industry representatives.

5.1.6.1. Issue: The Roof Coatings Manufacturers Association (RCMA) and the National Paint and Coatings Association (NPCA) have expressed concerns about the proposed VOC limit. They believe that lowering the VOC limit from 500 g/l to 400 g/l or 100 g/l could lead to a ban of unique and irreplaceable coatings that are low cost, have long term performance, have lower application rates, and decreased resistance to overnight moisture exposure.

Response: ARB is not proposing a 100 g/l VOC limit, which has been in effect in the South Coast AQMD since 2005. The South Coast AQMD has determined that it is technically feasible to implement a 100 g/l limit for Aluminum Roof coatings, because they have local climatic conditions that are not representative of other areas in the State. It appears that there are some products that meet this limit and may be used in Southern California. For the remainder of California, ARB staff has determined that the technology exists to formulate Aluminum Roof coatings that comply with a 400 g/l limit and are just as effective as the 500 g/l products.

5.1.6.2. Issue: Industry representatives, including NPCA and RCMA, recommend the use of a reactivity-based approach for regulating Aluminum Roof coatings. The RCMA suggested that the ARB use the units of grams of ozone generated per gallon of coating to establish a reactivity-based standard. NPCA and some manufacturers have also suggested that low-reactive products with higher VOC contents should be exempt from future SCM limits, because they have lower ozone formation potential. Industry representatives have suggested that lower reactivity products could be formulated by replacing some hydrocarbon solvents with other hydrocarbon solvents that have a lower maximum incremental reactivity (MIR) value.

Response: ARB staff analyzed industry's proposed approach for developing Aluminum Roof coatings with a reduced ozone formation potential. Staff compared ozone reductions from a mass-based limit to ozone reductions that could be achieved with a reactivity-based limit. With a mass-based limit, manufacturers would need to reduce the overall VOC content. With a reactivity-based limit, manufacturers could maintain their current overall VOC contents, but they would need to reformulate with less reactive hydrocarbon solvents.

The reactivity (i.e., maximum ozone formation potential) can be determined based on the MIR value for each of the chemicals contained in a coating. Since hydrocarbon solvents are mixtures of several chemicals, ARB developed a bin system to assign MIR values to hydrocarbon solvents, based on boiling point and chemical characteristics (ARB, 2007). For hydrocarbon solvents, the assigned MIR values range from 0.81 grams ozone per gram product (g O_3/g product) for Bin 12 up to 8.01 g O_3/g product for Bin 23. The most common hydrocarbon solvents reported for Aluminum Roof Coatings are Bin 15 (MIR = 1.82 g O_3/g product) and Bin 22 (MIR = 7.51 g O_3/g product).

Using data from the ARB Survey, ARB staff determined that the maximum ozone formation potential (OFP) for all Aluminum Roof coatings was 3.06 tpd ozone in 2004, outside of the South Coast AQMD (ARB, 2007). Implementing a 400 g/l VOC limit is expected to achieve an emission reduction of 0.18 tpd and a corresponding ozone reduction of 0.52 tpd, outside of the South Coast AQMD. Shown below are the estimated emission reductions and ozone reductions that would be achieved for various VOC limits:

VOC Limit (g/l)	Emission Reductions (excluding South Coast AQMD) (tons/day)	Estimated Ozone Reductions (excluding South Coast AQMD) (tons/day)
400	0.18	0.52
350	0.36	1.02
300	0.52	1.44
200	0.76	2.11
100	0.95	2.66

As shown above, the proposed mass-based limit of 400 g/l is expected to achieve 0.52 tpd of ozone reductions.

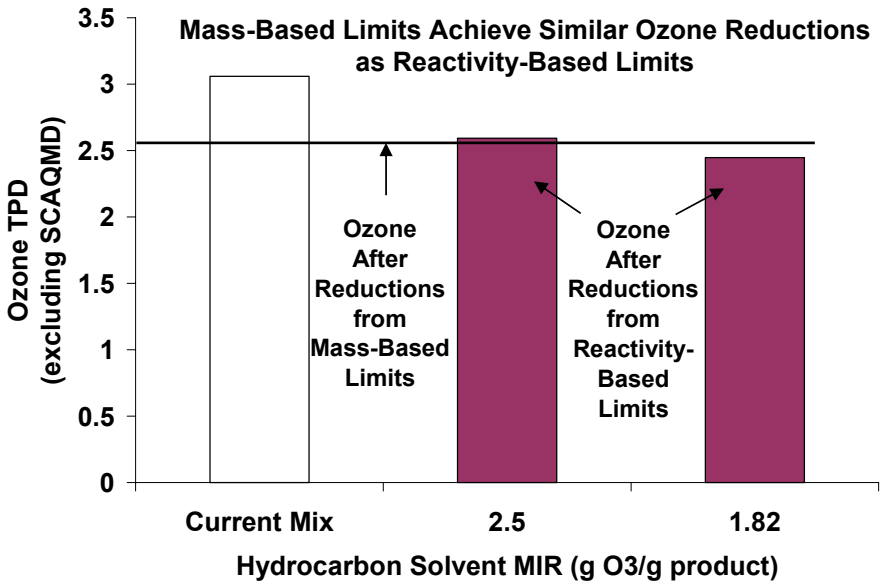
ARB staff then determined the expected ozone reductions from a reactivity-based limit. Staff identified all of the Aluminum Roof coatings that contained hydrocarbon solvents with MIR values greater than 1.82 g O_3/g product. Based on industry recommendations, staff evaluated two possible substitutions: (1) Replace all of the higher-MIR solvents with Bin 15 hydrocarbon solvents that had an MIR value of 1.82 g O_3/g product. This substitution would result in a maximum ozone formation potential of 2.0 tpd, outside of the South Coast AQMD; or (2) Replace all of the higher-MIR solvents with a blend of hydrocarbon solvents that had an MIR value of 2.50 g O_3/g product. This substitution would result in a maximum ozone formation potential of 2.2 tpd, outside of the South Coast AQMD. These analyses assume that the solvent substitution would be on an equivalent mass basis. However, industry representatives acknowledge that they might need to use larger amounts (e.g., 20% more) of the low-MIR hydrocarbon solvents to achieve a solvency that is comparable to the higher-MIR solvents. Therefore, it is expected that the maximum ozone formation potential could be up to 2.6 tpd for reformulated products. When this amount is compared to the 2004 baseline of 3.06 tpd, the amount of ozone reduction from a reactivity-based limit would likely be about 0.5 tpd. This amount is comparable to the reduction that would be expected from establishing a mass-based VOC limit of 400 g/l.

Based on this analysis, it does not appear that a reactivity-based limit would achieve emission reductions beyond what could be achieved by implementing the proposed mass-based limit of 400 g/l. Since a reactivity-based limit would require additional district resources without providing a significant increase in ozone reductions, ARB staff determined that the proposed mass-based limit was preferable. Figure 5.1-1 illustrates the analysis stated above.

ARB staff also evaluated what type of solvent substitution would be required to achieve an ozone reduction that is comparable to the 100 g/l VOC limit that is in effect in the South Coast AQMD. As shown above, a 100 g/l limit would achieve an estimated 2.66 tpd of ozone reductions outside of the South Coast AQMD. To achieve a similar type of reduction,

using solvent substitution, ARB staff estimate that it would be necessary to replace all hydrocarbon solvents with a solvent blend that has an MIR value of 0.21 g O_3/g product. ARB staff does not believe that existing hydrocarbon solvent blends are available with this type of MIR value and the necessary physical properties. This analysis assumes that the hydrocarbon substitution would be on an equivalent mass basis.

Figure 5.1-1
Aluminum Roof Coatings: Ozone Reductions From Using Less Reactive Solvents



5.1.6.3. Issue: The RCMA and NPCA believe that the use of high-reflective, low-emissive coatings such as Aluminum Roof coatings may have a niche within cool climate areas throughout the State of California.

Response: As mentioned previously, research results indicate that the application of these products can be advantageous in colder climates (e.g., such as Northern California) and they can provide energy savings. This may be associated with the low-emissive nature of the Aluminum Roof coatings that allow it to maintain heat in colder temperatures while remediating some solar radiation during warmer temperatures. ARB staff believes that high-reflective, low-emissive coatings are available in formulations that are compliant with the proposed 400 g/l VOC limit.

5.1.6.4. Issue: RCMA states that the Aluminum Roof category should retain the definition of 0.4 lbs aluminum per gallon that it had under the Metallic Pigmented category rather than use the definition of at least 0.7 lbs aluminum per gallon.

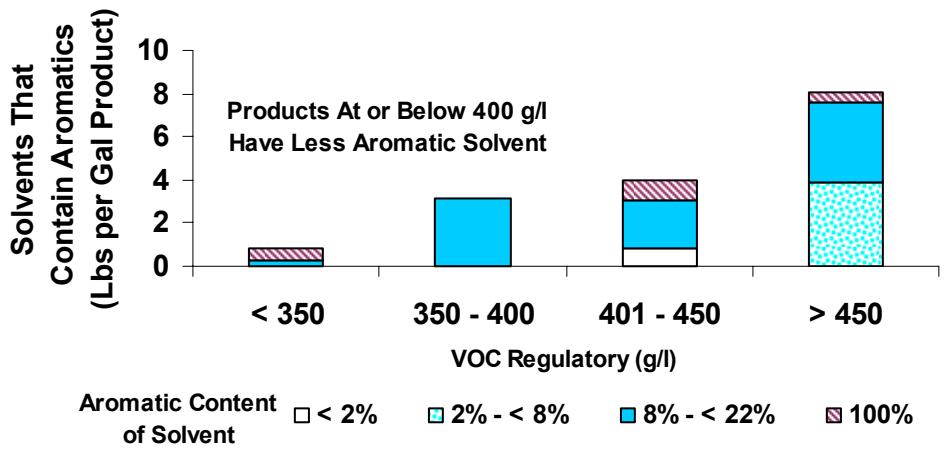
Response: Based on the results of the ARB Survey, the majority of aluminum roof products reported were bituminous-based coatings that

complied with the proposed 400 g/l VOC limit and met the proposed threshold of 0.7 lbs/gal. In a meeting with the Henry Company and RCMA, they stated that the optimal range for bituminous-based Aluminum Roof coatings is around 0.7 to 1.0 lbs/gal. Above 1.0 lb/gal, the benefits are minimal, and reflectivity and emissivity can decrease in value. From 0.4 to 0.7 lbs/gal there is a rapid increase in reflectivity potential for these bituminous-based coatings. An aluminum content requirement of 0.7 lbs/gal is also consistent with the South Coast AQMD Rule 1113 definition. Therefore, ARB staff believes that the 0.7 lbs/gal is appropriate at this time.

5.1.6.5. Issue: RCMA believes that lowering the VOC limit from 500 g/l to 400 g/l would decrease the use of aliphatic, low MIR, solvents and increase the use of aromatic, high MIR, solvents.

Response: ARB staff investigated the hydrocarbon solvent use in Aluminum Roof coatings based on ARB survey data. Hydrocarbon solvents are mixtures of several chemicals that contain varying amounts of aromatic hydrocarbons (ARB, 2007). Figure 5.1-2 illustrates the usage of aromatic hydrocarbon solvents at varying VOC contents. This shows the use of hydrocarbon blends containing high aromatics contents decreases with decreasing VOC content. Thus, the use of aromatic hydrocarbons does not increase when the VOC limit is lowered to 400 g/l.

Figure 5.1-2
Aromatic Hydrocarbon Solvent Usage vs. VOC Content



5.1.7. Conclusion

We recommend a 400 g/l VOC limit for Aluminum Roof coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on our review of ARB survey data, complying

marketshares, the number of companies making compliant products, and product information from manufacturers. The United States Environmental Protection Agency (U.S. EPA), Ozone Transport Commission (OTC), and Canada do not have a separate category for Aluminum Roof coatings. These products are regulated under the Metallic Pigmented category with a VOC limit of 500 g/l. The South Coast AQMD adopted a 100 g/l limit for Aluminum Roof coatings that became effective January 1, 2005. Our recommended limit is higher than the limit adopted by the South Coast AQMD, but lower than the limits set by the U.S. EPA, OTC, and Canada.

The South Coast area has a temperate climate that is not subject to the weather extremes that occur in other parts of California. ARB staff found that solventborne products are needed for colder, wetter climates until the technology advances for waterborne products. In addition, ARB staff is concerned about potential safety issues associated with the generation of hydrogen gas in waterborne aluminum coatings. Based on discussions with manufacturers, those products that do meet the South Coast limit have been repackaged with plastic containers and vents, have a shelf life of six months from production to application, and are usually made to order for specific jobs.

5.2. BASEMENT SPECIALTY COATINGS

VOC Limit Table (g/l)

USEPA: 600 (WST)	Canada: 400 (WCMS or WPS)	OTC: 400 (WCMS or WPS)	SCAQMD: 100 (WCMS or WPS)	SCM Proposed: 400

5.2.1. Category Definition

A clear or opaque coating that is labeled and formulated for application to concrete and masonry surfaces to provide a hydrostatic seal for basements and other below-grade surfaces. Basement Specialty Coatings must meet the following criteria:

- Coating must be capable of withstanding at least 10 psi of hydrostatic pressure, as determined in accordance with ASTM Standard D7088-04; and
- Coating must be resistant to mold and mildew growth and must achieve a microbial growth rating of 8 or more, as determined in accordance with ASTM Standard D3273-00 (Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber) and D3274-95 (Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation).

“Basement Specialty Coating” is a proposed new category that includes products which were formerly covered by the following two categories in the 2000 SCM:

Waterproofing Concrete/Masonry Sealer (WCMS): A clear or pigmented film-forming coating that is labeled and formulated for sealing concrete and masonry to provide resistance against water, alkali, acids, ultraviolet light and staining.

Waterproofing Sealer (WPS): A coating labeled and formulated for application to a porous substrate for the primary purpose of preventing the penetration of water.

These two categories have been eliminated from the proposed SCM and the types of products that were previously in these categories would be covered by the following: Basement Specialty Coating; Concrete/Masonry Sealer; Wood Coatings; Industrial Maintenance; Primer, Sealer, Undercoater; and Waterproofing Membrane.

Under the U.S. EPA Architectural Coating regulation, Basement Specialty Coatings would be covered by the "Waterproofing Sealers and Treatments (WST)" category.

5.2.2. Major Proposed Changes

- Basement Specialty Coating is a new category that includes coatings formerly classified under Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer.

5.2.3. Coating Description

Basement Specialty Coatings prevent the intrusion of water into basement areas and help to prevent mold, mildew, and efflorescence. They are designed to withstand hydrostatic pressures and are sometimes certified in accordance with Federal Specification TT-P-1411 (Paint, Copolymer-Resin, Cementitious for Waterproofing Concrete and Masonry Walls). Specification TT-P-1411 was officially cancelled on December 1, 1994 without replacement. However, there is an active standard which applies to this group, ASTM Standard D-7088-04 (Standard Practice for Resistance to Hydrostatic Pressure for Coatings Used in Below Grade Applications Applied to Masonry). Some waterborne latex products can reportedly withstand hydrostatic pressures of at least 10 psi, while some cementitious solventborne coatings can reportedly withstand hydrostatic pressures greater than 30 psi. Some of the solventborne products that were reported in the survey can be applied to wet basement walls. None of the waterborne coatings claimed to be suitable for application on wet basement walls. In addition to these products, there are also many zero-VOC cementitious powders that are mixed with water and are specifically intended for application on wet basement walls. For decorative purposes, these cementitious coatings may be tinted or topcoated with a waterborne acrylic coating. There are some safety concerns associated with the use of cementitious powder products, because they

contain silica dust which can become airborne during handling. Crystalline Silica is included on California's Proposition 65 List of "Chemicals Known to the State to Cause Cancer or Reproductive Toxicity".

Basement Specialty Coatings can either be applied by professional contractors or homeowners. Application methods for liquid coatings include brush, roller, and sprayer. Solventborne Basement Specialty Coatings are generally single component formulations with acrylic or vinyl toluene resins. Waterborne formulations contain acrylic, styrene-butadiene, and vinyl acrylic resins. Products that can withstand 10 psi hydrostatic pressure are available in waterborne formulations that have VOC contents less than 150 g/l. Waterborne coatings with VOC contents less than 150 g/l represent 23 percent of the sales volume for the Basement Specialty Coating group, excluding small containers. Solventborne products with VOC contents less than 400 g/l represent the remaining 77 percent of sales volume.

Some industry representatives requested a 400 g/l VOC limit for Basement Specialty Coatings to accommodate cementitious solventborne products that could be applied to wet surfaces and would be resistant to mold and mildew. ARB staff considered the following options:

Option 1: Establish a 400 g/l limit that would only be allowed for cementitious products which were capable of being resistant to a hydrostatic pressure of at least 30 psi and could be applied to wet surfaces. Basement coatings that could not meet these requirements would be covered by the Concrete/Masonry Sealer category and would be subject to a 100 g/l limit. This option was not chosen because some industry representatives were concerned that establishing a 30 psi threshold was unnecessary because basements aren't generally exposed to such high pressures (30 psi is equivalent to 69 feet of water at 60 degrees F). In addition, they expressed safety concerns associated with testing concrete blocks under such high pressures, because ASTM D-7088 was not designed for pressures greater than 10-15 psi. ARB staff agreed with these concerns.

Option 2: Establish a 150 g/l limit that would effectively restrict basement coatings to waterborne technology. Wet basement walls could be coated with zero-VOC cementitious powder products. This option was not chosen because industry representatives expressed safety concerns about the use of cementitious powders that contain silica dust which could be inhaled and create a health risk. In addition, the emission reductions that would be achieved with this option are relatively negligible.

Option 3: Establish a 400 g/l limit that would apply to basement coatings that were capable of being resistant to a hydrostatic pressure of at least 10 psi and could achieve a rating of at least 8 for mold and mildew resistance (ASTM, 2002; ASTM, 2005). ARB staff determined that this option was technologically feasible and included appropriate criteria that would help prevent abuse of the category.

Although, the 400 g/l limit is higher than the 100 g/l limit for Concrete/Masonry Sealers, the emission reduction losses are relatively negligible because this category has a small sales volume in California. This may not be the case in other areas (e.g., the Northeast, Midwest, etc.) where sales of basement coatings are much greater and there is an increased potential for achieving emission reductions.

5.2.4. Substrates/Exposures

Basement Specialty Coatings are intended for application to concrete and masonry substrates in basements and other below-grade surfaces. Products in this category provide a waterproofing seal to prevent water intrusion and some products can be applied to wet surfaces.

5.2.5. Survey Results

Basement Specialty Coating is a new category; therefore, it was not reported separately in ARB's 2005 Architectural Coating Survey. Please refer to the Concrete/Masonry Sealer section for survey data that were reported for Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer.

Table 5.2-1 contains complying marketshare data for the proposed new Basement Specialty Coating category. This table reflects combined data for Basement Specialty Coating products that were reported under two previous categories: Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer.

The table shows that 100 percent of the sales volume complies with the proposed VOC limit of 400 g/l. This complying marketshare is based on the assumption that available products will be able to meet the requirement for mold and mildew resistance that is established in the new category definition. However, it is possible that some products will not meet the new criteria, which would result in a lower complying marketshare. It is ARB staff's intention that the Basement Specialty Coating category be restricted to products that have resistance to hydrostatic pressure and mold/mildew, because we do not believe that a 400 g/l limit is necessary for products that only have 10 psi hydrostatic pressure resistance. Products that do not have mold/mildew resistance and do not meet the criteria for the Basement Specialty Coating definition would be covered by other categories (e.g., Concrete/Masonry Sealer). ARB staff identified four products that are intended for basement applications and could comply with the proposed 100 g/l VOC limit for Concrete/Masonry Sealer. Therefore, staff believes that compliant products are available for basement coatings that do not have the mold/mildew resistance to meet the performance criteria for Basement Specialty Coating. A listing of coatings intended for basement application is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

Table 5.2-1: Complying Marketshare & Emission Reductions Basement Specialty Coating

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
400	9	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.2.6. Conclusion

For the new Basement Specialty Coating category, we are recommending a VOC limit of 400 g/l, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare and information provided by manufacturers. The proposed VOC limit is higher than the 100 g/l limit contained in SCAQMD Rule 1113. However, manufacturers that provide coatings in the SCAQMD area can still sell products which exceed the 100 g/l limit, if they participate in SCAQMD's averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit. In addition, the emission reduction losses for this category are negligible for a 400 g/l limit as compared to a 100 g/l limit, due to the small sales volume. The proposed SCM VOC limit is lower than the national limit of 600 g/l promulgated by the United States Environmental Protection Agency (U.S. EPA). The proposed limit is the same as the limit for Waterproofing Concrete/Masonry Sealers (400 g/l) and higher than the limit for Waterproofing Sealers (250 g/l), as approved for the Ozone Transport Commission and proposed by Canada.

5.3. BITUMINOUS ROOF COATING

VOC Limit Table (g/l)

USEPA: 500 (Bituminous Coatings and Mastics)	Canada: 300	OTC: 300	SCAQMD: 50	SCM Proposed: 50

5.3.1. Category Definition

A coating which incorporates bitumens that is labeled and formulated exclusively for roofing.

5.3.2. Major Proposed Changes

- The proposed VOC limit for Bituminous Roof Coatings would decrease from 300 g/l to 50 g/l.

5.3.3. Coating Description

Bituminous Roof coatings have historically been an inexpensive and effective way to protect a roof from water penetration and corrosion from many elements. Today, the use of bituminous products remains prevalent in the roofing industry with a few minor formulation changes for environmental precautions and protection. As with all bitumen products, roofing bitumens may either be a product of petroleum refining (asphalts) or a product of the coal cooking process (coal tar pitch) (ARMA, 2007). Usually, Bituminous Roof coatings are used between layers for a flat or low-slope Built Up Roof (BUR) system or as a base coat for modern reflective coatings. Recently, bituminous products have been reinforced or modified with polymers to improve tensile strength and durability to improve physical properties for most environments. These are roof coatings that complement Modified Bitumen Systems (MBS). Both BUR and MBS are similar in that they may require layers of asphalt, adhesives, and plies or fabric sheets to ensure protective properties. Bituminous Roof coatings are used in several applications, including: adhesive/waterproofing agents for BUR and MBS systems; base layers for reflective coatings; and as weathering barriers for metal roofs.

Bituminous Roof coatings can be applied with a brush, trowel, mop, or sprayer. In the past, asphalt products were hot-applied with mops or were torch-applied, but these coatings have been replaced by safer, cold-applied products that cure at ambient temperatures. As a result, energy use in the field has decreased because it is not necessary to heat up and maintain hot asphalt. The finished characteristics of these coatings are typically brown or black in color with a flat, coarse texture. Bituminous products are not naturally reflective and they retain solar radiation due to absorptive properties of dark colors. Solar reflectance (a.k.a. albedo), the amount of solar radiation not absorbed, for BURs and MBSs ranges from 5% up to 25% and infrared emittance, the amount of thermal radiation given off, for bituminous products is around 90% (Kriner, 2006; Bretz et al., 1998). Therefore, these products do not meet Title 24 Cool Roof requirements for stand-alone roofing options, which need to achieve a minimum solar reflectance of 70 percent and infrared emittance of 75 percent (CEC, 2006). However, it's possible to meet Title 24 standards by using a bituminous basecoat and a white elastomeric topcoat. This type of system was applied to the Convention Center in Anaheim, California, and it qualified as a Title 24 Cool Roof (JAC, 2007).

Bituminous Roof coatings are generally applied by professional roofing crews, but they are also applied by homeowners and business owners. These products are single component formulations that contain asphalts, coal tars, and/or gilsonite (a naturally occurring asphalt). They may also contain additives such as clay, fibers, pigments, polymers, and/or surface active agents (RCMA, 2006). Some products contain polymers that improve UV resistance, flexibility, and resistance to aging and weathering. Some polymers contribute to a UL Class A

Fire Rating to improve the safety of the building. The two most popular modifiers are styrene-butadiene-styrene (SBS) and atactic polypropylene (APP) polymers. During curing, a natural process occurs known as “tobacco juicing,” which is when a residue seeps out of asphalt/coal during the drying process. It is water soluble and washes away with the first rain of the season. However, if not properly washed away, it can cause peeling of acrylic and aluminum topcoats (ARMA, 1994).

With bituminous coatings being petroleum based, the historical tendency was towards solventborne products that contained mineral spirits or other hydrocarbon solvents. In recent years, the trend in California has shifted to waterborne asphalt emulsions that satisfy local VOC requirements. Some industry experts consider asphalt emulsions to be inferior to solventborne asphalts due to slightly restrictive ambient temperature applications, elasticity, adhesion, and longevity. With advancements in waterborne formulations, pigment, and polymer additives, waterborne emulsions “can flow and be easily applied” while solvent-based additives are added “to provide additional properties to the coating, such as freeze resistance and improved film formation” (Sosinski, 2006). Polymer additives are also beneficial for roof performance by allowing the coating to stretch and retract during thermal expansions and contractions. After the curing process, predominately in warmer conditions, waterborne roof coatings can “provide excellent performance with respect to water resistance, dirt pick-up, and adhesion to the substrate” (Sosinski, 2006). These lower VOC waterborne products, through reformulations, are gradually providing performance comparable to solventborne coatings, particularly during warmer temperatures. However, both waterborne and solventborne coatings require periodic re-coating to retain their much needed protective properties.

In California, most Bituminous Roof coatings are waterborne asphalt emulsions and they function well in the moderately temperate conditions throughout the State. Outside of the South Coast Air Basin, which has a very temperate climate, the vast majority of California’s population still resides in areas that are temperate enough to apply asphalt emulsions throughout most of the year. However, residents of the Sierra Nevada, Northern California, and other parts of the country (e.g. Northeast and Midwest) are subject to colder or less temperate climates that may not permit the use of waterborne emulsions. Emulsion Bituminous Roof coatings can be adversely impacted by unexpected rain, heavy dew, thick fog, and extremely cold temperatures due to slower cure times compared to solventborne coatings. Traditional solventborne bituminous products may be beneficial in less temperate climates because they have the potential to adhere better and withstand sudden shifts in climate.

5.3.4. Substrates/Exposures

Bituminous Roof coatings can be used for new roofing, re-roofing, and re-covering projects on a wide variety of substrates. Certain substrates, like

concrete and wood, must be properly prepared to accept bituminous coatings. In some cases, it may be necessary to apply felt, fiberglass, polyester or composite sheets, prior to the application of bituminous coatings. Most roofs that are wet, damp, or subject to ponding water are generally not suitable for these coatings. All roofs should have positive drainage to maximize roof coating properties, including longevity. However, some products have the ability to deter the degradation effects associated with ponding water.

Solventborne and waterborne bituminous products are usually sensitive to ambient temperatures outside the range of 50 – 120 degrees F, and should never be subjected to freezing temperatures. Some specialty products can be applied outside of this temperature range. For most applications, the temperature must be at least 5 degrees F above the dew point for the best adhesion and cure. Solventborne products have a slight advantage in colder applications. They can be applied as low as 40 degrees F with some manufacturers stating applications as low as 32 degrees F.

In some cases, roofers use solventborne adhesives, cements, or sealants to patch roofs during inclement weather. They can then apply waterborne coatings when conditions are more favorable. It is important to note that roof patching adhesives, cements, and sealants are not covered by architectural coatings regulations. They are subject to VOC limits in districts' Adhesive and Sealant Rules. If applied correctly, Bituminous Roof coatings resist water penetration and have the ability to endure extreme environments. They can be formulated with polymer modifiers to resist mild alkali or acidic conditions and can be highly resistive to UV light.

5.3.5. Survey Results

Table 5.3-1 summarizes our estimate of sales and VOC emissions from the Bituminous Roof Coatings category, based on results from the ARB survey. In 2004, the sales volume for Bituminous Roof coatings in California was approximately 1.5 million gallons which represents 1.3 percent of the total California sales volume for architectural coatings. In 2000, the sales volume for Bituminous Roof coatings was more than 3 million gallons, because some manufacturers reported cements, adhesives, and sealers under the Bituminous Roof category. The drop in sales volume from 2000 to 2004 is primarily due to the elimination of cements, sealers, and adhesives from the survey data.

In 2004, VOC emissions from Bituminous Roof Coatings were about 0.4 tpd, which represents approximately 0.4 percent of the total emissions from architectural coatings. Solventborne coatings produce about 93 percent of the VOC emissions from this category, but only account for 9 percent of the sales volume.

Table 5.3-1: Survey Data
Bituminous Roof

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	41	133,728	9%	0%	100%	0%	2%	252	0.38
WB	38	1,330,598	91%	0%	100%	0%	0%	3	0.03
Total	**79**	**1,464,326**		**0%**	**100%**	**0%**	**0%**	**26**	**0.41**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.3-2 contains complying marketshare data for the Bituminous Roof Coatings category, based on results from the ARB survey. This table shows that 90 percent of the sales volume for Bituminous Roof coatings complies with the proposed VOC limit of 50 g/l. The expected VOC emission reductions for this proposed limit are 0.17 tpd.

Waterborne Bituminous Roof Coatings have a sales-weighted average (SWA) VOC Regulatory level of 3 g/l, which is below the proposed VOC limit for this category. From 2000 to 2004, the overall SWA VOC Regulatory level for this category has decreased from 120 g/l to 26 g/l, a 78 percent drop.

Table 5.3-2: Complying Marketshare & Emission Reductions
Bituminous Roof

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
50	35	90%	0.17

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

A listing of Bituminous Roof coating manufacturers and products that comply with the proposed VOC limit is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm). Of the 16 companies that reported sales in this category, eleven offered Bituminous Roof coatings that comply with the proposed limit (ARB, 2006). Of these eleven companies, three are considered to be small businesses, because they have fewer than 250 employees.

5.3.7. Manufacturer and Industry Issues

Some manufacturers and industry representatives have expressed concerns about certain aspects of the proposed SCM regarding VOC limits, definitions, and other technical issues. Below are key issues that have been brought to our attention during our interactions with the industry representatives.

5.3.7.1. Issue: The Roof Coatings Manufacturers Association (RCMA) and the National Paint and Coatings Association (NPCA) have expressed concerns about premature performance failures of low-VOC roof coating products, because they are not designed for colder, humid, and/or rainy climates. Also, they believe that premature application failures are a result of applying coatings in temperatures or humid conditions not suitable for lower VOC coatings. They believe that these premature failures could reduce life cycle performance and increase waste generation.

Response: Based on manufacturer product data sheets, total sales volume, and complying marketshare it appears that some waterborne products require a minimum application temperature of 50 degrees F versus 40 degrees F. However, the 90 percent complying marketshare suggests that these lower VOC waterborne products are just as effective as higher VOC solventborne coatings while providing adequate protection from cold, humid, and/or rainy climates.

5.3.7.2. Issue: The NPCA and RCMA recommend the use of a reactivity-based approach for regulating Roof Coatings. Some industry representatives have suggested that the ARB use the units of grams of ozone generated per gallon of coating to establish a reactivity-based standard. Industry and manufacturer representatives have also suggested that low-reactive products with higher VOC contents should be exempt from future SCM limits, because they have lower ozone formation potential. Industry representatives have suggested that lower-reactivity products could be formulated by replacing some hydrocarbon solvents with other hydrocarbon solvents that have a lower maximum incremental reactivity (MIR) value.

Response: ARB staff analyzed industry's proposed approach for developing Bituminous Roof coatings with a reduced ozone formation potential. Staff compared ozone reductions from a mass-based limit to ozone reductions that could be achieved with a reactivity-based limit. With a mass-based limit, manufacturers would need to reduce their overall VOC content. With a reactivity-based limit, manufacturers could maintain their current overall VOC contents, but they would need to reformulate with less reactive hydrocarbon solvents.

The reactivity (i.e., maximum ozone formation potential) can be determined based on the MIR value for each of the chemicals contained in a coating. Since hydrocarbon solvents are mixtures of several chemicals, ARB developed a bin system to assign MIR values to hydrocarbon solvents, based on boiling point and chemical characteristics (ARB, 2007). For hydrocarbon solvents, the assigned MIR values range from 0.81 grams ozone per gram product (g O_3/g product) for Bin 12 up to 8.01 g O_3/g product for Bin 23. The most common hydrocarbon solvents reported for Bituminous Roof Coatings are Bin 15 (MIR = 1.82 g O_3/g product).

Using data from the ARB Survey, ARB staff determined that the maximum ozone formation potential (OFP) for all Bituminous Roof coatings was 0.63 tpd Ozone in 2004, outside of the South Coast AQMD (ARB, 2007). Implementing a mass-based 50 g/l VOC limit is expected to achieve an emission reduction of 0.17 tpd and a corresponding ozone reduction of 0.47 tpd, outside of the South Coast AQMD.

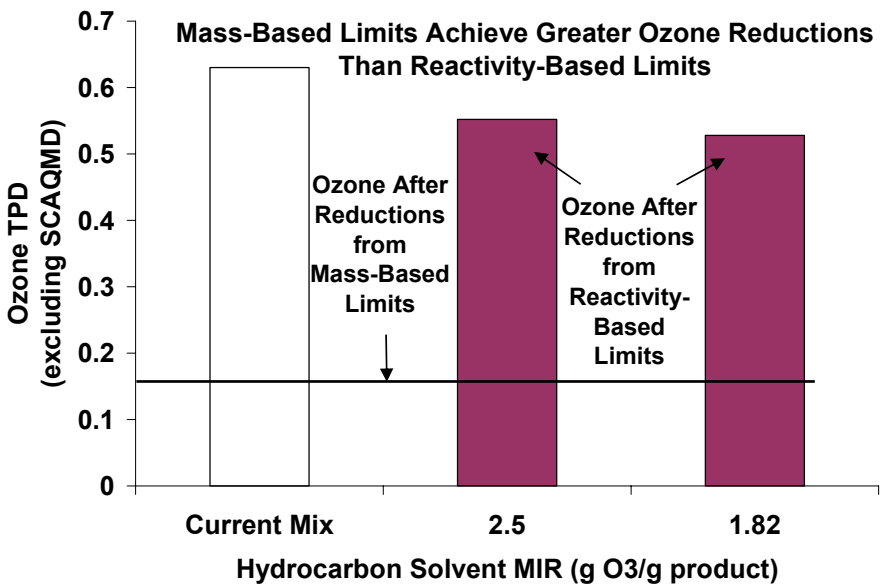
ARB staff then determined the expected ozone reductions from a reactivity-based limit. Staff identified all of the Bituminous Roof coatings that contained hydrocarbon solvents with MIR values greater than 1.82 g O_3/g product. Based on industry recommendations, staff evaluated two possible substitutions: (1) Replace all of the higher-MIR solvents with Bin 15 hydrocarbon solvents that had an MIR value of 1.82 g O_3/g product. This substitution would result in a maximum ozone formation potential of 0.44 tpd, outside of the South Coast AQMD; or (2) Replace all of the higher-MIR solvents with a blend of hydrocarbon solvents that had an MIR value of 2.50 g O_3/g product. This substitution would result in a maximum ozone formation potential of 0.46 tpd, outside of the South Coast AQMD. This analysis assumes that the hydrocarbon substitution would be on an equivalent mass basis. However, industry representatives acknowledge that they might need to use larger amounts (e.g., 20% more) of the low-MIR hydrocarbon solvents to achieve a solvency that is comparable to the higher-MIR solvents. Therefore, it is expected that the maximum ozone formation potential could be up to 0.55 tpd for reformulated products. When this amount is compared to the 2004 baseline of 0.63 tpd, the amount of ozone reduction from a reactivity-based limit would likely be about 0.1 tpd. This amount is less than the reduction that would be expected from establishing a mass-based VOC limit of 50 g/l.

Based on this analysis, it does not appear that a reactivity-based limit would achieve emission reductions beyond what could be achieved by implementing the proposed mass-based limit of 50 g/l. Since a reactivity-based limit would require additional district resources without providing an increase in reductions, ARB staff determined that the proposed mass-

based limit was preferable. Figure 5.3-1 illustrates the analysis stated above.

ARB staff also evaluated what type of solvent substitution would be required to achieve an ozone reduction that is comparable to the 50 g/l VOC limit that is proposed in the SCM. A 50 g/l limit would achieve an estimated 0.47 tpd of ozone reductions outside of the South Coast AQMD. To achieve a similar type of reduction, using solvent substitution, ARB staff estimates that it would be necessary to replace all hydrocarbon solvents with a solvent blend that has an MIR value of 0.5 g O_3/g product. ARB staff does not believe that existing hydrocarbon solvent blends are available with this type of MIR value and the necessary physical properties. This analysis assumes that the hydrocarbon substitution would be on an equivalent mass basis.

Figure 5.3-1
Bituminous Roof Coatings: Ozone Reductions From Using Less Reactive Solvents



5.3.7.3. Issue: RCMA stated that, in California, waterborne emulsions are applied as a part of regular roof maintenance during the summer while solventborne coatings are used during storms to repair leaking roofs.

Response: The ARB has recognized the need for emergency repair and has omitted adhesives, sealants, and cements from this SCM category. These products are subject to district rules, and generally have higher VOC limits to ensure proper application, curing, and the ability to handle repairs during inclement weather.

5.3.7.4. Issue: RCMA believes that lowering the VOC content may result in greater quantities of coating used per square foot, because compliant coatings have a higher viscosity and using them could increase solvent release, ozone formation, and consumer costs. They believe this could also lead to higher ozone formation by forcing manufacturers to use only highly reactive solvents.

Response: ARB staff does not expect this VOC limit to result in lower VOC solventborne products with highly reactive solvents. Products that comply with the proposed 50 g/l limit can be formulated with waterborne emulsions.

5.3.9. Conclusion

We recommend a 50 g/l VOC limit for Bituminous Roof coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on our review of ARB survey data, complying marketshares, number of companies making compliant products, and product information from manufacturers. The United States Environmental Protection Agency (U.S. EPA) has a 500 g/l limit for all bituminous coatings. The Ozone Transport Commission (OTC) and Canada have set a 300 g/l limit. The South Coast AQMD adopted a 50 g/l limit for all Roof coatings that became effective January 1, 2005. Our recommended limit is consistent with the limit adopted by the South Coast AQMD, but lower than the limits set by the U.S. EPA, OTC, and Canada.

With the proposed ARB VOC limit of 50 g/l, the complying marketshare for this category is 90 percent. This is substantial and indicates that technology is available to achieve a 50 g/l VOC limit.

5.4. BITUMINOUS ROOF PRIMER

VOC Limit Table (g/l)

USEPA: 500 (Bituminous Coatings and Mastics)	Canada: 350	OTC: 350	SCAQMD: 350	SCM Proposed: 350

5.4.1. Category Definition

A primer which incorporates bitumens that is labeled and formulated exclusively for roofing and intended for the purpose of preparing a weathered or aged surface or improving the adhesion of subsequent surfacing components.

5.4.2. Major Proposed Changes

- Definition has been altered to specify the role of bituminous roof primers.

5.4.3. Coating Description

Bituminous Roof Primers are used to prepare a surface for the application of a bituminous/asphalt based roofing system or a reflective topcoat. They are designed to improve adhesion to substrates that are not prepared to receive topcoats or roofing systems. They also provide protection from water intrusion and improved weatherability. Some substrates do not require the use of primers to enhance adhesion. In some cases, Bituminous Roof Coatings can be used as basecoats and they are sufficient to prepare the surface for a reflective topcoat. However, excessively weathered, dirty, and aged substrates typically require a Bituminous Roof Primer prior to application of a reflective topcoat.

Typically, Bituminous Roof Primers are single component coatings. Most of the reported products have solventborne formulations with mineral spirits or other hydrocarbon solvents, but waterborne products are also available with asphalt emulsions. One of the reported waterborne products incorporates a styrene-butadiene resin to improve curing time.

Bituminous Roof Primers are cold-applied in a thin layer, using a brush or sprayer. Manufacturers do not recommend applying a thick layer of primer because there may be an increase in curing time due to slower evaporation of solvent. This can cause adhesion failures (e.g. peeling and bubbling) and potential problems with topcoat application. These coatings are generally applied by roofing contractors, but they can also be applied by homeowners.

5.4.4. Substrates/Exposures

Bituminous Roof Primers are for exterior use only and are primarily used to prepare existing bituminous roofs. They can also be applied to a wide range of substrates, including asphalt, concrete, stone, masonry, metal, plywood, hardboard, and other composition materials.

Drying times and re-coat times vary widely for bituminous roof primers. Some must be topcoated within 24 hours or repriming is necessary. Others require 1 - 4 months of curing before applying a topcoat, to ensure that “tobacco juices” do not bleed into the top-coat and cause staining. During application, it is advisable to apply roof primer to flat, low-slope roofs with positive drainage, and no ponding water. Cold weather below 50˚F can also increase curing time, so extra time is required before applying any other roof coatings. Hot weather above 120˚F can cause Bituminous Roof Primers to become less viscous and induce sagging, running, and bubbling. Since Bituminous Roof Primers are designed primarily for primer purposes, direct exposure to the elements is not recommended.

5.4.5. Survey Results

Table 5.4-1 summarizes our estimate of sales and VOC emissions from the Bituminous Roof Primers category based on results from the ARB survey. In 2004, the sales volume for Bituminous Roof Primers in California was approximately 68,000 gallons which represents less than 0.1 percent of the total California sales volume for architectural coatings. From 2000 to 2004, the sales volume for Bituminous Roof Primers decreased 60 percent and the overall sales-weighted average VOC Regulatory level increased from 211 g/l to 324 g/l, a 54 percent increase.

In 2004, VOC emissions from Bituminous Roof Primers were about 0.24 tpd, which represents less than one percent of the total emissions from architectural coatings. Solventborne coatings produce about 96 percent of the VOC emissions, but they only account for 88 percent of the sales volume.

Table 5.4-1: Survey Data
Bituminous Roof Primer

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day) [4]
SB	26	59,968	88%	0%	100%	0%	0%	346	0.23
WB	5	8,124	12%	0%	100%	0%	0%	167	0.01
Total	**31**	**68,092**		**0%**	**100%**	**0%**	**0%**	**324**	**0.24**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.4-2 contains complying marketshare data for the Bituminous Roof Primers category, based on results from the 2005 ARB survey. This table shows that 79 percent of the sales volume for Bituminous Roof Primers complies with the current VOC limit of 350 g/l. In 2000, 73 percent of the sales volume complied with the 350 g/l limit.

Table 5.4-2: Complying Marketshare & Emission Reductions
Bituminous Roof Primer

Existing VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
350	15	79%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

A listing of Bituminous Roof Primer manufacturers and products that comply with the proposed VOC limit is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm). Of the nine companies that

reported sales in this category, four offered Bituminous Roof Primers that comply with the existing limit (ARB, 2006). Of these four companies, one company is considered to be a small business, because they have less than 250 employees.

5.4.6. Conclusion

We recommend maintaining the existing 350 g/l VOC limit for Bituminous Roof Primers. The proposed VOC limit is technologically and commercially feasible, based on our review of ARB survey data, the complying marketshare, the number of companies making compliant products, and product information from manufacturers. The United States Environmental Protection Agency (U.S. EPA) has a higher 500 g/l limit for all bituminous coatings. Our recommended limit is consistent with the limit adopted by the South Coast AQMD and the Ozone Transport Commission, and the limit proposed by Canada.

5.5. BOND BREAKERS

VOC Limit Table (g/l)

USEPA: 600	Canada: 350	OTC: 350	SCAQMD: 350	SCM Proposed: 350

5.5.1 Category Definition

A coating labeled and formulated for application between layers of concrete to prevent a freshly poured top layer of concrete from bonding to the layer over which it is poured.

5.5.2. Major Proposed Changes

- None.

5.5.3. Coating Description

Bond Breakers are coatings used to prevent bonding of concrete slabs to each other during tilt-up and precast construction. After the first concrete slab is poured and the final trowelling is complete, Bond Breaker is applied. Manufacturers generally recommend applying at least two coats. After the Bond Breaker dries, the second concrete slab can be poured on top of the Bond Breaker. After the second concrete slab dries, it is lifted to make a wall. Bond Breakers can also be applied on top of aged concrete surfaces, prior to pouring a new slab. Some products contain a temporary dye that allows one to conduct a quick visual inspection and ensure good coverage. The dye is no longer visible within hours after application. Many Bond Breakers are multi-functional and they can also be used for concrete curing and sealing. Some of the products that function as concrete curing compounds are designed to meet the requirements of ASTM standard C-309-06 (Liquid Membrane-Forming Compounds for Curing

Concrete). Products are usually applied by professional contractors using sprayers.

All of the Bond Breakers reported in the ARB survey are single component products sold in large containers and they fall into two main groups:

- Chemically Reactive: These products react with the alkali or lime in the concrete and seal the concrete pores.
- Non-Reactive: These products form a membrane, but they do not react with the concrete.

Chemically Reactive: These Bond Breakers react with the alkali or lime in the concrete and seal the concrete pores. This prevents fresh concrete and water from penetrating into the set concrete and sticking to the first slab. These chemically reactive products are not designed to dissipate, so Bond Breaker manufacturers generally recommend that concrete surfaces be cleaned with power washing, prior to the application of subsequent coatings or sealers. Most of the reported products in the chemically reactive group are waterborne formulations containing hydrocarbon resin, oleoresin, or polybutene resin. There are also solventborne formulations with hydrocarbon resin. Some waterborne formulations are available with VOC contents less than 200 g/l. For the Chemically Reactive group, products with VOC contents less than 200 g/l represent 3% of the reported sales volume, while 97% of the products in this group have VOC contents between 300 - 360 g/l.

Non-Reactive: These Bond Breakers form a membrane, but they do not react with the concrete. These products are designed to dissipate or break down in 4 - 6 weeks. After dissipation, residual material can be removed by pressure washing, prior to the application of subsequent coatings or sealers. Most of the reported products in the non-reactive group are waterborne formulations containing hydrocarbon resin, but there are also solventborne formulations with hydrocarbon resin. For the Non-reactive group, products with VOC contents less than 200 g/l represent 0% of the reported sales volume and almost 100% of the products have VOC contents between 250 -300 g/l.

5.5.4. Substrates/Exposures

Bond Breakers are applied to concrete slabs. Some products are designed to be resistant to rainfall, ultraviolet light exposure, and abrasion from foot traffic during the construction process.

5.5.5. Survey Results

Table 5.5-1 summarizes our estimate of sales and VOC emissions from the Bond Breaker category, as reported for the ARB 2005 survey.

Table 5.5-1: Survey Data
Bond Breaker Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	2	PD	PD	0%	100%	0%	0%	717	0.01
WB	11	PD	PD	0%	100%	0%	0%	300	0.16
Total	**13**	**187,785**		**0%**	**100%**	**0%**	**0%**	**302**	**0.17**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

The sales volume for Bond Breakers represents about 0.2 percent of the total California sales volume of architectural coatings in 2004. VOC emissions from Bond Breakers represent approximately 0.2 percent of the total emissions from architectural coatings. When compared to the data reported for calendar year 2000, Bond Breakers sales volume increased 100 percent in 2004, VOC emissions increased 148 percent, and the sales-weighted average VOC content increased 24 percent.

Table 5.5-2 contains complying marketshare data for Bond Breaker coatings, based on results from the 2005 ARB survey. This table shows that 73 percent of the sales volume for Bond Breakers complies with the current VOC limit of 350 g/l. When considering the number of products reported, approximately 69 percent comply with the current limit. Of the 5 companies that reported in this category, all 5 offered Bond Breaker coatings that comply with the current limit.

Table 5.5-2: Complying Marketshare & Emission Reductions
Bond Breaker Coatings

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
350	9	73%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.5.6. Conclusion

It appears to be technologically feasible to formulate Bond Breakers with VOC contents less than 300 g/l. However, the resulting emission reductions would be negligible. Therefore, we recommend that the VOC limit for Bond Breaker coatings remain at 350 g/l, at this time. The current VOC limit is technologically and commercially feasible, based on complying marketshare, the number of companies making complying products, and product information from manufacturers. The current VOC limit is lower than the national limit promulgated by the United States Environmental Protection Agency (U.S. EPA) for this category. The current limit of 350 g/l VOC is consistent with the limits in

effect in the South Coast Air Quality Management District, the Ozone Transport Commission, and the proposed limit for Canada.

5.6. CONCRETE CURING COMPOUNDS

VOC Limit Table (g/l)

USEPA: 350	Canada: 350	OTC: 350	SCAQMD: 100 (general) 350 (roadways & bridges)	SCM Proposed: 350

5.6.1. Category Definition

A coating labeled and formulated for application to freshly poured concrete to perform one or more of the following functions:

- Retard the evaporation of water; or
- Harden or dustproof the surface of freshly poured concrete.

5.6.2. Major Proposed Changes

- The category definition was modified to include products that are used on freshly poured concrete for hardening and dustproofing. It does not include products that are only suitable for application on cured concrete.

5.6.3. Coating Description

After concrete is poured, it undergoes a period of curing during which chemical and physical changes occur as the cement reacts with water. According to the American Concrete Institute, “The curing period is defined as the time period beginning at placing, through consolidation and finishing, and extending until the desired concrete properties have developed. The objectives of curing are to prevent the loss of moisture from concrete and, when needed, supply additional moisture and maintain a favorable concrete temperature for a sufficient period of time.” (ACI, 2001).

Concrete Curing Compounds help control the evaporation of water, which allows the concrete to properly hydrate during the curing period. These products are used on a variety of concrete surfaces, including walls, roadways, bridges, floors, sidewalks, and ramps. Many products are designed to comply with the requirements of ASTM C-309-06 (Liquid Membrane-Forming Compounds for Curing Concrete). The ASTM C-309 specification includes Type I materials, which are clear products, and Type II materials, which are white pigmented products that may be specified for use in hot weather. Other applicable standards are the American Association of State Highway and Transportation Officials (AASHTO) M-148 and the California Department of Transportation (CalTrans) Standard Specification 90-7.01B, which designates the acceptable types of Concrete Curing Compounds, based on ASTM C-309. CalTrans has

worked on revising this specification to allow for the use of low-VOC (≤100 g/l) products wherever possible, but they have had difficulty identifying low-VOC products that provide acceptable performance for roadways and bridges. Due to these difficulties, the South Coast AQMD established a special category for Concrete Curing Compounds that are applied on roadways and bridges with a VOC limit of 350 g/l.

All of the products that were reported in the survey are single component products sold in large containers and they are usually applied by professional contractors, using sprayers. They can also be applied with rollers or brushes. Concrete Curing Compounds fall into two general groups:

- New Concrete Only - Products that are applied to freshly poured concrete during the initial curing process; and
- New & Aged Concrete - Products that can either be applied to freshly poured concrete or to aged concrete.

There are several types of products that are only intended for application on freshly poured concrete. In general, these products form a membrane or film that seals in moisture for several days and ensures that the concrete is properly hydrated during the curing process. They also help resist cracking and dusting. Provided below are descriptions of Concrete Curing Compounds that are only for freshly poured concrete.

New Concrete Only - Cure & Wear Away: Some Concrete Curing Compounds form membranes that wear away or dissipate within a few months if they are exposed to sunlight, weathering, and abrasion. After the membrane wears away or is removed manually, the concrete can be sealed or topcoated. Some of these products contain a temporary dye that allows one to conduct a quick visual inspection and ensure good coverage. The dye begins to fade within hours after application with exposure to sunlight. The products in this group generally comply with ASTM C-309, Type I. Most of the products in this group are waterborne formulations. Most of them contain hydrocarbon resin, but there are also waterborne products with alkyd, acrylic, polyvinyl acetate, and oleoresin binders. A small portion of the sales volume includes solventborne formulations with phenolic resin. In this group, 11% of the sales volume had VOC contents less than 100 g/l and 35% had VOC contents less than 250 g/l.

New Concrete Only - Cure & Remain on Surface: For concrete surfaces that will not be topcoated, there are Concrete Curing Compounds that form a membrane and remain on the surface, rather than wearing away. The products in this group generally comply with ASTM C-309, Type II. This group is the only one where most products are designed to meet the Type II specification, which is a requirement for some CalTrans specifications. Most of the sales volume for these products includes solventborne formulations with styrene-butadiene resin or waterborne formulations with hydrocarbon resins. There are also some

waterborne products with wax emulsions and solventborne products with vinyl toluene resin. In this group, 4% of the sales volume had VOC contents less than 100 g/l and 35% had VOC contents less than 250 g/l.

New Concrete Only – Cure, Harden, Dustproof: Some Concrete Curing Compounds form a membrane and they help produce a hard, dustproof surface. These products reportedly enhance the strength and durability of the concrete. Some of the products in this group comply with ASTM C-309, Type I, while others comply with Type II. All of the reported products were waterborne formulations, most of which had wax emulsions. Other resin types include alkyd and hydrocarbon resins. In this group, 81% of the sales volume had VOC contents less than 100 g/l and 100% had VOC contents less than 250 g/l.

New Concrete Only – Evaporation Retarder: In the 2000 SCM, the definition for Concrete Curing Compounds only has one criteria - retarding the evaporation of water. However, there are products in this category that retard evaporation, but are not considered to be curing compounds. These products are called “evaporation reducers”, “vapor retarders”, or “evaporation retarders” and they can be used during the initial curing stages when water is evaporating too rapidly (e.g., during hot, dry, or windy conditions). Some products form a monomolecular film that slows evaporation, but still allows the concrete finishing work to be completed. After the finishing work is complete, Concrete Curing Compounds can be applied to control the evaporation of water during the remainder of the curing process. Since evaporation retarders are not curing compounds, they are not designed to comply with ASTM C-309. Since they are relatively new products, no industry-wide specifications have been developed for them, at this time (FHWA, 2006). Evaporation retarders only account for 1% of the total sales volume for Concrete Curing Compounds. All of the reported products were waterborne formulations, most of which contain fatty alcohol binders. In this group, 63% of the sales volume had VOC contents less than 100 g/l and 100% had VOC contents less than 250 g/l.

New & Aged Concrete: Some products in the Concrete Curing Compound category can be used for both new concrete and aged concrete. These products are designed for multiple functions, including curing, sealing, hardening, and dustproofing. On freshly poured concrete, they provide a film to slow the evaporation of water and they help create a hard, dustproof surface. Subsequent applications can provide a seal that improves resistance to abrasion, staining, and chemicals. On aged concrete, these products are designed to renew the surface, by providing a dustproof seal that protects against abrasion, staining, and chemicals. The products in this group generally comply with ASTM C-309, Type I. A large portion of the sales volume for this group (45%) consists of zero-VOC, waterborne, sodium silicate formulations that penetrate and react with the concrete. These penetrating, reactive products are designed so they don’t impair the adhesion of topcoats or sealers. Another large portion of the sales volume for this group (38%) consists of waterborne, acrylic formulations with VOC

contents between 140 g/l and 250 g/l. The remaining products are either waterborne formulations with hydrocarbon resin or styrene acrylate or solventborne formulations with acrylic or hydrocarbon resins. In this group, 45% of the sales volume had VOC contents less than 100 g/l and 84% had VOC contents less than 250 g/l.

Most of the products for new and aged concrete were reported in the Concrete Curing Compound category, but they were also reported under Waterproofing Sealer and Waterproofing Concrete/Masonry Sealer. ARB staff believes that these products should all be grouped together under the Concrete Curing Compound category. Therefore, the definition for Concrete Curing Compounds has been modified to include products that are used for hardening and dustproofing and can be applied to freshly poured concrete. The revised definition does not include products that are only suitable for application on cured or aged concrete. For this SCM revision, products that were formerly reported under Waterproofing Sealer or Waterproofing Concrete/Masonry Sealer (e.g., curing/sealers, hardener/dustproofers) should be classified as Concrete Curing Compounds, in accordance with the revised definition.

5.6.4. Substrates/Exposures

Concrete Curing Compounds are applied to freshly poured concrete and masonry surfaces, with interior and exterior exposures. Some products are also suitable for application to aged concrete. Some Concrete Curing Compounds are designed to wear away upon exposure to the elements, while others contain UV stabilizers and other ingredients that provide protection against weathering, staining, oils, salts, chemicals, and abrasion.

5.6.5. Survey Results

Table 5.6-1 summarizes our estimate of sales and VOC emissions, as reported for the ARB survey.

Table 5.6-1: Survey Data
Concrete Curing Compounds

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	12	43,771	6%	0%	93%	7%	0%	344	0.11
WB	102	749,795	94%	0%	32%	68%	0%	155	0.32
Total	**114**	**793,566**		**0%**	**35%**	**65%**	**0%**	**166**	**0.43**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

The sales volume for Concrete Curing Compounds represents about 0.7 percent of the total California sales volume of architectural coatings in 2004. VOC emissions from Concrete Curing Compounds represent approximately 0.45 percent of the total emissions from architectural coatings. When compared to the data reported for calendar year 2000, Concrete Curing Compounds sales volume increased 14 percent in 2004, VOC emissions increased 16 percent, and the sales-weighted average VOC content increased 14 percent.

Table 5.6-2 contains complying marketshare data for Concrete Curing Compounds, based on results from the ARB survey. When determining the complying marketshare, we included those curing/sealer and hardener/dustproofer products that were formerly reported under Waterproofing Sealer and Waterproofing Concrete/Masonry Sealer, but would be covered by the revised Concrete Curing Compound category. This table shows that 99 percent of the sales volume for Concrete Curing Compounds complies with the current VOC limit of 350 g/l. When considering the number of products reported, approximately 91 percent comply with the current limit. Of the 26 companies that reported in this category, 25 offered Concrete Curing Compounds that comply with the current limit.

Table 5.6-2: Complying Marketshare & Emission Reductions Concrete Curing Compounds

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
350	121	99%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.6.6. Conclusion

For some applications, it appears to be technologically feasible to formulate Concrete Curing Compounds that can meet VOC limits below 350 g/l. However, there are concerns about the feasibility of formulating products below 350 g/l that can be used on roadways and bridges and will meet the requirements of ASTM C-309, Type II, as contained in CalTrans Standard Specifications. Therefore, we recommend maintaining a 350 g/l VOC limit for Concrete Curing Compound coatings. ARB staff considered the possibility of creating a special category for Type II products, similar to the approach used in the South Coast AQMD, but staff determined that the associated emission reductions would not be substantial enough to warrant this action. The current VOC limit is the same as the limit in effect for the United States Environmental Protection Agency (U.S. EPA), the Ozone Transport Commission, and the proposed limit for Canada. The current VOC limit is higher than the limit contained in SCAQMD Rule 1113 for regular Concrete Curing Compounds (100 g/l), but the same for Concrete Curing Compounds used on roadways and bridges.

5.7. CONCRETE/MASONRY SEALERS

VOC Limit Table (g/l)

USEPA: 600 (WST)	Canada: 250 (WPS); 400 (WCMS)	OTC: 250 (WPS); 400 (WCMS)	SCAQMD: 100	SCM Proposed: 100

5.7.1. Category Definition

A clear or opaque coating that is labeled and formulated primarily for application to concrete and masonry surfaces to perform one or more of the following functions:

- Prevent penetration of water; or
- Provide resistance against abrasion, alkalis, acids, mildew, staining, or ultraviolet light; or
- Harden or dustproof the surface of aged or cured concrete.

Please note that "Concrete/Masonry Sealer" is a new category that is a consolidation of the following two categories that were contained in the 2000 SCM:

> Waterproofing Concrete/Masonry Sealer: A clear or pigmented film-forming coating that is labeled and formulated for sealing concrete and masonry to provide resistance against water, alkali, acids, ultraviolet light and staining.
>
> Waterproofing Sealer: A coating labeled and formulated for application to a porous substrate for the primary purpose of preventing the penetration of water.

These two categories have been eliminated from the proposed SCM and the types of products that were previously in these categories would be covered by the following: Concrete/Masonry Sealer; Wood Coatings; Industrial Maintenance; or Primer, Sealer, Undercoater.

5.7.2. Major Proposed Changes

- Concrete/Masonry Sealer is a new category to replace Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer.
- Some products that were previously covered by Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer were reclassified under the new Basement Specialty Coating category or Waterproofing Membrane category.

- The term "Waterproofing" has been removed from the category name, because most products claim to provide water resistance, rather than waterproofing.
- The category definition has been revised to remove references to "film-forming" or "penetrating" properties.
- For products that were formerly covered by Waterproofing Concrete/Masonry Sealer, the proposed VOC limit decreases from 400 g/l to 100 g/l.
- For products that were formerly covered by Waterproofing Sealer, the proposed VOC limit decreases from 250 g/l to 100 g/l.

5.7.3. Coating Description

Concrete/Masonry Sealers cover a wide range of applications and functions. Provided below are descriptions for some of the primary applications based on the products reported in ARB's Architectural Coating Survey. ARB staff evaluated the various functions associated with Concrete/Masonry Sealers to determine the potential impact of the proposed SCM VOC limit. For the purpose of this analysis, ARB staff developed groups that were based on products with similar purposes or functions. In some cases, a product could belong to multiple groups. These multi-functional products were only evaluated in a single group to simplify the analysis.

Basement Coatings: Based on the definitions contained in the 2000 SCM, basement coatings could be classified as either Waterproofing Concrete/Masonry Sealers or Waterproofing Sealers. However, for this proposed revision of the SCM, ARB staff believes that basement coatings should be classified under the new "Basement Specialty Coating" category (see Section 5.2.)

Crack Filling and Repair: Some concrete surfaces become deteriorated due to chemical attack, freeze/thaw expansion and contraction damage, and chloride ion intrusion. In addition, concrete can be damaged by spalling when rebar corrodes and causes chips of concrete to break away. Crack Filling and Repair products can seal existing areas that are cracked and deteriorated, as well as penetrating into sound concrete to provide a protective layer. Products are spread over horizontal concrete surfaces in both interior and exterior areas. These coatings are generally applied by professional contractors who pour the material onto the surface and spread it with a roller, broom, or squeegee. Materials can also be applied with low-pressure spray equipment. A small number of Crack Filling and Repair products were reported with a sales volume that only amounts to approximately 0% of the reported sales volume and 0% of the VOC emissions for Waterproofing Concrete/Masonry Sealers. All of the reported Crack Filling and Repair products are available in solventborne, multi-component, high-solids, epoxy or acrylic epoxy formulations that have VOC contents less than 100 g/l.

Curing Compound and Sealer: Based on the definitions contained in the 2000 SCM, concrete curing compounds and sealers could be classified as either Waterproofing Concrete/Masonry Sealers or Waterproofing Sealers. However, for this proposed revision of the SCM, ARB staff believes that curing compounds and sealers should be classified under Concrete Curing Compounds (see Section 5.6.).

Dampproofing: These products are applied on concrete and masonry surfaces to help prevent the transmission or absorption of water or water vapor. They are generally used for exterior applications and can be applied either above-grade or in below-grade applications, such as building foundations or walls. Products are generally bituminous waterborne or solventborne formulations and they can be applied on damp surfaces and uncured concrete, usually by professional contractors. Dampproofing materials are generally applied in relatively thick coats (e.g., 60 - 120 mil wet film thickness) and they can be applied with heavy-duty spray equipment, bristle brush, roller, or trowel.

Dampproofing products accounted for 2% of the reported sales volume and 4% of the VOC emissions for Waterproofing Sealers. Products are available in single component, waterborne bituminous emulsions with VOC contents less than 100 g/l. These low-VOC products represent approximately 43 percent of the sales volume for the Dampproofing group, excluding small containers.

Deck Coating: These products are applied to concrete and masonry decks in a variety of locations (e.g., parking garages, roofs, stadiums, balconies, pool areas, tennis courts, bridges, etc.) The coatings are designed to make the concrete waterproof or water resistant, while withstanding abrasion and wear from vehicle traffic and pedestrian traffic. These products are suitable for interior and exterior areas on horizontal and vertical surfaces. Materials are generally applied by professional contractors, using either roller, squeegee, or spray. After the initial application, aggregate or sand can be spread over the wet coating to provide a non-skid surface.

Deck coatings accounted for 15% of the reported sales volume for Waterproofing Concrete/Masonry Sealers and 3% of the sales for Waterproofing Sealers. They also accounted for 15% of the VOC emissions for Waterproofing Concrete/Masonry Sealers and 4% of the VOC emissions for Waterproofing Sealers. Products are often elastomeric and resin types include: acrylic, amine/amide, epoxy, polyurethane, and silicone/silane. Solventborne and 100% solids deck coatings with VOC contents less than 100 g/l are available in multi-component formulations (e.g., epoxy, polyurethane). Higher-VOC solventborne formulations include single component, moisture-cure urethanes and multi-component polyurethanes. Waterborne deck coatings with VOC contents less than 100 g/l are available in single component formulations with acrylic or silane/siloxane resins. Higher-VOC waterborne formulations are also available with silane/siloxane resins. Low-VOC products (<100 g/l) represent

approximately 27 percent of the sales volume for the Deck Coating group, excluding small containers.

Decorative/Protective Sealer: These products are applied to concrete and masonry areas to provide a decorative appearance, while providing resistance to water and stains (e.g., oil and grease). In addition, they can also help reduce efflorescence which can result when moisture leaches salts out of a concrete/masonry surface, causing a powder or stain to appear. These products are often designed to provide a clear, glossy finish to improve the appearance of concrete, tile, brick, slate, and other substrates. In some cases, they may serve as the final seal coat after concrete has been dyed or painted. Coatings can either be applied by professional contractors (e.g., in commercial or institutional areas) or by homeowners (e.g., for patios, walkways, or garage floors). Application methods include: brush, roller, wax applicator, and spray equipment. Most products are suitable for exterior exposures, but some are only intended for indoor use. Decorative/Protective Sealers can be film-forming or penetrating.

Decorative/Protective Sealers accounted for 25% of the reported sales volume for Waterproofing Concrete/Masonry Sealers and 16% of the sales for Waterproofing Sealers. They also accounted for 25% of the VOC emissions for Waterproofing Concrete/Masonry Sealers and 17% of the VOC emissions for Waterproofing Sealers. Waterborne coatings with VOC contents less than 100 g/l are available in single component formulations with acrylic or silicone/silane resins. These low-VOC products include silicone/silane products that are designed to prevent or resist efflorescence. Higher-VOC waterborne products are available in single component formulations (acrylic, silicone/silane, urethane, vinyl acrylic) and multi-component formulations (epoxy, acrylic, polyurethane). Solventborne coatings with VOC contents less than 100 g/l are available in multi-component formulations with epoxy resins. Higher-VOC solventborne products are available in single component formulations (acrylic, oil, silicone/silane) or multi-component formulations (acrylic, urethane). Low-VOC (<100 g/l) products represent approximately 16 percent of the sales volume for the Decorative/Protective Sealers group, excluding small containers. For products with VOC contents greater than 100 g/l, it is expected that some could be re-classified as Low Solids coatings, because they contain one pound or less of solids per gallon coating.

It is important to note that the previous Waterproofing Sealer category included Decorative/Protective Sealers that were intended for use on wood substrates only. These products are now classified under the proposed new Wood Coating category (see Section 5.38).

Dustproofing/Hardening: Based on the definitions contained in the 2000 SCM, Dustproofing/Hardening products could be classified as either Waterproofing Concrete/Masonry Sealers or Waterproofing Sealers. However, for this proposed revision of the SCM, ARB staff believes that Dustproofing/Hardening

products should be classified under Concrete Curing Compounds, if they are suitable for application on freshly poured concrete (see Section 5.6).

Penetrating and Reactive Products: These coatings are covered by the new Reactive Penetrating Sealer category (see Section 5.27) and the new Stone Consolidant category (see Section 5.34). Reactive Penetrating Sealers penetrate and chemically react with concrete and masonry substrates to provide a breathable protective seal that is resistant to water, chemicals, and deicing salts. Stone Consolidants are used for historical preservation efforts to consolidate deteriorated concrete and masonry substrates and restore structural integrity.

Water Repellent for Weather Resistance: These products are applied to walls and other exterior surfaces, primarily to provide water repellency and protection from wind-driven rain. In addition, these products allow the surface to breathe so water vapor can escape without damaging the protective seal. These coatings are typically applied to exterior walls made of brick, stucco, cinder block, and tilt-up concrete, but they can also be used for interior applications. Many of the products are elastomeric formulations which help smooth over surface imperfections and allow the coating to expand and contract over hairline cracks. These products have a medium build, with thicknesses between a typical nonflat and a high-build mastic coating. Other products in the Water Repellent/Weather Resistance group are non-elastomeric, clear, penetrating materials that also provide weather resistance and breathability. Coatings can either be applied by professional contractors or homeowners and application methods include: sprayer, brush, and roller.

Water Repellent/Weather Resistance coatings accounted for 30% of the reported sales volume for Waterproofing Concrete/Masonry Sealers and 17% of the sales for Waterproofing Sealers. They also accounted for 16% of the VOC emissions for Waterproofing Concrete/Masonry Sealers and 4% of the VOC emissions for Waterproofing Sealers. Products are single component, solventborne and waterborne formulations. Resin types include: acrylic, ethylene vinyl acetate, silicone/silane, and vinyl acrylic. Water Repellents for Weather Resistance are available in single component, waterborne formulations that have VOC contents less than 100 g/l. These low-VOC products include acrylic products that are designed to bind chalky surfaces and silicone/silane products that are designed to prevent or resist efflorescence. Low-VOC (<100 g/l) products represent approximately 69 percent of the sales volume for the Water Repellents for Weather Resistance group, excluding small containers. For products with VOC contents greater than 100 g/l, it is expected that some could be re-classified as Industrial Maintenance coatings, if they are used in areas that comply with the Industrial Maintenance definition. They may also be re-classified as Low Solids coatings, because they contain one pound or less of solids per gallon coating.

Waterproofing Membranes: These coatings are covered by the new Waterproofing Membrane category (see Section 5.38). The new Waterproofing Membrane category does not include products that are used to coat the surface of parking decks, roof decks, bridges, etc. Those types of deck coatings are covered under the Concrete/Masonry Sealer category, as described above.

Provided below is a table that summarizes the data provided above for the major subcategories included in the Concrete/Masonry Sealer category:

Table 5.7-1
Summary of Concrete/Masonry Sealer Subcategories

Subcategory	Waterproofing Sealer		Waterproofing Concrete/Masonry Sealer		% Compliant with 100 g/l Limit
	% of Volume	% of Emissions	% of Volume	% of Emissions	
Dampproof	2%	4%	-	-	43%
Deck	3%	4%	15%	15%	27%
Decor./Protect	16%	17%	25%	25%	16%
Penet./React.	0%	1%	1%	0%	68%
Water Rep.	17%	4%	30%	16%	69%
Subtotal	38%	30%	71%	56%	-
Wood Coating - Clear	53%	66%	-	-	-
WP Memb.	4%	0%	27%	41%	-
Total	**95%**	**96%**	**98%**	**97%**	**41%**

5.7.4. Substrates/Exposures

Concrete/Masonry Sealers can be applied to concrete and masonry substrates with both interior and exterior exposures. In general, these products provide resistance to water, stains, and some chemicals. Some products are also designed to withstand wear and abrasion from vehicle traffic.

5.7.5. Survey Results

Tables 5.7-2a and 5.7-2b summarize sales and VOC emissions from Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer, as reported for the ARB survey. For the proposed SCM, most of the products that are summarized in these tables would be combined into one new category (Concrete/Masonry Sealers). However, some of the products that were reported as Waterproofing Concrete/Masonry Sealer or Waterproofing Sealer would be classified under Basement Specialty Coating, Wood Coating, or Waterproofing Membrane. For example, clear Wood Coatings accounted for 53% of the reported sales volume and 66% of the VOC emissions for Waterproofing Sealers. Waterproofing Membranes accounted for 25% of the reported sales volume for Waterproofing Concrete/Masonry Sealers and 4% of the sales for Waterproofing Sealers. They also accounted for 41% of the VOC emissions for Waterproofing Concrete/Masonry Sealers and 0% of the VOC emissions for Waterproofing

Sealers. Please refer to Sections 5.2, 5.38, and 5.39 for information on Basement Specialty Coating, Waterproofing Membrane, and Wood Coating.

Table 5.7-2a: Survey Data
Waterproofing Concrete/Masonry Sealers

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	135	955,355	50%	1%	35%	64%	0%	248	2.24
WB	195	953,023	50%	0%	36%	64%	1%	140	0.57
Total	**330**	**1,908,378**		**0%**	**36%**	**64%**	**1%**	**194**	**2.81**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Waterproofing Sealer was one of the categories that could be included in averaging programs during 2004. Under these programs, manufacturers could sell Waterproofing Sealers with VOC levels above 250 g/l, if emissions from these products were offset by emissions from other products that had VOC levels below regulatory limits. For Waterproofing Sealers, seven percent of the total sales volume consisted of high-VOC products with VOC levels above 250 g/l. These high-VOC products accounted for approximately 0.3 tpd of VOC emissions which represents 23 percent of total emissions for Waterproofing Sealers.

Table 5.7-2b: Survey Data
Waterproofing Sealers

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	61	195,212	13%	0%	83%	17%	1%	297	0.60
WB	136	1,316,699	87%	3%	66%	31%	0%	170	0.83
Total	**197**	**1,511,911**		**3%**	**68%**	**30%**	**0%**	**186**	**1.43**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.7-3 contains complying marketshare data for the proposed new Concrete/Masonry Sealer category. This table reflects combined data for products that were reported under two previous categories: Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer. However, the table does not include those products that would be classified under Basement Specialty Coating, Concrete Curing Compounds, Waterproofing Membrane, or Wood Coating. Please refer to Sections 5.2, 5.6, 5.37, and 5.38 for information about these other categories.

Table 5.7-3: Complying Marketshare & Emission Reductions Concrete/Masonry Sealers

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
100	133	41%	0.54

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Table 5.7-3 shows that 41 percent of the sales volume for Concrete/Masonry Sealers complies with the proposed VOC limit of 100 g/l. When considering the number of products reported, approximately 35 percent of the reported products comply with the proposed limit. Of the 68 companies that reported in this category, 41 offered Concrete/Masonry Sealers that comply with the proposed limit.

5.7.6. Product Testing Results

5.7.6.1. AVES: SCAQMD awarded a contract to AVES to develop architectural coatings with a zero or near zero content of VOC. This project included the development of a single component Waterproofing Sealer. The new coating was tested side-by-side against three single component commercially available coatings. The report for this project does not include detailed information on the commercially available coatings that were tested. (AVES, 2001)

AVES developed a zero-VOC waterborne Waterproofing Sealer with a hydrophobic acrylic copolymer resin called RESILEX®. The coating was developed for use on wood and concrete surfaces. Analysis by Gas Chromatography/Mass Spectrometry (GC/MS) confirmed that the VOC content was less than 10 g/l. This zero-VOC product was tested side-by-side against commercially available products with the following reported VOC levels: < 8 g/l (waterborne); < 400 g/l (waterborne); and <350 g/l (solventborne). Results of the testing are summarized below:

Table 5.7-4
Summary of AVES Coatings Project - Waterproofing Sealers

Substrate	Comparative Test Performed	Test Method	New Coating Performance As Compared to Commercially Available Products
Wood	Freeze/Thaw	ASTM D2243	Worse
	Moisture Vapor Transmission	ASTM D1653	Equivalent or Better
	Water Repellent Efficiency	ASTM D5401	Better
	Swell	ASTM D4446	Equivalent
	Water Uptake	Non-standard method	Equivalent

Table 5.7-4
Summary of AVES Coatings Project - Waterproofing Sealers

Substrate	Comparative Test Performed	Test Method	New Coating Performance As Compared to Commercially Available Products
Concrete	Freeze/Thaw	ASTM D2243	Worse
	Moisture Vapor Transmission	ASTM D1653	Equivalent or Better
	Beading	Non-standard method	Equivalent or Better
	Coating Penetration	Non-standard method	Better

These test results indicate that low-VOC products have inferior freeze/thaw resistance, but can provide equivalent or better performance for other performance characteristics. However, the test did not include any testing for chemical resistance, abrasion resistance, and other properties that are associated with Concrete/Masonry Sealers. Therefore, we cannot conclude that it is technologically feasible to implement a zero-VOC limit for the Concrete/Masonry Sealer category.

5.7.6.2. UMR: In 2005, the UMR Coatings Institute at the University of Missouri - Rolla conducted a coatings testing project for the South Coast AQMD. The project included tests on products classified as Waterproofing Concrete/Masonry Sealers. UMR tested some general coating properties, including: percent nonvolatile; stability; viscosity; freeze/thaw resistance; dry time; gloss; and hiding – contrast ratio. They also tested performance properties, including: alkali, acid, and stain resistance; prohesion/color change (delta E); chloride/nitrate ion screening; efflorescence; and water vapor transmission. The project was intended to test seven products, three high-VOC products (VOC > 100 g/l) and four low-VOC products (VOC $\leq$ 100 g/l). However, the South Coast AQMD conducted laboratory tests to measure the VOC contents for three of the low-VOC products and the results showed that the three products actually had VOC levels greater than 100 g/l. Therefore, the project actually involved six high-VOC products and one low-VOC product. Listed below are the products that were tested, including their published and measured VOC values.

Table 5.7-5
UMR Project - Waterproofing Concrete/Masonry Sealers That Were Tested

Manufacturer	Product Name	VOC Published Value (Measured Value)
Chem Rex	Thorocoat 200	92 g/l
Monopole	Monochem Aquaseal Silane 40-2040	86 g/l (200 g/l)
Monopole	Monochem Aquaseal Silane 20-2020	65 g/l (220 g/l)
Prosoco	StandOff #55103	270 g/l
Chem Rex	Enviroseal 40	350 g/l
Textured Coatings of America	Tex-Cote XL-70	390 g/l
Behr	#980 (low solids)	12 g/l (630 g/l)

Of the seven coatings tested, five were penetrating coatings, and two were film forming coatings. Of the five penetrating coatings, two appear to be Low Solids coatings that would not meet the proposed VOC regulatory limit of 100 g/l, but would meet the VOC actual limit of 120 g/l for low solids coatings. Of the five higher solids coatings, only one meets the 100 g/l proposed limit, and it is a film-forming coating. Therefore, the testing results for this coating group are not very instructive, since only one non-Low Solids product was tested with a VOC level below 100 g/l. Nevertheless, the one coating below 100 g/l VOC regulatory did perform comparably on most tests with the higher VOC coatings (UMR, 2006).

5.7.7. Other Issues

During the development process for the proposed SCM, ARB staff received comments regarding air barriers, which share some similarities with Concrete/Masonry Sealers. Air barriers control the unintended movement of air into and out of a building (ABAA, 2007). Air barrier systems can significantly reduce energy costs by keeping warm air inside during colder months and cool air inside during warmer months. They can also help prevent mold and mildew by controlling the transfer of water vapor. The National Institute of Standards and Technology conducted a study where they used computer modeling to determine the energy savings that could potentially be achieved by improving the airtightness of buildings. This study predicted potential cost savings from 3 percent to 36 percent for annual heating and cooling costs. The smallest savings corresponded to the warmer, cooling-dominated climates of Phoenix and Miami. The largest savings corresponded to the colder, heating-dominated climates of Bismarck and Minneapolis (NIST, 2005). Since the potential energy savings are highest in colder climates, air barriers have been used primarily in the Northeast and Midwest. However, it is expected that the use of air barriers could increase in warmer climates, such as California, as a means of improving energy efficiency and reducing greenhouse gases.

Air barrier systems can include a variety of different materials that help prevent air leakage. These materials can include sealants, sheet membranes, liquid coatings, etc. Some air barriers are membrane sheets made from bituminous materials, polystyrene, urethane insulation, phenolic insulation board, cement board, foil-backed gypsum board and other materials (JAC, 2005). Air barriers are also available in liquid form as coatings that can be applied by spray, roller, or brush. These liquid coatings can be preferable in cases where spray application is less labor-intensive than installing sheet membranes. Liquid coatings used for air barriers are generally elastomeric formulations with bituminous or acrylic resins. They are applied using sprayer, brush, or roller, to achieve dry film thicknesses from 15 to 60 mils. Spray-applied urethane foams are another type of air barrier liquid coating (MeLampy, 2007). Air barrier materials are subject to requirements for air transfer or air permeance, as

determined in accordance with ASTM Standard E2178 (Standard Test Method for Air Permeance of Building Materials).

Massachusetts, Michigan, and Wisconsin have incorporated air barrier requirements into their commercial building codes and it is expected that other states will incorporate similar requirements (ABAA, 2007). The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) publishes Standard 90.1 ("Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings"). ASHRAE Standard 90.1 is used as a building energy code throughout the United States and a proposal to incorporate air barrier requirements into this standard was first introduced in 2003 (Weitz, 2006). The review and approval process is ongoing and it is expected that the update of Standard 90.1 would occur in 2010 or later. After Standard 90.1 is updated, review and implementation at the state level could take an additional three years (Weitz, 2007).

The air barrier industry is relatively new and has been primarily focused in the Northeast and Midwest. Since the use of air barrier coatings has not become very widespread in California, ARB staff has not yet obtained survey data that would be used to support a technology assessment for these products. Based on the types of products that are currently being used elsewhere, it appears that air barrier liquid coatings could potentially be covered by the Concrete/Masonry Sealer category. However, it may be necessary to evaluate these products more thoroughly to determine the appropriate VOC limit.

5.7.8. Conclusion

We recommend a 100 g/l VOC limit for Concrete Masonry Sealer coatings, effective January 1, 2010. As described above, many products that meet the proposed limit were already commercially available in 2004. Therefore, we conclude that the proposed VOC limit is technologically and commercially feasible by January 1, 2010. The proposed VOC limit is the same as the VOC limit currently in effect in the South Coast AQMD.

The proposed SCM VOC limit is lower than the national limit promulgated by the United States Environmental Protection Agency (U.S. EPA) and the VOC limit approved by the Ozone Transport Commission. Under the U.S. EPA Architectural Coating regulation, Basement Specialty Coatings would be covered by the "Waterproofing Sealers and Treatments" category which has a VOC limit of 600 g/l.

Some manufacturers requested a 250 g/l VOC limit for this category. ARB staff does not believe a 250 g/l limit is appropriate, because it would result in a 70 percent decrease in emission reductions and it is technologically feasible to formulate 100 g/l products that meet the various performance needs for Concrete/Masonry Sealers.

5.8. DRIVEWAY SEALERS

VOC Limit Table (g/l)

USEPA: 500 (Bituminous Coatings and Mastics)	Canada: N/A	OTC: N/A	SCAQMD: 100 (Traffic Coating)	SCM Proposed: 50

5.8.1. Category Definition

A coating labeled and formulated for application to worn asphalt driveway surfaces to perform one or more of the following functions:

- Fill cracks;
- Seal the surface to provide protection; or
- Restore or preserve the appearance.

5.8.2. Major Proposed Changes

- Driveway Sealer is a new category. These products were formerly covered by the "Other" default category. The proposed VOC limit decreases to 50 g/l from the default limits. For the default category, the VOC limit is dependent on whether the coating can be classified as Flat (100 g/l), Nonflat (150 g/l), or Nonflat – High Gloss (250 g/l).

5.8.3. Coating Description

Driveway Sealer is a new category that includes products formerly covered by the "Other" default category. They are coatings that are used to restore weathered asphalt driveways. Driveway Sealers can extend driveway longevity and protect against weather, erosion, oil, and gasoline. If applied and cured properly, Driveway Sealers are waterproof. These products are applied with a brush, squeegee, roller, or sprayer and they can be applied by homeowners or contractors. All of the products reported in ARB's survey are single component, asphaltic/bituminous products that leave a black finish and most are waterborne emulsions. Some Driveway Sealers must be mixed with sand or other additives to improve performance. The use of bituminous Driveway Sealers can contribute to what is known as a "heat island effect." Dark asphalt surfaces within the city can retain more heat which may result in higher mean temperatures as compared to the outlying country.

Non-bituminous Driveway Sealers (e.g., acrylic coatings) are also available throughout North America, but they do not appear to be used extensively in California for asphalt driveways. These non-bituminous products may have the ability to last longer than bituminous coatings, with potential life expectancies of

up to 7 years. These coatings can also be tinted in a variety of colors, similar to the coatings applied to tennis courts. Another possible advantage for non-bituminous sealers is that they may cure faster than asphalt emulsions. With faster cure times, these products may be more suitable for application in non-temperate climates (e.g., Northeast, Midwest, etc.) that can experience unexpected rain, freezing, or heavy dew.

ARB staff identified several manufacturers that advertise acrylic sealers for asphalt driveways. These products were not sold in California during the last survey, but were sold either in Canada or the United States. These products were manufactured through USE Hickson Products Limited (Canada), Dalton Enterprise (US), and Metacrylics (San Jose, CA). The Canadian company manufactures at least three acrylic based driveway sealers that claim drying times within an hour. However, these products have VOC contents between 150 and 200 g/l. The Dalton Enterprise, Inc. company manufactures a line known as Latex-ite. This company advertises a 100% acrylic product and asphalt-emulsions with acrylic copolymers both having less than 100 g/l VOC. Metacrylics, a company located in San Jose, California, produces waterborne acrylic-bituminous emulsions that contain 50 g/l VOC. The higher VOCs reported for the above products appear to be required to maintain shorter dry times needed in the Canadian market to deal with colder, wetter climates that are more inclement.

ThorWorks Industries, Inc., manufactures acrylic sealers for pavements and concrete. These products are considered to be Concrete/Masonry Sealers because they are not specifically designed for asphaltic driveway surfaces and most had VOC contents well over 100 g/l. However, ARB staff did identify manufacturers that reported acrylic resins in the last survey, and these products were mixtures with waterborne bituminous emulsions. One of the more prevalent manufacturers of this technology is APOC/Gardner-Gibson. They produce polymer asphalt Driveway Sealers that are sold throughout California with most VOC contents near or lower than the proposed limit of 50 g/l. Therefore, it is appropriate to select a 50 g/l limit for this category in California, without adversely affecting acrylic technology in Driveway Sealers.

5.8.4. Substrates/Exposures

Driveway Sealers are used exclusively outdoors on asphalt. New asphalt driveways must cure and weather for at least 6 months prior to applying Driveway Sealers. Since driveways are continuously exposed to automotive liquids, Driveway Sealers are typically resistant to oils, gasoline, and automotive liquids.

5.8.5. Survey Results

Table 5.8-1 summarizes our estimate of sales and VOC emissions from the Driveway Sealer category based on data from the ARB survey. In 2004, the sales volume for Driveway Sealers in California was 2.2 million gallons which represents 2% of the total California sales volume for architectural coatings.

Table 5.8-1: Survey Data
Driveway Sealers

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	3	PD	PD	0%	100%	0%	0%	439	0.02
WB	38	PD	PD	0%	100%	0%	0%	2	0.02
Total	**41**	**2,205,366**		**0%**	**100%**	**0%**	**0%**	**3**	**0.04**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.8-2 shows that virtually all of the reported Driveway Sealers comply with the proposed VOC limit of 50 g/l.

Table 5.8-2: Complying Marketshare & Emission Reductions
Driveway Sealer

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
50	38	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Of the six companies that reported in this category, all offered Driveway Sealers that comply with the proposed limit (ARB, 2006). Three of these companies were identified as small businesses, because they have fewer than 250 employees.

5.8.6. Conclusion

We recommend a 50 g/l VOC limit for Driveway Sealer coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on our review of ARB survey data , the high complying marketshare, the number of companies making compliant products, and product information from manufacturers. The proposed limit is lower than the U.S. EPA limit of 500 g/l for Bituminous Coatings. It's also lower than the South Coast AQMD's limit of 100 g/l for Traffic Coatings. Neither the Ozone Transport Commission (OTC) nor Canada has Driveway Sealer as a category.

5.9. DRY FOG

VOC Limit Table (g/l)

USEPA: 400	Canada: 400	OTC: 400	SCAQMD: 150	SCM Proposed:150

5.9.1. Category Definition

A coating labeled and formulated only for spray application such that overspray droplets dry before subsequent contact with incidental surfaces in the vicinity of the surface coating activity.

5.9.2. Major Proposed Changes

- The VOC limit for Dry Fog coatings will decrease from 400 g/l to 150 g/l.

5.9.2. Coating Description

Dry Fog coatings are similar to interior flat and nonflat coatings, but the overspray from Dry Fog coatings dries within 10 to 15 feet of application. Dry Fog (also called dry fall) coatings are used in areas where applicators want to eliminate overspray. These products will typically reflect light and provide high hiding. Conventional application is by spray, which allows excess paint drops to dry before they reach the ground. Overspray drying distances tend to be about 10 to 15 feet below the surface of application, which may vary due to weather conditions such as humidity and temperature. Overspray drying distances have increased slightly which may be due to the decrease in VOC content of the products. Some companies manufacture low-VOC Dry Fog coatings that are designed to be low-odor products that eliminate fire hazards and reduce cleanup costs.

The type of resin used has a large impact on the VOC content. Typically, Dry Fog coatings are formulated with acrylic or alkyd resins, but some products contain styrene butadiene or cellulosic resins.

The main solvent in acrylic, latex paints is water, while alkyd resins are formulated using hydrocarbon solvents. For waterborne products, coalescing agents are one of the main contributors to VOC emissions. Other contributors are additives that improve the paint, such as: resin coalescing aids, polymer plasticizers, freeze/thaw stabilizers, anti-foam agents, preservatives, thickeners and colorants. Common freeze/thaw stabilizers are glycols which prevent the paint from coagulating when frozen (Klein, 1993).

5.9.3. Substrates/Exposure

Generally, Dry Fog coatings are used in interior commercial and industrial settings. The only exterior use would be in areas such as parking garages or covered areas where the coating is not subject to weathering or moist conditions. Dry Fog coatings are applied to steel, galvanized metal and aluminum, pre-primed roof decking, concrete, and masonry. Unsuitable surfaces are high-abuse and high-corrosion areas. Application in times of high humidity is not recommended.

5.9.4. Survey Results

Table 5.9-1 summarizes our estimate of sales and VOC emissions from the Dry Fog coatings category, based on the ARB survey. In 2004, the sales volume for Dry Fog coatings was about 378,000 gallons with approximately 0.8 tpd of VOC emissions. Dry Fog coatings represent a relatively small portion of the total amount of architectural coatings in California in terms of both sales and emissions.

The sales volume for Dry Fog coatings was evenly split between waterborne and solventborne products. Solventborne Dry Fog coatings generally have VOC levels greater than 350 g/l, while waterborne coatings are around 100 g/l. The sales volume for both solventborne and waterborne Dry Fog coatings increased from 2000 to 2004. The overall sales-weighted average VOC level for Dry Fog coatings has remained relatively constant, with a negligible decrease.

Table 5.9-1: Survey Data
Dry Fog Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	36	187,112	50%	95%	0%	5%	0%	361	0.68
WB	35	190,595	50%	98%	2%	0%	2%	107	0.13
Total	**71**	**377,707**		**97%**	**1%**	**2%**	**1%**	**233**	**0.82**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.9-2 contains complying marketshare data for Dry Fog coatings, based on results from the ARB survey. This table shows that about 40 percent of the sales volume complies with the proposed VOC limit of 150 g/l. Nearly 30 of the approximately 70 products reported already comply with the proposed limit. Of the nine companies that reported in this category, eight offered Dry Fog coatings that comply with the proposed limit.

Table 5.9-2 shows that implementing the proposed 150 g/l limit would achieve approximately 0.3 tpd in VOC emission reductions for the non-South Coast AQMD portion of California, on an annual average basis.

Table 5.9-2: Complying Marketshare & Emission Reductions Dry Fog

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
150	27	42%	0.31

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.9.5. Manufacturer Information

Several of the reported complying products were also included on Master Painter's Institute (MPI) Approved Products lists because they were certified to meet designated performance standards. MPI approved more than 25 Dry Fog coatings that comply with the proposed 150 g/l limit and meet one of the following standards: MPI #133 (Dry Fall, Water Based, for Galvanized Steel, Flat - MPI Gloss Level 1); MPI #155 (Dry Fall, Latex, "Eggshell-Like" - MPI Gloss Level 3); MPI #158 (Dry Fall, Water Based, for Galvanized Steel - MPI Gloss Level 5); and MPI #226 (Dry Fall, Latex, "Eggshell-Like" - MPI Gloss Level 5). Manufacturers of compliant, MPI-approved products include Benjamin Moore, Frazee Paint, ICI Paints, PPG, Sherwin Williams, and Vista Paint. Additional information on Dry Fog manufacturers and products is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

5.9.6. Manufacturer and Industry Issues

Manufacturers claim that low-VOC waterborne products perform well on clean, newly constructed surfaces, but high-VOC solventborne products are needed for dirty surfaces that are covered in oil, dust, grease, salts and other contaminants. However, manufacturers also state that similar surface preparation is required for both low-VOC and high-VOC products. For example, Benjamin Moore and Dunn Edwards manufacture both low-VOC and high-VOC Dry Fog coatings. Both companies market their low-VOC and high-VOC Dry Fog products in exactly the same manner, and claim the same benefits for both. ARB compared product data sheets for Benjamin Moore's M50 Production Alkyd Sweep-Up Coating (high-VOC) to their M53 Sweep-Up Spray Latex Flat (low-VOC). On the product data sheet for the low-VOC product, Benjamin Moore claims that a labor saving feature is that minimal surface preparation is required, thereby reducing application cost. This is the same claim made on the product data sheet for the high-VOC coating. In addition, the low-VOC product is recommended for use in a larger variety of areas than the high-VOC product. ARB also compared the Dunn Edwards Alkylfall Alkyd Dry Fall Flat (high-VOC) to their Aquafall Latex Dry

Fall Eggshell (low-VOC) and Aquafall Latex Dry Fall Flat (low-VOC). Similar surface preparation is required for all three of the products.

5.9.7. Conclusion

ARB recommends a 150 g/l VOC limit for Dry Fog coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on ARB's review of survey data, the high complying marketshare, the number of companies making complying products, and product information from manufacturers. The proposed VOC limit is lower than the national limit promulgated by the U.S. EPA and OTC and the proposed limit for Canada. The proposed limit is the same as the VOC limit adopted by South Coast AQMD.

In 2004, 42% of the sales volume already complied with the proposed limit, which demonstrates the widespread use of existing low-VOC technology in formulating Dry Fog coatings. The products that are complying are also manufactured by a wide range of manufacturers, from large to small companies. The Dry Fog coatings that meet the proposed VOC limit are generally acrylic waterborne coatings. ARB staff did not identify any solventborne products that would meet the proposed VOC limit.

5.10. FAUX FINISHING

VOC Limit Table (g/l)

USEPA: 700	Canada: 350	OTC: 350	SCAQMD: 350	SCM Proposed: 350

5.10.1. Category Definition

A coating labeled and formulated to meet one or more of the following criteria:

- A glaze or textured coating used to create artistic effects including, but not limited to: dirt, suede, old age, smoke damage, and simulated marble and wood grain; or
- A decorative coating used to create a metallic, iridescent, or pearlescent appearance that contains at least 48 grams of pearlescent mica pigment or other iridescent pigment per liter of coating as applied (at least 0.4 pounds per gallon); or
- A decorative coating used to create a metallic appearance that contains less than 48 grams of elemental metallic pigment per liter of coating as applied (less than 0.4 pounds per gallon), when tested in accordance with SCAQMD Method 318-95; or
- A decorative coating used to create a metallic appearance that contains greater than 48 grams of elemental metallic pigment per liter of coating as applied (greater than 0.4 pounds per gallon) and which requires a clear topcoat to prevent the degradation of the finish under normal use

conditions. The metallic pigment content shall be determined in accordance with SCAQMD Method 318-95; or

- A clear topcoat to seal and protect a Faux Finishing coating that meets the above requirements. These clear topcoats must be sold and used solely as part of a Faux Finishing coating system and they must be labeled as such.

5.10.2. Major Proposed Changes

- The definition has been changed to clarify that Faux Finishes include metallic, iridescent, or pearlescent appearing coatings.
- The definition has been changed to include clear topcoat sealers that are exclusively sold and used for Faux Finish coating systems.

5.10.3. Coating Description

Faux Finishing coatings are used to create a variety of decorative effects. In some cases, they are used to create the illusion of natural materials (e.g., wood, marble, granite, leather, etc.) or the appearance of fabrics (denim, canvas, linen, etc.) They can also be used to make a surface look metallic, pearlescent, or aged like an antique. Faux Finishing products are often clear or translucent glazes that are mixed with Nonflat paints. The purpose of adding the Faux Finishing glaze is to increase the amount of “open time” during which the coating remains wet and workable.

Japan Finishes (or Japan Colors) are flat, quick -drying paste colors (T.J. Ronan, 2007). They are similar to the oil paints that are used by artists and they can be used as Faux Finishing coatings after mixing with a glaze.

Concrete stains are another type of product that is used to create a faux effect. On concrete floors, these stains can be used to make the concrete look like tile, marble, stone, or brick. Concrete stains are <u>not</u> included in the Faux Finishing category and are subject to the VOC limit for the Stains category.

Faux Finishing is generally a multi-stage process, as described below:

1. Apply a basecoat color and allow to dry. (Note: The coatings that are used for basecoats are usually Nonflat coatings. These coatings are <u>not</u> included in the Faux Finishing category and are subject to the VOC limit for Nonflat coatings, even though they are used as part of a Faux Finish system).
2. Mix the Faux Finishing glaze with a Nonflat paint to create a tinted glaze mixture (e.g., four quarts of Faux Finishing glaze can be mixed with one quart of a Nonflat paint).
3. Apply the Faux Finishing glaze mixture to the wall using a brush, roller, sponge, rag, or other method. While the coating is still wet, it’s possible to

create a variety of effects using brushes, combs, plastic wrap, and other objects.

4. Some manufacturers recommend the use of clear topcoats to protect Faux Finishing coatings. The recommended topcoats include clear wood coatings, such as waterborne polyurethane varnishes, solventborne polyurethane varnishes, and solventborne alkyd varnishes.

Faux Finishing products are sold in paint stores and artist supply stores. These products are used by the general public, graphic artists, motion picture and television studios, and businesses that specialize in decorating with Faux Finishing coatings.

For the proposed SCM, the definition for Faux Finishing has been modified to include textured coatings. This modification was made to clarify that Faux Finishing coatings include textured coatings that create the look of suede, venetian plaster, granite, and other surfaces. The modification is not intended to include high-build, textured coatings that have been classified as Mastic Texture. High-build, textured coatings that are applied for waterproofing or weather resistance are subject to the VOC limits for Mastic Texture or Concrete/Masonry Sealer.

Some industry representatives requested that the Faux Finishing definition be modified to include the clear sealers that are applied over Faux Finishing coatings. Some manufacturers of Faux Finishing products recommend the use of varnishes or other clear sealers that are intended for wood. Under the proposed SCM, these types of coatings would be classified as “Wood Coatings” and their use would be restricted to wood applications only. ARB staff agreed that clear topcoat sealers should be included in the Faux Finishing definition, as long as their usage was limited to Faux Finishing coating systems only.

The definition for Faux Finishing has also been modified to clarify that it includes coatings which have a metallic appearance and contain pearlescent mica pigments. In the South Coast AQMD’s Rule 1113, “mica particles” were included in the definition for the Metallic Pigmented category. “Mica particles” can be used in a variety of coatings as a filler or extender pigment, because they are relatively inexpensive. Extender pigments can reduce coating raw material costs because they can be used as substitutes for more expensive ingredients (e.g., binders, flatting agents, thickeners, titanium dioxide pigments, etc.) (Braun, 1993). Since Rule 1113 used the term “mica particles”, some coating manufacturers interpreted the rule to mean that they could use mica to formulate Nonflat coatings and be subject to the high VOC limit for Metallic Pigmented (500 g/l), rather than the low VOC limit for Nonflat (50 g/l). South Coast AQMD found this to be an incorrect interpretation and issued a compliance advisory to that effect.

ARB's 2000 SCM did not allow for the use of "mica particles" in the definition for Metallic Pigmented; therefore, misinterpretation was not an issue. However, during the rule development efforts for the proposed SCM, ARB staff and stakeholders agreed that it would be beneficial to provide some clarification regarding the use of mica. ARB staff has proposed putting metallic-looking coatings in the Faux Finishing category and we've proposed using the term "pearlescent mica pigment", rather than "mica particles", to help prevent potential abuses. The intent is that manufacturers will only use large quantities of "pearlescent mica pigment" in coatings that are intended to create a metallic look for faux finishing types of applications. Coatings that contain non-pearlescent mica pigments will be subject to VOC limits in other categories (e.g., Flat, Nonflat, etc.)

Some Faux Finishing coatings contain a combination of pearlescent mica and metallic pigments to create metallic effects. In addition to these products, there are coatings that use only metallic pigments to create metallic effects. Some of these metallic-looking products contain less than 48 g/l of metallic pigment, so they are clearly classified under Faux Finishing and are not covered by the Metallic Pigmented category. However, there are also metallic-looking products that contain more than 48 g/l of metallic pigment, but are marketed as Faux Finishing coatings because they are used to create the appearance of aged metal (e.g., rusted iron, copper with a patina, etc.) Unlike most Metallic Pigmented coatings, these Faux Finishing products with high metal pigment contents have waterborne formulations and relatively low VOC levels (<150 g/l). For some of these products, manufacturers recommend a waterborne clear topcoat sealer (<150 g/l) to prevent damage to the surface rust or patina. The Metallic Pigmented category does not include clear topcoats and clear Wood Coatings are limited to wood substrates. In addition, the Primer, Sealer, and Undercoater category has a proposed VOC limit of 100 g/l, so the clear topcoat sealers would not be compliant in that category. Therefore, ARB staff is proposing that the Faux Finishing category include Faux Finishing products that contain more than 48 g/l of metallic pigment and require a clear topcoat sealer. Due to the relatively low VOC content of these products and their sealers, this will have a negligible impact on emission reductions.

District staff recommended that the Faux Finishing definition include a method for determining whether a coating is metallic looking and, therefore, qualifies as a Faux Finishing coating. The American Society for Testing and Materials (ASTM) has a Work Item titled "WK1164 New Standard Practice for Multiangle Color Measurement of Interference Pigmented Materials". This Work Item addresses measurement of materials containing pearlescent mica pigments (ASTM, 2003). WK1164 has not been formalized as a standard test method; therefore, ARB staff did not include it in the definition. Instead, ARB staff has proposed including definitions from ASTM E284-06b, "Standard Terminology of Appearance". If a coating has an appearance that is "metallic", "pearlescent", or "gonioapparent",

as defined per ASTM E284-06b, it could qualify as a Faux Finishing coating (ASTM, 2006).

Most of the reported Faux Finishing products are waterborne coatings with acrylic or vinyl acrylic resins. There are also some solventborne products with alkyd resin and some waterborne products with polyvinyl acetate or polyvinyl alcohol. All of the Faux Finishing products are single component formulations.

5.10.4. Substrates/Exposures

Faux Finishing products are primarily used indoors, but they can also be used outdoors. These coatings are applied to wallboard, plaster, wood, concrete, masonry and brick. Clear sealers are sometimes used to provide protection over Faux Finishing coatings that are exposed to high traffic or abrasion and outdoor areas that are exposed to severe weathering.

5.10.5. Survey Results

Table 5.10-1 summarizes our estimate of sales and VOC emissions from the Faux Finishing category, as reported for the ARB survey.

Table 5.10-1: Survey Data
Faux Finishing Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	15	4,430	1%	100%	0%	0%	77%	392	0.02
WB	590	299,379	99%	98%	0%	2%	22%	255	0.32
Total	**605**	**303,810**		**98%**	**0%**	**2%**	**23%**	**257**	**0.34**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

The sales volume for Faux Finishing represents about 0.3 percent of the total California sales volume of architectural coatings in 2004. VOC emissions from Faux Finishing represent approximately 0.4 percent of the total emissions from architectural coatings. When compared to the data reported for calendar year 2000, the Faux Finishing sales volume increased 75 percent in 2004, VOC emissions increased 57 percent, and the sales-weighted average VOC content declined about 2 percent.

Table 5.10-2 contains the complying marketshare for Faux Finishing coatings in large containers, based on results from the ARB survey and the existing VOC limit of 350 g/l.

Table 5.10-2: Complying Marketshare & Emission Reductions Faux Finishing Coatings

Existing VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
350	261	98%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

This table shows that 98 percent of the sales volume for Faux Finishing complies with the current VOC limit of 350 g/l. When considering the number of products reported, approximately 96 percent comply with the current limit. Of the 12 companies that reported in this category, 10 offered Faux Finishing products that comply with the current limit.

Faux Finishing products with VOC contents less than 100 g/l represent 42% of the sales volume for large containers and these products consist of the textured coatings (e.g., suede, granite, venetian plaster, etc.) and crackle coatings. Faux Finishing products with VOC contents less than 200 g/l represent 49% of the sales volume for large containers and these products also consist primarily of the textured and crackle coatings. Between 200-350 g/l, Faux Finishing products include pearlescent/metallic-looking coatings and the clear/translucent glazes. Faux Finishing products with VOC contents less than 300 g/l represent 60% of the sales volume for large containers.

5.10.6. Conclusion

We recommend maintaining a 350 g/l VOC limit for Faux Finishing coatings. This VOC limit is technologically and commercially feasible, based on the high complying marketshare, the number of companies making complying products, and information provided by manufacturers. It appears to be technologically feasible to formulate Faux Finishing glazes and textured coatings with VOC contents below 300 g/l. However, ARB staff is not proposing a lower VOC limit, because the potential emission reductions that would be achieved were considered to be insignificant and a lower VOC limit wouldn't capture all of the types of Faux Finishing coatings. The SCM VOC limit is lower than the national limit promulgated by the U.S. EPA. The SCM VOC limit is the same as the limit promulgated for SCAQMD and the Ozone Transport Commission and the proposed limit for Canada.

5.11. FIRE RESISTIVE

VOC Limit Table (g/l)

USEPA: 850 (clear) 450 (opaque) (includes fire-resistant and fire-retardant coatings)	Canada: 350	OTC: 350	SCAQMD: 350	SCM Proposed: 350

5.11.1. Category Definition

A coating labeled and formulated to protect structural integrity by increasing the fire endurance of interior or exterior steel and other structural materials. The Fire Resistive category includes sprayed fire resistive materials and intumescent coatings that are used to bring structural materials into compliance with federal, State, and local building code requirements. Fire Resistive coatings shall be tested in accordance with ASTM Designation E-119-07. Fire Resistive coatings and testing agencies must be approved by building code officials.

5.11.2. Major Proposed Changes

- The definition for Fire Resistive Coatings has been revised to clarify that intumescent coatings are included in this category.

5.11.3. Coating Description

The purpose of Fire Resistive coatings is to delay the onset of critical temperatures that will compromise the load-bearing capacity of the building to which the coating is applied. Fire-resistive materials and coatings themselves carry no fire-resistance rating, because a Fire Resistive coating is only one component of a total fire rated assembly. A Fire Resistive coating imparts an additional degree of resistance to the total fire rated assembly. For example, structural steel retains only about half of its design strength at 1,100^{o} F. Unprotected, a steel building structure exposed to fire may collapse under the load it was designed to carry at normal temperatures. In accordance with the acceptance criteria in ASTM E-119, a fire-resistive material must limit steel temperatures during the standard fire exposure test to 1,000 ^{o} F for columns and 1,100^{o} F for beams.

There is a critical difference between coatings defined as Fire Resistive and those defined as Fire Retardant. The latter are classified by Underwriters Laboratory under the category of Fire Retardant Coatings, and are qualified on the basis of their surface burning characteristics (such as flame spread and smoke created) and their ability to reduce the surface burning characteristics of the particular substrate to which they are applied. Unlike Fire Resistive coatings, they have not been rated for fire resistance (Falconer, 2006).

Spray-applied fire-resistant materials (SFRMs) are the most commonly used fire-resistive materials, and are referred to as low-density, gypsum-based or cementitious materials. They can be applied by means of wet spray, where the water is mixed with the dry material at the pump, or dry spray, where the water is injected at the spray nozzle. SFRMs are manufactured in various formulations designed to provide specific weights, densities, and weather resistance. Density and resistance are related to the amount of cement and other raw materials. SFRMs are classified as low-density (15 to 18 pounds per cubic foot), medium density (22 to 30 pounds per cubic foot), and high-density (+40 pounds per cubic foot). Low- and medium-density materials are generally used for interior or conditioned-space applications, although some medium-density products are designed for exterior use. SFRMs provide a thermal barrier in a fire and work to keep the temperature of the substrate from reaching a certain temperature for a given period of time. (Heemstra, 2005) This discussion on SFRMs is not intended to imply that these products are subject to the proposed SCM, but are mentioned in order to provide a more complete overview of fire-resistive materials currently in use. SFRMs that are delivered to the end-user in a dry state and mixed with water at the job site are not considered architectural coatings, and therefore are not subject to the VOC limits of the proposed SCM.

Intumescent fire-protective coatings, in contrast to conventional SFRMs, are applied in relatively thin films. (Heemstra, 2005) Intumescent coatings fall into two basic coating types: single component and multi-component coatings. The single component intumescent coating types include alkyd, acrylic, and vinyl/polyvinyl acetate products. Single component intumescent coatings are typically applied in several coats to build up thickness to the desired level. These coatings may require an exterior finish coat and must be cured prior to the finish coat being applied. Single component coatings may require mesh reinforcement, which is applied between applications of the coating. Plural-component epoxy intumescent coatings consist of high-solids materials that are typically applied in one or two applications. Plural spray is a technique that requires specialized equipment used by licensed applicators. The coatings cure very quickly and are typically ready for finish coat applications within two days. These coatings may also require mesh reinforcement, which is applied between applications of the coating. It should be noted that the required intumescent coating thickness will vary widely, depending on the specific coating product and substrate size and shape. (Helsel, 2006)

Both waterborne and solventborne commercial intumescent fire-resistive coatings are available for published fire resistance-rated assemblies for ratings up to four hours. Generally, these coatings protect structural steel by forming an intumescent char layer that insulates the structural steel from the heat of the fire. The intumescent char formation process involves the interaction of four key components:

- an acid source, typically ammonium polyphosphate;
- a carbon source that reacts with the acid to form a carbonaceous char;

- a blowing agent, such as melamine, that decomposes to liberate large volumes of non-flammable gases, including carbon dioxide, ammonia, and water vapor. The gases cause the carbonaceous char to foam, thus producing a meringue-like structure that insulates against heat; and
- a binder or resin that binds together the intumescent ingredients and provides adhesion to the substrate. The binder aids in the formation of a uniform cellular foam structure by trapping gases given off by the decomposing blowing agent, ensuring a controlled expansion of the carbonaceous char. The binder also protects the intumescent ingredients by providing resistance to water, UV light, and abrasion. (Falconer, 2006)

Fire-resistive coatings are used in the petrochemical industry for exterior surfaces at refineries and offshore platforms. They are also used in commercial areas to coat exterior and interior structural steel. Other uses include office buildings, health care facilities, multi-family housing units (such as apartments and condominiums), hotels, restaurants, and schools. They are rarely used in single family homes. (Brimo-Cox, 2005)

5.11.4. Substrates/Exposures

An important performance consideration for Fire Resistive coatings is their ability to maintain their resistive properties while exposed to environmental conditions that may exist during the material's service life. Prior to listing an intumescent Fire Resistive coating under the classification of "Mastic and Intumescent Coatings", UL requires the product to undergo a series of environmental exposures, including accelerated aging and high humidity. In addition, all products intended for exterior use, whether conventional SFRM or mastic and intumescent coatings, must be tested and qualified for exterior use to ensure that their fire-resistive performance is not compromised by exposure to weathering. Test exposures include ultraviolet light, freeze-thaw, carbon dioxide and sulfur dioxide air mixture, and salt spray. The loss of fire resistance caused by any of these interior and exterior exposure conditions cannot be greater than 25% of the fire resistance of the control sample. Fire Resistive coatings are then categorized for one or more of three purposes: conditioned interior space, interior general, or exterior. Conventional SFRMs are usually limited to interior use unless the fire test design information specifically indicates the product is qualified for exterior use. Typically, the higher-density Portland cement-based SFRMs qualify for exterior use applications. Waterborne intumescent coatings may require a topcoat to qualify for exterior and interior general use. (Falconer, 2006)

5.11.5. Survey Results

Table 5.11-1 summarizes our estimate of sales and VOC emissions from the Fire Resistive coatings category based on ARB survey results. In 2004, the sales volume for Fire Resistive coatings in California was approximately

12,500 gallons. This represents about 0.01 percent of the total California sales volume of architectural coatings.

Table 5.11-1: Survey Data
Fire Resistive

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	8	PD	PD	77%	0%	23%	0%	279	0.02
WB	1	PD	PD	100%	0%	0%	0%	18	0.00
Total	**9**	**12,557**		**91%**	**0%**	**9%**	**0%**	**123**	**0.02**

(ARB, 2006)
1. PD = Protected Data. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

For Fire Resistive coatings, the sales volume during 2000 was protected data; therefore, we are unable to comment on whether the sales volume increased or decreased from 2000 to 2004.

VOC emissions from Fire Resistive coatings are about 0.02 tpd, which represents approximately 0.02 percent of the total emissions from architectural coatings. From 2000 to 2004, the VOC emissions increased approximately 50 fold and the sales-weighted average VOC content increased 177% from 45 g/l to 123 g/l.

Table 5.11-2 contains complying marketshare data for Fire Resistive coatings, based on results from the ARB survey. This table shows that about 99 percent of the sales volume for Fire Resistive coatings complies with the existing VOC limit. Eight of the nine products reported already comply with the existing limit. Of the four companies that reported in this category, three offered Fire Resistive coatings that comply with the existing limit. Products with a VOC content equal to or lower than 350 g/l represent about 99 percent of the market. (ARB, 2006)

Table 5.11-2: Complying Marketshare & Emission Reductions
Fire Resistive

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
350	8	99%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.11.6. Conclusion

We recommend no change to the 350 g/l VOC limit for Fire Resistive coatings, based on complying marketshare, the number of companies making complying products, and product information from manufacturers. The high marketshare

complying with the existing limit demonstrates widespread use of existing technology for formulating Fire Resistive coatings. Keeping the existing limit will allow for a wide range of product types, including solventborne and waterborne, necessary in the various environments in which Fire Resistive coatings are used. The existing VOC limit is lower than the national limit promulgated by the U.S. EPA for this category. A limit of 350 g/l is consistent with the limits in effect for the South Coast AQMD and the Ozone Transport Commission, and the proposed limit for Canada.

5.12. FLAT

VOC Limit Table (g/l)

USEPA: 250	Canada: 100	OTC: 100	SCAQMD: 50	SCM Proposed: 50

5.12.1. Category Definition

A coating that is not defined under any other definition in this rule and that registers gloss less than 15 on an 85-degree meter or less than 5 on a 60-degree meter according to ASTM Designation D 523-89 (1999).

5.12.2. Major Proposed Changes

- The VOC limit for Flat coatings will decrease from 100 g/l to 50 g/l.

5.12.3. Coating Description

Flat coatings are generally used in low traffic areas, for decorative purposes, and to provide good hiding. Flat coatings leave a matte finish, with no gloss or shine. The Flat finish tends to minimize surface irregularities and imperfections. They are widely used on both residential and commercial buildings. These coatings are typically used to paint ceilings and walls in living rooms, dining rooms, guest bedrooms, and halls that are not subject to heavy use (Consumer Reports, 2003). Flat coatings are not typically used in bathrooms or kitchens because they generally have less moisture resistance than Nonflat coatings.

Flat coatings can be brushed, rolled, or sprayed onto desired substrates. Application typically requires surfaces that are cured, firm, dry, and cleaned free of dust, dirt, oil, grease, wax, chalk, mildew or anything that could contaminate or affect the performance of the coating. Most Flat coatings are single component, waterborne products that allow for a soap and water cleanup. All of the reported products with VOC contents at or below 100 g/l are single component, waterborne formulations.

Some manufacturers market “zero VOC” Flat coatings by emphasizing environmental benefits, “low odor” qualities, and “quick return to service.”

Because of these features, manufacturers stress the coatings' suitability for use in enclosed, centrally-ventilated buildings that need to be occupied soon after painting (e.g. schools, office buildings, hospitals, restaurants, hotel rooms and residences).

Formulations for Flat coatings are similar to Nonflat formulations, but Flat coatings may contain more pigment and softer resins. With the use of softer resins, less coalescing agent is needed, which provides advantages for developing low-VOC products. When low-VOC Nonflat coatings are formulated with soft resins, the film can remain sticky and subject to dirt pickup and fingerprints, but this is less of an issue with Flat coatings which contain more pigment and less resin. The most prevalent resins for Flat coatings are vinyl acrylic and 100% acrylic, which are commonly called latex. Flat coatings are generally not used in areas of high moisture, so they can be formulated with vinyl acrylic resins that are often softer than 100% acrylic resins.

Although most Flat coatings are waterborne, the VOCs in latex coatings come from additives such as resin coalescing aids, polymer plasticizers, freeze/thaw stabilizers and anti-foam agents. These additives help create homogeneous films, improve block and print resistance, prevent coagulation, ease application, and reduce defects formed during application. Other additives that contribute to the VOC content are preservatives, thickeners and colorants. Resin coalescing aids and freeze/thaw stabilizers are the two main contributors to VOCs in Flat coatings (Klein, 1993). Currently, most Flat coating manufacturers use ester alcohols (e.g., Texanol®) as coalescing agents. Freeze/thaw stabilizers are glycols (e.g., ethylene glycol or propylene glycol) that help prevent the paint from coagulating or solidifying when exposed to freezing temperatures and provides more "open time".

Most Flat coatings are already waterborne and the proposed VOC limit will require most of these products to be reformulated using lower-VOC technology. This will involve choosing the appropriate combination of resin, coalescing agent, and additives. Many Flat coatings already contain minimal amounts of the glycols required to achieve freeze/thaw resistance, and it is expected that some reformulations will further reduce the amount of glycols and make products more vulnerable to freeze/thaw damage. However, some manufacturers have overcome this potential problem by using heated delivery vehicles and heated warehouses. In addition, a large portion of California has a relatively mild climate that is rarely subject to freezing temperatures, so freeze/thaw resistance is less critical in those areas. Other manufacturers may reduce the amount of coalescing agents because it is more technologically feasible to reduce coalescing agents from flats than non-flats. This is due to the fact that flats contain more pigment and extender pigments, they contain less resin, and they use softer resins.

5.12.4. Substrates/Exposures

Flat coatings can be used on a large variety of interior and exterior substrates, including drywall, plaster, wallpaper, brick, concrete block, wood siding, vinyl siding, aluminum siding, and stucco. They are also used on exterior walls and overhangs. Generally, temperatures of application are limited to above 50 degrees F.

5.12.5. Survey Results

Table 5.12-1 summarizes our estimate of sales and VOC emissions from the Flat coatings category based on the ARB survey. Flat coatings represent the largest coating category in terms of sales volume and VOC emissions. In 2004, the sales volume for Flat coatings in California was approximately 37 million gallons. This represents about 34 percent of the total California sales volume for architectural coatings. Emissions from Flat coatings in 2004 were about 14 tpd, which is about 15% of the total emissions from architectural coatings.

Waterborne Flat coatings dominate the market. There were 15 solventborne products reported in the Survey, but these products only account for about 1/100th of a percent of the Flat coatings category. From 2000 to 2004, the sales volume for solventborne coatings decreased by 0.1%, while overall sales of Flat coatings remained relatively constant. The overall sales-weighted average VOC level for Flat coatings decreased more than 16 percent from 98 g/l to 82 g/l.

Flat coatings were one of the categories that could be included in averaging programs during 2004. Under these programs, manufacturers could sell Flat coatings with VOC levels above 100 g/l, if emissions from these products were offset by emissions from other products that had VOC levels below regulatory limits. For Flat coatings, one percent of the total sales volume consisted of high-VOC products with VOC levels above 100 g/l. These high-VOC products accounted for approximately 0.3 tpd of VOC emissions which represents two percent of the total emissions from Flat coatings.

Table 5.12-1: Survey Data
Flat Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	14	4,082	0%	2%	92%	7%	2%	331	0.02
WB	2,770	37,260,792	100%	49%	36%	15%	2%	82	13.79
Total	**2,784**	**37,264,874**		**49%**	**36%**	**15%**	**2%**	**82**	**13.80**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.12-2 contains complying marketshare data for Flat coatings, based on results from the ARB survey. This table shows that about seven percent of the sales volume for Flat coatings complies with the proposed VOC limit. Over 350 of the approximately 2,800 products reported already comply with the proposed limit. Of the 46 companies that submitted data for this category, 28 offered Flat coatings that comply with the proposed limit.

Table 5.12-2 shows that implementing the proposed 50 g/l limit would achieve approximately 3 tpd in VOC emission reductions for the non-South Coast AQMD portion of California, on an annual average basis.

Table 5.12-2: Complying Marketshare & Emission Reductions Flat Coatings

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
50	358	7%	3.12

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.12.6. Product Testing Results

Consumers Union: Consumers Union, an independent nonprofit organization, recently published test results for interior Flat coatings. Tests were performed on 20 interior Flat coatings that were marketed as high-grade products. Each product was tested using three colors that represented the basic tint bases.

Of the 20 products that were tested, 4 products comply with the proposed VOC limit of 50 g/l. Out of a possible score of 100, the complying products scored in the range of 51-79, while the highest score for any product was 85. Coatings were tested for hiding ability, surface smoothness, staining, scrubbing, gloss change, blocking, mildew, and fading. The products that were tested performed fairly well in all of the categories tested (Consumer Reports, 2006; 2006a).

The results obtained show that current technology exists to comply with the proposed VOC limit of 50 g/l. The number of compliant products that were available at the time of ARB's 2005 survey was relatively limited but, since 2004, additional compliant products have entered the market and it is expected that a much larger number of compliant products will be available by the implementation date in 2010.

5.12.7. Manufacturer Information

There were 358 products that were submitted in the 2005 Architectural Coatings Survey that comply with the proposed VOC limit. From the information provided on manufacturers' product data sheets, the low-VOC compliant coatings have

similar properties to high-VOC coatings. The low-VOC products seem to provide equal protection from staining, scrubbing and everyday use. In addition, manufacturers claim that the low-VOC compliant products possess the following properties:

Properties of Interior Flat Coatings (<50 g/l)
- Appearance/Aesthetics
- Excellent Hide
- Touch-Up
- Removal of Household Stains
- Scrub Resistance
- Fast Drying
- Scuff/Mar Resistance
- Low Odor
- Good Adhesion
- Spatter Resistance
- Non Yellowing

Properties of Exterior Flat Coatings (<50 g/l)
- Durability
- Hides Imperfections
- Color Retention
- Fade Resistance
- Chalk Resistance
- Mildew Resistance
- Dirt Pickup Resistance
- Alkali/Efflorescence Resistance over Stucco and Masonry
- Tanin Stain Resistance
- Superior Adhesion

Several of the reported complying products were also included on Master Painter's Institute (MPI) Approved Products lists because they were certified to meet designated performance standards. MPI approved 21 Flat coatings that comply with the proposed 50 g/l limit and meet the following standards: MPI #10 (Latex, Exterior Flat - MPI Gloss Level 1); MPI #53 (Latex, Interior, Flat - MPI Gloss Level 1); and MPI #143 (Latex, Interior, Institutional Low Odor/VOC, Flat - MPI Gloss Level 1). Approved products include PPG Pure Performance, Kelly Moore Enviro-Cote, and Vista Paint Coverall Exterior Flat paints.

5.12.8. Manufacturer and Industry Issues

5.12.8.1. Issue: A number of manufacturers expressed concerns about formulating a quality exterior Flat coating that can comply with the proposed VOC limit of 50 g/l and achieve consumer acceptance. Exterior Flat coatings are exposed to weathering and UV light, so consumers want products with properties such as durability, color retention, fade resistance, chalk resistance, mildew resistance, dirt pickup resistance, and alkali/efflorescence resistance.

Response: ARB staff considered separating the Flat category into interior and exterior categories, but they determined that it was unnecessary because it is technologically feasible to formulate exterior Flat coatings that can comply with a 50 g/l limit. In addition, it was believed that the enforcement of a different VOC limit for exterior and interior flats would be problematic.

In 2004, four percent of the sales volume for exterior Flat coatings complied with a 50 g/l VOC limit and nine percent of the sales volume for interior products was compliant with a 50 g/l limit. Since that time, many

manufacturers have introduced new low-VOC exterior Flat coatings, because the 50 g/l limit in South Coast AQMD Rule 1113 will become effective in 2008. While there are more interior products on the market that fall below the proposed VOC limit, ARB staff believe that it is technologically feasible to formulate low-VOC exterior Flat coatings by 2010.

5.12.8.2. Issue: One manufacturer recommended that ARB increase the proposed VOC limit to 75 g/l to accommodate Flat coatings that are applied to tilt-up concrete in areas with high temperatures and desert conditions. The manufacturer claimed that these coatings will experience a decrease in adhesion, alkali resistance, flow, and leveling, if they don't contain additional VOCs.

Response: The proposed SCM contains a Concrete/Masonry Sealer category for products that are applied to new tilt-up concrete. The proposed VOC limit for this category is 100 g/l. Several manufacturers are currently providing products that can be classified as Concrete/Masonry Sealers and are intended for application on new tilt-up concrete, including Benjamin Moore, BASF Building Systems, Glidden/ICI, and Seal-Krete. These products would then be subject to the 100 g/l limit of the Concrete/Masonry Sealers. Therefore, ARB staff determined that it is not necessary to increase the proposed VOC limit for Flat coatings.

5.12.9. Conclusion

We recommend a 50 g/l VOC limit for Flat Coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the number of companies making complying products, testing data, and product information from manufacturers. Based on data for calendar year 2004, the complying marketshare is 7 percent which is relatively low. However, when considering Flat, Nonflat, and Nonflat High Gloss categories, ARB staff believes that the Flat category has the best potential for meeting a 50 g/l VOC limit because Flat coatings have less resin, more pigments and extenders, and the best ability to use softer resins. Therefore, Flats can withstand the decreased quantities of coalescing solvent and propylene or ethylene glycol. In addition, ARB staff plan to conduct a technology assessment prior to 2010 to ensure that the 50 g/l limit is feasible.

The proposed VOC limit is lower than the national limit promulgated by the U.S. EPA and OTC, and the proposed limit for Canada. The proposed limit is consistent with the limit adopted by the South Coast AQMD that will become effective on July 1, 2008.

5.13. FLOOR

VOC Limit Table (g/l)

USEPA: 400	Canada: 250	OTC: 250	SCAQMD: 50	SCM Proposed: 100

5.13.1. Category Definition

An opaque coating that is labeled and formulated for application to flooring, including, but not limited to, decks, porches, steps, garage floors, and other horizontal surfaces which may be subject to foot traffic.

5.13.2. Major Proposed Changes

- The VOC limit for Floor coatings will decrease from 250 g/l to 100 g/l.
- The definition is being modified to clarify that the Floor category is intended for garage floors and porch/deck/stair applications.

5.13.3. Coating Description

Floor Coatings cover a wide range of applications and functions. However, the Floor Coating category is not intended for products that are applied to industrial/institutional/commercial floors or clear coatings for wood floors. Those types of products would be covered by other categories (e.g., Concrete/Masonry Sealer, Industrial Maintenance, Wood Coating, etc.) Provided below is a description of the primary applications, based on the products reported in ARB's 2005 Architectural Coating Survey.

Porch, Deck, and Stairs: These products are opaque coatings for patios, porches, stairs, balconies, pool decks, and other similar surfaces that may be subject to foot traffic. Many products are also recommended for basements, but they don't offer protection against water intrusion from below-grade hydrostatic pressure. Gloss levels range from flat to high gloss and some products have non-skid or anti-slip properties. Many products are designed to be resistant to abrasion, water, detergents, and oil. Application methods include brush, roller, spray, squeegee, and trowel, and products can either be applied by professional contractors or homeowners. Some floor coatings are single component solventborne or waterborne formulations with resin types that include: alkyd, urethane, polyurethane, acrylic, acrylic copolymer, and epoxy. Floor coatings are also available in multi-component solventborne formulations with resin types that include: epoxy, urethane, and polyurethane. Overall, Porch/Deck/Stair coatings that can comply with the proposed 100 g/l limit represent 69% of the reported sales volume for this group (not including small containers).

Garage Floors: These products are opaque coatings for garage floors that are designed to be resistant to abrasion, hot tire pick up, and some chemicals (e.g.,

oil, grease, and gasoline stains). Most of the sales volume for garage floor products consists of single component, waterborne, acrylic epoxy formulations that are compliant with the proposed 100 g/l VOC limit. Other formulation types include multi-component waterborne epoxies and single component waterborne products with acrylic and polyurethane resins. Overall, Garage Floor coatings that can comply with the proposed 100 g/l limit represent 99.9% of the reported sales volume of this group (not including small containers). Products can either be applied by homeowners or professional contractors and application methods include brush, roller, and sprayer. Prior to application, it is usually necessary to etch the concrete by using muriatic acid or some other etching solution. After etching, the surface must be neutralized or cleaned, thoroughly rinsed, and dried before coatings can be applied. Garage floor coatings need to be fully cured before they are strong enough to withstand vehicle traffic. Therefore, it is usually recommended that the coatings be allowed to cure for 5 - 7 days before allowing vehicle traffic.

Sports Surfaces: These products are used on sports surfaces (e.g., tennis courts, running tracks, playgrounds, ball courts, and gymnasium floors). The coatings are generally designed to provide abrasion resistance and withstand wear from foot traffic. Many have non-skid or anti-slip properties and some are also resistant to fading from exterior exposure to ultraviolet light. Most are opaque, but some are also available in clear formulations. Clear products that are applied to wood gymnasium floors would not be included in the Sports Surfaces group, because those coatings are covered by the Wood Coatings category. In addition, there are some products in the Concrete/Masonry Sealer category that are primarily marketed as deck coatings, but can also be used on tennis courts. Sports Surfaces products can be applied by professional contractors or homeowners and application methods include sprayer, roller, brush, and squeegee.

Most of the reported sales volume for the Sports Surfaces group involves coatings that are used in conjunction with rubber granules to create a cushioned surface. These products for cushioned surfaces are either single component, solventborne polyurethanes with VOC values above 200 g/l or multi-component, solventborne polyurethanes with VOC values below 50 g/l. Other Sports Surfaces products for non-cushioned surfaces are either multi-component, solventborne polyurethanes or single component, waterborne acrylics. For cushioned surfaces only, products that meet the 100 g/l VOC limit represent 5% of the sales volume (not including small containers). For non-cushioned surfaces only, products that meet the 100 g/l VOC limit represent 77% of the sales volume (not including small containers). For all Sports Surfaces products, 11% of the sales volume meets the 100 g/l VOC limit (not including small containers).

5.13.4. Substrates/Exposures

Floor coatings are typically applied to concrete, wood, and asphalt substrates, with both interior and exterior exposures. Coatings are used on a variety of surfaces, such as wood porches and stairs; concrete garage floors; wood gymnasium floors; concrete patios and pool decks; running tracks; and concrete tennis courts.

5.13.5. Survey Results

Table 5.13-1 summarizes our estimate of sales and VOC emissions from the Floor coatings category, based on the ARB survey. In 2004, the sales volume for Floor coatings in California was 1.2 million gallons. This represents about one percent of the total California sales volume of architectural coatings.

Table 5.13-1: Survey Data
Floor Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	105	71,170	6%	1%	0%	99%	5%	239	0.19
WB	273	1,168,722	94%	7%	0%	92%	1%	98	0.53
Total	**378**	**1,239,892**		**7%**	**0%**	**93%**	**1%**	**106**	**0.72**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

ARB staff compared the results from ARB's two most recent architectural coating surveys which gathered sales data for calendar years 2000 and 2004. Sales of Floor coatings declined 13% and emissions declined 17% from 2000 to 2004. The sales-weighted average VOC Regulatory value increased 5%. These changes reflect a refinement of the products that were included in this category. As part of the SCM rule development process, ARB staff did a careful review of all products that were reported in the Floor Coating category to ensure that they were in one of the following groups: Porch/Deck/Stair; Garage Floor; or Sports Surfaces. Products that didn't fit into these groups were moved to more appropriate categories (e.g., Waterproofing Concrete/Masonry Sealer; Industrial Maintenance, etc.)

Table 5.13-2 contains the complying marketshare for Floor coatings in large containers, based on results from the ARB survey. There are more than 160 Floor coating products that comply with the proposed VOC limit. Of the 25 companies that reported in this category, 16 offered Floor coatings that comply with the proposed limit. Products with a VOC content equal to or lower than 50 g/l represented 0.4 percent of the reported sales volume.

Table 5.13-2 shows that implementing the proposed 100 g/l limit would achieve approximately 0.07 tpd in VOC emission reductions for the non-South Coast AQMD portion of California, on an annual average basis.

Table 5.13-2: Complying Marketshare & Emission Reductions Floor Coatings

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
100	168	85%	0.07

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.13.6. Product Testing Results

The South Coast AQMD awarded KTA-Tator, Inc. a contract to perform a technology assessment of zero-and-low-VOC coatings with respect to their availability and performance characteristics on March 1, 2001. They tested six floor products, with the intention of evaluating three low-VOC products below 100 g/l and three high-VOC products above 100 g/l. The selection of these products was based on manufacturers' published VOC contents, but laboratory analysis showed that only one product actually had a measured VOC content that was below 100 g/l (zero VOC), while the remaining five had VOC contents ranging from 111 g/l to 308 g/l. Based on the data, the results indicate that the performance was comparable for the three lower VOC products (measured VOC from zero to 112 g/l) and the three higher VOC products (measured VOC from 136 to 308 g/l). Although one of the low VOC products had a very slow dry time, it had excellent abrasion resistance (SCAQMD, 2002).

5.13.7. Conclusion

We recommend a 100 g/l VOC limit for Floor coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the high complying marketshare, the number of companies making complying products, and information provided by manufacturers. The proposed VOC limit is lower than the national limit promulgated by the U.S. EPA, OTC states, and Canada for this category. The proposed VOC limit is higher than the 50 g/l limit contained in SCAQMD Rule 1113. However, manufacturers that provide coatings in the SCAQMD area can still sell products which exceed the 50 g/l limit, if they participate in SCAQMD's averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit.
In addition, ARB staff research reviewed lists of low-VOC products that could be applied to floors and had VOC contents near or below 50 g/l. Under the SCM, almost all of the products that were reviewed would be classified as Concrete/Masonry Sealers or Industrial Maintenance coatings, rather than Floor

Coatings. Since Floor Coatings need to stand up to abrasion from pedestrian traffic, it has been challenging to develop resins that can be used to formulate 50 g/l products with acceptable performance. Therefore, ARB staff believes that the proposed 100 g/l VOC limit is most appropriate at this time.

5.14. FORM RELEASE COMPOUNDS

VOC Limit Table (g/l)

USEPA: 450	Canada: 250	OTC: 250	SCAQMD: 250	SCM Proposed: 250

5.14.1. Category Definition

A coating labeled and formulated for application to a concrete form to prevent the freshly poured concrete from bonding to the form. The form may consist of wood, metal, or some material other than concrete.

5.14.2. Major Proposed Changes

- None.

5.14.3. Coating Description

Concrete forms are generally made of wood, metal, or fiberglass and they provide shape and support during the concrete pouring and curing process. Form Release Compounds are applied on the forms in a thin film to prevent the freshly poured concrete from sticking to the form. They can also help provide a smooth concrete surface by preventing bugholes or air voids. Form Release Compounds are designed so they do not stain the concrete surface or leave a residue that could interfere with the adhesion of concrete sealers or coatings. On wooden forms, repeated use of Form Release Compounds can provide a water repellent coating that can extend the useful life of the form. Some products contain rust inhibitors that help prevent rusting of metal forms. Form Release Compounds are often formulated to meet the Corps of Engineers specifications CE-204, section 3-03-K or CW-03101 (now known as the Unified Facilities Guide Specifications, section 03 11 14.00 10, “Formwork for Concrete”). Products are usually applied by professional contractors and application methods include sprayer, brush, roller, and wiping on with a cloth. All of the Form Release Compounds that were reported in the ARB survey are single component products sold in large containers and they fall into two main groups:

- Chemically Reactive: These products react with the alkali or lime in the concrete to form a slippery film.
- Non-Reactive: These products provide an oily film, but they do not react with the concrete.

Chemically Reactive: These Form Release compounds react with the alkali or lime in the concrete to form a slippery film that prevents concrete from sticking to the forms. Products are available in waterborne formulations (oleoresins and paraffin oils) and solventborne formulations (fatty acids, mineral oils, naphthenic oils, oleoresins, paraffin oils, soybean oils, and tall oils). They generally don't contain fuel oils or kerosene and some are designed to be biodegradable. Many products are not suitable for use on molds made of latex, plaster, rubber, or foam. In addition, some are not suitable for tilt-up construction. Both solventborne and waterborne formulations are available with VOC contents less than 100 g/l. For the Chemically Reactive group, these <100 g/l products represent 12% of the sales volume. Products with VOC contents less than 200 g/l represent 14% of the sales volume, while 81% of the products in this group have VOC contents between 200 -250 g/l.

Non-Reactive: These products provide an oily film, but they do not react with the concrete. Most of the reported products are solventborne formulations (naphthenic oils, paraffin oils, petroleum distillates, mineral oils, and vegetable oils), but there are also waterborne formulations (vegetable oil emulsions). Some products are not suitable for use on molds made of latex, expanded polystyrene, rubber, or styrene-butadiene rubber (SBR). In addition, some are not suitable for tilt-up construction. For the Non-Reactive group, products with VOC contents less than 200 g/l represent 0% of the sales volume, while 99% of the products have VOC contents between 200 -250 g/l.

5.14.4. Substrates/Exposures

Form Release Compounds are applied to substrates that include, but are not limited to, wood, metal, and fiberglass. They are temporary coatings, so they are not designed to withstand long-term exposure to chemicals or the elements.

5.14.5. Survey Results

Table 5.14-1 summarizes our estimate of sales and VOC emissions from the Form Release Compounds category, based on the ARB survey.

Table 5.14-1: Survey Data
Form-Release Compound Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	28	284,655	88%	0%	4%	96%	0%	243	0.79
WB	11	38,957	12%	0%	3%	97%	0%	158	0.01
Total	**39**	**323,612**		**0%**	**4%**	**96%**	**0%**	**233**	**0.80**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

The sales volume for Form Release Compounds represents about 0.3 percent of the total California sales volume of architectural coatings in 2004. VOC emissions from Form Release Compounds represent approximately 1.8 percent of the total emissions from architectural coatings. When compared to the data reported for calendar year 2000, the sales volume for Form Release Compounds increased 27 percent in 2004, VOC emissions increased 31 percent, and the sales-weighted average VOC content increased 9 percent.

Table 5.14-2 contains the complying marketshare for Form Release Compounds, based on results from the ARB survey. This table shows that 97 percent of the sales volume for Form Release Compounds complies with the current VOC limit of 250 g/l. When considering the number of products reported, approximately 87 percent comply with the current limit. Of the 11 companies that reported in this category, 9 offered Form Release Compounds that comply with the current limit.

Table 5.14-2: Complying Marketshare & Emission Reductions
Form-Release Compound Coatings

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
250	34	97%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.14.6. Conclusion

For some limited applications, it appears to be technologically feasible to use products with VOC contents less than 100 g/l, if they are formulated to chemically react with the concrete. However, these low-VOC products seem to have more substrate limitations and would not be suitable for as many uses as the products with non-reactive formulations. Therefore, we recommend that the VOC limit for Form Release Compounds remain at 250 g/l at this time. The current VOC limit is technologically and commercially feasible, based on complying marketshare,

number of companies making complying products, and product information from manufacturers. The current VOC limit is lower than the national limit promulgated by the U.S. EPA for this category. The current limit of 250 g/l VOC is consistent with the limits in effect for the South Coast Air Quality Management District, the Ozone Transport Commission, and the proposed limit for Canada.

5.15. GRAPHIC ARTS

VOC Limit Table (g/l):

USEPA: 500	Canada: 500	OTC: 500	SCAQMD: 500	SCM Proposed: 500

5.15.1. Category Definition

A coating labeled and formulated for hand-application by artists using brush, airbrush, or roller techniques to indoor and outdoor signs (excluding structural components) and murals including lettering enamels, poster colors, copy blockers, and bulletin enamels.

5.15.2. Major Proposed Changes

- The definition was modified to include the use of airbrushes as an application method.

5.15.3. Coating Description

Graphic Arts coatings (or sign paints) are typically used for decorative applications, such as outdoor advertising billboards, metal highway signs, commercial signs, and safety warning signs. The use of paints on billboards has declined, because most billboard signs are now pre-printed and attached to the billboard on site. The graphic arts category includes primers, topcoats, and clear finish topcoats that are used on stationary signs. It also includes copy blockers which are used to “white-out” an old sign prior to painting a new sign.

The Graphic Arts category does <u>NOT</u> include the following types of applications -

- Coatings that are used on the structural components of billboards. These coatings would be covered by another category (e.g., Flat, Nonflat, Rust Preventative, etc.)
- Coatings that are used to paint line markings on gym floors, athletic fields, or playgrounds. Coatings that are used to paint lines on wood gym floors would be covered by the Wood Coating category. Coatings for striping on athletic fields are usually covered by the Flat category. Coatings for playgrounds could be covered by Flat, Nonflat, or Concrete/Masonry Sealer, depending on the substrate and type of product.

- Coatings that are used to paint signs on the exterior or interior wall of a building. These coatings would be covered by another category (e.g., Flat, Nonflat, Rust Preventative, etc.).
- Coatings that are used to paint temporary vinyl banner signs or canvas backdrops for theaters. Some local air districts have specific rules that contain VOC limits for coatings used on fabrics.
- Signs painted in a shop or factory are not Architectural Coatings.

The Graphic Arts coatings that were reported in the survey are single component formulations consisting of solventborne alkyds or waterborne acrylics. All of the solventborne products have VOC contents less than 450 g/l and all of the waterborne products have VOC contents less than 300 g/l. Graphic Arts coatings can be used by professional artists or homeowners and application methods include brush, roller, and spray.

5.15.4. Substrates/Exposures

Substrates for Graphic Arts coatings include wood, metal, concrete, masonry, masonite, fiberglass, plastic, and vinyl surfaces.

5.15.5. Survey Results

Table 5.15-1 summarizes our estimate of sales and VOC emissions from the Graphic Arts category, based on ARB survey results.

Table 5.15-1: Survey Data
Graphic Arts Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	91	PD	PD	0%	0%	100%	87%	385	0.01
WB	43	PD	PD	0%	0%	100%	55%	211	0.00
Total	**134**	**PD**		**0%**	**0%**	**100%**	**80%**	**352**	**0.02**

(ARB, 2006)
1. PD= Protected Data. Sales data are protected, because fewer than three companies provided survey data.
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.15-2 contains the complying marketshare for Graphic Arts coatings, based on the ARB survey. This table shows that all of the products and all of the sales volume comply with the current limit. No emission reductions are expected because ARB staff is not proposing a change to the VOC limit.

Table 5.15-2: Complying Marketshare & Emission Reductions Graphic Art Coatings

Existing VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
500	134	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.15.6. Conclusion

We recommend maintaining a 500 g/l VOC limit for Graphic Arts coatings. This VOC limit is technologically and commercially feasible, based on the high complying marketshare. It appears to be technologically feasible to formulate Graphic Arts coatings with VOC contents below 500 g/l. However, ARB staff is not proposing a lower VOC limit, because the potential emission reductions that would be achieved were considered to be insignificant. The SCM VOC limit is the same as the VOC limits promulgated for the SCAQMD, the Ozone Transport Commission, and the United States Environmental Protection Agency (U.S. EPA). The SCM VOC limit is also the same as the limit proposed for Canada.

5.16. HIGH TEMPERATURE

VOC Limit Table (g/l)

USEPA: 650	Canada: 420	OTC: 420	SCAQMD: 420	SCM Proposed: 420

5.16.1. Category Definition

A high performance coating labeled and formulated for application to substrates exposed continuously or intermittently to temperatures above 204 °C (400 °F).

5.16.2. Major Proposed Changes

- None.

5.16.3. Coating Description

High Temperature coatings are primarily used to protect metal substrates from exposure to temperatures above 204 ˚C (400 ˚F). This temperature is higher than what Industrial Maintenance coatings will withstand (250 ˚F). This type of coating will generally be used in industrial environments (e.g., chemical plants, marine structures, ships, power plants and refining plants) where metal equipment such as stacks, furnaces, piping, boilers, heat exchangers and hot process tanks are subject to high temperatures. Typical methods of application are by airless

spray, conventional spray, brush, and roller. It is important to apply the coating at a dry film thickness (DFT) that is close to the DFT recommended by the manufacturer. Applying a coating that is too thick makes the coating subject to cracking, blistering and a loss of adhesion to the substrate. High Temperature coatings are available in limited colors. Pigments that vary from the "natural" aluminum decrease the heat resistance (JPCL, 1999).

The typical resin that is used to formulate High Temperature coatings is a silicone acrylic, but resin types include other forms of siloxane (e.g., aluminum or modified). Silicone acrylics soften at elevated temperatures, so manufacturers recommend that a zinc silicate primer be applied to increase corrosion resistance and the mechanical properties of the High Temperature coating. Generally, for metal surfaces that are subject to temperatures of 450 ˚C to 540 ˚C, it is recommended that one to two coats of a silicone aluminum topcoat be used over a zinc silicate primer (JPCL, 1999).

Because of the resins that are used, the carrier solvent is generally an aliphatic hydrocarbon. All of the products reported in this category are solventborne products and most have single component formulations.

5.16.4. Substrates/Exposures

The primary substrate for High Temperature coatings is metal, but other substrates include concrete and masonry. High Temperature coatings can be used on both interior and exterior substrates. Surface preparation is crucial for high temperature coatings; surfaces must be free from imperfections, halogens and any other contamination. Since surface preparation is crucial, manufacturers recommend methods that are similar to those for Industrial Maintenance coatings (e.g., abrasive blasting or other mechanical methods).

5.16.5. Survey Results

Table 5.16-1 summarizes our estimate of sales and VOC emissions from the High Temperature coatings category, based on the ARB survey. High Temperature coatings represent a small portion of sales of architectural coatings. In 2004, the sales volume for High Temperature coatings in California was approximately 12,000 gallons. This represents less than 0.01 percent of the total California sales volume of architectural coatings.

Solventborne High Temperature coatings dominate the market. Although the number of solventborne products has remained relatively constant, the sales volume for High Temperature coatings dropped approximately 50 percent from 2000 to 2004. The overall sales-weighted average VOC level for High Temperature coatings has remained relatively constant from 2000 to 2004.

VOC emissions from High Temperature coatings are about 0.05 tpd, which represents less than 0.01 percent of the total emissions from architectural coatings.

Table 5.16-1: Survey Data
High Temperature

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers [2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	83	11,736	100%	9%	0%	91%	31%	407	0.05
WB	0	0	0%	NA	NA	NA	NA	NA	0
Total	**83**	**11,736**		**9%**	**0%**	**91%**	**31%**	**407**	**0.05**

(ARB, 2006)

1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.16-2 contains the complying marketshare for High Temperature coatings, based on the ARB survey. This table shows that 90 percent of the existing sales volume for High Temperature coatings complies with the current VOC limit. Of the 9 companies that reported in this category, 5 offered High Temperature coatings that comply with the current limit. No emission reductions are expected, because ARB staff is not proposing a change to the VOC limit.

Table 5.16-2: Complying Marketshare & Emission Reductions
High Temperature

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
420	18	90%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.16.6. Conclusion

We recommend maintaining a 420 g/l VOC limit for High Temperature coatings. The current VOC limit is technologically and commercially feasible based on the complying marketshare and the number of companies making complying products. It appears to be technologically feasible to formulate High Temperature coatings with VOC contents below 420 g/l. However, ARB staff is not proposing a lower VOC limit because the potential emission reductions that would be achieved were considered to be insignificant.

The current VOC limit is lower than the national limit promulgated by the U.S. EPA for this category. The current limit is consistent with the limit adopted by the South Coast AQMD and the OTC, and the proposed limit for Canada.

5.17. INDUSTRIAL MAINTENANCE

VOC Limit Table (g/l)

USEPA: 450	Canada: 340	OTC: 340	SCAQMD: 100	SCM Proposed: 250

5.17.1. Category Definition

A high performance architectural coating, including primers, sealers, undercoaters, intermediate coats, and topcoats, formulated for application to substrates, including floors, exposed to one or more of the following extreme environmental conditions labeled as specified in the SCM labeling requirements:

- Immersion in water, wastewater, or chemical solutions (aqueous and non-aqueous solutions), or chronic exposure of interior surfaces to moisture condensation; or
- Acute or chronic exposure to corrosive, caustic or acidic agents, or to chemicals, chemical fumes, or chemical mixtures or solutions; or
- Frequent exposure to temperatures above 121 °C (250 °F); or
- Frequent heavy abrasion, including mechanical wear and frequent scrubbing with industrial solvents, cleansers, or scouring agents; or
- Exterior exposure of metal structures and structural components.

5.17.2. Major Proposed Changes

- None.

5.17.3. Coating Description

Industrial Maintenance coating is a generic term for a variety of high performance coatings used to protect substrates in harsh environmental conditions. These coatings are applied to steel, concrete and other materials for the primary purpose of providing protection against corrosion, exposure to chemicals, abrasion, heat, immersion in water, and other severe conditions. Industrial Maintenance coatings are typically used to protect the infrastructure of public utilities, transportation systems, and industrial production facilities. Specific examples are: bridges and roadways; chemical manufacturing plants; chemical storage tanks and piping; oil exploration, production, and refining facilities; power generation and distribution facilities; pulp and paper mills; pharmaceutical plants; food processing plants; wastewater storage and treatment facilities; and water treatment and distribution facilities. Industrial Maintenance coatings are also applied in non-industrial areas that are subjected to extreme abrasion (e.g., scrubbing with cleaning chemicals). These areas include hospitals, schools, prisons, and warehouses. Some Industrial Maintenance coatings are intended for limited types of use while others are versatile and multifunctional. These

coatings are restricted to professional use only, and it is generally recommended that personnel use respirators and other protective equipment.

Protection against corrosion is a primary function of many Industrial Maintenance coatings. Corrosion occurs when the substrate reacts with water, oxygen or other chemicals and it leads to the degradation of the material properties of the substrate. Industrial Maintenance coatings protect against this by forming a corrosion-resistant barrier between the substrate and the environment.
A specific class of coating uses zinc as a sacrificial anode to form an electrochemical cell that protects the substrate at the expense of the zinc. These coatings are categorized as Zinc-Rich Primers, and are not part of the Industrial Maintenance category.

Industrial Maintenance coatings do not include coatings used for shop application, such as for the manufacture of parts or products in a factory.
Other products that are excluded from the Industrial Maintenance category are coatings applied to vehicles, such as cars, trucks, railcars, ships, boats, and airplanes.

A variety of application methods are used to apply Industrial Maintenance coatings, including conventional air spray, airless spray, roller and brush. Sometimes, plural-component spray guns are used to apply these coatings.

Industrial Maintenance coatings can be solventborne or waterborne, single component or multi-component. Industrial Maintenance systems may consist of a single coating or they may include two coatings (primer and topcoat) or three coats (primer, midcoat, and topcoat). All of the products that comprise an Industrial Maintenance system are covered by the Industrial Maintenance category.

Formulations for Industrial Maintenance coatings vary, due to the wide range of applications for these coatings. Most coatings are based on alkyd, polyurethane, epoxy or acrylic resin technologies.

Traditional Industrial Maintenance coatings for metal substrates were solventborne alkyd coatings. Most of these products had VOC contents that exceeded 300 g/l. As VOC limits have decreased, these coatings have been replaced by other resin technologies. Alternatives to solventborne alkyds are water-reducible alkyd resins and alkyd emulsions. Although these products offer some of the attractive properties of solventborne alkyds, they have not yet obtained a significant marketshare (Mestach, 2004).

Polyurethane-based formulations are usually solventborne, and they are used for exterior industrial exposures. These coatings can exhibit good color and gloss retention, in addition to chemical and abrasion resistance, when exposed to weathering (Bayne, 2006). Two-component polyurethane coatings must be

prepared by mixing in a curing agent prior to application. Besides two-component formulations, moisture-cured polyurethane formulations are available that rely on absorption of moisture from ambient air for curing (McNeill, 1992).

Epoxy-based formulations are often used as primers, due to their adhesion properties. These coatings are generally multi-component coatings, prepared by mixing in a hardener prior to application, and are often used as a primer with an acrylic topcoat. Epoxy coatings can be solventborne, waterborne, or contain 100% solids with no VOC. Although 100% solids epoxy coatings have shown good performance in immersion conditions, they are more difficult to apply than higher VOC coatings and usually need a sealer to be applied over concrete.

Acrylic coating technology in waterborne and solventborne formulations is used for Industrial Maintenance coatings, because of the exterior durability and chemical inertness of the coatings. Many waterborne acrylic formulations are available as single component products with low VOC contents. These coatings can be used as a primer or a topcoat.

Anti-Graffiti coatings remain in the Industrial Maintenance category. Although there are coatings under 100 g/l that are recommended for anti-graffiti purposes, staff found that coatings up to 250 g/l are being used by State and city agencies. In addition, an economic analysis of a 150 g/l limit for anti-graffiti coatings showed that the limit was not cost effective.

Antenna coatings are included in the Industrial Maintenance category. These coatings are used to coat reflector antennas. Due to the small volumes of these types of products used annually, staff believes these coatings can be sold in small containers. In the infrequent cases where a project needs larger containers, a variance can be sought from the local district.

5.17.4. Substrates/Exposures

Industrial Maintenance coatings are used both indoors and outdoors at industrial facilities or on other substrates exposed to severe environmental conditions (e.g., immersion in water, wastewater, or chemical solutions; exposure to chemicals and acids; exposure to high temperatures, etc.).

Typical substrates include: concrete; masonry; asphalt; and both ferrous and non-ferrous metal, including steel, iron, and aluminum. Due to the variety of uses and types of coatings, the recommended surface preparation and application methods vary. Some coatings recommend abrasive blasting or other mechanical means of surface preparation according to a specific reference standard. For other applications, substrate preparation with a wire brush, sandpaper or a solvent for cleaning is recommended.

5.17.5. Survey Results

Table 5.17-1 summarizes our estimate of sales and VOC emissions from the Industrial Maintenance category, based on the ARB survey. In 2004, the sales volume for Industrial Maintenance coatings in California was approximately 2.1 million gallons. From 2000 to 2004, there was a 55% decrease in sales volume. Much of the sales volume was recategorized from Industrial Maintenance to the Rust Preventative category when the 250 g/l VOC limit for Industrial Maintenance coatings took effect. The coatings that moved to Rust Preventative were primarily solventborne alkyd coatings that did not comply with the 250 g/l VOC limit, and possessed application and performance properties that made them well suited for Rust Preventative coatings.

Industrial Maintenance coatings were one of the categories that could be included in averaging programs during 2004. Under these programs, manufacturers could sell Industrial Maintenance coatings with VOC levels above 250 g/l, if emissions from these products were offset by emissions from other products that had VOC levels below regulatory limits. For Industrial Maintenance coatings, seven percent of the total sales volume consisted of high-VOC products with VOC levels above 250 g/l. These high-VOC products accounted for approximately 0.7 tpd of VOC emissions which represents 15 percent of the total emissions from Industrial Maintenance coatings.

Table 5.17-1: Survey Data
Industrial Maintenance

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	2,292	1,422,836	67%	16%	7%	77%	2%	224	3.61
WB	945	714,936	33%	9%	12%	79%	0%	168	0.65
Total	**3,237**	**2,137,772**		**13%**	**9%**	**78%**	**1%**	**205**	**4.26**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.17-2 contains the complying marketshare for Industrial Maintenance coatings, based on results from the ARB survey. Since we're proposing no change to the VOC limit, we expect no emission reductions.

Table 5.17-2: Complying Marketshare & Emission Reductions Industrial Maintenance

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
250	1654	69%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.17.6. Product Testing Results

5.17.6.1. NTS Study

As part of the 1999 amendments to Rule 1113 (Architectural Coatings), the South Coast Air Quality Management District (SCAQMD) funded a study to compare the performance of low-VOC and high-VOC coatings. SCAQMD solicited proposals to conduct side-by-side comparisons to address issues brought up by industry members regarding low-VOC coatings. A steering committee was formed to oversee the technical aspects of the study. This committee, called the Technical Advisory Committee (TAC), was comprised of representatives from the Air Resources Board (ARB), SCAQMD, academia, and the architectural coatings industry.

In 1998, the TAC selected National Technical Systems (NTS) as the contractor to carry out the Phase II Assessment Study of Architectural Coatings. The study consisted of a laboratory portion, an accelerated weathering portion, and an outdoor exposure portion. The three portions of this study took place between 1998 and 2002. Industrial Maintenance was one of the categories examined in this study.

The laboratory portion of the study is summarized in ARB's Staff Report for the 2000 SCM (ARB, 2000a). The results of the accelerated weathering and outdoor exposure portions of the study are summarized below.

Accelerated Weathering: The accelerated weathering portion of the study was performed by Atlas Weathering Services Group. At their site in Phoenix, Arizona, Emmaqua (Equatorial Mount with Mirrors for Acceleration with Water) equipment was used to expose test panels to severe sunlight and deionized water spray for 85 days. These tests were completed in 2000.

The accelerated weathering portion of the study tested 20 Industrial Maintenance systems, including 10 above 250 g/l, and 10 below 250 g/l.
Panels were tested in triplicate. The following tests were performed: dry film thickness; pre-test and post-test gloss at 20, 60, and 85 degrees; pre-test and post-test CIE; and pre-test and post-test yellowing. CIE is an acronym for *Comission Internationale de l'Eclairage* or International Commission on

Illumination, which is a scale used to compare color. Visual observations were also noted at the end of the test. The ratings from these visual inspections were based on overall appearance, which factored in corrosion, chalkiness, blistering or cracking, gloss and color.

For the Industrial Maintenance coatings systems, complying systems under 250 g/l performed worse than non-complying systems in yellowing tests, and slightly worse in gloss, CIE tests, and visual observations than Industrial Maintenance systems over 250 g/l.

Of the 10 coating systems under 250 g/l, 5 were below 100 g/l. Compared to the coating systems between 100 g/l and 250 g/l, the systems under 100 g/l performed worse in visual observations, and better in gloss retention and yellowing tests than systems with VOC contents between 100 g/l and 250 g/l.

24-Month Outdoor Exposure: The outdoor exposure portion of the study consisted of tests performed at regular intervals of exposure, and observations made by the TAC during inspections. This portion of the study tested 20 Industrial Maintenance systems. These were the same coatings tested in the accelerated weathering portion of the study. Panels were tested in duplicate at Saugus and El Segundo in southern California. The Saugus site featured a dry, desert like climate, while the El Segundo site featured more of a coastal climate and an industrial setting, since it was next to Los Angeles International Airport. The TAC made regular visits to these sites, where the condition of the test panels was evaluated. The TAC inspected the panels 3, 6, 9, 12, 18 and 24 months after the start of the exposure. At the 12, 18 and 24 month periods of the study, ratings were given to the panels, and the results are summarized below. The ratings from these visual inspections were based on overall appearance, which factored in corrosion, chalkiness, blistering or cracking, gloss and color.

In addition to the evaluations of the panels made by the TAC, NTS performed tests on the panels at the start of the outdoor exposure, and repeated those tests after 6, 12, 18 and 24 months. Tests performed by NTS were gloss on 20, 60 and 85 degree meters, CIE color, and yellowing. Written comments were made on chalking, cracks, flakes and blisters. This portion of the study began in April 2000 and was completed in April 2002.

Overall, non-complying systems generally had equivalent performance in the gloss tests, and better performance in CIE and yellowing tests. At the Saugus test site, coating systems over 250 g/l performed slightly worse in gloss tests, and better in CIE and yellowing tests than coating systems under 250 g/l. At the El Segundo test site, coating systems over 250 g/l performed equivalent in gloss tests, and better in CIE and yellowing tests than coating systems under 250 g/l.

Considering only coatings below 250 g/l, the coating systems below 100 g/l performed better in gloss tests, and worse in CIE and yellowing tests than systems between 100 g/l and 250 g/l at the Saugus test site. At the El Segundo test site, coating systems below 100 g/l performed equivalently in gloss tests, and worse in CIE and yellowing tests.

In addition to the tests performed by NTS, the TAC rated the panels based on visual observation during the 12, 18 and 24 month site visits to the Saugus and El Segundo facilities. Ratings were based on rust, blistering, gloss, chalkiness, and overall appearance. According to the TAC rankings, the non-complying (>250 g/l) systems performed better than the complying systems at the Saugus site, consistently throughout the test period. At the El Segundo site, the complying systems performed better than the non-complying coatings at the 12 month mark, and equivalently at the 18 and 24 month marks. Considering only coatings below 250 g/l, the systems below 100 g/l were rated higher than systems between 100 g/l and 250 g/l throughout the test period at the Saugus test site. At the El Segundo test site, systems below 100 g/l were rated higher than systems between 100 g/l and 250 g/l at the 12 and 24 month reviews, and worse at the 18 month review.

During discussion of the study by the TAC, some criticisms of the testing procedures were made. One criticism was that the coatings were applied using a draw down technique in accordance with ASTM test methods, rather than by the manufacturers' recommendations. Although the draw down technique was specified in the testing protocol that was approved by the TAC, some members felt that ignoring the manufacturers' recommended application method affected the performance of the panels. Upon inspection of the panels, the scribes observed on the Industrial Maintenance panels seemed to be inconsistent. Some had multiple scribes, or scribes of varying depth and width. The rack the panels were tested on consisted of multiple rows, some of which were closer to the ground than others. Some TAC members felt that the panels on the lower rows could have been subjected to more moisture or different rates of temperature change, since they were closer to the ground than others. After the coatings were applied to the test panels, the panels were kept in storage for several months before the outdoor exposure began. According to some members of the TAC, this went against manufacturer recommendations and could have affected the performance of the coatings.

5.17.6.2. SCAP: The Southern California Alliance of Publicly-Owned Treatment Works (SCAP) evaluated low-VOC coating systems suitable for wastewater environments as a result of the May 14, 1999 amendments to SCAQMD Rule 1113. The POTWs Assessing Coating Technology (PACT) Committee was established to oversee the coating evaluation project for SCAP. The project concluded in February 2003 and is described below (SCAP, 2003).

Program Goals

1) Identify low-VOC coating systems suitable for use in wastewater treatment and conveyance facilities,
2) Evaluate coating performance in standard ASTM tests,
3) Verify ASTM accelerated laboratory tests with weathering performance in the field,
4) Compare the performance of coating systems across three VOC ranges,
5) Provide guidance to the SCAP membership regarding the rule amendment, and
6) Inform SCAQMD about the availability and performance of low-VOC industrial maintenance coatings pertinent to the wastewater industry.

Coating Selection

To kick off the program, a letter was sent to thirty-five coating manufacturers requesting recommendations for products suitable for wastewater environments. The solicitation campaign purposely included major manufacturers, specialty manufacturers utilized by the wastewater industry, as well as low-VOC specialty manufacturers identified by SCAQMD staff. Approximately half of the manufacturers responded to the request. The Committee decided that coatings with a pot-life of less than 2 hours at 77 degrees F are not practical for the wastewater industry, unless they are recommended for application with plural spray equipment. Within this parameter, the Committee selected coatings for the program with input from the manufacturers' recommendations. A total of 21 coating systems were tested in the program.

Application Challenges

Almost all of the coatings in the test program had "challenges" during application. One-third of the coatings required thinning with VOC-containing solvent. Directly due to thinning, two coatings were bumped up to a higher VOC category and six coatings had an unknown final VOC content.

SCAP found it remarkable that so many coatings required thinning for application in an environmentally controlled laboratory. In the field, they expect even more thinning due to weather variations. SCAP recommended that SCAQMD further investigate this issue and appropriately revise their assessment.

Laboratory Testing Versus Field Testing

The test program highlighted the importance of field-testing coating systems. The accelerated weather and corrosion laboratory tests did not accurately predict performance in the field. Therefore, new and reformulated coating systems will require field-testing and evaluation prior to use.

SCAP concluded that atmospheric coatings systems below 100 g/l were not readily available. In order to allow end-users enough time to test industrial maintenance coatings prior to use in 2006, these coatings would need to be available for purchase by the end of 2003. At that time, the manufacturers they regularly work with were still reformulating their coating systems below 250 g/l to meet the January 1, 2004 deadline and had not begun to reformulate coating systems to below 100 g/l. SCAP recommended SCAQMD postpone the 100 g/l VOC limit for industrial maintenance coatings several years, at least until January 1, 2008.

Shelf Life

In the Proposed Amended Rule 1113 Staff Report dated December 6, 2002, SCAQMD states on pages II-5 and II-6, "However, if all of their assessments are not complete, Essential Public Service agencies can utilize the sell-through provision provided." Most of the products included in this study have a shelf life of one-year or less. Therefore, in the wastewater industry, products are typically good only one year past their manufacture date. One year is insufficient time to complete a field test program.

Program Conclusions

1) Coating systems with VOC contents between 100-<250 g/l exposed to the atmosphere and coatings systems with VOC contents between 100-<250 g/l and <100 g/l exposed via wastewater immersion perform similarly to existing coating systems with VOC contents between 250-<340 g/l.
2) Almost all of the coating systems caused "challenges" during application in the laboratory. One-third of the coating systems had to be thinned with solvent.
3) Atmospheric coating systems with VOC contents below 100 g/l are not readily available for purchase by end-users.
4) Accelerated weathering and corrosion laboratory tests did not correlate with field exposure tests for most atmospheric coating systems. Field exposure is the best method to demonstrate coating performance since localized airborne contaminants and weather conditions significantly influence coating performance.
5) No clear trends were defined solely by the VOC contents in the coating systems. Performance varied by coating chemistry, manufacturer and product.

5.17.6.3. EPSA: Pursuant to the adoption of the June 1999 amendments to the SCAQMD's Rule 1113, Architectural Coatings, several public agencies formed a cooperative group with the SCAQMD to conduct a technology assessment of the newer, compliant, low-VOC industrial maintenance coatings that were being introduced into the market. This group, referred to as the "Essential Public

Service Agencies" (EPSA) is comprised of the Los Angeles Department of Water and Power (LADWP), the Department of Water Resources (DWR), the California Department of Transportation (CalTrans), and the Metropolitan Water District of Southern California (MWD). The EPSA tested the available low-VOC coatings and MWD compiled a summary of the results of the testing program (MWD, 2005).

The results showed considerable variability in the performance of the Industrial Maintenance coatings. Based on MWD's testing experience, several newer coating formulations showed promise for protection of our critical infrastructure. In addition, MWD's testing indicated that coating formulations utilizing solvents recently exempted by SCAQMD (e.g., TBAc) showed strong promise for high performance and VOC compliance. Although MWD was cautiously optimistic that manufacturers would introduce compliant coatings into the market that met their service and performance requirements as the July, 2006 effective date for the SCAQMD 100 g/l VOC limit drew near, the release of products has been slower than originally anticipated. They are continuing to monitor the performance of compliant Industrial Maintenance coating systems, since poor performance can result in increased maintenance of critical infrastructure.

5.17.6.4. UMR:

In 2005, the UMR Coatings Institute at the University of Missouri-Rolla conducted a coatings testing project for the SCAQMD (UMR, 2006). The project included tests on products classified as Industrial Maintenance coatings.
UMR tested some general coating properties, including: percent nonvolatile; stability; viscosity; freeze/thaw resistance; dry time; gloss; and hiding – contrast ratio. They also tested performance properties, including: Taber abrasion; impact resistance; adhesion on steel; accelerated weathering (QUV); MEK rubs; prohesion; and conical mandrel flexibility. All testing was done in accordance with ASTM standards, unless otherwise noted or agreed upon by the SCAQMD. All paints were supplied to the UMR Coatings Institute by SCAQMD.

For Industrial Maintenance, the project tested three coating systems, containing a primer, intermediate coat, and topcoat. Two systems had low-VOC products (VOC $\leq$100 g/l) and one system had higher-VOC products (VOC >100 g/l and $\leq$250 g/l), based on published VOC values. On average, the low-VOC systems performed comparably with the higher-VOC system on most tests. In fact, one of the low-VOC systems performed the best of the three systems on several tests, including: gloss retention after being exposed to UV light, condensation, and salt fog cycles.

5.17.7. Conclusion

We recommend maintaining a 250 g/l VOC limit for Industrial Maintenance coatings. The proposed VOC limit is lower than the national limit adopted by the

U.S. EPA and OTC states, and the proposed limit for Canada. The proposed VOC limit is higher than the 100 g/l SCAQMD limit. However, manufacturers that provide coatings in the SCAQMD area can still sell products which exceed the 100 g/l limit, if they participate in SCAQMD's averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit. The SCAQMD has also allowed the use of Tertiary Butyl Acetate (TBAc) as an exempt solvent for Industrial Maintenance coatings. Because of health concerns, ARB has not yet granted a VOC exemption for TBAc in an ARB regulation. In addition, the SCM needs to be technologically feasible throughout California. Since Industrial Maintenance products are applied to critical infrastructure, it is vital that they meet the performance specifications established by public agencies. ARB staff believes that additional research is needed to verify the performance of 100 g/l Industrial Maintenance coatings in a way that protects the infrastructure throughout California, without an averaging program or a TBAc exemption. The SCAQMD area has a mild climate, so climatic conditions are less of a concern. However, in other areas of California, the infrastructure is exposed to more extreme climates (e.g., mountainous areas with freezing temperatures; coastal areas with persistent cold temperatures, salt spray, high humidity, etc.). ARB staff believes that additional research is needed to develop products that perform well in these areas. Therefore, ARB staff believes that the current 250 g/l VOC limit is most appropriate at this time.

The South Coast AQMD recommended that ARB create a new category for immersion Industrial Maintenance coatings with a VOC limit of 100 g/l. Although tests show that low VOC coatings performed well in immersion environments, staff believes a 250 g/l limit is needed due to issues with application and adhesion to concrete. Therefore, ARB staff did not create a new category for immersion Industrial Maintenance coatings.

In the early stages of the SCM development, staff explored narrowing the definition of the Industrial Maintenance category. The purpose of this was to try to achieve reductions while keeping a higher limit for coatings that protected critical infrastructure without an exemption for TBAc, or a provision for averaging. Due to potential changes in marketing practices from the revised definition and feedback from industry, the original definition was retained.

5.18. LOW SOLIDS

VOC Limit Table (g/l)

USEPA: 120	Canada: 120	OTC: 120	SCAQMD: 120	SCM Proposed: 120

5.18.1. Category Definition

A coating containing 0.12 kilogram or less of solids per liter (1 pound or less of solids per gallon) of coating material as recommended for application by the

manufacturer. The VOC content for Low Solids Coatings shall be calculated in accordance with SCM requirements.

5.18.2. Major Proposed Changes

- The definition has been modified to clarify how the VOC content should be calculated. Some Low Solids products are sold as concentrates and must be diluted prior to use. For these products, the VOC content should be calculated based on the manufacturer's recommended dilution rate.

5.18.3. Coating Description

Low Solids coatings are generally used to provide water repellency, stain resistance, wood protection, and for decorative purposes. These coatings are mostly waterborne, single component coatings that are sold in hardware stores and home centers. Low Solids coatings are typically applied by brush, roller, mop, or low-pressure spray. Resin types include urethanes, silanes, and siloxanes.

By definition, Low Solids coatings contain one pound (0.12 kilogram) of solids or less per gallon of coating. They can be used for a wide variety of applications (e.g., concrete sealers, stains, wood coatings, etc.), but they can be classified as Low Solids coatings if they meet the definition criteria. Being a Low Solids coating can be beneficial, because Low Solids coatings are regulated on the basis of VOC Actual (a.k.a. "Material VOC"), rather than VOC Regulatory. Therefore, the VOC content of the Low Solids coating is calculated without subtracting out the water and exempt compounds.

5.18.4. Substrates/Exposures

Low Solids coatings are used on interior and exterior surfaces. They can be applied to architectural concrete block, concrete, fired clay, sandstone, stone, quarry tile, masonry, and wood.

5.18.5. Survey Results

Table 5.18-1 summarizes our estimate of sales and VOC emissions for Low Solids coatings, based on the ARB survey. In 2004, the sales volume for Low Solids coatings in California was approximately 66,000 gallons. This represents less than 0.1 percent of the total California sales volume for architectural coatings. The Low Solids category is the fourth smallest coating category, with regard to both sales volume and VOC emission levels.

Waterborne Low Solids coatings represent 100 percent of the sales volume and have VOC Actual levels less than 120 g/l. The sales volume for waterborne Low Solids coatings increased approximately 390 percent from 2000 to 2004. The

overall sales-weighted average VOC content increased 2 percent from 2000 to 2004. VOC emissions from Low Solids coatings are about 0.04 tpd, which represents less than 0.05 percent of the total emissions from architectural coatings.

It is important to note that there are many products which may meet the Low Solids criteria (≤1 lb solids/gal), but the manufacturers choose to classify these products under another category because these coatings can fit the definitions of two separate categories. The data provided below only represents those products that were actually reported under the Low Solids category for the purpose of ARB's survey.

Table 5.18-1: Survey Data
Low Solids Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	0	0	0%	NA	NA	NA	NA	NA	0
WB	33	65,680	100%	0%	88%	12%	1%	60	0.04
Total	**33**	**65,680**		**0%**	**88%**	**12%**	**1%**	**60**	**0.04**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Actual (grams VOC per liter of coating, including water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.18-2 contains the complying marketshare for Low Solids coatings, based on results from the ARB survey. This table shows that all of the reported Low Solids coatings comply with the current VOC limit.

Table 5.18-2: Complying Marketshare & Emission Reductions
Low Solids Coatings

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
120	33	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.18.6. Conclusion

We recommend maintaining the current 120 g/l VOC limit for Low Solids coatings. It may be technologically feasible to lower this limit, but the emission reduction benefits that would be gained are negligible. The current VOC limit is technologically and commercially feasible, based on the complying marketshare and product information from manufacturers. The current VOC limit is the same as the limit promulgated by the U.S. EPA, the OTC states, the SCAQMD, and the proposed limit for Canada. The U.S. EPA divides Low Solids coatings into Low

Solids Stain and Low Solids Wood Preservative categories, but the same VOC limit applies to both (U.S. EPA, 1998).

5.19. MAGNESITE CEMENT

VOC Limit Table (g/l)

USEPA: 600	Canada: N/A	OTC: 450	SCAQMD: 450	SCM Proposed: 450

5.19.1. Category Definition

A coating labeled and formulated for application to magnesite cement decking to protect the magnesite cement substrate from erosion by water.

5.19.2. Major Proposed Changes

- None.

5.19.3. Coating Description

Magnesite is a naturally occurring mineral composed of magnesium carbonate. Magnesite cement can be formed by thermally processing magnesium carbonate and mixing it with magnesium chloride or magnesium sulfate. Exterior and interior floors can be made from magnesite cement, which provides a seamless, non-combustible, durable surface. Magnesite Cement coatings include clear and pigmented sealers that are used to protect magnesite floors, decks, and stairs from exposure to water and weathering. They also cover older magnesite cement surfaces that are discolored, patched, or worn (MFS, 2007).

The Magnesite Cement coatings reported in the survey are single component, solventborne formulations with acrylic resin. Application methods include brush or roller and products can be applied by professional contractors or homeowners.

5.19.4. Substrates/Exposures

Magnesite Cement coatings are intended for exterior and interior surfaces made of magnesite cement.

5.19.5. Survey Results

Table 5.19-1 summarizes our estimate of sales and VOC emissions, as reported for the ARB survey.

Table 5.19-1: Survey Data
Magnesite Cement Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day) [4]
SB	16	PD	100%	0%	100%	0%	0%	446	0.09
WB	0	0	0%	0%	0%	0%	0%	NA	0.00
Total	**16**	**PD**		**0%**	**100%**	**0%**	**0%**	**446**	**0.09**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

VOC emissions from Magnesite Cement coatings are about 0.09 tpd, which represents approximately 0.1 percent of the total emissions from architectural coatings. When compared to the data reported for calendar year 2000, VOC emissions increased 21 percent, and the sales-weighted average VOC Regulatory content increased 1 percent.

Table 5.19-2 contains the complying marketshare for Magnesite Cement coatings, based on results from the ARB survey. This table shows that 100 percent of the sales volume for Magnesite Cement coatings complies with the current VOC limit of 450 g/l.

Table 5.19-2: Complying Marketshare & Emission Reductions
Magnesite Cement Coatings

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
450	16	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.19.6. Conclusion

We recommend maintaining the current 450 g/l VOC limit for Magnesite Cement coatings. The current VOC limit is technologically and commercially feasible, based on complying marketshare. The current VOC limit is lower than the national limit promulgated by the U.S. EPA for this category. The current limit is consistent with the limits of the SCAQMD and the OTC states.

5.20. MASTIC TEXTURE

VOC Limit Table (g/l)

USEPA: 450	Canada: 300	OTC: 300	SCAQMD: 300	SCM Proposed: 100

5.20.1. Category Definition

A coating labeled and formulated to cover holes and minor cracks and to conceal surface irregularities, and is applied in a single coat of at least 10 mils (at least 0.010 inch) dry film thickness.

5.20.2. Major Proposed Changes

- The proposed VOC limit decreases from 300 g/l to 100 g/l.
- The Mastic Texture category is targeted for eventual elimination, since products can be covered by other categories (e.g., Concrete/Masonry Sealer, Flat, etc.)

5.20.3. Coating Description

Mastic Texture coatings are applied to walls and other surfaces, primarily to provide water resistance and a long-lasting, low-maintenance, decorative coating. The main substrates are exterior concrete and masonry surfaces, but the coatings can also be applied to metal and wood. In addition, a small number of products in this category are intended for decorative applications on interior drywall and plaster. One of the primary uses of Mastic Texture products is for coating newly installed tilt-up concrete walls. New tilt-up concrete often has small cracks or holes that need to be coated or sealed to provide protection from the elements and help prevent deterioration of the concrete. Tilt-up concrete has been used extensively to construct warehouses and “big-box” retail stores. In addition, the use of tilt-up concrete has grown rapidly for many other types of building construction. When Mastic Texture coatings are applied to these structures, the thickness of the coating provides added resistance to rain and the elasticity allows the coating to maintain its integrity while stretching over small cracks that move with the expansion and contraction of the concrete. Many products are also designed to be “breathable” to allow water vapor to pass through the coating. This breathability helps prevent coatings from blistering or peeling, due to water that may be trapped in the concrete (Angelini, 2007).

While some manufacturers state that their Mastic Texture products will smooth over small cracks and minor surface imperfections, they also recommend that small cracks and holes be filled with a patching compound prior to application of the coating. Most of the products are elastomeric formulations which help cover surface imperfections and allow the coating to expand and contract over cracks. Many products claim to be resistant to wind-driven rain, in accordance with Federal Specification TT-C-555B “Coating, Textured (For Interior and Exterior

Masonry Surfaces)". This specification was officially cancelled in 2001, but manufacturers still cite it on their data sheets. The active industry standard is ASTM D6904-03, "Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied to Masonry".

Although the name of this category implies that the coatings are textured, the definition does not require that products actually be textured. Some product lines are designed to provide a range of textures, including smooth, medium, and coarse. Perlite and silica sand are used to create various textures. All of the products are high-build, with most having dry film thicknesses of 10 - 15 mils.

Mastic Texture coatings can either be applied by professional contractors or homeowners and application methods include: sprayer, roller, and brush. Most of the reported products have single component, waterborne formulations with acrylic or vinyl acrylic resins. There are also single component, solventborne coatings with alkyd resins. Mastic Texture coatings are available in waterborne formulations that have VOC contents less than 100 g/l. These low-VOC products represent approximately 82 percent of the sales volume, excluding small containers. If this category is eliminated in the future, they may be re-classified as Concrete/Masonry Sealers, Flats, or Faux Finishing coatings.
For products with VOC contents greater than 100 g/l, it is expected that some could be re-classified as Industrial Maintenance coatings, if they comply with the Industrial Maintenance definition.

5.20.4. Substrates/Exposures

Mastic Texture coatings are typically applied to exterior walls made of brick, stucco, cinder block, and tilt-up concrete, but they can also be used for exterior metal and wood substrates. A small number of products are recommended for interior applications on drywall and plaster substrates.

5.20.5. Survey Results

Table 5.20-1 summarizes our estimate of sales and VOC emissions from the Mastic Texture coatings category based on the ARB survey. In 2004, the sales volume for Mastic Texture coatings in California was approximately 677,000 gallons. This represents less than one percent of the total California sales volume of architectural coatings.

Table 5.20-1: Survey Data
Mastic Texture

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	4	PD	PD	0%	9%	91%	0%	248	0.26
WB	58	PD	PD	0%	92%	8%	0%	70	0.25
Total	**62**	**677,063**		**0%**	**77%**	**23%**	**0%**	**101**	**0.51**

(ARB, 2006).
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

ARB staff compared the results from ARB's two most recent architectural coating surveys which gathered sales data for calendar years 2000 and 2004. Sales of Mastic Texture coatings increased 8 percent and emissions declined 25 percent from 2000 to 2004. The sales-weighted average VOC Regulatory value declined 24 percent. The decline in emissions is due to the decrease in VOC content.

Table 5.20-2 contains the complying marketshare for Mastic Texture coatings, based on results from the ARB survey. Based on reported sales volume, 79 percent of the reported Mastic Texture coatings comply with the proposed VOC limit of 100 g/l. Based on the number of products reported, 65 percent of the products comply with the proposed limit. Of the 11 companies that reported in this category, 8 offered Mastic Texture coatings that comply with the proposed limit. These data indicate that there is already widespread use of existing low-VOC Mastic Texture coatings.

Table 5.20-2: Complying Marketshare & Emission Reductions
Mastic Texture Coatings

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
100	40	79%	0.10

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.20.6. Future Issues

ARB staff's analysis indicates that there is no need to continue having a specialty category for Mastic Texture coatings in the future. Coatings that are currently under the Mastic Texture category can be covered by the Industrial Maintenance category, the new Concrete/Masonry Sealer category, the Flat category, or the Faux Finishing category. There is not adequate technological justification to maintain a higher VOC limit for the Mastic Texture coatings. Therefore, ARB staff recommends that districts eliminate the Mastic Texture category in future versions of their architectural coating rules.

5.20.7. Manufacturer Information

Product information sheets published by coatings manufacturers indicate that Mastic Texture coatings that meet the proposed VOC limit are available that possess performance characteristics similar to higher-VOC coatings. A listing of Mastic Texture products is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm). This table includes products reported in ARB's survey and other products identified by ARB staff during a literature search. Some products in the table have been tested and approved in accordance with the Master Painter's Institute (MPI) standards, including MPI#40 "Latex, Exterior, High Build"; MPI#42 "Textured Coating, Latex, Flat"; and MPI#113 "Elastomeric, Pigmented, Exterior, Water Based, Flat".

5.20.8. Conclusion

We recommend a 100 g/l VOC limit for Mastic Texture coatings, effective January 1, 2010. This limit coincides with the VOC limit for the Concrete/Masonry Sealer category. As mentioned previously, it is expected that many Mastic Texture coatings could be covered by the Concrete/Masonry Sealer category in the future, if the Mastic Texture category is eliminated.
The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare, the number of companies making complying products, and product information from manufacturers. The proposed limit is lower than the adopted limit for the U.S. EPA, SCAQMD, the OTC states, and the proposed limit for Canada.

5.21. METALLIC PIGMENTED

VOC Limit Table (g/l)

USEPA: 500	Canada: 500	OTC: 500	SCAQMD: 500	SCM Proposed: 500

5.21.1. Category Definition

A coating that is labeled and formulated to provide a metallic appearance. Metallic Pigmented coatings must contain at least 48 grams of elemental metallic pigment (excluding zinc) per liter of coating as applied (0.4 pounds per gallon), when tested in accordance with SCAQMD Method 318-95. The Metallic Pigmented Coating category does not include coatings applied to roofs or Zinc-Rich Primers.

5.21.2. Major Proposed Changes

- Aluminum Roof and Zinc-Rich Primers were removed from the Metallic Pigmented category and were established as separate categories. The Metallic Pigmented definition reflects these changes.

5.21.3. Coating Description

Metallic Pigmented coatings, after the removal of Aluminum Roof and Zinc-Rich Primer categories, are generally used for aesthetic appeal and decoration, but can be used to help alleviate corrosion, withstand high-heat applications, and improve solar reflectance. These products are used on a variety of objects, such as fences, gates, mailboxes, decks, siding, attics, tanks, and kilns. Metallic Pigmented coatings are also used as heat radiation barriers in attics and underneath decks to maintain temperate indoor conditions. Some specialty coatings in this category offer barrier protection from UV light, moisture, rust, chemicals, abrasion, industrial fumes, or extreme high heat (200 - 1,000 degrees F). If a Metallic Pigmented coating was formulated to withstand temperatures above 400 degrees F, it would still be covered by the Metallic Pigmented category (500 g/l) and would not be subject to the lower limit in the High Temperature category (420 g/l). Metallic Pigmented Coatings can be applied by a sprayer, roller, or brush and they can have an array of gloss characteristics ranging from flat to high gloss. They are predominately used by professionals for commercial and industrial applications, but homeowners also use them to protect metal surfaces or to create a metallic appearance.

Metallic Pigmented coatings are composed of a wide array of ingredients to handle the different substrates and conditions. These products can contain a variety of resin types, including: acrylics, alkyds, amines/amides, epoxies, linseed oil, oils, oleoresins, phenolic, silicone, styrene-butadiene, urethane/polyurethane, fluoropolymers, and vinyl acetate-ethylene copolymers. Metallic Pigmented coatings may also contain fibers or fillers to increase viscosity. The metallic pigments include, but are not limited to: aluminum flakes (predominately), copper powder, and iron filings.

Most products are solventborne, single component coatings, but multi-component coatings (e.g., epoxies) are available with comparable performance characteristics. Recently, waterborne emulsions have been introduced to comply with environmental needs and government regulations. Waterborne coatings have VOC Regulatory values ranging from about 150 g/l to 300 g/l, while solventborne coatings range from 150 g/l to 550 g/l. A vast majority of the solventborne products are within the range of 400 g/l to 550 g/l, with outliers below 100 g/l and above 600 g/l.

In the SCAQMD's Rule 1113, "mica particles" were included in the definition for the Metallic Pigmented category. "Mica particles" can be used in a variety of

coatings as a filler or extender pigment, because they are relatively inexpensive. Extender pigments can reduce coating raw material costs because they can be used as substitutes for more expensive ingredients (e.g., binders, flatting agents, thickeners, titanium dioxide pigments, etc.) (Braun, 1993). Since Rule 1113 used the term “mica particles”, some coating manufacturers interpreted the rule to mean that they could use mica to formulate Nonflat coatings and be subject to the high VOC limit for Metallic Pigmented coatings (500 g/l), rather than the low VOC limit for Nonflat coatings (50 g/l). SCAQMD found this to be an incorrect interpretation and issued a compliance advisory to that effect.

ARB’s 2000 SCM did not allow for the use of “mica particles” in the definition for Metallic Pigmented; therefore, misinterpretation was not an issue. However, during the rule development efforts for the proposed SCM, ARB staff and stakeholders agreed that it would be beneficial to provide some clarification regarding the use of mica. ARB staff has proposed putting metallic-looking coatings in the Faux Finishing category and has proposed using the term “pearlescent mica pigment”, rather than “mica particles”, to help prevent potential abuses. The intent is to only provide the higher limit to manufacturers that use large quantities of “pearlescent mica pigment” in coatings to create a metallic look for faux finishing applications. Coatings that contain non-pearlescent mica pigments will be subject to lower VOC limits in other categories (e.g., Flat, Nonflat, etc.).

5.21.4. Substrates/Exposures

Metallic Pigmented coatings are applied indoors and outdoors. These products can be applied to a variety of substrates, including wood, metal, asphalt, concrete, and masonry.

5.21.5. Survey Results

Table 5.21-1 summarizes our estimate of sales and VOC emissions from the Metallic Pigmented category, based on the ARB survey. In 2004, the sales volume for Metallic Pigmented coatings in California was approximately 45,000 gallons, which represents less than 0.1 percent of the total California sales volume for architectural coatings. It is important to note that this sales volume does not include Aluminum Roof and Zinc-Rich Primer products. Data for these categories is provided elsewhere in this report in the Aluminum Roof and Zinc-Rich Primer sections. For the purposes of the Survey, Aluminum Roof coatings and Zinc-Rich Primers were reported as Metallic Pigmented coatings, so ARB staff used product information to pull out products that could be classified under the new categories of Aluminum Roof and Zinc-Rich Primer. Aluminum Roof products were the main contributor to VOC emissions when they were considered as part of the Metallic Pigmented category. With Aluminum Roof and Zinc-Rich Primer coatings removed from Metallic Pigmented, the category has a

small sales volume with a relatively high percentage coming from small containers (one quart or less).

VOC emissions from Metallic Pigmented coatings are about 0.13 tpd, which represents less than half a percent of the total emissions from architectural coatings. A large percent of the emissions from this category (92%) is attributable to solventborne coatings which make up 72 percent of the sales volume. About 27% of sales for this category were small containers (one quart or less).

Table 5.21-1: Survey Data
Metallic Pigmented

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	71	32,842	72%	4	8	88	20%	316	0.12
WB	15	12,587	28%	22	47	31	46%	212	0.01
Total	**84**	**45,429**		**9**	**19**	**72**	**27%**	**287**	**0.13**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.21-2 contains the complying marketshare for the Metallic Pigmented category, based on results from the ARB survey. This table shows that 99 percent of the marketshare of Metallic Pigmented coatings comply with the current VOC limit.

Table 5.21-2: Complying Marketshare & Emission Reductions
Metallic Pigmented

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
500	61	99%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Of the 20 companies that reported in this category, all offered Metallic Pigmented coatings that comply with the current limit. Of these companies, 10 are considered to be small businesses because they have fewer than 250 employees.

5.21.6. Manufacturer Information

The Master Painters Institute (MPI) does not have a specific category for Metallic Pigmented coatings. However, there are three Aluminum Coating categories and

one Heat-Resistant category that are pertinent to Metallic Pigmented coatings. A list of the reported Metallic Pigmented products from the 2005 Survey and MPI approved products that can meet a VOC Regulatory limit of 500 g/l is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm). The four MPI categories that included Metallic Pigmented coatings are MPI #1 (Aluminum Paint), MPI #2 (Aluminum Paint, Heat Resistant - Up to 427 °C/800 °F), MPI #21 (Heat Resistant Coating, - Up to 205 °C/402 °F, MPI Gloss Level 5-6), and MPI #22 (Aluminum Paint, High Heat - up to 590 °C/1100 ° F).

5.21.7. Future Issues

As California works towards improving energy efficiency and reducing greenhouse gases, issues associated with Metallic Pigmented materials may become more prominent. One of these issues is discussed below:

Radiant Barriers: Attic and deck radiant barriers represent roughly 10 percent of the sales volume for Metallic Pigmented Coatings, and they are becoming more popular with consumers due to a desire to improve energy efficiency and decrease energy bills. These products generally have emissive properties that can reflect as much as 65% of radiant heat into and out of a building. Using radiant barriers coupled with a high emissive roof coating can drastically decrease the heat gain and loss of a building and substantially decrease the amount of energy needed to maintain a temperate indoor environment. Radiant barriers work bidirectionally as energy-efficient coatings. Heat from the outdoors is reflected away from the roof in summer and interior heat is reflected back into the building in winter, which can result in energy savings throughout the year. According to Zielnik, "…This is similar to the principle now used in energy-efficient 'Low-e' window systems, where outside heat is kept outside in summer and indoor heat is kept inside in winter with the window emitting very little heat outdoors…" (Zielnik, 2006). It is expected that the use of radiant barriers could increase in buildings as a means of improving energy efficiency and reducing potential temperature increases related to climate change.

5.21.8. Conclusion

We recommend maintaining the current 500 g/l VOC limit for Metallic Pigmented coatings. While it may be technologically feasible to produce metallic pigmented coatings below 350 g/l, the emission reduction benefits that would be gained are negligible. The current VOC limit is technologically and commercially feasible, based on the complying marketshare, the number of companies making compliant products, and product information from manufacturers. The current limit is the same as the limit adopted by the U.S. EPA, SCAQMD, OTC states, and the proposed limit for Canada.

5.22. MULTI-COLOR

VOC Limit Table (g/l)

USEPA: 580	Canada: 250	OTC: 250	SCAQMD: 250	SCM Proposed: 250

5.22.1. Category Definition

A coating that is packaged in a single container and that is labeled and formulated to exhibit more than one color when applied in a single coat.

5.22.2. Major Proposed Changes

- None.

5.22.3. Coating Description

Multi-Color coatings are decorative paints that contain individual flecks of different colors, against a solid background color. The visual effect can be similar to the appearance of materials such as granite, cork, leather and stone. In the paint can, pigment flecks are contained within a chemical capsule and are suspended in a base paint of a contrasting color. When the coating is sprayed on a surface, the suspended pigment capsules break open and produce a speckled textured coating with a low gloss finish. Multi-Color coatings are resistant to stains, scratches, and scuff marks and they are durable enough to withstand repeated washings. Some manufacturers recommend applying a clear topcoat to protect the coating and provide added durability. Multi-Color coatings are recommended for commercial and institutional facilities, such as hospitals, office buildings, schools, and municipal buildings.

Multi-Color coatings are primarily used by professional contractors and they are often sold directly from the manufacturer to the end user. They are generally designed for spray application only, but some products can be applied with a special roller. Most of the Multi-Color coatings that were reported in the survey were waterborne acrylics, but there were also waterborne polyurethanes and solventborne alkyds. All products were single component formulations.

5.22.4. Substrates/Exposures

Multi-Color coatings can be applied to primed drywall, gypsum board, fiberboard, wood, acoustical tile, paneling, plaster, stucco, masonry, concrete block, brick, ceramic, glass, fiberglass, metal, plastic, laminate, and vinyl wallcovering. All of the products that were reported in the survey were intended for interior exposures only, but there are also Multi-Color coatings that are formulated for exterior exposures. Multi-Color coatings are <u>not</u> recommended for the following areas:

- Floors;
- Areas subjected to excessive structural movement (e.g., expansion joints);
- Areas exposed to hydrostatic pressure (e.g., basement walls);
- Areas exposed to corrosives or high heat; or
- Areas with frequent water contact (e.g., shower stalls, commercial bathrooms, etc.).

5.22.5. Survey Results

Table 5.22-1 summarizes our estimate of sales and VOC emissions, as reported for the ARB survey.

Table 5.22-1: Survey Data
Multi-Color Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	1	PD	PD	100%	0%	0%	100%	551	0.00
WB	12	PD	PD	100%	0%	0%	0%	94	0.00
Total	**13**	**13,635**		**100%**	**0%**	**0%**	**2%**	**103**	**0.00**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

When compared to the data reported for calendar year 2000, VOC emissions decreased 37 percent, and the sales-weighted average VOC Regulatory content decreased 55 percent.

Table 5.22-2 contains the complying marketshare for Multi-Color coatings, based on results from the ARB survey. This table shows that approximately 100 percent of the sales volume complies with the current VOC limit of 250 g/l.

Table 5.22-2: Complying Marketshare & Emission Reductions
Multi-Color Coatings

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
250	9	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.22.6. Conclusion

We recommend maintaining the current 250 g/l VOC limit for Multi-Color coatings. It may be technologically feasible to lower this limit, but the emission reduction benefits that would be gained are negligible. The current VOC limit is

technologically and commercially feasible, based on complying marketshare. The current VOC limit is lower than the national limit promulgated by the U.S. EPA. The current limit is consistent with the limits adopted by the SCAQMD and the OTC states, and the proposed limit for Canada.

5.23. NONFLAT

VOC Limit Table (g/l)

USEPA: 380	Canada: 150	OTC: 150	SCAQMD: 50	SCM Proposed: 100

5.23.1. Category Definition

A coating that is not defined under any other definition in this rule and that registers a gloss of 15 or greater on an 85-degree meter and 5 or greater on a 60-degree meter according to ASTM Designation D 523-89 (1999).

5.23.2. Major Proposed Changes

- For Nonflat coatings, the proposed VOC limit will decrease from 150 g/l to 100 g/l.

5.23.3. Coating Description

The term Nonflat coating includes two categories that are identified in ARB's Architectural Coating survey: Nonflat - Low Gloss and Nonflat - Medium Gloss. For the purposes of the survey, Nonflat - Low Gloss has a gloss level of 5 or above and less than 20 on a 60-degree meter. Nonflat - Medium Gloss has a gloss of 20 or above and less than 70 on a 60-degree meter. This section of the report contains information for both Low Gloss and Medium Gloss products, because they are both regulated under the Nonflat category in the SCM.

Nonflat coatings are typically used in areas of high traffic where frequent cleaning is necessary or moisture is present (Consumer Reports, 2003). Residential applications include family rooms, children's rooms, kitchens, bathrooms, high traffic hallways, and other areas. For commercial buildings and institutional facilities, Nonflat coatings are used on surfaces such as walls, corridors, and stairwells. These coatings are applied by professional contractors and homeowners and application methods include brush, roller, and sprayer.

Most Nonflat coatings are waterborne, single component products. These types of coatings have been preferred by consumers for many years, because they are generally easy to use, are low odor, and can be cleaned up with soap and water. Some manufacturers of Nonflat paints are marketing "zero VOC" products by highlighting the environmental benefits and the quality of the paint. The most prevalent resins for Nonflat coatings are vinyl acrylic and 100% acrylic, which are

commonly called latex. Because most Nonflat coatings are waterborne, the VOCs in latex coatings come from additives such as resin coalescing aids, polymer plasticizers, freeze/thaw stabilizers and anti-foam agents. These additives help create homogeneous films, improve block and print resistance, prevent coagulation, ease application, and reduce defects formed during application. Other additives that contribute to the VOC content are preservatives, thickeners and colorants. Resin coalescing aids and freeze/thaw stabilizers are the two main contributors to VOCs in Nonflat coatings. Currently, most coating manufacturers use ester alcohols (e.g., Texanol®) as coalescing agents. Freeze/thaw stabilizers are glycols (e.g., ethylene glycol or propylene glycol) that help prevent the paint from coagulating or solidifying when exposed to freezing temperatures and provides more “open” time.

Most Nonflat coatings are already waterborne and the proposed VOC limit will require most of these products to be reformulated using lower-VOC technology. This will involve choosing the appropriate combination of resin, coalescing agent, and additives. Many Nonflat coatings already contain small amounts of the glycols required to achieve freeze/thaw resistance, and it is expected that some reformulations will further reduce the amount of glycols and make products more vulnerable to freeze/thaw damage. They can also use softer resins which would require less coalescing agents. However, this could lead to more dirt pickup and less blocking resistance. To comply with a 100 g/l limit, it’s possible to formulate Nonflat coatings that still contain some glycol and have some freeze/thaw resistance. However, to comply with the 50 g/l limit in the SCAQMD, some manufacturers have completely eliminated the glycol and they use heated delivery vehicles and heated warehouses to prevent freeze damage. Also, the SCAQMD has a relatively mild climate, so freeze/thaw resistance is less critical.

5.23.4. Substrates/Exposures

Nonflat coatings are used for both interior and exterior applications. With proper surface preparation and priming, Nonflat coatings can be used on a large variety of substrates including drywall, plaster, concrete block, wood, and metal. They work best on smooth, well-prepared walls because the gloss may bring out imperfections present on the substrate. Generally, ambient and surface temperatures of application are limited to above 50˚ Fahrenheit.

5.23.5. Survey Results

Table 5.23-1a and Table 5.23-1b summarize ARB’s estimates of sales and VOC emissions, based on the ARB survey. Table 5.23-1a provides data for the Nonflat - Low Gloss subcategory and Table 5.23-1b provides data for the Nonflat Medium Gloss subcategory. In Table 5.23-2, data from these two categories are combined to determine the complying marketshare and potential emission reductions for the overall Nonflat category.

In 2004, the sales volume for Nonflat - Low Gloss coatings in California was approximately 12 million gallons. This represents about 11 percent of the total California sales volume of architectural coatings. Nonflat - Low Gloss coatings were the third largest in terms of sales volume, after Flat and Nonflat - Medium Gloss.

Waterborne coatings dominate the Nonflat - Low Gloss coatings market. From 2000 to 2004, overall sales of Nonflat - Low Gloss coatings have increased by more than 80 percent, from approximately 6.6 million to 12 million gallons. This increase in sales can be attributed to increases in new home construction and the robust repaint business. Homeowners with dual family incomes are finding it affordable to invest in beautifying their homes, which may be attributable to the increase in the professional painting market (Frost & Sullivan, 2006). Additionally, the overall increase in the coatings market could be partially due to the prevalence of home improvement television with several such television shows premiering between 2000 and 2004. Customer preference for eggshell and other low gloss nonflat coatings over flat coatings would also explain the large growth in the Nonflat - Low Gloss category.

With the increase in sales, VOC emissions from Nonflat - Low Gloss coatings have also increased more than 60% to 6.6 tpd, which represents approximately 7 percent of the total emissions from architectural coatings.

Table 5.23-1a: Survey Data
Nonflat Coatings – Low Gloss

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	26	3,856	0%	87%	2%	11%	79%	402	0.02
WB	1,309	12,019,222	100%	68%	15%	18%	3%	118	6.62
Total	**1,335**	**12,023,079**		**68%**	**15%**	**18%**	**4%**	**118**	**6.64**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

In 2004, the sales volume for Nonflat - Medium Gloss coatings in California was approximately 20 million gallons. Nonflat - Medium Gloss is the second largest coating category in terms of sales volume and it represents about 18 percent of the total California sales volume for architectural coatings.

Waterborne coatings dominate the Nonflat - Medium Gloss coatings market. From 2000 to 2004, overall sales of Nonflat - Medium Gloss coatings increased by approximately 11 percent, from about 18 million to 20 million gallons. VOC emissions from Nonflat-Medium Gloss coatings are about 12 tpd and they represent 12 percent of the total emissions from architectural coatings.

Nonflat-Medium Gloss coatings were one of the categories that could be included in averaging programs during 2004. Under these programs, manufacturers could sell Nonflat-Medium Gloss coatings with VOC levels above 150 g/l, if emissions from these products were offset by emissions from other products that had VOC levels below regulatory limits. For Nonflat-Medium Gloss coatings, five percent of the total sales volume consisted of high-VOC products with VOC levels above 150 g/l. These high-VOC products accounted for approximately 1.3 tpd of VOC emissions which represents 11 percent of the total emissions for Nonflat-Medium Gloss coatings.

Table 5.23-1b: Survey Data
Nonflat Coatings – Medium Gloss

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	194	77,878	0%	35%	6%	59%	49%	372	0.33
WB	2,218	19,994,953	100%	56%	13%	31%	4%	128	11.40
Total	**2,412**	**20,072,832**		**55%**	**13%**	**31%**	**4%**	**129**	**11.73**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.23-2 contains the complying marketshare for Nonflat coatings, including Low Gloss and Medium Gloss products, based on results from the ARB survey. The table also includes a small number of products that were reported under Rust Preventative in the survey, but are expected to be in the Nonflat category due to proposed revisions in the Rust Preventative definition. This table shows that about 28 percent of the sales volume for Nonflat coatings complies with the proposed VOC limit. Over 950 products out of approximately 3,060 reported products comply with the proposed limit. Of the 46 companies that submitted data for Nonflat coatings, 24 offered Nonflat coatings that comply with the proposed limit. ARB staff also evaluated the complying marketshare at 50 g/l and found that only four percent of the sales volume had VOC contents at or below 50 g/l.

Table 5.23-2 shows that implementing the proposed 100 g/l limit would achieve approximately 2.44 tpd in VOC emission reductions for the non-SCAQMD portion of California, on an annual average basis.

Table 5.23-2: Complying Marketshare & Emission Reductions Nonflat Coatings

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
100	958	28%	2.44

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.23.6. Product Testing Results

5.23.6.1. Consumers Union: Consumers Union, an independent nonprofit organization, recently published test results that were performed on both interior and exterior Nonflat coatings. Tests were performed on 40 interior Nonflat coatings that were marketed as high-grade products. Each product was tested using three colors that represent the basic tint bases. Manufacturers of the paints include PPG, ICI and Sherwin Williams.

Of the 40 products tested, at least 9 products comply with the proposed 100 g/l VOC limit (VOC values were not readily available for all of the listed products). Out of a possible score of 100, the complying products scored in the range of 52-80 and the highest score for any product was 88. Most of the coatings tested performed poorly in fade resistance tests, regardless of whether they were above or below 100 g/l. Complying products scored well and performed comparably to higher-VOC products in several categories, such as: hiding, surface smoothness, staining, scrubbing, sticking, and resistance to mildew (Consumer Reports, 2006; 2006a).

Consumers Union also tested 12 exterior Nonflat coatings. Each product was tested using three colors that represent the basic tint bases. Coatings were tested for appearance after nine years, and to determine resistance to dirt, color change, and mildew. Only one exterior product (Glidden Endurance Satin) complies with the proposed 100 g/l VOC limit, but it received an overall score of 86 which was one of the highest scores given to an exterior Nonflat coating. Appearance of the coating was maintained over nine years of simulated weathering and the coating provided good resistance to dirt, mildew, and color change. The results obtained show that current technology exists to produce coatings that comply with the proposed VOC limit of 100 g/l and perform comparably to higher VOC coatings.

5.23.6.2. UMR: In 2005, the UMR Coatings Institute at the University of Missouri - Rolla conducted a coatings testing project for the SCAQMD (UMR, 2006). The project included tests on products classified as Nonflat - Low Gloss and Nonflat - Medium Gloss coatings. UMR tested some general coating properties, including: percent nonvolatile; stability; viscosity; freeze/thaw resistance; dry time; gloss; and hiding - contrast ratio. They also tested performance properties,

including: scrub resistance; stain resistance; blocking resistance; flow/level and sag; accelerated weathering (i.e., QUV testing); and surface tension. All testing was done in accordance with ASTM standards, unless otherwise noted or agreed upon by the SCAQMD. All paints were supplied to the UMR Coatings Institute by SCAQMD.

For Nonflat – Low Gloss coatings, the project was intended to test four products, two low-VOC products (VOC ≤50 g/l) and two high-VOC products (VOC >50 g/l and ≤150 g/l). However, the SCAQMD conducted laboratory tests to measure the VOC contents for two of the products and the results showed that one of the low-VOC products actually had a VOC level greater than 150 g/l, which made it noncompliant with existing VOC limits. In addition, one of the low-VOC coatings was actually a medium gloss coating. Therefore, the Nonflat – Low Gloss testing actually involved two high-VOC products and one low-VOC product. For Nonflat - Medium Gloss coatings, the project originally intended to test four products, two low-VOC products (VOC ≤50 g/l) and two high-VOC products (VOC >50 g/l and ≤150 g/l). However, in addition to these four coatings, there were two coatings that were previously miscategorized. Therefore, six medium gloss coatings were tested, three low-VOC and three high-VOC.

Of the nine Nonflat coatings tested, one was noncompliant with the 150 g/l VOC limit and so was not considered in this evaluation. Of the remaining eight, the four low-VOC products overall performed comparably with the four high-VOC products on several tests. However, on average, the freeze/thaw resistance and stain/dirt pickup resistance for the low-VOC products was noticeably poorer than the high-VOC products. Also, the scrub resistance for the low-VOC products was somewhat poorer than the high-VOC products.

A 100 g/l limit will allow for more glycols for better freeze/thaw resistance and more coalescing agents for harder resins, resulting in better dirt pickup resistance and scrub resistance. Staff believes that additional time is needed to improve the technology and create 50 g/l Nonflats that can perform well throughout California.

5.23.6.3. NTS:

As part of the 1999 amendments to Rule 1113 (Architectural Coatings), the SCAQMD funded a study to compare the performance of low-VOC (≤150 g/l) and high-VOC (>150 g/l) Nonflat coating systems (ARB, 2003). A steering committee was formed to oversee the technical aspects of the study. This committee, called the Technical Advisory Committee (TAC), was comprised of representatives from the Air Resources Board (ARB), SCAQMD, academia, and the architectural coatings industry. The TAC selected National Technical Systems (NTS) as the contractor to carry out the Phase II Assessment Study of Architectural Coatings. The study consisted of laboratory analysis, accelerated weathering, and outdoor exposure. Testing took place from 1998 to 2002.

Accelerated Weathering

Accelerated weathering tests were performed by Atlas Weathering Services Group located in Phoenix, Arizona. Emmaqua (Equatorial Mount with Mirrors for Acceleration with Water) equipment was used to expose test panels to severe sunlight and deionized water spray for 85 days. These tests were completed in 2000.

The accelerated weathering portion of the project provided test results for ten Nonflat coating systems. These systems included a primer and topcoat that were designed to work together for substrate protection. The test program included products from several manufacturers, but samples were only identified by code numbers, rather than by manufacturer and product name. Manufacturers of coating systems that were used in the study included: Benjamin Moore, Dunn Edwards, Frazee Industries, ICI/Glidden, Vista Paints, Masterchem, Morwear, PPA Technologies, Aquarius Coatings, and Zehrung. The low-VOC products that were tested included two “zero VOC” topcoats and one topcoat with a VOC level of 135 g/l. The high-VOC topcoats had published VOC levels from 170-400 g/l. The gloss ranges for the products were from 7-82 degrees on a 60 degree meter. Two of the systems discussed here could be classified as high gloss Nonflats.

Panels were tested in triplicate to determine the following properties: dry film thickness; pre-test and post-test gloss at 20, 60, and 85 degrees; pre-test and post-test CIE; and pre-test and post-test yellowing. CIE is an acronym for *Comission Internationale de l'Eclairage* or International Commission on Illumination, which is a scale used to compare color. Overall, the testing revealed that the low-VOC Nonflat coating systems outperformed the high-VOC systems in gloss retention, CIE, and yellowing tests. Based on visual observations, the low-VOC coatings performed equivalently to the high-VOC coatings. It is important to note that the value of the NTS testing is less relevant for the limits being proposed now since the VOC content range is large and solventborne alkyds, known for yellowing and poorer gloss retention, were included.

24- Month Outdoor Exposure

The outdoor exposure portion of the study consisted of tests performed at regular intervals and observations made by the TAC during inspections.
The exposure portion of the study provided test results for 11 Nonflat coating systems. These were the same coatings tested in the accelerated weathering portion of the study, with the addition of a zero VOC product. Panels were tested in duplicate at Saugus and El Segundo in southern California. The Saugus site featured a dry, desert-like climate, while the El Segundo site featured more of a coastal climate and an industrial setting, since it was next to Los Angeles International Airport. The TAC made regular visits to these sites, where the condition of the test panels was evaluated. The TAC inspected the panels

3, 6, 9, 12, 18 and 24 months after the start of the exposure. At the 12, 18 and 24 month periods of the study, ratings were given to the panels, and the results are summarized below.

In addition to the evaluations of the panels made by the TAC, NTS performed tests on the panels at the start of the outdoor exposure, and repeated those tests after 6, 12, 18 and 24 months. Tests performed by NTS were gloss using 20, 60 and 85 degree meters, CIE color, and yellowing. Written comments were made on chalking, cracks, flakes and blisters. This portion of the study began in April 2000 and was completed in April 2002. In the Non-Flat Coatings category, complying systems performed similarly to non-complying systems. Complying systems showed better performance in gloss tests. At the Saugus test site, complying systems performed better in yellowing tests and equivalently in CIE tests, and at the El Segundo test site, non-complying systems performed equivalently in yellowing tests, and better in CIE tests. With regard to visual evaluations, at both the Saugus and El Segundo sites, the complying nonflat systems performed better than the noncomplying nonflat systems.

5.23.7. Manufacturer Information

ARB staff reviewed survey data and manufacturer product data sheets to identify Nonflat coatings that could comply with the proposed 100 g/l VOC limit. In some cases, survey data for calendar year 2004 indicated that a product was above 100 g/l, but the more recent product data sheets indicated that the product had subsequently been reformulated below 100 g/l.

Based on product data sheets, manufacturers claim that the low-VOC compliant products possess the following properties:

Properties of Interior Nonflat Coatings (<100 g/l)

- Stain Resistant
- Washable
- Scrubbable
- Non-Yellowing
- Hides Imperfections
- Resistant to Mildew
- Spatter Resistant
- Superior Leveling
- Excellent Adhesion
- Low Odor

Properties of Exterior Nonflat Coatings (<100 g/l)

- Resistant to weathering
- Fade and chalk resistant
- Resistant to blistering and flaking
- Alkali Resistant
- Mildew Resistant
- Durable
- Moisture Resistant
- Adhesion

Several of the reported complying products were also included on Master Painter's Institute (MPI) Approved Products lists because they were certified to meet designated performance standards (MPI, 2007). MPI approved more than 90 Nonflat coatings that comply with the proposed 100 g/l limit and meet one of the following standards: MPI #43 (Latex, Interior, "satin-like" - MPI Gloss Level 4); MPI #44 (Latex, Interior, "velvet-like" - MPI Gloss Level 2); MPI #52 (Latex,

Interior, “eggshell-like” - MPI Gloss Level 3); MPI #54 (Latex, Interior, Semi-Gloss - MPI Gloss Level 5); MPI #144 (Latex, Interior, Institutional Low Odor/VOC, “velvet-like” - MPI Gloss Level 2); MPI #145 (Latex, Interior, Institutional Low Odor/VOC, “eggshell-like” - MPI Gloss Level 3); and MPI #147 (Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss - MPI Gloss Level 5). Approved products include PPG Pure Performance, PPG Speedhide, Rodda Paint Unique II, Vista Paint Carefree paints; ICI Ralph Lauren Eggshell, Frazee Envirokote, and Kelly Moore Enviro-Cote.

5.23.8. Conclusion

We recommend a 100 g/l VOC limit for Nonflat coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare, the number of companies making complying products, and product information from manufacturers. In addition, the proposed limit is supported by the results of product testing conducted by Consumers Union, MPI, UMR, and NTS.

The proposed VOC limit is lower than the national limit adopted by the U.S. EPA and the OTC states, and the proposed limit for Canada. The proposed 100 g/l VOC limit is higher than the 50 g/l limit contained in SCAQMD Rule 1113. However, manufacturers that provide coatings in the SCAQMD area can still sell products which exceed the 50 g/l limit, if they participate in SCAQMD’s averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit. In addition, the SCM needs to be technologically feasible throughout California. To comply with the 50 g/l limit, some Nonflat coating manufacturers have eliminated glycols in their formulations. As a result, their products must be transported in heated trucks and stored in heated areas, to prevent freezing. Paints with high water contents can coagulate and become unusable if they become frozen. The SCAQMD has a mild climate, so freezing temperatures are less of a concern. However, in other areas of California, freezing temperatures are more prevalent. ARB staff believes that additional research is needed to develop products that perform well in areas with more extreme climates, particularly for exterior Nonflat coatings. Therefore, ARB staff believes that the proposed 100 g/l VOC limit is most appropriate at this time.

5.24. NONFLAT – HIGH GLOSS

VOC Limit Table (g/l):

USEPA: 380	Canada: 250	OTC: 250	SCAQMD: 50	SCM Proposed: 150

5.24.1. Category Definition

A nonflat coating that registers a gloss of 70 or greater on a 60-degree meter according to ASTM Designation D 523-89. Nonflat – High Gloss coatings must be labeled in accordance with SCM labeling requirements.

5.24.2. Major Proposed Changes

- The Quick Dry Enamel category was eliminated because it is no longer necessary to have a special category for these products. Quick Dry Enamel coatings are included in the Nonflat - High Gloss category.
- For Nonflat - High Gloss coatings, the proposed VOC limit will decrease from 250g/l to 150g/l.

5.24.3. Coating Description

Nonflat - High Gloss coatings are typically used in areas subject to high traffic, because they resist stains better and are more washable than Flat coatings. Nonflat - High Gloss coatings are used both residentially and commercially, frequently for trim painting (e.g. doors, window frames, shutters, wood trim, etc.). Nonflat - High Gloss coatings are used much less than Low Gloss and Medium Gloss products. Residential applications include kitchens, bathrooms, hallways, and children's rooms. For commercial buildings and institutional facilities, Nonflat - High Gloss coatings are used on surfaces such as walls, corridors and stairwells. These coatings are applied by professional contractors and homeowners and application methods include brush, roller, and sprayer.

Most Nonflat - High Gloss coatings are waterborne, single component products. These types of coatings have been preferred by consumers for many years because they are generally easy to use, are low odor, and can be cleaned up with soap and water. The most prevalent resins for Nonflat - High Gloss coatings are vinyl acrylic and 100% acrylic, which are commonly called latex. Other resin types include alkyds and urethanes. Because most Nonflat - High Gloss coatings are waterborne, the VOCs in latex coatings come from additives such as resin coalescing aids, polymer plasticizers, freeze/thaw stabilizers and anti-foam agents. These additives help create homogeneous films, improve block and print resistance, prevent coagulation, ease application, and reduce defects formed during application. Other additives that contribute to the VOC content are preservatives, thickeners and colorants. Resin coalescing aids and freeze/thaw stabilizers are the two main contributors to VOCs in Nonflat - High Gloss coatings. Currently, most coating manufacturers use ester alcohols

(e.g., Texanol®) as coalescing agents. Freeze/thaw stabilizers are glycols (e.g., ethylene glycol or propylene glycol) that prevent the paint from coagulating or solidifying when exposed to freezing temperatures.

Nonflat - High Gloss coatings are similar to Nonflat - Low Gloss and Nonflat - Medium Gloss coatings, but there are formulation differences. Generally, more resin is needed to create a glossy appearance and, consequently, more coalescing solvent is needed to support the resin. For that reason, Nonflat - High Gloss has been broken out as a separate category with a higher VOC limit than the other Nonflat coatings.

In previous years, the SCM included a Quick Dry Enamel category which consisted of products that dried quickly and had gloss levels similar to Nonflat - High Gloss coatings. In the 2000 SCM, the VOC limit was 250 g/l for Quick Dry Enamel and Nonflat - High Gloss. To comply with this limit, manufacturers developed formulations that resulted in similar drying properties and gloss characteristics for both categories. The decreased drying time of acrylic binders has resulted in Nonflat - High Gloss coatings that meet the criteria of a Quick Dry Enamel at a lower VOC level. Quick Dry Enamel coatings were often specified when the coated surface needed to dry quickly to minimize dust contamination (e.g., new home construction), or in areas that needed to be returned to service quickly (e.g., restaurants). Nonflat - High Gloss coatings can now be used for these applications and a special category for Quick Dry Enamels is unnecessary. For that reason, ARB staff has proposed eliminating the Quick Dry Enamel category, as we indicated in the 2000 SCM Staff Report. It is assumed that products which were formerly classified as Quick Dry Enamels will now be included in the Nonflat - High Gloss category.

5.24.4. Substrates/Exposure

Nonflat - High Gloss coatings are used for both interior and exterior applications. With proper surface preparation and priming, Nonflat - High Gloss coatings can be used on a large variety of substrates including drywall, plaster, concrete block, wood, and metal. These products are commonly exposed to areas where moisture is present and are often subject to frequent cleaning. Generally, ambient and surface temperatures of application are limited to above 50˚ Fahrenheit.

5.24.5. Survey Results

This section includes survey data for Quick Dry Enamels and Nonflat - High Gloss coatings. Sales volume and VOC emissions are presented separately for the two categories, because they were reported separately for the survey. Data for complying marketshare and emission reductions reflects the combined data for both categories, because we are proposing that they be combined under Nonflat - High Gloss.

Table 5.24-1 summarizes our estimate of sales and VOC emissions from the Nonflat - High Gloss category, based on the ARB survey. Nonflat - High Gloss coatings have the tenth highest sales volume for architectural coatings in California. In 2004, the sales volume for Nonflat - High Gloss coatings in California was approximately 1.8 million gallons. This represents less than 2 percent of the total California sales volume for architectural coatings.

Waterborne Nonflat - High Gloss coatings represent 98 percent of the Nonflat - High Gloss sales volume and VOC levels are generally below 200 g/l. For solventborne products, a significant portion is sold in small containers and VOC levels are generally greater than 250 g/l, the current SCM VOC limit. The sales volume for Nonflat - High Gloss coatings decreased 9 percent from 2000 to 2004. The sales-weighted average VOC Regulatory value decreased 38 percent from 2000 to 2004.

VOC emissions from Nonflat - High Gloss coatings are about 1.3 tpd, which represents approximately 1 percent of the total emissions from architectural coatings.

Table 5.24-1: Survey Data
Nonflat Coatings – High Gloss

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers [2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	201	40,777	2%	13%	9%	78%	40%	373	0.17
WB	263	1,719,682	98%	42%	0%	57%	2%	146	1.17
Total	**464**	**1,760,459**		**42%**	**1%**	**58%**	**3%**	**151**	**1.34**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.24-2 summarizes our estimate of sales and VOC emissions for Quick Dry Enamels, based on the ARB survey. In 2004, the sales volume for Quick Dry Enamels in California was approximately 760,000 gallons, which represents less than one percent of the total California sales volume for architectural coatings.

Unlike the Nonflat categories, the Quick Dry Enamel category market is dominated by solventborne products which represent 93 percent of the sales volume. The sales volume for solventborne products has increased about 17 percent from 2000 to 2004, and the sales volume for waterborne products has increased more than 200 percent. For Quick Dry Enamels, the VOC levels were generally greater than 250 g/l, the current SCM VOC limit. The sales-weighted average VOC is much higher than the current VOC limit and it increased six percent from 2000 to 2004. The VOC emissions from Quick Dry Enamels were

3.23 tpd, which represents about 3 percent of the total emissions from architectural coatings.

Quick Dry Enamel was one of the categories that could be included in averaging programs during 2004. Under these programs, manufacturers could sell Quick Dry Enamels with VOC levels above 250 g/l, if emissions from these products were offset by emissions from other products that had VOC levels below regulatory limits. For Quick Dry Enamels, 90 percent of the total sales volume consisted of high-VOC products with VOC levels above 250 g/l. These high-VOC products accounted for approximately 3.1 tpd of VOC emissions which represents 95 percent of the total emissions from Quick Dry Enamels.

Table 5.24-2: Survey Data
Quick Dry Enamel

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	84	713,196	93%	32%	14%	54%	2%	390	3.17
WB	45	50,070	7%	6%	0%	94%	0%	237	0.06
Total	**129**	**763,266**		**30%**	**13%**	**57%**	**2%**	**380**	**3.23**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.24-3 contains the complying marketshare for Nonflat - High Gloss coatings based on results from the ARB survey. These data include products that were formerly classified as Quick Dry Enamels. The table shows that 28 percent of the market-share for Nonflat High Gloss coatings complies with the proposed VOC limit. Of the 28 companies that reported in this category, 15 offered Nonflat High Gloss coatings that comply with the proposed limit. Table 5.24-3 shows that implementing the proposed 150 g/l limit would achieve approximately 0.9 tpd in VOC emission reductions for the non-SCAQMD portion of California, on an annual average basis.

Table 5.24-3: Complying Marketshare & Emission Reductions
Nonflat High Gloss

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
150	94	28%	0.91

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.24.6. Product Testing Results

5.24.6.1. UMR:
In 2005, the UMR Coatings Institute at the University of Missouri - Rolla conducted a coatings testing project for the SCAQMD (UMR, 2006). The project included tests on products classified as Nonflat - High Gloss coatings.
UMR tested some general coating properties, including: percent nonvolatile; stability; viscosity; freeze/thaw resistance; dry time; gloss; and hiding – contrast ratio. They also tested performance properties, including: scrub resistance; stain resistance; blocking resistance; flow/level and sag; accelerated weathering (i.e., QUV testing); and surface tension. All testing was done in accordance with ASTM standards, unless otherwise noted or agreed upon by the South Coast AQMD. All paints were supplied to the UMR Coatings Institute by South Coast AQMD.

For Nonflat - High Gloss coatings, they intended to test four products, two low-VOC products (VOC $\leq$50 g/l) and two high-VOC products (VOC >50 g/l and $\leq$250 g/l). However, the VOC content for one of the low-VOC products was actually greater than 50 g/l and the other low-VOC product had a gloss level that was below the threshold for High Gloss. Therefore, the Nonflat – High Gloss testing actually involved three high-VOC products.

Two of the samples were around 150 g/l, and one was near the current 250 g/l limit. Since none of the products were 50 g/l or below, it was not possible to make a comparison between coatings that comply with the 50 g/l South Coast AQMD limit and the proposed 150 g/l SCM limit.

5.24.7. Manufacturer Information

ARB staff reviewed survey data and manufacturer product data sheets to identify Nonflat – High Gloss coatings that could comply with the proposed 150 g/l VOC limit. In some cases, survey data for calendar year 2004 indicated that a product was above 150 g/l, but the more recent product data sheets indicated that the product had subsequently been reformulated below 150 g/l.

Based on product data sheets, manufacturers claim that the low-VOC compliant products possess the following properties:

Properties of Interior Nonflat-High Gloss (<150 g/l)

- Washable
- Scrubbable
- High hiding
- Good Mar Resistance
- Low Odor
- Tough
- Durable
- Dries Quickly

Properties of Exterior Nonflat-High Gloss (<150 g/l)

- Provides block resistance
- Moisture resistant
- Superior gloss retention
- Flow and leveling
- Durable
- Blister, alkali and fade resistant
- Non photochemically reactive
- Adhesion

Some complying products are included on Master Painter's Institute (MPI) Approved Products lists because they have been certified to meet designated performance standards (MPI, 2007). ARB staff identified six single component products that had gloss levels above 70 and were MPI-approved to meet one of the following standards: MPI #114 (Latex, Interior, Gloss - MPI Gloss Level 6) or MPI #119 (Latex, Exterior, Gloss - MPI Gloss Level 6). Approved products include Frazee Mirro-Glide Gloss Interior/Exterior Acrylic Finish, Kelly-Moore Dura-Poxy Interior/Exterior 100% Acrylic Gloss Enamel, PPG Manor Hall Interior/Exterior Gloss Acrylic Latex, Rodda Paint Unique II Gloss Exterior Interior Latex, Sherwin Williams Pro Classic Waterborne Interior Gloss Enamel, and Vista Carefree Gloss.

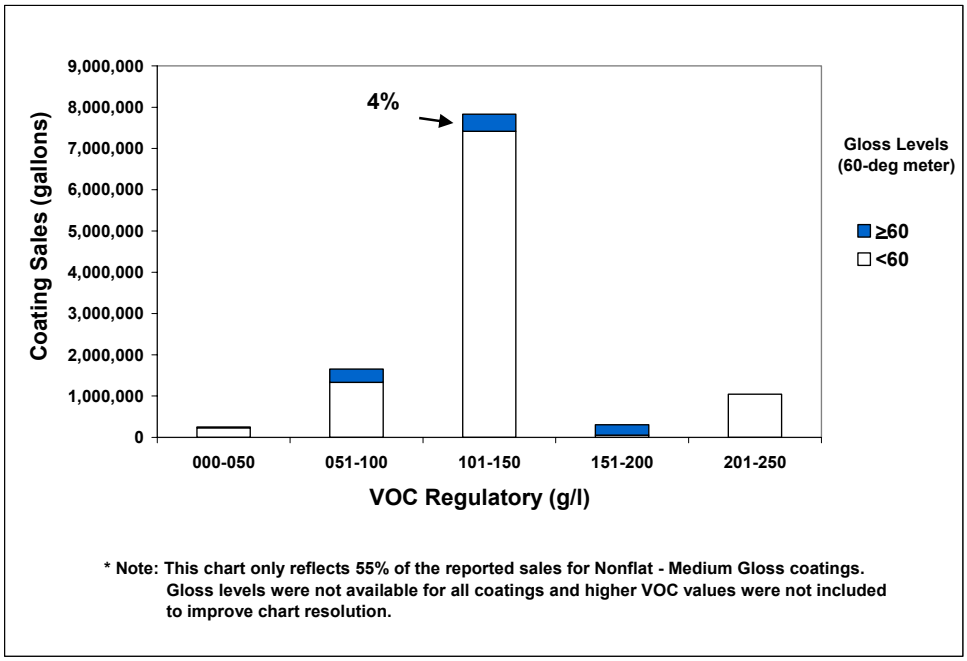
5.24.8 Manufacturer Concerns

Nonflat High Gloss Definition Change: Manufacturers have expressed concerns regarding the gloss range contained in the current definition for Nonflat - High Gloss. Industry requested that ARB consider lowering the threshold for Nonflat - High Gloss coatings from 70 to 60 units on a 60-degree meter. If this occurred, products with a gloss level of 60 units or more would shift from Nonflat - Medium Gloss to Nonflat - High Gloss and they would be allowed the higher 150 g/l VOC limit. Manufacturers requested this change to accommodate product lines that have coatings in two different gloss categories (Nonflat - High Gloss and Nonflat - Medium Gloss).

ARB staff analyzed the survey data and identified gloss levels for 55% of the reported sales volume for Nonflat – Medium Gloss coatings. Staff then determined how much of this sales volume subset would potentially be shifted to Nonflat – High Gloss if the gloss threshold was lowered to 60 units on a 60-degree meter. Nine percent of this subset would potentially be shifted to Nonflat - High Gloss. Three percent would be compliant with a 100 g/l limit (the Nonflat category proposed limit), four percent would be compliant with the proposed 150 g/l limit, and two percent wouldn't be able to comply with a 150 g/l limit. ARB staff decided to leave the threshold as is, since the vast majority of Nonflat - Medium Gloss products have gloss levels below 60 units and changing the threshold would make the SCM inconsistent with the existing specifications used by CalTrans and Master Painters Institute (MPI). Figure 5.24-1 illustrates

the sales volume for Nonflat - Medium Gloss coatings with gloss levels above and below the suggested threshold of 60 units.

Figure 5.24-1
Nonflat – Medium Gloss Coatings: Gloss Level vs. VOC



5.24.9. Conclusion

We recommend a 150 g/l VOC limit for Nonflat - High Gloss coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare, the number of companies making complying products, product information from manufacturers, and test data. The proposed VOC limit is lower than the national limit adopted by the U.S. EPA and the OTC states, and the proposed limit for Canada. The proposed limit is higher than the 50 g/l limit contained in SCAQMD Rule 1113. However, manufacturers that provide coatings in the SCAQMD area can still sell products which exceed the 50 g/l limit, if they participate in SCAQMD's averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit.

In addition, the SCM needs to be technologically feasible throughout California. To comply with the 50 g/l limit, some coating manufacturers have eliminated glycols in their formulations. As a result, their products must be transported in heated trucks and stored in heated areas, to prevent freezing. Paints with high water contents can coagulate and become unusable if they become frozen. The SCAQMD has a mild climate, so freezing temperatures are less of a concern. However, in other areas of California, freezing temperatures are more prevalent. ARB staff believes that additional research is needed to develop products that perform well in areas with more extreme climates, particularly for Nonflat – High

Gloss coatings. In addition, more coalescing agents allow for the use of harder resins that improve scrub resistance and dirt pickup resistance. Therefore, ARB staff believes that the proposed 150 g/l VOC limit is most appropriate at this time.

5.25. PRE-TREATMENT WASH PRIMERS

VOC Limit Table (g/l)

USEPA: 780	Canada: 420	OTC: 420	SCAQMD: 420	SCM Proposed: 420

5.25.1. Category Definition

A primer that contains a minimum of 0.5 percent acid, by weight, when tested in accordance with ASTM Designation D 1613-06 that is labeled and formulated for application directly to bare metal surfaces to provide corrosion resistance and to promote adhesion of subsequent topcoats.

5.25.2. Major Proposed Changes

- None.

5.25.3. Coating Description

Pre-Treatment Wash Primers are used as bonding agents on metal substrates to provide adhesion with topcoats, partially due to a reaction with the substrate. They also impart a corrosion resistant film and can be applied to metal alloys, ferrous metals, or nonferrous metals. These primers form very thin films and are similar to etching solutions.

Pre-Treatment Wash Primers are primarily applied with sprayers. Since these coatings typically dry very fast, brush and roller application is usually limited to small areas and touch up. Contractors and professional painters are the primary users of these products. Most products that comply with the 420 g/l VOC limit are single component waterborne coatings with acrylic resins. Non-compliant products are usually multi-component, solventborne coatings with a vinyl resin.

5.25.4. Substrates/Exposures

Pre-Treatment Wash Primers can be applied to metal alloys, ferrous metals, or nonferrous metals, including aluminum, steel, and galvanized metal. They can be used outdoors or indoors.

5.25.5. Survey Results

Table 5.25-1 summarizes our estimate of sales and VOC emissions for Pre-Treatment Wash Primers, based on the ARB survey. Pre-Treatment Wash

Primers are one of the smallest categories with regard to sales volume and VOC emissions. In 2004, the sales volume for Pre-Treatment Wash Primers in California was approximately 5,000 gallons, which represents less than 0.01 percent of the total sales volume for architectural coatings. From 2000 to 2004, the sales volume for Pre-Treatment Wash Primers decreased 93 percent and the overall sales-weighted average VOC content increased 6 percent. This decrease in sales volume is primarily due to improved quality control efforts for survey submittals.

VOC emissions from Pre-Treatment Wash Primers are about 0.01 tpd, which is about 0.01 percent of the total emissions from architectural coatings. Most of these emissions are from solventborne products.

Table 5.25-1: Survey Data
Pre Treatment Wash Primer

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers [2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	7	PD	PD	0%	0%	100%	97%	747	0.01
WB	3	PD	PD	0%	0%	100%	0%	132	0.00
Total	**10**	**4,959**		**0%**	**0%**	**100%**	**21%**	**266**	**0.01**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.25-2 contains the complying marketshare for Pre-Treatment Wash Primers. This table shows that about 99 percent of the sales volume complies with the current VOC limit. Of the five companies that reported in this category, two offered products that comply with the current limit.

Table 5.25-2: Complying Marketshare & Emission Reductions
Pre-Treatment Wash Primer

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
420	2	99%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.25.6. Conclusion

We recommend maintaining a 420 g/l VOC limit for Pre-Treatment Wash Primers. This VOC limit is technologically and commercially feasible based on the complying marketshare and the number of companies making complying products. The current VOC limit is lower than the limit adopted by the U.S. EPA.

The current limit is the same as the limit adopted by the South Coast AQMD and the OTC states, and the proposed limit for Canada.

5.26. PRIMERS, SEALERS, AND UNDERCOATERS

VOC Limit Table (g/l)

USEPA: 350 g/l (primers and undercoaters); 400 g/l (sealers, including clear wood finishes)	Canada: 200	OTC: 200	SCAQMD: 100	SCM Proposed: 100

5.26.1. Category Definition

A coating labeled and formulated for one or more of the following purposes:

- To provide a firm bond between the substrate and the subsequent coatings; or
- To prevent subsequent coatings from being absorbed by the substrate; or
- To prevent harm to subsequent coatings by materials in the substrate; or
- To provide a smooth surface for the subsequent application of coatings; or
- To provide a clear finish coat to seal the substrate; or
- To block materials from penetrating into or leaching out of a substrate.

During development of the 2000 SCM, ARB staff indicated that the Quick Dry Primer, Sealer, Undercoater category would become obsolete. Products in the Quick-Dry Primer, Sealer, Undercoater category were defined in the 2000 SCM as follows:

Quick-Dry Primer, Sealer, Undercoater: A primer, sealer, or undercoater that is dry to the touch in 30 minutes and can be recoated in 2 hours when tested in accordance with ASTM Designation D 1640-95.

Staff proposes to eliminate the Quick Dry Primer, Sealer, Undercoater category because there is no longer the need for a higher VOC limit to accommodate quick-drying products. The products formerly in this category will now be subject to the VOC limits of the Primer, Sealer, Undercoater or Specialty Primer, Sealer, Undercoater categories.

Although Primers, Sealers, and Undercoaters were considered one category in the 2000 SCM, the definitions were separated as follows:

Primer: A coating labeled and formulated for application to a substrate to provide a firm bond between the substrate and subsequent coats.

Sealer: A coating labeled and formulated for application to a substrate for one or more of the following purposes: to prevent subsequent coatings from being

absorbed by the substrate, or to prevent harm to subsequent coatings by materials in the substrate.

Undercoater: A coating labeled and formulated to provide a smooth surface for subsequent coatings.

Staff proposes to combine the above three separate definitions into a single definition for the Primers, Sealers, and Undercoaters category.

5.26.2. Major Proposed Changes

- The Quick Dry Primer, Sealer, Undercoater category has been eliminated. Some of the products that were formerly in this category will be covered by the Primers, Sealers, and Undercoaters category.
- Three separate definitions for “Primer”, “Sealer”, and “Undercoater” have been combined into a single definition for “Primer, Sealer, and Undercoater”.
- The revised Primer, Sealer, and Undercoater definition includes products intended to seal the substrate without being topcoated.
- The VOC limit for the Primer, Sealer, Undercoater category has been reduced from 200 g/l to 100 g/l.

5.26.3. Coating Description

The Primers, Sealers, and Undercoaters category is a generic term that describes the initial coat which provides a suitable substrate for subsequent coatings. It also describes clear sealer coatings that do not require a topcoat. Primers, Sealers, and Undercoaters are used by homeowners and professionals and they are typically sprayed, rolled, or brushed on to the substrate.

In general, the lower-VOC Primers, Sealers, and Undercoaters typically employ the use of acrylic, acrylic copolymer, or vinyl acrylic copolymer resins, while the higher VOC coatings are formulated with alkyd, urethane, and polyurethane resins. Comparison between the ARB 2005 survey and the ARB 2001 survey indicates an increasing reliance on lower-VOC Primers, Sealers, and Undercoaters. This coating category consists primarily of single component formulations; although a very small amount (3 percent) of the solventborne products are multi-component.

5.26.4. Substrates/Exposures

Primers, Sealers, and Undercoaters are used indoors and outdoors on a wide variety of substrates. The products in this category vary widely in their purpose, from preparing walls for application of vinyl wallpaper to filling porous concrete masonry units. Substrates include drywall, previously painted porous surfaces, masonry, concrete, concrete block, brick, stone, wood, plywood, plaster,

polyurethane, aluminum or galvanized siding, vinyl, composition board, ferrous metal, hardboard siding, fiberglass, plastics, spray applied polyurethane foam, organic polymers, foil/mylar, acoustic ceiling tiles, popcorn ceilings, flakeboard, acrylic based mortar systems, wallpaper, asbestos siding, polyvinyl chloride (PVC), copper, oriented strand board (OSB), and bituminous surfaces.

Because most products are topcoated, they are not exposed to substances in the environment, but must tolerate the environment of the substrate to which they are applied and the environment of the coating that serves as a topcoat. The product data sheets of many Primers, Sealers, and Undercoaters specify a time frame within which they must be topcoated. If not topcoated within the specified time frame, additional surface preparation and/or recoating prior to topcoating may be necessary. As the substrates and topcoats used with Primers, Sealers, and Undercoaters vary widely, so does the range of conditions to which they must be resistant. Primer, Sealers, and Undercoaters may need to be resistant to, and perform well, under conditions that are alkaline, acidic, etc.

A small number of the reported Primer, Sealer, Undercoater products require no topcoat. These coatings may be used to prevent toxic outgassing of the substrate, or to provide moisture, dust, and mar resistance.

5.26.5. Survey Results

Table 5.26-1a summarizes our estimate of sales and VOC emissions for Primers, Sealers, and Undercoaters, based on the ARB survey. Primers, Sealers, and Undercoaters represent the 4th largest coating category with regard to sales volume and the 5th largest coating category with regard to VOC emissions. In 2004, the sales volume for Primers, Sealers, and Undercoaters in California was approximately 10.4 million gallons, which represents about 9 percent of the total sales volume for architectural coatings.

Waterborne Primers, Sealers, and Undercoaters represent 98 percent of the sales volume. Solventborne products represent 2 percent of the market and generally have VOC levels greater than 200 g/l, the current SCM VOC limit. The sales volume for solventborne products decreased approximately 83 percent from 2000 to 2004, while overall sales volume for Primers, Sealers, and Undercoaters increased by approximately 28 percent. The overall sales-weighted average VOC level decreased 17 percent from 2000 to 2004.

VOC emissions from Primers, Sealers, and Undercoaters are about 6.4 tpd, which represents approximately 7 percent of the total emissions from architectural coatings. Because most of the products sold are waterborne, most of the emissions are from waterborne products, even though these products have a lower sales-weighted average VOC content than solventborne products.

Primer, Sealer, and Undercoater was one of the categories that could be included in averaging programs during 2004. Under these programs, manufacturers could sell Primers, Sealers, and Undercoaters with VOC levels above 200 g/l, if emissions from these products were offset by emissions from other products that had VOC levels below regulatory limits. For Primers, Sealers, and Undercoaters, one percent of the total sales volume consisted of high-VOC products with VOC levels above 200 g/l. These high-VOC products accounted for approximately 0.5 tpd of VOC emissions which represents seven percent of total emissions for Primers, Sealers, and Undercoaters.

Table 5.26-1a: Survey Data
Primers, Sealers, and Undercoaters

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers [2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	128	225,380	2%	20%	54%	26%	14%	371	0.93
WB	560	10,176,638	98%	38%	10%	52%	1%	122	5.48
Total	**688**	**10,402,018**		**38%**	**11%**	**52%**	**2%**	**128**	**6.41**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.26-1b summarizes our estimate of sales and VOC emissions from the Quick Dry Primers, Sealers, and Undercoaters category, based on the ARB survey. Quick Dry Primers, Sealers, and Undercoaters represent the 25th largest coating category with regard to sales volume and the 17th largest category in regard to VOC emission levels. In 2004, the sales volume for Quick Dry Primers, Sealers, and Undercoaters in California was approximately 250,000 gallons, which represents about 0.2 percent of the total volume for architectural coatings.

Waterborne products represent 12 percent of the Quick Dry Primers, Sealers, and Undercoaters market. Solventborne products represent 88 percent of the market and generally have VOC levels greater than 200 g/l, which is the current SCM VOC limit. The sales volume for solventborne products decreased approximately 83 percent from 2000 to 2004, while the overall sales volume for Quick Dry Primers, Sealers, and Undercoaters decreased about 85 percent. The overall sales-weighted average VOC level remained the same from 2000 to 2004.

VOC emissions from Quick-dry Primer, Sealer, Undercoater coatings are about one ton per day (tpd), which represents approximately one percent of the total emissions from architectural coatings. Virtually all of the estimated emissions in this category are attributable to the fraction comprised of the solventborne coatings.

Quick Dry Primer, Sealer, and Undercoater was one of the categories that could be included in averaging programs during 2004. Under these programs,

manufacturers could sell Quick Dry Primer, Sealer, and Undercoaters with VOC levels above 200 g/l, if emissions from these products were offset by emissions from other products that had VOC levels below regulatory limits. For Quick Dry Primers, Sealers, and Undercoaters, 61 percent of the total sales volume consisted of high-VOC products with VOC levels above 200 g/l. These high-VOC products accounted for approximately 0.8 tpd of VOC emissions which represents 75 percent of total emissions for Quick Dry Primers, Sealers, and Undercoaters.

Table 5.26-1b: Survey Data
Quick Dry Primer, Sealer and Undercoater

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	30	220,361	88%	52%	0%	48%	3%	410	1.02
WB	5	29,349	12%	0%	0%	100%	4%	20	0.00
Total	**35**	**249,710**		**46%**	**0%**	**54%**	**3%**	**364**	**1.02**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.26-2 contains the complying marketshare for the Primers, Sealers, and Undercoaters category, based on results from the ARB survey. This table includes products that were previously classified as Quick Dry Primers, Sealers, and Undercoaters. This table shows that about 36 percent of the sales volume complies with the proposed VOC limit. When considering the number of products reported, almost 50 percent of the reported products comply with the proposed limit. Implementing the proposed 100 g/l limit would achieve approximately 1.1 tpd in VOC emission reductions for the non-South Coast AQMD portion of California, on an annual average basis.

Table 5.26-2: Complying Marketshare & Emission Reductions
Primers, Sealers, and Undercoaters

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
100	310	36%	1.12

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Considering interior and exterior products separately, 56 percent of the sales volume for interior products complies with the proposed limit, 34 percent of the sales volume for exterior products complies, and 23 percent of the sales volume for dual interior/exterior use complies.

5.26.6. Product Testing Results

5.26.6.1. KTA-Tator: The KTA-Tator Study, agreed to by the joint industry-government Technical Advisory Committee of the SCAQMD, encompassed four architectural coating categories, one of which was Primers, Sealers, and Undercoaters (PSUs) (SCAQMD, 2002). Both high- and low-VOC, interior and exterior PSUs were tested to determine whether commercially-available architectural coatings that contain lower VOC content perform better, equivalent to, or worse than products with a higher VOC content. The VOC content of coatings tested ranged from 118 g/l to 457 g/l (as reported by manufacturers). "Low-VOC" products had VOC contents less than or equal to 200 g/l, while "High-VOC" products had VOC contents greater than 200 g/l. Testing was conducted to determine coating characteristics and performance.

Characteristics testing included tests to determine VOC Content, volume solids, Infrared Spectroscopic Analysis, viscosity, hiding, dry time, and sag resistance. For waterborne coatings, percent water and freeze/thaw resistance testing were also conducted. All tests to determine characteristics were based on standard ASTM testing procedures. Performance testing for interior PSUs included tests to determine grain raising, adhesion, sandability; and chemical resistance, even though these products are intended to be used on a clean substrate and covered with a top coat. Performance testing for exterior PSUs included tests to determine the degree of grain raising, adhesion, stain blocking, and weathering under accelerated conditions. Most of the testing was based on standard ASTM testing procedures. If no ASTM procedure was available, testing protocols developed by coating manufacturers were used. In the case of the sandability performance test, there was neither an ASTM method nor a coating manufacturer testing protocol available, and the testing procedure was developed by KTA-Tator.

Measured VOC Content Data

The manufacturers' published VOC values generally agreed with laboratory analysis results, but there were some differences. Three discrepancies existed out of the eleven PSUs tested, with one testing higher in VOC content than the published value and two testing lower. One test sample with a published VOC content of 141 g/l, revealed a VOC content of 227 g/l when tested. Another test sample with a published VOC content of less than 200 g/l, tested well below that maximum at 91 g/l, making this the lowest VOC sample tested. The third discrepancy involved a sample with a published maximum VOC content of 250 g/l, but testing indicated a VOC content of 106 g/l.

Results of the KTA-Tator study indicate that low-VOC products perform as well or better than high-VOC products when tested for the following properties: dry to touch time; sag resistance; grain raising; tape adhesion; stain blocking; sandability; chemical resistance; and accelerated weathering.

Dry to Touch Time

The dry to touch time for all PSUs tested ranged from 10 minutes to 124 minutes. The average dry to touch time for low-VOC PSUs was less than 26 minutes, while the average dry to touch time for high-VOC PSUs was more than double that, at slightly more than one hour.

Sag Resistance
For sag resistance, all of the low-VOC PSUs for interior use performed better than the high-VOC PSU interior products. The majority of the low-VOC PSUs for exterior use performed better than the high-VOC PSUs in sag resistance testing.

Grain Raising
Both low- and high-VOC PSUs performed reasonably well on the substrates tested (white pine, Louisiana Pacific (LP) siding, and red cedar woods). Overall, low-VOC products tended to raise the grain less than high-VOC products. Rated on a scale where a ranking of 1 indicates no grain raising and 5 equates to severe grain raising, most products were ranked either 1 or 2, with two high-VOC PSUs being ranked a 3 on the white pine wood and one high-VOC PSU being ranked as a 3 on the red cedar wood. None of the low-VOC PSUs received a ranking of 3 or above on any of the tested substrates.

Tape Adhesion
Tape adhesion testing was performed on four substrates: drywall, white pine wood, LP siding wood, and red cedar wood. Interior PSUs were tested on drywall and white pine wood substrates, and exterior PSUs were tested on LP siding wood and red cedar wood.

Low-VOC interior PSUs adhered better to their drywall and white pine wood substrates than did the high-VOC interior PSUs, when subjected to the same tape adhesion testing. Similarly, low-VOC exterior PSUs performed better than the high-VOC exterior PSUs when applied to a red cedar substrate and a tape adhesion test conducted. High- and low-VOC exterior PSUs performed very similarly when the tape adhesion test was conducted after the products were applied to LP siding wood.

Stain Blocking Characteristics
Rated on a scale where a ranking of zero indicates severe tannin staining and 10 equates to no tannin staining, all exterior PSUs tested on LP siding wood performed well. All products, including both high- and low-VOC exterior PSUs, received a ranking of 10, with the exception of one low-VOC exterior PSU which received a ranking of 9. It should be noted that this product had the highest VOC content of the low-VOC PSUs tested.

In general, all exterior PSUs, regardless of VOC content, performed less well when blocking tannin stains from the red cedar wood substrate. Both the high (8) and low (1) rankings were captured by high-VOC exterior PSUs, with ratings for

high-VOC exterior PSUs averaging 5.3. Low-VOC exterior PSUs ranked slightly better, with an average rating of 6.3.

Sandability Characteristics
Both low- and high-VOC interior PSUs performed well on the substrates tested (white pine wood and drywall), with the exception of one of the low-VOC interior PSUs, which sanded poorly.

Chemical Resistance
Both low- and high-VOC interior PSUs performed identically in all chemical resistance testing. Five products typically found in households (ketchup, mustard, crayons, blue magic maker, and lipstick) were tested on two substrates (drywall and white pine wood). For both substrates, the following results were seen for both high- and low-VOC interior PSUs: ketchup caused no noticeable effect; mustard and blue magic marker resulted in severe staining; crayons caused moderate staining; and lipstick yielded minor staining.

Accelerated Weathering
Accelerated weathering testing was conducted for all exterior PSUs using red cedar wood and LP siding wood as substrates. After 500 hours, specimens were removed from accelerated weathering testing and data on pre- and post-exposure color shift and gloss were compared. The most significant change in color was seen with a high-VOC exterior PSU, and the least amount of color change was seen in a low-VOC exterior PSU. Both high- and low-VOC exterior PSUs showed no reduction in gloss after accelerated weathering testing, with the exception of one low-VOC exterior PSU which showed a slight decrease in gloss.

5.26.6.2. UMR: In 2005, the UMR Coatings Institute at the University of Missouri - Rolla conducted a coatings testing project for the South Coast AQMD (UMR, 2006). The project included tests on products classified as Primers, Sealers, and Undercoaters. UMR tested some general coating properties, including: percent nonvolatile; stability; viscosity; freeze/thaw resistance; dry time; gloss; and hiding - contrast ratio. They also tested performance properties, including: adhesion; stain bleed through resistance; tannin stain resistance; grain raising and sandability; enamel holdout; and flow/level and sag. All testing was done in accordance with ASTM standards, unless otherwise noted or agreed upon by the South Coast AQMD. All paints were supplied to the UMR Coatings Institute by South Coast AQMD.

For Primers, Sealers, and Undercoaters, they tested four products, two low-VOC products (VOC $\leq$100 g/l) and two high-VOC products (VOC >100 g/l and $\leq$200 g/l). On average, on most tests, the two low-VOC samples below 100 g/l performed comparably with the two high-VOC samples above. However, on average, the two low-VOC samples did perform somewhat poorer on overcoat adhesion and stain bleed through (coffee) than the high-VOC samples. It is

interesting to note that the low-VOC samples did perform equally well as the high-VOC samples on tannin resistance.

5.26.7. Manufacturer Information

Product information sheets published by coatings manufacturers indicate that a wide variety of Primer, Sealer, Undercoater coatings that meet the proposed VOC limit are available that possess performance characteristics similar to higher-VOC coatings. Review of the product information sheets shows that claims by some manufacturers are similar to those of Specialty Primer, Sealer, Undercoater products in that they can be used over properly prepared chalky surfaces and have the ability to block both non-water soluble and water soluble stains, such as tannins. A summary of product information for Primer, Sealer, Undercoater coatings with a range of VOC contents is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

5.26.8. Conclusion

We recommend a 100 g/l VOC limit for Primers, Sealers, and Undercoaters, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare, testing, and product information from manufacturers. The proposed VOC limit is lower than the national limits adopted by the U.S. EPA for Primers and Undercoaters (350 g/l) and Sealers, including clear wood finishes (400 g/l). It is also lower than the limit adopted by the OTC states and the proposed limit for Canada. Our proposed limit is consistent with the limit adopted by the South Coast AQMD.

The high sales volume that already complies with the proposed limit demonstrates widespread use of existing low-VOC technology for Primers, Sealers, and Undercoaters. While almost all Primers, Sealers, and Undercoaters are currently waterborne latex coatings, the proposed limit would require more waterborne products to be formulated using lower-VOC technology.

In addition to the above factors, results of the KTA-Tator study indicate that low-VOC products perform as well or better than high-VOC products when tested for the following properties: dry to touch time; sag resistance; grain raising; tape adhesion; stain blocking; sandability; chemical resistance; and accelerated weathering.

We further recommend that the Quick Dry Primers, Sealers, and Undercoaters category be eliminated and those products formerly classified under this category be categorized under Primers, Sealers, and Undercoaters. Many products currently classified as Primers, Sealers, and Undercoaters claim the same dry time as Quick Dry Primers, Sealers, and Undercoaters. Additionally, data from the KTA-Tator study support the assertion that low-VOC Primers, Sealers, and

Undercoaters dry as rapidly as higher-VOC products, negating the need for a separate Quick Dry Primers, Sealers, and Undercoaters category.

5.27. REACTIVE PENETRATING SEALERS

VOC Limit Table (g/l)

USEPA: 600 (WST)	Canada: 400 (WCMS or WPS)	OTC: 400 (WCMS or WPS)	SCAQMD: 100 (WCMS or WPS)	SCM Proposed: 350

5.27.1. Category Definition

A clear or pigmented product that is labeled and formulated for application to above-grade concrete and masonry substrates to provide protection from water and waterborne contaminants, including but not limited to, alkalis, acids, and salts. Reactive Penetrating Sealers must penetrate into concrete and masonry substrates and chemically react to form covalent bonds with naturally occurring minerals in the substrate. Reactive Penetrating Sealers line the pores of concrete and masonry substrates with a hydrophobic coating, but do not form a surface film. Reactive Penetrating Sealers must meet all of the following criteria:

- The Reactive Penetrating Sealer must improve water repellency at least 80 percent after application on a concrete or masonry substrate. This performance must be verified on standardized test specimens, in accordance with one or more of the following standards: ASTM C67-07 (Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile); or ASTM C97-02 (Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone); or ASTM C140-06 (Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units); and

- The Reactive Penetrating Sealer must not reduce the water vapor transmission rate by more than 2 percent after application on a concrete or masonry substrate. This performance must be verified on standardized test specimens, in accordance with ASTM E96/E96M-05 (Standard Test Method for Water Vapor Transmission of Materials).

- Products labeled and formulated for vehicular traffic surface chloride screening applications must meet the performance criteria listed in the National Cooperative Highway Research Report 244 (Concrete Sealers for the Protection of Bridge Structures) (1981).

Please note that “Reactive Penetrating Sealer” is a proposed new category that includes products which were formerly covered by the following two categories in the 2000 SCM:

Waterproofing Concrete/Masonry Sealer (WCMS): A clear or pigmented film-forming coating that is labeled and formulated for sealing concrete and masonry to provide resistance against water, alkali, acids, ultraviolet light and staining.

Waterproofing Sealer (WPS): A coating labeled and formulated for application to a porous substrate for the primary purpose of preventing the penetration of water.

These two categories have been eliminated from the proposed SCM and the types of products that were previously in these categories would be covered by the following: Basement Specialty Coating; Concrete/Masonry Sealer; Reactive Penetrating Sealer; Wood Coatings; Industrial Maintenance; Primer, Sealer, Undercoater; Stone Consolidant; and Waterproofing Membrane.

Under the U.S. EPA Architectural Coating regulation, Reactive Penetrating Sealers would be covered by the "Waterproofing Sealers and Treatments (WST)" category.

5.27.2. Major Proposed Changes

- Reactive Penetrating Sealer is a new category that includes products formerly classified under Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer.

5.27.3. Coating Description

These products penetrate and chemically react with concrete and masonry substrates to provide a protective hydrophobic seal that repels liquid water and is resistant to chemicals and deicing salts (chloride ions). They are often considered to be concrete treatments, rather than coatings, and some are formulated to be resistant to oils and grease. They are "breathable", which means they repel the intrusion of liquid water but they allow water vapor to escape from the substrate without damaging the protective seal. The breathability can be measured with ASTM E96/E96M-05 ("Standard Test Methods for Water Vapor Transmission of Materials").

Reactive Penetrating Sealers can be used on walls, roadways, bridge decks, sidewalks, driveways, historical monuments, and other surfaces. They are often specified for high-traffic areas, because they penetrate below the surface and are less likely to be worn away by surface abrasion. For these applications, silanes and siloxanes are considered to provide better protection (SHRP, 1992; RMJ, 1997). Products that are intended for use on uncured or "green" concrete are formulated for alkaline stability, because new concrete is highly alkaline.

There are numerous test methods that can be used to assess the performance of Reactive Penetrating Sealers, depending on the type of substrate and the desired properties. The Sealant Waterproofing and Restoration Institute (SWRI) has compiled a handbook of recommended performance tests that include water repellency, water vapor transmission, water absorption, durability, chloride ion intrusion, slip resistance, and depth of penetration (SWRI, 2006). Many of the products for bridges and roadways are tested in accordance with the procedures contained in the National Cooperative Highway Research Program (NCHRP) Report 244 “Concrete Sealers for Protection of Bridge Structures” published in 1981. Another common test method is the American Association of State Highway and Transportation Officials (AASHTO) T259, “Resistance of Concrete to Chloride Ion Penetration”.

Chloride screening is a term that describes the act of reducing the penetration of water that contains chlorides. When water that contains chlorides penetrates into concrete, it can cause corrosion that can damage structural integrity. The use of salts on bridges or roadways can create a solution of water that contains dissolved chlorides. Concrete sealers that are formulated for chloride screening help prevent penetration of this water and their performance can be assessed by using the criteria contained in the National Cooperative Highway Research Report 244 (“Concrete Sealers for the Protection of Bridge Structures”).

Most Reactive Penetrating Sealers are low-viscosity fluids (similar to water) and they do not fill or bridge cracks (Slaton, 2006). However, some European products are in the form of crèmes or gels, which helps the material remain in place to allow deeper penetration and prevents the material from running down a vertical or sloped surface (Wacker, 2007). Most products leave a clear finish that does not usually change the appearance of the substrate, but some clear siloxane products can cause a slight darkening on light-colored surfaces.
In addition to these clear products, there are reactive concrete stains that penetrate and chemically react with concrete to change the color. Some manufacturers have developed formulations (e.g., acrylic/silane) that provide both a decorative finish and protection against water, chloride ions, etc. Some of these stain/sealer products claim to meet the same performance criteria as the clear products, in terms of water repellency and vapor transmission. Therefore, the definition for Reactive Penetrating Sealers contains both clear and pigmented products. The Reactive Penetrating Sealer category does not cover reactive concrete stains that are formulated for decorative purposes only and need to be covered with a protective clear sealer. Decorative products that provide no water repellency and have no resistance to contaminants would be covered by the Stains category, because they do not meet the criteria for Reactive Penetrating Sealers.

Reactive Penetrating Sealers are generally applied by professional contractors and they can be used on horizontal and vertical surfaces, with interior and exterior exposures. Application methods include: low-pressure sprayer, brush,

and roller. These products are not easily removed after application and they can interfere with bonding of subsequent sealants or coatings. Therefore, it is usually recommended that crack filling and repairs be completed prior to application of the sealer.

Reactive Penetrating Sealers generally have one of following formulation types: silane; siloxane; silane/siloxane blend; inorganic silicate; silane/silicate blend; or siliconate. As formulated in the can, these products often contain low levels of VOCs or zero VOCs. However, after application, silanes and some siloxanes undergo a chemical reaction that releases VOCs (e.g., ethanol or methanol). Shown below is an example of the reactions that can occur. Initially, the alkylalkoxysilane reacts with water to create an alkyl silanol and releases ethanol. The product of this initial reaction subsequently reacts with silanol groups in the concrete to bond with the substrate and create a silicone network in the concrete pores (D.B. Becker, 2007; McGettigan, 1994):

R-SiOEt + H2O → R-SiOH + CH3CH2OH (ethanol)

R-SiOH + SiOH (in concrete) → R-SiOSi-R + H2O

where
- R-SiOEt = Alkylalkoxysilane
- H2O = Water
- R-SiOH = Alkyl Silanol
- CH3CH2OH = Ethanol
- SiOH = Silanol
- R-SiOSi-R = Silicone Crosslinking Network

The VOCs that are released during the chemical reaction are known as cure volatiles and they should be included when determining the VOC content of a product. However, ARB staff found that there was some inconsistency in the industry regarding this matter. Some manufacturers are correctly including cure volatiles in their reported VOC contents while others are not. As a result, some products that are being marketed as low-VOC products actually have much higher VOC levels when the VOC is determined correctly. For example, during the South Coast AQMD testing project with the University of Missouri, they tested two silane-based concrete/masonry sealers. Both products had published VOC values below 100 g/l, but laboratory analysis revealed that the actual VOC contents were 200 g/l and 220 g/l (UMR, 2006). ARB staff has found that most manufacturers determine their VOC values based on formulation data, because it is less expensive than conducting a laboratory analysis in accordance with EPA Test Method 24. For silanes and siloxanes, EPA Test Method 24 refers to ASTM D5095 (Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments), which includes measurement of cure volatiles. Since VOC data from coating manufacturers were sometimes uncertain, ARB staff worked with raw material suppliers to determine what the theoretical VOC should be for various chemistries.

Provided below are descriptions for the different types of chemicals commonly used in Reactive Penetrating Sealers (Degussa, 2007; Dow Corning, 2007; Henry, 2006; McGettigan, 1994; McGovern, 2000; Slaton, 2006):

Silane: A silicone-based monomer with four chemical attachments. For example, in an alkoxy silane (e.g., $R\text{-}Si(OCH_3)_3$), one end of the molecule has an inorganic alkoxy group that reacts with the concrete and the other end has an organic group (e.g., alkyl, phenyl, fluoro) that makes the substrate hydrophobic. This hydrophobicity makes silanes suitable for use as water repellents. Silane monomers are smaller molecules than siloxane polymers. Therefore, silanes are able to penetrate deeper into concrete and masonry substrates, which may provide greater durability. Products with a high concentration of silanes are often specified for use on dense materials that are difficult to penetrate or previously coated surfaces. Commonly used silanes include Butyltrimethoxysilane (CAS #1067-57-8); Trimethoxyoctylsilane (CAS #3069-40-7); Triethoxy(2-methylpropyl)silane (CAS #17980-47-1); and Triethoxyoctylsilane (CAS #2943-75-1). Silanes are provided in solventborne and waterborne formulations and both types of formulations generally release VOCs during cure.

Siloxane: A linear Si-O-Si polymer or pre-polymer (e.g., silicone, polydimethylsiloxane, dimethicone, simethicone). Siloxanes are less volatile than silanes and may be more appropriate for application during warm weather. Many siloxanes only contain silanol (Si-OH) as the reactive group or they possess no reactive groups and only included in the formulation to promote water beading, bulking, or other properties. In those cases, they do not release VOCs during cure. Siloxanes are provided in solventborne and waterborne formulations and both types of formulations may release VOCs during cure, depending on the type of reactive functionality.

Silane/Siloxane Blend: A product formulated with a combination of silanes, siloxanes, and other components. Silane/Siloxane Blends are provided in solventborne and waterborne formulations and both types of formulations generally release VOCs during cure.

Inorganic Silicate: A compound containing Silicon, Oxygen and one or more metals (e.g., Lithium Silicate or Sodium Silicate). Inorganic Silicates are commonly used as densifying treatments for concrete. Some inorganic silicate products can be applied on freshly poured concrete to act as a curing compound, hardener, and dustproofer. If the product is designed for curing freshly poured concrete, it would be classified as a Concrete Curing Compound. However, if the product is designed for aged or cured concrete, it could be classified as a Reactive Penetrating Sealer or a Concrete/Masonry Sealer. Inorganic Silicates can react with calcium hydroxide in the substrate or carbon dioxide in the air to create an insoluble precipitate. The precipitated compound helps prevent water

penetration by physically blocking the pores, but it does not make the substrate chemically hydrophobic. Inorganic Silicates do not release VOCs during cure.

Silane/Silicate Blend: A product formulated with a combination of silanes, silicates, and other components. Silane/Silicate Blends generally release VOCs during cure.

Siliconate: A compound (e.g., potassium methylsiliconate) that results from reacting a silicone-based monomer with a metal hydroxide to create a water-soluble water repellent. Siliconates react with atmospheric carbon dioxide to form a silicone resin that acts as a barrier to water. This reaction proceeds relatively slowly as compared to silane/siloxane reactions. Dilute waterborne solutions (<2%) are recommended, because concentrated solutions can result in the formation of a visible salt on the surface (e.g., potassium carbonate). Siliconates are provided in waterborne formulations that may contain VOCs, but do not release VOCs during cure.

Some manufacturers have developed low-VOC Reactive Penetrating Sealers to comply with the 100 g/l limit in the South Coast AQMD. One technique for lowering the VOC content involves partially reacting the silane or siloxane ingredients during the manufacturing process, which causes some of the cure volatiles to be released during manufacture rather than during application. However, this technique can adversely affect product performance if the material doesn't have sufficient activity remaining to allow for effective reaction and bonding with the substrate.

Based on the reported survey data, Reactive Penetrating Sealers accounted for approximately 1% of the reported sales volume for Waterproofing Concrete/Masonry Sealers and 0% of the sales for Waterproofing Sealers. They also accounted for 0% of the VOC emissions for Waterproofing Concrete/Masonry Sealers and 1% of the VOC emissions for Waterproofing Sealers. This analysis is based on the data as reported, but it may not be entirely accurate if manufacturers determined VOC contents incorrectly.

5.27.4. Substrates/Exposures

Reactive Penetrating Sealers are intended for application to above-grade concrete and masonry substrates. Products in this category are intended for interior and exterior exposures on horizontal and vertical surfaces.

5.27.5. Survey Results

Reactive Penetrating Sealer is a new category and it was not reported separately in the ARB survey. Please refer to the Concrete/Masonry Sealer section for survey data that were reported for Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer.

Table 5.27-1 contains estimated complying marketshare data for the proposed new Reactive Penetrating Sealer category. This table reflects combined data for products that seemed to be marketed as reactive penetrating materials and were reported under Waterproofing Concrete/Masonry Sealer or Waterproofing Sealer. ARB staff is not certain that all manufacturers included cure volatiles when calculating VOC values for their products. Therefore, some of the survey data may be in error. Based on the data, as reported, approximately 93 percent of the sales volume complies with the proposed VOC limit of 350 g/l. When considering the number of products reported, 91 percent of the products comply with the proposed limit.

Table 5.27-1: Complying Marketshare & Emission Reductions Reactive Penetrating Sealer

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
350	20	93%	0.00

5.27.6. Conclusion

For the new Reactive Penetrating Sealer category, we are recommending a VOC limit of 350 g/l, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on information provided by manufacturers. This would provide a consistent VOC limit for Reactive Penetrating Sealers and Concrete Curing Compounds. Both of these categories use similar reactive penetrating materials, but the products in the Concrete Curing Compound category must be suitable for use on freshly poured concrete. Other types of concrete and masonry coatings that do not meet the criteria for Reactive Penetrating Sealer would be covered by another category (e.g., Concrete/Masonry Sealer, Basement Specialty Coating, Waterproofing Membrane, etc.).

The proposed VOC limit is higher than the 100 g/l limit contained in SCAQMD Rule 1113. However, manufacturers that provide coatings in the SCAQMD can still sell products which exceed the 100 g/l limit, if they participate in South Coast AQMD's averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit. In addition, the emission reduction losses for this category are negligible for a 350 g/l limit as compared to a 100 g/l limit. The proposed SCM VOC limit is lower than the national limit of 600 g/l promulgated by the U.S. EPA. The proposed limit is lower than the limit for Waterproofing Concrete/Masonry Sealers (400 g/l) and higher than the limit for Waterproofing Sealers (250 g/l), as adopted by the OTC states and proposed by Canada.

5.28. RECYCLED COATINGS

VOC Limit Table (g/l)

USEPA: N/A	Canada: 250	OTC: 250	SCAQMD: 250	SCM Proposed: 250

5.28.1. Category Definition

An architectural coating formulated such that it contains a minimum of 50% by volume post-consumer coating, with a maximum of 50% by volume secondary industrial materials or virgin materials.

5.28.2. Major Proposed Changes

- The definition for Recycled Coatings was modified to be similar to the criteria established for Green Seal certification.

5.28.3. Coating Description

Recycled Coatings are waterborne topcoats and primers, with sheens ranging from flat to semigloss. These products are generally identified as latex coatings with acrylic resins, and some manufacturers can custom-match colors. Recycled Coatings are generally collected at community household hazardous waste collection sites. Some manufacturers sell their recycled coatings through their retail stores. Other manufacturers receive coatings from counties, then reprocess the coating, and sell the product back to the county.

Recycled Coatings are typically applied by brush, roller, or spray and are used by professional contractors and homeowners. Local governments often use Recycled Coatings in graffiti abatement programs.

The State of California has developed programs to encourage the purchase of recycled coatings. The State Agency Buy Recycled Campaign (SABRC) is a joint effort between the California Integrated Waste Management Board (CIWMB) and the Department of General Services (DGS) to implement State law that requires State agencies and the Legislature to purchase products with recycled content (CIWMB, 2007, 2007a). State regulations contain purchasing requirements for State agencies and the State legislature (CPC, 2007). Under these requirements, at least 50 percent of paint purchases made by state agencies must be recycled products which contain at least 50% post-consumer content.

Environmentally Preferable Purchasing (EPP) is another State program that promotes the procurement of recycled products that have a reduced impact on human health and the environment (CPC, 2007a).

In August 2006, Green Seal published GS-43, "Environmental Standard for Recycled-Content Latex Paint", which defined two categories of recycled coatings (GS, 2006):

- Consolidated Paint - Contains a minimum of 95% by volume post-consumer paint with a maximum of 5% by volume secondary industrial materials or virgin materials.
- Reprocessed Paint - Contains a minimum of 50% by volume post-consumer paint, with a maximum of 50% by volume secondary industrial materials or virgin materials.

As of June 2007, Green Seal had not yet published a certified product list for recycled paints.

Master Painter's Institute (MPI) has also defined standards for two classes of recycled coatings (Remanufactured and Consolidated) at various gloss levels (MPI, 2007):

- MPI Standards for Latex Recycled (Remanufactured) Coatings - Contains a minimum of 50% by volume post-consumer paint and a maximum of 50% by volume secondary industrial materials or virgin materials.
  MPI Standards for Remanufactured Coatings include MPI #10RR (Exterior Flat); MPI #15RR (Exterior Low Sheen); MPI #44RR (Interior MPI Gloss Level 2); and MPI #53RR (Interior MPI Gloss Level 1).
- MPI Standards for Latex Recycled (Consolidated) Coatings - Contains a minimum of 95% post consumer paint, with a maximum of 5% by volume secondary industrial materials, or virgin material. MPI Standards for Consolidated Coatings include MPI #10RC (Exterior Flat); MPI #15RC (Exterior Low Sheen); MPI #44RC (Interior MPI Gloss Level 2); and MPI #53RC (Interior MPI Gloss Level 1).

As of June 2007, Master Painter's Institute was accepting products for certification, but they had not yet published lists of approved recycled paints.

5.28.4. Substrates/Exposures

Recycled Coatings can be used on a variety of interior and exterior surfaces, such as drywall, concrete/masonry (e.g., concrete block, stucco, etc.), wood, and metal.

5.28.5. Survey Results

Table 5.28-1 summarizes our estimate of sales and VOC emissions from the Recycled Coatings category, as reported for the ARB survey.

Table 5.28-1: Survey Data
Recycled Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	0	0	-	-	-	-	-	-	-
WB	7	223,381	100%	0%	46%	54%	0%	193	0.00
Total	**7**	**223,381**		**0%**	**46%**	**54%**	**0%**	**193**	**0.00**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

The sales volume for Recycled Coatings represents about 0.2 percent of the total California sales volume of architectural coatings in 2004. No VOC emissions are calculated for Recycled Coatings, because it is assumed that the emissions have already been accounted for, based on the original coating. When compared to the data reported for calendar year 2000, Recycled Coating sales volume decreased 31 percent in 2004 and the sales-weighted average VOC content decreased 5 percent.

Table 5.28-2 contains the complying marketshare for Recycled Coatings, based on results from the ARB survey. This table shows that 100 percent of the sales volume for Recycled Coatings complies with the current VOC limit of 250 g/l. When considering the number of products reported, approximately 100 percent comply with the current limit.

Table 5.28-2: Complying Marketshare & Emission Reductions
Recycled Coatings

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
250	7	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.28.6. Manufacturer Information

The California Integrated Waste Management Board has developed a Recycled Content Product Directory in support of the State Agency Buy Recycled Campaign. This directory lists several suppliers of Recycled Coatings that have been certified as “SABRC Compliant”, including: Amazon Environmental, Inc.; Kathleen and Company; Kelly-Moore; Visions Recycling; and Xstream Coatings.

5.28.7. Conclusion

We recommend maintaining a 250 g/l VOC limit for Recycled Coatings. This VOC limit is technologically and commercially feasible, based on the high complying marketshare. The SCM VOC limit is the same as the VOC limits adopted by the South Coast AQMD and the OTC states. The SCM VOC limit is also the same as the limit proposed for Canada.

The proposed limit for Recycled Coatings is higher than the proposed limits for Flat, Nonflat, and Nonflat - High Gloss coatings, because to encourage recycling, the limit needs to accommodate older coatings that consumers have yet to turn over to recycling collection events. As recently as 2002, the VOC limits for many latex house paints were 250 g/l, and in the non-SCAQMD portion of California, the current VOC limit for Nonflat - High Gloss coatings is 250 g/l. Accordingly, we believe it makes sense to keep the VOC limit for Recycled Coatings at 250 g/l, to accommodate the VOC contents of the “feedstock” coatings.

5.29. ROOF COATING

VOC Limit Table (g/l)

USEPA: 250	Canada: 250	OTC: 250	SCAQMD: 50	SCM Proposed: 50

5.29.1. Category Definition

A non-bituminous coating labeled and formulated for application to roofs for the primary purpose of preventing water penetration, reflecting ultraviolet light, or reflecting solar radiation.

5.29.2. Major Proposed Changes

- The proposed VOC limit for Roof Coatings would decrease from 250 g/l to 50 g/l.
- The definition has been revised for clarification purposes.

5.29.3. Coating Description

Roof Coatings are used to prevent water penetration and UV absorption to increase the longevity of a roofing system. Roof Coatings can be applied without primers and can adhere well to old coatings, including oil-based paints (AJ, 2006). Roof Coatings can be used to restore or rehabilitate a roof, which may be a more cost-effective option than completely replacing the roof system (Daisey, 2006). Depending on the product composition, Roof Coatings will lose some reflectance, due to dirt pickup, over several years of exposure. Therefore, recoating is recommended every 7 to 10 years to improve reflectivity (Zielnik, 2006; Zielnik, 2006b).

Roof Coatings are designed to possess many different properties to withstand environmental and substrate material stresses. Desired characteristics of a well-performing roof coating include: elongation to deal with thermal-mechanical stresses; tensile strength to handle potential tears and rips from foot traffic and impactions; and solar reflectivity and thermal emissivity to reduce roof and building heat gain. Solar reflectance is the amount of solar radiation not absorbed and thermal emittance is the amount of heat given off of the surface. The advantage of high thermal emissivity and solar reflectivity is that it reduces energy use during peak demand when rates are highest, and helps reduce the demand charge that a facility owner or homeowner pays year-round on the basis of peak demand use (Zielnik, 2006). Metal roofs can benefit greatly from white roof coatings since they are naturally reflective, but exhibit poor emissive properties. Uncoated bare metal roofs have an emissivity of about 10 percent while roofs that are coated with white reflective elastomeric paints have an emissivity as high as 80+ percent (Daisey, 2006). These coatings can also be used to extend the life of many traditional roofing systems. Applying protective solar reflective coatings can be advantageous, not only for energy savings from cooling demand, but also because they have the potential to improve the longevity of a roof by adding a barrier to water damage and UV light (Radiation Control Fact Sheet, 2005).

Roof Coatings can be applied by brush, roller, and sprayer but specialized equipment may be required, depending on the resin and substrate. When applied, these coatings are naturally smooth and vary from flat to high gloss, but texture is dependent on roofing substrate and system. Since they can be used for residential, commercial, and industrial purposes, they are generally applied by contractors and professional roofers. However, homeowners can also apply these coatings. Application limitations that may hinder adhesion and coating properties are rain within 24 hours of application, and newly laid asphalt/bituminous coatings that must cure at least 30 to 90 days prior to application to ensure “tobacco juices” are removed. Newly mixed and poured concrete must cure for at least 14 to 30 days prior to application of Roof Coatings.

Roof Coatings can also be applied over spray polyurethane foam (SPF) systems. These systems are unique in that they provide both insulation and waterproofing characteristics, while performing as a long service life coating with periodic repairs and maintenance (JAC, 2007a). Some advantages of these coatings are a high strength-to-area ratio coupled with energy savings. With polyurethane foam as an insulator/waterproofer, reflective Roof Coatings could potentially perform substantially better and have improved longevity due to the ease of repair, maintenance, and low roof load. An example of such an application is within a Dallas school district. Since the 1980s, this district has applied SPF with white reflective topcoats to roughly 140 schools, due to the associated benefits of energy savings, serviceability, and renewability (JAC, 2007b). This is

advantageous because costly roof removal and installation is eliminated. Many Roof Coatings are suitable for the application over SPF roofs.

Most Roof Coatings are waterborne single component products with resins that include: acrylic, acrylic copolymer, epoxy, silicones, vinyl acrylic copolymer, polyvinyl acetate, or a combination of these resins for varied properties and environmental conditions. Waterborne Roof Coatings have achieved greater market acceptance because of features related to performance, cost, and health and safety (Sosinski, 2006). Acrylics are resistant to chemically- and photochemically-induced polymer degradation, because their main polymer chain is a carbon-to-carbon single bond, making them relatively inert and not as susceptible to chemical change (Sherwin-Williams, 2001). This durability promotes good weathering performance, due to resistance to hydrolysis and lack of UV absorption (AJ, 2006).

Solventborne Roof Coatings are usually single component, but multi-component products are available. Solventborne single component roof coatings have resins that include: amines/amides, chlorinated rubber, epoxy, urethane, polyurethane, silicones, and acrylic copolymers. Multi-component Roof Coatings are solventborne products with resins such as urethane, polyurethane, amides/amines, and epoxies. These multi-component urethanes are the only solventborne products that will meet the proposed VOC limit of 50 g/l.

All Roof Coatings have volume percent solids that range from around 30 percent to 100 percent, with an average of 50 percent. Solventborne products contain the highest volume solids on average with a range of 39 to 100 percent, while the volume solids for waterborne products ranges from 14 to 66 percent. Typically, thicker coating layers correlate to better performance because it takes longer for the coating to degrade. Some manufacturers recommend that two coats be applied to create a relatively thick coating to ensure development of protective properties. Application temperatures for both waterborne and solventborne products typically range from 50 to 100 degrees F, with extremes of 35 to 120 degrees F.

Some manufacturers commented that solventborne Roof Coatings are needed for cold temperature applications. Application temperatures are generally the same for solventborne and waterborne coatings, but solventborne coatings typically have shorter curing times due to solvent evaporation, even in temperatures near freezing. Evaporation of water from waterborne coatings is not ideal in cold temperatures, especially near freezing. The faster cure time for solventborne coatings can be advantageous in unpredictable weather conditions, because it helps prevent the coating from washing off if unexpected rain or freezing temperatures occur within the first 24 hours of application. Waterborne products can potentially be ruined when subjected to similar weather conditions. However, in general, roof coatings should be applied when the temperature is at least 5 degrees F above the dew point for best adhesion and cure.

Some manufacturers expressed concern that the proposed 50 g/l VOC limit will induce premature coating failures because low-VOC coatings can be difficult to apply in cold, humid, or rainy climates. Most of California's residents live in temperate climatic conditions that are suitable for the application of lower VOC products. However, residents of the Sierra Nevada, Northern California, and other parts of the country (e.g. the Northeast and Midwest) are subject to less temperate climates that may not permit the use of lower VOC products during certain times of the year. Roof Coating application and adhesion can be adversely impacted by unexpected rain, heavy dew, thick fog, and extremely cold temperatures.

5.29.4. Substrates/Exposures

Roof Coatings are applied to exterior residential, commercial, and industrial roofs. Roof Coatings can be applied on a wide array of substrates such as metal, concrete, primed wood, cured asphalt roofs, and polyurethane foam. Polyurethane foam is becoming a more popular substrate for roof applications due to its low roof load weight and insulating capacity.

Roof Coatings are not intended for use on roof systems that are susceptible to ponding water, and they require a surface that is clean and free of dirt, dust, oil, surface chemicals, or other contaminants for best adhesion. However, some products can have excellent resistance to ponding water.

5.29.5. Survey Results

Table 5.29-1 summarizes our estimate of sales and VOC emissions from Roof Coatings, based on the ARB survey. In 2004, the sales volume for Roof Coatings in California was 1.4 million gallons which represents 1.3 percent of the total California sales volume for architectural coatings. Waterborne Roof Coatings represent 97 percent of the market and have a sales-weighted average (SWA) VOC Regulatory value of 40 g/l, which is below the proposed 50 g/l VOC limit. The overall sales-weighted average VOC Regulatory value for Roof Coatings is 46 g/l and it has decreased 33 percent from 2000 to 2004.

In 2004, VOC emissions from Roof Coatings were about 0.4 tpd, which represents approximately 0.4 percent of the total emissions from architectural coatings. Solventborne coatings produce about 30 percent of the emissions, but only account for 3 percent of the sales volume. According to the ARB survey, roughly 3 tpd of VOCs are released from coatings related to roofing, including emissions from Aluminum Roof, Bituminous Roof, Bituminous Roof Primer, and Roof Coatings.

Table 5.29-1: Survey Data
Roof Coatings

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	32	42,967	3%	0%	100%	0%	2%	232	0.11
WB	180	1,363,922	97%	0%	100%	0%	0%	40	0.28
Total	**212**	**1,406,889**		**0%**	**100%**	**0%**	**0%**	**46**	**0.39**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.29-2 contains the complying marketshare for Roof Coatings, based on the ARB survey. This table shows that 83 percent of the sales volume for Roof Coatings complies with the proposed VOC limit. The expected VOC emission reductions for the proposed limit are 0.07 tpd.

Table 5.29-2: Complying Marketshare & Emission Reductions
Roof Coatings

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
50	112	83%	0.07

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

A listing of Roof Coating manufacturers and products that comply with the proposed VOC limit is provided on ARB's website (www.arb.ca.gov/coatings/arch/docs.htm). Of the 38 companies that reported in this category, 23 offered Roof Coatings that comply with the proposed limit. Of these 23 companies, 13 are considered to be small businesses because they have fewer than 250 employees.

5.29.6. Manufacturer and Industry Issues

Many manufacturers and industry representatives have expressed concerns about certain aspects of the proposed SCM regarding VOC limits, definitions, and other technical issues. Below are key issues that have been brought to our attention during our interactions with the industry representatives.

5.29.6.1. Issue: The Roof Coatings Manufacturers Association (RCMA) and the National Paint and Coatings Association (NPCA) have expressed concerns about premature performance failures of low-VOC roof coating products, because they are not designed for colder, humid, and/or rainy climates. Also, they believe that premature application failures are a result of applying coatings in temperatures or humid conditions not suitable for

lower VOC coatings. They believe that these premature failures could reduce life cycle performance and increase waste generation.

Response: Based on manufacturer product data sheets, total sales volume, and complying marketshare, it appears that some waterborne products are more prone to an application temperature minimum of 50 degrees Fahrenheit. However, the high complying marketshare indicates that waterborne products are just as effective as higher VOC solventborne coatings while providing adequate protection from cold, humid, and/or rainy climates.

5.29.6.2. Issue: The NPCA and RCMA recommend the use of a reactivity-based approach for regulating Roof Coatings. Some industry representatives have suggested that the ARB use the units of grams of ozone generated per gallon of coating to establish a reactivity-based standard. Industry representatives have also suggested that low-reactive products with higher VOC contents should be exempt from future SCM limits because they have lower ozone formation potential. Industry representatives have suggested that lower-reactivity products could be formulated by replacing some hydrocarbon solvents with other hydrocarbon solvents that have a lower maximum incremental reactivity (MIR) value.

Response: ARB staff analyzed industry's proposed approach for developing Roof Coatings with a reduced ozone formation potential. The maximum ozone formation potential can be determined based on the MIR value for each of the chemicals contained in a coating. Since hydrocarbon (HC) solvents are mixtures of several chemicals, ARB developed a bin system to assign MIR values to hydrocarbon solvents, based on boiling point and chemical characteristics (ARB, 2007). For hydrocarbon solvents, the assigned MIR values range from 0.81 grams ozone per gram product (g O^3/g product) for Bin 12 up to 8.01 g O^3/g product for Bin 23. The most common hydrocarbon solvents reported for Roof Coatings are Bin 15 (MIR = 1.82 g O^3/g product) and Bin 22 (MIR = 7.51 g O^3/g product).

Using data from the ARB Survey, ARB staff determined that the maximum ozone formation potential (OFP) for all Roof Coatings was 0.64 tpd Ozone in 2004, outside of the South Coast AQMD (ARB, 2007). Implementing a 50 g/l VOC limit is expected to achieve an emission reduction of 0.07 tpd and a corresponding ozone reduction of 0.20 tpd, outside of the South Coast AQMD.

ARB staff identified all of the Roof Coatings that contained hydrocarbon solvents with MIR values greater than 1.82 g O^3/g product. Based on industry recommendations, staff assumed that all of these higher-MIR

solvents were replaced with Bin 15 hydrocarbon solvents that had an MIR value of 1.82 g O^3/g product or with a blend of hydrocarbon solvents that had an MIR value of 2.50 g O^3/g product. If this type of substitution occurred, ARB staff estimates that the maximum ozone formation potential would be 0.62 tpd, outside of the South Coast AQMD. This indicates that about 0.02 tpd of ozone reduction could occur by reformulating existing Roof Coatings at current VOC levels. This analysis assumes that the hydrocarbon substitution would be on an equivalent mass basis. However, industry representatives acknowledge that they might need to use larger amounts (e.g., 20% more) of the low-MIR hydrocarbon solvents to achieve a solvency that is comparable to the higher-MIR solvents. Therefore, the amount of ozone reduction from a reactivity-based limit would likely be less than 0.02 tpd. This amount is less than the reduction that would be expected from establishing a mass-based VOC limit at 50 g/l. Based on this analysis, it does not appear that a reactivity-based limit would achieve emission reductions beyond what could be achieved by implementing the proposed mass-based limit of 50 g/l. Since a reactivity-based limit would require additional district resources, without providing an increase in reductions, ARB staff determined that the proposed mass-based limit was preferable.

5.29.6.3. Issue: RCMA stated that, in California, waterborne emulsions are applied as part of regular roof maintenance during summer while solventborne coatings are used during storms to repair leaking roofs.

Response: Although waterborne emulsions can be applied as part of regular roof maintenance and solventborne coatings can be used during storms to repair leaks, this may not always be the case. The ARB has recognized the need for emergency repair and has omitted adhesives, sealants, and cements from this SCM as they fall under districts' adhesion rules. These coatings are subject to district rules, and generally, have higher VOC limits to ensure a proper application, cure, and repair to handle unpredictable roof incidents during inclement weather.

5.29.6.4. Issue: RCMA believes that lowering the VOC content may result in greater quantities of coating used per square foot, because compliant coatings have a higher viscosity and using them could increase solvent release, ozone formation, and consumer costs. They believe this could also lead to higher ozone formation by forcing manufacturers to switch to highly reactive solvents.

Response: Staff believes manufacturers will comply with the 50 g/l limit through the use of waterborne products that have a lower viscosity. The high complying marketshare consists of waterborne emulsions. Therefore, staff doesn't expect an increase in quantities used per square foot.

5.29.6.5. Issue: RCMA believes that lowering the VOC content may result in the use of toxic solvents such as ethylene glycol as a replacement for propylene glycol.

Response: The change from propylene glycol to ethylene glycol has already occurred. More than 27% of the solvent use in this category is ethylene glycol versus less than 0.1% use of propylene glycol. Thus, ARB does not believe that lowering the VOC limit will result in coatings that are more toxic than presently exist.

5.29.7. Conclusion

We recommend a 50 g/l VOC limit for Roof Coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare, the number of companies making compliant products, and product information from manufacturers. The proposed limit is lower than the limit adopted by the U.S. EPA and OTC states, and the proposed limit for Canada. The proposed limit is consistent with the limit adopted by the South Coast AQMD.

5.30. RUST PREVENTATIVE

VOC Limit Table (g/l)

USEPA: 400	Canada: 400	OTC: 400	SCAQMD: 100	SCM Proposed: 250

5.30.1. Category Definition

A coating formulated to prevent the corrosion of metal surfaces for one or more of the following applications:

- Direct-to-metal coating; or
- Coating intended for application over rusty previously coated surfaces.

The Rust Preventative category does not include the following:

- Coatings that are required to be applied as a topcoat over a primer; or
- Coatings that are intended for use on wood or any other non-metallic surface.

Rust Preventative coatings are for metal substrates only and must be labeled as such, in accordance with the labeling requirements in the SCM.

5.30.2. Major Proposed Changes

- The Rust Preventative category is limited to direct-to-metal (DTM) coatings and coatings that can be applied over rust.
- Rust Preventative coatings are not limited to non-industrial uses. The definition has been revised to allow the use of Rust Preventative coatings for industrial applications.
- The proposed VOC limit for Rust Preventative Coatings is decreasing from 400 g/l to 250 g/l.

5.30.3. Coating Description

Rust Preventative coatings are used to provide corrosion protection for metal substrates. This category does not include coatings that are recommended for nonmetallic substrates (e.g., wood, masonry, plaster, drywall, fiberglass, etc.). Rust Preventative coatings are applied directly to metal, or over previously coated surfaces that exhibit corrosion. The finish can range from flat to glossy and the coatings can be applied with a brush, roller, or spray gun. Rust Preventative coatings are used by homeowners, contractors, maintenance personnel, and professional painters.

This category was originally intended for those who are not professional paint contractors, such as homeowners and maintenance personnel. The intent was to provide an effective, single component product that would prevent corrosion of metal substrates for residential and commercial uses. However, after implementation of the 2000 SCM, ARB staff found that products from other categories were shifted to the Rust Preventative category which still allowed for the use of higher VOC solventborne alkyd technology. After the Industrial Maintenance 250 g/l limit became effective, many Industrial Maintenance products were re-labeled as Rust Preventative coatings. Based on ARB's survey, the Rust Preventative category is primarily comprised of solventborne coatings that would not meet the Industrial Maintenance VOC limit. The Rust Preventative category also includes products that were shifted from other categories with lowered VOC limits (e.g., Primers, Sealers, and Undercoaters).

Some products in the category contain a corrosion inhibitor. Corrosion inhibitors are additives which alleviate or slow down the electrochemical oxidation of metals by forming an electrically insulating and/or chemically impermeable coating on exposed metal surfaces to suppress electrochemical reactions. Common materials used for this purpose are chromates, phosphates, and a wide range of specially-designed chemicals that resemble surfactants. Some inhibitors are added to waterborne Rust Preventative coatings to prevent corrosion that occurs during the drying process (Halox, 2006).

Traditional coatings in this category use alkyd resins for their good performance combined with ease of application. Most of these are solventborne and have

VOC contents above 300 g/l. Under the proposed SCM, small containers (one quart or less) of solventborne alkyd coatings can still be used for residential applications and small projects.

Rust Preventative coatings that comply with the proposed 250 g/l limit are predominantly single component waterborne coatings using acrylic latex resins. These types of coatings are currently used in light and medium Industrial Maintenance applications, including the protection of metal substrates from exterior exposure. For Rust Preventative coatings that were sold in 2004, ARB's survey shows a low complying marketshare. However, most of the products using waterborne acrylic technology were reported in the Industrial Maintenance category. Advantages of this technology include ease of cleanup, less hazardous waste disposal, fewer concerns with flammability, single component ease of use, and corrosion resistance performance (AJ, 2006; Medford, 1995; Procopio, 2003).

5.30.4. Substrates/Exposures

Rust Preventative coatings are used indoors or outdoors on a variety of metal substrates that are exposed to corrosive environments, or on previously coated surfaces that show existing signs of corrosion. These substrates include iron, steel, aluminum, galvanized iron, galvanized steel, etc. Coatings that are intended for use on non-metal substrates are not included in the Rust Preventative category. Substrates are prepared by sanding, high pressure wash, wire brush, or cleaning with a solvent.

5.30.5. Survey Results

Table 5.30-1 summarizes our estimate of sales and VOC emissions for Rust Preventative coatings, based on the ARB survey. Solventborne coatings represent about 96 percent of the Rust Preventative sales volume. The total sales volume for Rust Preventative coatings has increased from about 63,000 gallons in 1996, to about 210,000 gallons in 2000, and to about 2,000,000 gallons in 2004. About 11 percent of the sales volume for 2004 came from small containers.

Table 5.30-1: Survey Data
Rust Preventative

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	498	2,004,661	96%	30%	4%	66%	11%	376	8.59
WB	126	90,839	4%	5%	38%	56%	14%	198	0.09
Total	**624**	**2,095,500**		**29%**	**6%**	**66%**	**11%**	**368**	**8.68**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.30-2 contains the complying marketshare for Rust Preventative coatings, based on the ARB survey. This table shows that about 3 percent of the sales volume for Rust Preventative coatings complies with the proposed VOC limit. Although the complying marketshare from the survey data is low, several products in the Industrial Maintenance category exist that reflect the characteristics and use of complying Rust Preventative coatings. Complying waterborne acrylic latex coatings that can be applied to metal in the Industrial Maintenance category represent about 270,000 gallons from 288 products. If added to the existing complying products in the Rust Preventative category, the complying marketshare would increase to about 16 percent.

Table 5.30-2 shows that implementing the proposed 250 g/l limit would achieve approximately 1.6 tpd in VOC emission reductions for the non-South Coast AQMD portion of California, on an annual average basis.

Table 5.30-2: Complying Marketshare & Emission Reductions
Rust Preventative

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
250	52	3%	1.57

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.30.6. Conclusion

We recommend a 250 g/l VOC limit for Rust Preventative coatings, effective January 1, 2012. This extra time is needed to provide Rust Preventative manufacturers time to reformulate low VOC alkyd technologies. Under the proposed VOC limit and the proposed definition, most solventborne coatings and topcoats would be excluded from the category. Lowering the VOC limit from 400 g/l to 250 g/l will eliminate many high-VOC solventborne coatings that were shifted to the Rust Preventative category after VOC limits were implemented from the 2000 SCM. New products in this category and existing products that

comply with the proposed limit are expected to use waterborne acrylic latex technology. These types of products have previously been used in the Industrial Maintenance category to protect metal substrates from corrosion. These coatings generally have VOC contents under 250 g/l and are predominantly single component. Although the current Rust Preventative category is primarily comprised of solventborne alkyd coatings, it is technologically feasible to protect metal substrates from corrosion with waterborne acrylic coatings.

The proposed VOC limit for the Rust Preventative category is higher than the 100 g/l limit in the SCAQMD. However, coating manufacturers who sell in the SCAQMD can continue to sell high-VOC Rust Preventative coatings if they participate in the SCAQMD averaging program. Since the SCM does not have an averaging provision, we believe a 250 g/l VOC limit is appropriate for this category.

5.31. SHELLACS

VOC Limit Table (g/l)

USEPA:	Canada:	OTC:	SCAQMD:	SCM Proposed:
730 Clear 550 Opaque	730 Clear 550 Opaque	730 Clear 550 Opaque	730 Clear 550 Opaque	730 Clear 550 Opaque

5.31.1. Category Definition

A clear or opaque coating formulated solely with the resinous secretions of the lac beetle (Laciffer lacca), and formulated to dry by evaporation without chemical reaction.

5.31.2. Major Proposed Changes

- The definition for Shellac has been revised to remove the words “thinned with alcohol”, which allows for the inclusion of products that are not thinned with alcohol.

5.31.3. Coating Description

Shellac is a natural organic resin that comes from a beetle (Laciffer lacca) about the size of an apple seed. The beetle alights on certain trees indigenous to India and Thailand and, during its reproductive cycle, feeds on the sap of the tree. The beetle secretes an amber colored resinous substance called lac, which forms a cocoon around the beetle. This cocoon is the raw material for shellac, and is called sticklac because it contains resin, parts of the twig and bug remains. The sticklac is washed and then refined.

Dried shellac resin is dissolved in solvent (typically ethanol) to produce Shellac coating. Once the dry flakes are dissolved in ethanol, esterificaton begins.

Esterification proceeds more rapidly when the unused Shellac coatings are stored at high temperatures and, over time, the alcohol modifies the shellac resins causing the unused coating to become gummy and lose the ability to dry (Jewitt, 2007). For this reason, Shellac coatings should not be stored above 75 ^{0} F (Zinsser, 2004).

The ratio of dry shellac flakes dissolved in solvent is referred to as the “cut”, and refers to the amount (in pounds) of dry shellac flakes dissolved in one gallon of solvent. For example, a 3-pound cut would consist of 3 pounds of shellac dissolved in 1 gallon of alcohol.

Because Shellac coatings re-dissolve in alcohol, newly applied Shellac coating “melts” into previously applied Shellac coatings. This ease of repair on finished substrates is frequently cited as an advantage of Shellac coatings. The ability of Shellac coatings to withstand damage by water decreases as the film coating ages (Jewitt, 2007).

Aqueous solutions of inorganic alkalis readily dissolve shellac. Shellac is insoluble in ester, ethers (except glycol ethers), hydrocarbons, chlorinated solvents, and water. It can be dispersed in water with soda ash, borax, ammonia, morpholine, or triethanolamine (Zimmer, 1997). Usually the milder alkalis such as ammonia, borax, and sodium carbonate are used to prepare aqueous solutions (Indian Shellac, 2007). The details of a water-dispersed Shellac coating, which was not reported in the survey, are provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

All products reported in this category are solventborne single component coatings. Shellac coatings can be applied with a brush, pad, sprayer, or wiping cloth, and are used by professionals, homeowners, and hobbyists.

5.31.4. Substrates/Exposures

Clear Shellac coatings are typically used on new unsealed wood or over existing wood finishes, and for sealing metal surfaces. Opaque Shellac coatings are primarily used on substrates where light transmission is not necessary and masking of discolored surfaces is desired, such as stain damaged drywall. Shellac coatings can also be used on metal, vinyl, polyvinyl chloride (PVC), fiberglass, and masonry. Due to water sensitivity, Shellac coatings that can be used indoors and outdoors typically limit exterior use to spot priming, to be followed by full-surface priming with a waterborne or solventborne primer.

Shellac coatings should not be used on surfaces where hot items are to be placed because Shellac coatings are sensitive to heat, beginning to soften at about 150 ^{0} F. Depending on the wax content of the Shellac coating, white areas may form on the surface of the coating when subjected to water. Because of their acidic composition, alkaline compounds such as those found in some

household cleaning products will mar and discolor Shellac coatings (Jewitt, 2007).

5.31.5. Survey Results

Information on Clear Shellac coatings and Opaque Shellac coatings was collected separately in the ARB survey, and is presented as reported in this section.

Table 5.31-1a summarizes ARB survey data for Clear Shellac coatings. We are unable to state the 2004 sales volume for Clear Shellac coatings as these data are protected to preserve confidentiality.

Solventborne Clear Shellac coatings represent 100 percent of the market and generally have VOC levels lower than 730 g/l, the current SCM VOC limit. We are unable to comment on the relative increase/decrease in sales volume for Clear Shellac coatings from 2000 to 2004, because sales data from both surveys are protected. The overall sales-weighted average VOC level for Clear Shellac coatings has increased slightly (about 3 percent) from 2000 to 2004. While it is technologically feasible to produce Clear Shellac coatings at 600 g/l, the emission reduction benefits that would be gained from a 600 g/l VOC limit are negligible.

VOC emissions from Clear Shellac coatings are about 0.35 tpd, which represents approximately 0.37 percent of the total emissions from architectural coatings. All of the products sold in this category are solventborne; therefore all of the emissions are attributable to solventborne coatings.

Table 5.31-1a: Survey Data
Shellacs - Clear

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	8	PD	100%	100%	0%	0%	27%	617	0.35
WB	0	0	-	-	-	-	-	-	-
Total	**8**	**PD**		**100%**	**0%**	**0%**	**27%**	**617**	**0.35**

(ARB, 2006)
1. PD= Protected Data. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.31-1b summarizes ARB survey data for the Opaque Shellac coatings category. We are unable to state the 2004 sales volume for Opaque Shellac coatings as these data are protected to preserve confidentiality.

Solventborne Opaque Shellac coatings represent 100 percent of the market and generally have VOC levels lower than 550 g/l, the current SCM VOC limit. We

are unable to comment on the relative increase/decrease in sales volume for Opaque Shellac coatings from 2000 to 2004, because sales data from both surveys are protected. The overall sales-weighted average VOC level for Opaque Shellac coatings has decreased slightly (about 3 percent) from 2000 to 2004.

VOC emissions from Opaque Shellac coatings are about 0.81 tpd, which represents approximately 0.86 percent of the total emissions from architectural coatings. All of the products sold in this category are solventborne; therefore, all of the emissions are attributable to solventborne coatings.

Table 5.31-1b: Survey Data
Shellacs - Opaque

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	2	PD	100%	0%	0%	100%	2%	521	0.81
WB	0	0	-	-	-	-	-	-	-
Total	**2**	**PD**		**0%**	**0%**	**100%**	**2%**	**521**	**0.81**

(ARB, 2006)
1. PD = Protected Data. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.31-2a contains the complying marketshare for Clear Shellac coatings, based on results from the ARB survey. This table shows that 100 percent of the sales volume for Clear Shellac coatings complies with the existing VOC limit of 730 g/l.

Table 5.31-2a: Complying Marketshare & Emission Reductions
Shellacs - Clear

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
730	8	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Table 5.31-2b contains the complying marketshare for Opaque Shellac coatings, based on results from the ARB survey. This table shows that 100 percent of the marketshare of Opaque Shellac coatings complies with the existing limit of 550 g/l. While it is technologically feasible to produce Opaque Shellacs coatings at 500 g/l, implementing a VOC limit of 500 g/l would achieve negligible emission reductions.

Table 5.31-2b: Complying Marketshare & Emission Reductions Shellacs - Opaque

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
550	2	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.31.6. Future Considerations

With the proposed changes to the Wood Coatings category, Shellacs remain as the only architectural coatings category defined by its resin content. We anticipate that in the future, districts may elect to phase out the Shellac categories, and the products reported in these categories will default to the categories for which they are formulated (primarily Wood Coatings and Specialty Primers, Sealers, and Undercoaters). Many Shellac coatings claim to block water stains and smoke odors, fitting within the definition of Specialty Primers, Sealers, and Undercoaters. Clear Shellac coatings are also sold as clear wood finishes, which are covered by the Wood Coatings category.

One manufacturer asserts that Shellac coatings are necessary because professional contractors rely on them to block smoke odors and severe staining from smoke damage. Two sources contradict the assertion that Shellac coatings are the only coatings that can effectively block smoke stains. A representative of the Institute of Inspection, Cleaning and Restoration Certification, a nonprofit organization that certifies firms and technicians in cleaning and restoration, indicates that smoke particles are about 0.01 to 1 micron in size, penetrate surfaces, and are difficult to remove. It is suggested that the surface should be cleaned and then painted with a stain-blocking primer (Kenny, 2005). Others suggest that the application of gloss or semi-gloss latex coatings, which have less of a tendency to “breathe” than flat latex coatings, is sufficient to seal in odors from smoke (Joseph, 2004).

In addition to this category being somewhat redundant due to overlapping functions defined by other coating categories, the sales weighted average VOC content is extremely high. However, during a literature search, ARB staff found a water-dispersed shellac coating with a VOC content of 87 g/l.

5.31.7. Conclusion

At this time, we are not seeking to lower the existing limits of 730 g/l for Clear Shellac and 550 g/l for Opaque Shellac, because of the relatively low emissions from these categories. In the future, districts may decide to eliminate the Clear Shellac and Opaque Shellac categories. If this occurs, products that were formerly categorized as Clear Shellac coatings or Opaque Shellac coatings

would have to comply with other category limits, such as Wood Coatings or Specialty Primers, Sealers, and Undercoaters.

The current limit of 730 g/l for Clear Shellac coatings and 550 g/l for Opaque Shellac coatings is consistent with the limits adopted by the U.S. EPA, the South Coast AQMD, the OTC states, and with the proposed limit for Canada.

5.32. SPECIALTY PRIMERS, SEALERS, AND UNDERCOATERS

VOC Limit Table (g/l)

USEPA: 350 (primers and undercoaters) or 400 (sealers, including interior clear wood sealers)	Canada: 350	OTC: 350	SCAQMD: 100	SCM Proposed: 100

5.32.1. Category Definition

A coating that is formulated for application to a substrate to block water-soluble stains resulting from: fire damage; smoke damage; or water damage.

5.32.2. Major Proposed Changes

- The Specialty Primer, Sealer, and Undercoater category no longer includes those products that are used for general purpose stain blocking or to condition excessively chalky surfaces. This category now includes only those products designed to block water-soluble stains that result from fire, smoke, or water damage.
- The proposed VOC limit for the Specialty Primer, Sealer, and Undercoater category would decrease from 350 g/l to 100 g/l.

5.32.3. Coating Description

The Specialty Primer, Sealer, and Undercoater category describes coatings that are typically applied as the initial coat to block or cover water-soluble stains resulting from fire, smoke, or water damage. These products help provide a suitable substrate for subsequent coatings by providing a good bonding surface and preventing stains from being seen through the topcoat. Specialty Primers, Sealers, and Undercoaters are typically sprayed, rolled, or brushed on to the substrate and are used in residential and commercial settings by homeowners and professionals.

All of the reported Specialty Primers, Sealers, and Undercoaters were single component products and most were solventborne. Most of the reported lower-VOC (waterborne) coatings were formulated with acrylic, acrylic copolymer, or vinyl acrylic copolymer resins, while the higher-VOC (solventborne) products typically contained alkyd or styrene butadiene resins.

Note that the proposed Specialty Primer, Sealer, and Undercoater category would no longer include those products for use on excessively chalky surfaces, or those used for general purpose stain blocking. Stain blocking, for the purposes of this category, is limited to water-soluble stains resulting from fire, smoke, and water damage. Many of the coatings that fall within the Primer, Sealer, and Undercoater category have characteristics similar to those coatings previously defined as Specialty Primer, Sealer, Undercoater products. Specifically, they claim to block tannin stains, condition excessively chalky surfaces, and conceal stains that are not water-soluble.

5.32.4. Substrates/Exposures

Specialty Primers, Sealers, and Undercoaters can be used on a large variety of interior and exterior substrates including drywall, plaster, brick, concrete block, wood siding, and stucco. Because these products are topcoated, they are not exposed to substances in the environment, but must tolerate the environment of the substrate to which they are applied and the environment of the coating that serves as a topcoat. The product data sheets for many Specialty Primers, Sealers, and Undercoaters specify a time frame within which they must be topcoated. If not topcoated within the specified time frame, additional surface preparation and/or recoating prior to topcoating may be necessary. As the substrates and topcoats used with Specialty Primers, Sealers, and Undercoaters vary widely, so does the range of conditions to which they must be resistant. Specialty Primers, Sealers, and Undercoaters may need to be resistant to and perform well under conditions that are alkaline, acid, porous, non-porous, etc.

5.32.5. Survey Results

Table 5.32-1 summarizes our estimate of sales and VOC emissions for Specialty Primers, Sealers, and Undercoaters, based on the ARB survey. Specialty Primers, Sealers, and Undercoaters represent the 8th largest coating category with regard to sales volume and the 7th largest coating category with regard to VOC emissions. In 2004, the sales volume for Specialty Primers, Sealers, and Undercoaters in California was approximately 2 million gallons. This represents about 1.8 percent of the total California sales volume for architectural coatings.

Waterborne Specialty Primers, Sealers, and Undercoaters represent approximately 24 percent of the sales volume. Solventborne products represent 76 percent of the sales volume and generally have VOC levels less than 350 g/l, the current SCM VOC limit. The sales volume for solventborne Specialty Primers, Sealers, and Undercoaters has increased approximately 7,000 percent from 2000 to 2004, while the overall sales volume has increased more than 400 percent. These large increases can be attributed to the introduction of new products into the market. In addition, part of the increase resulted when manufacturers re-classified Quick Dry Primers, Sealers, and Undercoaters and

Primers, Sealers, and Undercoaters as Specialty Primers, Sealers, and Undercoaters, because the VOC limits for Quick Dry Primers, Sealers and Undercoaters and Primers, Sealers, and Undercoaters were reduced. This disproportionate increase in the use of solventborne coatings has caused an increase in the overall sales-weighted average VOC level for Specialty Primers, Sealers, and Undercoaters of 136 percent, rising from an overall SWA of 120 g/l in 2000 to an overall SWA of 283 g/l in 2004.

VOC emissions from Specialty Primers, Sealers, and Undercoaters are about 6.2 tpd, which represents approximately 6.6 percent of the total emissions from architectural coatings. Over three-quarters of the Specialty Primers, Sealers, and Undercoaters are solventborne and they account for more than 96 percent of the VOC emissions from this category.

Table 5.32-1: Survey Data
Specialty Primers, Sealers and Undercoaters

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	74	1,532,541	76%	0%	7%	93%	2%	343	6.01
WB	45	476,924	24%	8%	4%	88%	2%	89	0.23
Total	**119**	**2,009,464**		**2%**	**6%**	**92%**	**2%**	**283**	**6.23**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.32-2 contains the complying marketshare for Specialty Primers, Sealers, and Undercoaters, based on the ARB survey. This table shows that about 22 percent of the sales volume for Specialty Primers, Sealers, and Undercoaters complies with the proposed VOC limit. When considering the number of products reported, approximately 26 percent of the reported products comply with the proposed limit.

Table 5.32-2 shows that implementing the proposed 100 g/l limit would achieve approximately 2.6 tpd in VOC emission reductions for the non-South Coast AQMD portion of California, on an annual average basis.

Table 5.32-2: Complying Marketshare & Emission Reductions
Specialty Primers, Sealers and Undercoaters

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
100	25	22%	2.62

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Considering Specialty Primers, Sealers, and Undercoaters formulated for interior and exterior use separately, the survey data indicate that 54 percent of the sales volume for interior products complies with the proposed limit, 4 percent of the sales volume for exterior products complies, and 22 percent of the sales volume for dual use products complies.

5.32.6. Product Testing Results

5.32.6.1. Kimerling and Bhatia Study

Kimerling and Bhatia conducted research to identify block copolymers for use in waterborne primer coatings (Kimerling and Bhatia, 2004). In the study titled "Block copolymers as low-VOC coatings for wood: characterization and tannin bleed resistance", they investigated three amphiphilic (containing both hydrophobic and hydrophilic groups) block copolymers as potential waterborne coating components that could create a hydrophobic barrier to block tannin extraction. The three amphiphilic block copolymers were examined and compared to three commercially available primers, one of which was a solventborne alkyd primer. This research found that amphiphilic block copolymer coatings are capable of preventing tannin bleed, and in fact performed better than the solventborne alkyd primer tested. It should also be noted that the commercially available waterborne tannin blocking polymer, Rhoplex® PR-33, performed as well as the block copolymers when tested for topcoat discoloration.

5.32.6.2. KTA-Tator Study

The KTA-Tator Study, agreed to by the joint industry-government Technical Advisory Committee of the SCAQMD, encompassed four architectural coating categories, one of which was Primers, Sealers, and Undercoaters (PSUs) (SCAQMD, 2002). Both high- and low-VOC, interior and exterior PSUs were tested to determine whether commercially-available architectural coatings that contain lower VOC content perform better, equivalent to, or worse than products with a higher VOC content. The VOC content of coatings tested ranged from 118 g/l to 457 g/l (as reported by manufacturers). "Low-VOC" products had VOC contents less than or equal to 200 g/l, while "High-VOC" products had VOC contents greater than 200 g/l. Testing was conducted to determine coating characteristics and performance.

Characteristics testing included tests to determine VOC content, volume solids, Infrared Spectroscopic Analysis, viscosity, hiding, dry time, and sag resistance. For waterborne coatings, percent water and freeze/thaw resistance testing were also conducted. All tests to determine characteristics were based on standard ASTM testing procedures. Performance testing for interior PSUs included tests to determine grain raising, adhesion, sandability; and chemical resistance, even though these products are intended to be used on a clean substrate and covered with a top coat. Performance testing for exterior PSUs included tests to

determine the degree of grain raising, adhesion, stain blocking, and weathering under accelerated conditions. Most of the testing was based on standard ASTM testing procedures. If no ASTM procedure was available, testing protocols developed by coating manufacturers were used. In the case of the sandability performance test, there was neither an ASTM method nor a coating manufacturer testing protocol available, and the testing procedure was developed by KTA-Tator.

Measured VOC Content Data

The manufacturers' published VOC values generally agreed with laboratory analysis results, but there were some differences. Three discrepancies existed out of the eleven PSUs tested, with one testing higher in VOC content than the published value and two testing lower. One test sample with a published VOC content of 141 g/l, revealed a VOC content of 227 g/l when tested. Another test sample with a published VOC content of less than 200 g/l, tested well below that maximum at 91 g/l, making this the lowest VOC sample tested. The third discrepancy involved a sample with a published maximum VOC content of 250 g/l, but testing indicated a VOC content of 106 g/l.

Stain Blocking Characteristics

Product testing results from the KTA-Tator Study indicate that low VOC products are similar to high-VOC products in their ability to block tannin stains. Rated on a scale where a ranking of zero indicates severe tannin staining and 10 equates to no tannin staining, all exterior PSUs tested on LP siding wood performed well. All products, including both high- and low-VOC exterior PSUs, received a ranking of 10, with the exception of one low-VOC exterior PSU which received a ranking of 9. It should be noted that this product had the highest VOC content of the low-VOC PSUs tested.

In general, all exterior PSUs, regardless of VOC content, performed less well when blocking tannin stains from the red cedar wood substrate. Both the high (8) and low (1) rankings were reported for high-VOC exterior PSUs, with ratings for high-VOC exterior PSUs averaging 5.3. Low-VOC exterior PSUs ranked slightly better, with an average rating of 6.3.

5.32.6.3. UMR

In 2005, the UMR Coatings Institute at the University of Missouri - Rolla conducted a coatings testing project for the South Coast AQMD (UMR, 2006). The project included tests on products classified as Primers, Sealers, and Undercoaters. UMR tested some general coating properties, including: percent nonvolatile; stability; viscosity; freeze/thaw resistance; dry time; gloss; and hiding - contrast ratio. They also tested performance properties, including: adhesion; stain bleed through resistance; tannin stain resistance; grain raising and sandability; enamel holdout; and flow/level and sag. All testing was done in accordance with ASTM standards, unless otherwise noted or agreed upon by the

South Coast AQMD. All paints were supplied to the UMR Coatings Institute by South Coast AQMD.

For Primers, Sealers, and Undercoaters, they tested four products, two low-VOC products (VOC ≤100 g/l) and two high-VOC products (VOC >100 g/l and ≤200 g/l). On average, on most tests, the two low-VOC samples below 100 g/l performed comparably with the two high-VOC samples above. However, on average, the two low-VOC samples did perform somewhat poorer on overcoat adhesion and stain bleed through (coffee) than the high-VOC samples. It is interesting to note that the low-VOC samples did perform equally well as the high-VOC samples on tannin resistance.

5.32.7. Manufacturer Information

Product information sheets published by coatings manufacturers indicate that a wide variety of Specialty Primer, Sealer, Undercoater coatings that meet the proposed VOC limit are available that possess performance characteristics similar to higher-VOC coatings. A summary of product information for Specialty Primer, Sealer, Undercoater coatings with a range of VOC contents is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

For information on products that can be used on excessively chalky surfaces or over general stains, please see the table for general Primer, Sealer, Undercoater coatings that is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

5.32.8. Conclusion

We recommend a 100 g/l VOC limit for Specialty Primers, Sealers, and Undercoaters, effective January 1, 2012. Most of the proposed VOC limits in the SCM are effective in 2010. The later effective date for Specialty Primers, Sealers, and Undercoaters is intended to allow manufacturers to develop appropriate stain-blocking test methods. The proposed VOC limit is technologically and commercially feasible by January 1, 2012, based on the complying marketshare, test data, the number of companies making complying products, and product information from manufacturers. The proposed VOC limit is consistent with the limit adopted by the South Coast AQMD. The proposed limit is lower than the limits adopted by the U.S. EPA and the OTC states and the proposed limit for Canada. The U.S. EPA divides Specialty Primers, Sealers, and Undercoaters into two categories, one for primers and undercoaters with a VOC limit of 350 g/l, and one for sealers, including clear wood finishes, with a VOC content limit of 400 g/l. (U.S. EPA, 1998).

5.33. STAINS

VOC Limit Table (g/l)

USEPA: 550 (semitransparent) ; 350 (opaque)	Canada: 250	OTC: 250	SCAQMD: 100 (exterior); 250 (interior)	SCM Proposed: 250

5.33.1. Category Definition

A semitransparent or opaque coating labeled and formulated to change the color of a surface but not conceal the grain pattern or texture.

5.33.2. Major Proposed Changes

- The definition for Stains has been revised. Clear stains and clear penetrating oils previously included in the Stains category are now included in the Wood Coatings category.

5.33.3. Coating Description

The Stains category includes products for both wood and concrete surfaces. Wood stains are used for aesthetic purposes while providing some protection from water, UV radiation, and tannin bleed. These coatings come in a variety of different colors to enhance the natural characteristics of the wood without completely hiding them. Semitransparent stains change the color of the surface without concealing the grain pattern or texture. Opaque stains completely conceal the natural grain pattern while allowing the texture of the surface to be seen.

Stains are all single component coatings that are sprayed, wiped, rolled, or brushed on. If stains are applied with a sprayer, back brushing is recommended to achieve good penetration. Excess is often wiped off with a cloth, leaving a flat finish with little or no sheen. Stains are generally easy to apply for the typical homeowner and they are also applied by professional contractors.

Semitransparent wood stains often contain drying oils, such as linseed or tung oil, which penetrate the wood surface and solidify upon exposure to air. They commonly contain water repellents, usually paraffin wax or wax-like chemicals, to prevent wood from absorbing water, which causes the wood to crack, warp, and split. UV stabilizers are usually included in exterior wood stains to protect the surface from degradation caused by UV radiation. High quality stains may also contain preservatives to protect wood from decay, discoloration, and insect attack (Feist, 1996). The majority of solventborne, semitransparent stains contain alkyd resins, but they may also contain acrylic, urethane, polyurethane, or phenolic resins. These coatings penetrate the surface of the wood and do not form a film that flakes off over time. Semitransparent penetrating stains can also be reapplied without extensive surface preparation. Waterborne latex stains,

which contain acrylic and/or alkyd resins, may not penetrate the surface of the wood as well as solventborne products. Instead, they may form a thin film on the surface that provides less durability, and tends to degrade and flake from the surface (Williams, 1999). Technology for latex penetrating stains continues to progress and many products currently available are able to provide good penetration.

Opaque wood stains are most commonly latex waterborne formulations that contain synthetic resins, primarily acrylic or vinyl acrylic. These stains have a higher concentration of pigment, which protects wood from degradation caused by exposure to UV radiation. Waterborne latex opaque stains contain a higher amount of solids and form a thicker film than solventborne opaque stains. They are also more flexible, have better color retention, and are less prone to mildew. Although they are easy to clean up, extensive surface preparation is required for proper adhesion. Solventborne opaque stains usually contain alkyds or oil, tend to be less flexible, and are more prone to crack and flake, but require less surface preparation (Williams, 1999).

Stains can be applied to both wood and concrete surfaces and staining can be accomplished through the use of pigments, dyes, or chemicals. Many concrete stains are formulated to penetrate and react chemically with the concrete substrate to produce a variety of color effects. Reactive concrete stains contain inorganic metallic salts dissolved in an acid and water solution. Non-reactive concrete stains can contain drying oils and acrylic resins. Progress has been made in the development of UV-stable reactive stains for exterior applications. Newer technologies offer better durability and color retention (JAC, 2005a).

Stained surfaces are often coated with a protective clear topcoat. Concrete/Masonry Sealers are used as protective topcoats on concrete, while clear Wood Coatings are used on wood.

Clear, penetrating oil finishes and clear stains are no longer included in the Stains category as they are used primarily for protective purposes and do not change the color of the wood surface. These finishes are included in the Wood Coatings category.

5.33.4. Substrates/Exposures

Stains are used indoors and outdoors in residential, commercial, and institutional areas. Semitransparent stains are used on a variety of interior wood surfaces including cabinets, floors, paneling, trim, doors, molding, and stairs. Semitransparent and opaque stains are commonly applied to exterior wood surfaces such as decks, shakes, shingles, siding, boat docks, and fences. In addition to wood, stains can also be applied to interior or exterior concrete, cement, asphalt, masonry, and stucco. Concrete driveways, garage floors, sidewalks, and patios are all common areas for application of concrete stains.

Most stains have some resistance to UV radiation and are water repellent. Because opaque stains contain more pigment, they are more resistant to UV radiation than semitransparent stains. Deck stains are formulated to withstand foot traffic and standing water.

5.33.5. Survey Results

Table 5.33-1 summarizes our estimate of sales and VOC emissions for Clear/ Semitransparent Stains, based on the ARB survey. Clear/Semitransparent Stains represent the ninth largest category with regard to sales volume. In 2004, the sales volume for Clear/Semitransparent Stains in California was approximately 1.9 million gallons. This represents just less than 2 percent of the total California sales volume for architectural coatings.

VOC emissions from Clear/Semitransparent Stains are about 6.3 tpd, which represents approximately 6.6 percent of the total emissions from architectural coatings. Because most of the products sold are solventborne, most of the emissions are from solventborne products.

Table 5.33-1: Survey Data
Stains – Clear/Semitransparent

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	1,049	1,462,300	78%	29%	47%	24%	33%	367	5.95
WB	287	402,937	22%	14%	86%	0%	13%	240	0.32
Total	**1,336**	**1,865,237**		**26%**	**55%**	**19%**	**29%**	**339**	**6.28**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Waterborne Clear/Semitransparent Stains represent 22 percent of the sales volume. Solventborne products represent 78 percent of the sales volume and generally have VOC levels greater than 250 g/l, the current SCM VOC limit.

Table 5.33-2 shows the breakdown of solventborne and waterborne Clear/Semitransparent Stains above and below 250 g/l. With 43 percent of the overall sales volume, the majority of the market is comprised of solventborne stains above 250 g/l. This is followed by solventborne stains less than or equal to 250 g/l (high solids stains) with 35 percent of the overall sales volume.

Table 5.33-2
Stains – Clear/Semitransparent: Solventborne & Waterborne Data

	Number of Products	Sales in California (gal/year)	% Sales
SB ≤ 250 g/l	137	660,939	35%
SB > 250 g/l	912	801,361	43%
WB ≤ 250 g/l	176	309,065	17%
WB > 250 g/l	111	93,871	5%
Total	**1336**	**1,865,237**	**100%**

Two solventborne and seven waterborne Clear/Semitransparent Stains with VOC levels below 100 g/l represented less than 0.5 percent of the overall sales volume.

The sales volume for solventborne Clear/Semitransparent Stains has decreased approximately 14 percent from 2000 to 2004. This change is also reflected in the overall sales volume for Clear/Semitransparent Stains, which also decreased 14 percent. The overall sales-weighted average VOC Regulatory value has decreased 3 percent from 2000 to 2004.

Table 5.33-3 contains the complying marketshare for Clear/Semitransparent Stains, based on the ARB survey. This table shows that 74 percent of the sales volume complies with the current VOC limit. When considering the number of products reported, approximately 40 percent comply with the current limit. Of the 32 companies that reported in this category, 22 offered Clear/Semitransparent Stains that comply with the current limit.

Table 5.33-3: Complying Marketshare & Emission Reductions
Stains – Clear/Semitransparent

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
250	308	74%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Table 5.33-4 summarizes our estimate of sales and VOC emissions for Opaque Stains, based on the ARB survey. In 2004, approximately 960,000 gallons of Opaque Stains were sold in California. This represents just less than 1 percent of the total California sales volume for architectural coatings.

Waterborne Opaque Stains represent almost all of the market with 98 percent of the reported sales volume. Solventborne Opaque Stains represent only 2 percent of the sales volume and generally have VOC levels greater than 250 g/l. The sales volume for solventborne Opaque Stains decreased approximately 91 percent from 2000 to 2004 and the overall sales volume declined 12 percent. The overall sales-weighted average VOC Regulatory value decreased 41 percent from 2000 to 2004.

VOC emissions from Opaque Stains are about 0.5 tpd, which represents approximately 0.5 percent of the total emissions from architectural coatings. Because most of the products sold are waterborne, most of the emissions are from waterborne products.

Table 5.33-4: Survey Data
Stains - Opaque

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	104	20,627	2%	0%	95%	5%	2%	300	0.07
WB	327	936,880	98%	0%	98%	2%	0%	103	0.42
Total	**431**	**957,506**		**0%**	**98%**	**2%**	**0%**	**107**	**0.48**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.33-5 contains complying marketshare data for opaque stains, based on results from the 2005 ARB survey. This table shows that 98 percent of the sales volume for Opaque Stains complies with the current VOC limit. When considering the number of products reported, approximately 77 percent comply with the current limit. Of the 21 companies that reported in this category, 19 offered Opaque Stains that comply with the current limit.

Table 5.33-5: Complying Marketshare & Emission Reductions
Stains - Opaque

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
250	327	98%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.33.6. Product Testing Results

5.33.6.1. Consumer Reports: Consumers Union tested a number of exterior opaque and semitransparent stains. The stains were ranked by their effectiveness at resisting dirt, color change, and mildew. The tests showed that opaque finishes hold up the longest when compared to clear or semitransparent stains. They typically last at least three years while clear stains don't offer more than a year of protection before their appearance begins to degrade. Semitransparent stains, which have a small amount of pigment usually last 2-3 years before reapplication. The downside of an opaque stain is the film can peel, chip, and crack like a paint film and extensive preparation may be needed before application of subsequent coats. Top-rated opaque stains can reportedly

last about nine years. Olympic Premium 596 opaque latex stain, with a VOC content of 98 g/l according to the ARB survey, outperformed all other stains and received a good rating after nine years. Behr Plus 10 opaque alkyd stain also received a good rating after nine years, but did not perform as well, due to the lack of resistance to dirt and color change. According to the product data sheet, Behr Plus 10 is an oil/latex emulsion that cleans up with water and has a VOC content less than 135 g/l. Olympic Water Repellent alkyd semitransparent stain lasted about six years and received a fair rating, while other semitransparent stains lasted up to three years. In the ARB survey, Olympic Water Repellent stain had a reported VOC level of 533 g/l. Alkyd semitransparent stains outperformed latex semitransparent stains, while latex opaque stains outperformed alkyd opaque stains. Testing still underway shows that Thompson's Water Seal Deck and House latex semitransparent stain has received a very good rating after three years and a good rating after six years, better than previously tested alkyd semitransparent stains (Consumer Reports, 2006b).

Consumers Union also tested a number of stains for use as deck treatments. Twenty products were tested on CCA (chromated copper arsenate) pressure-treated lumber at a facility in Yonkers, New York for three years. The treatments were ranked by their effectiveness at resisting dirt, color change, mildew, and cracking. Two opaque stains performed the best. Alkyd-based Cabot Decking Stain, with a reported VOC content of 248 g/l in the ARB survey, received a very good rating for resisting dirt, color change and mildew, but did not resist cracking. Latex-based Cabot Solid Color stain at 108 g/l also received a very good rating, and was able to resist cracking. The best semitransparent product was Wolman DuraStain, a waterborne alkyd/acrylic stain with a maximum VOC content of 250 g/l that received a good rating and resisted dirt and cracking, but not color change and mildew. Testing still underway indicates that latex opaque stains continue to outperform alkyd opaque stains. Though latex semitransparent stains continue to improve, alkyds still performed better (Consumer Reports, 2006c).

5.33.6.2. KTA-Tator Study: The KTA-Tator Study, agreed to by the joint industry-government Technical Advisory Committee of the SCAQMD, encompassed four architectural coating categories, one of which was Interior Stains (SCAQMD, 2002). Both high- and low-VOC Interior Stains were tested to determine whether commercially-available architectural coatings that contain lower VOC content perform better, equivalent to, or worse than products with a higher VOC content. The VOC content of coatings tested ranged from zero g/l to 350 g/l (as reported by manufacturers). Testing was conducted to determine coating characteristics and performance.

Six interior stains were tested: three "low-VOC" products had VOC contents less than or equal to 250 g/l and three "high-VOC" products had VOC contents

greater than 250 g/l. General characteristics tested included VOC content, volume solids content, viscosity, dry time (to touch), and sag resistance. For waterborne interior stains, the percent water and freeze/thaw properties were also determined. All tests to determine characteristics were based on standard ASTM testing procedures. Performance tests included open time/lapping, grain raising, adhesion, stain blocking, and scrub resistance. Most of the testing was based on standard ASTM testing procedures. If no ASTM procedure was available, testing protocols developed by coating manufacturers were used.

General Characteristics Testing

The measured VOC content varied widely from published VOC contents for products in the "low-VOC" (≤250 g/l) group. All three stains in this group actually had VOC contents above 250 g/l. One product with a published VOC content of 0 g/l actually tested at 315 g/l. Another that was reported to have a VOC content of 15 g/l had a measured value of 261 g/l. Despite these discrepancies, the three stains in the "low-VOC" group all had lower VOC contents than the three stains in the "high-VOC" group. The measured VOC content of the interior stains in the "high-VOC" group ranged from 328 g/l to 489 g/l, compared to the measured content in the "low-VOC" group, which ranged from 261 g/l to 315 g/l. Because none of the "low-VOC" stains had VOC contents below 250 g/l, these tests would not support a proposed reduction of the VOC limit for the Stains category.

After five freeze/thaw cycles, none of the waterborne interior stains exhibited changes in hiding, gloss, or color. Viscosity remained the same and the stains did not exhibit pigment agglomerations or coagulation. The stains with higher VOC contents had drying times much greater than those with lower VOC contents. The stain with the lowest VOC level of 261 g/l had a drying time of just 7.5 minutes, while the average drying time for "high-VOC" stains was 180 minutes. "Low-VOC" stains performed the same as the "high-VOC" stains in the sag resistance test. Only the stain with the highest VOC content had a higher sag resistance.

Performance Testing

The interior stains were tested for open time/lapping characteristics on white pine, oak, and maple wood. No visible overlap was observed in any of the stains. The tape adhesion test showed that all stains showed no disbonding when applied to all three types of wood.

Both groups performed well in the grain raising test. One stain from the "low-VOC" group had slight grain raising on white pine wood, while one stain from each group had slight grain raising on oak wood. When the stains were tested on maple wood, a stain from the "low-VOC" group showed minimal grain raising.

In the stain blocking test lower VOC products performed about the same as higher VOC products. Stains with lower VOC contents were able to block

staining better on oak and maple wood than on white pine. Higher VOC stains did the best on oak, while also faring well on white pine and maple. The best performers on white pine and oak were both products from the “high-VOC” group. Lower VOC stains slightly outperformed higher VOC stains on maple.

The final test for interior stains was the scrub resistance test. It was performed on pine, oak, and maple wood to determine the number of scrub cycles carried out before there was visible wear-through. One clear stain in the lower VOC group was left out because it could not be rated visually. The best performer on all three types of wood was a “high-VOC” stain. Two different “high-VOC” stains also accounted for the worst performers. One stain from the “low-VOC” group with a measured VOC content of 315 g/l performed second best on all three wood types. The stain with the highest VOC content of 489 g/l was the worst performer on oak, but was average on pine and maple.

5.33.6.3. AVES Report: South Coast AQMD awarded AVES, an affiliate of ATC Associates Inc., a contract to develop architectural coatings with a VOC content at or near zero g/l for a variety of coating categories, including exterior opaque stains and exterior and interior semitransparent stains (AVES, 2001). These coatings were then tested next to three commercially available coatings from each category. Three new coatings systems were also tested, and were each comprised of a semitransparent stain, a sanding sealer, and either a varnish, two coats of lacquer, or three coats of lacquer. All of the coatings were tested for performance, repair, and refinishing. The new zero-VOC stains were composed of ultra-fine acrylic resin dispersions with surfactants and zero-VOC pigment dispersions. The exterior semitransparent stain also contained fungicides and UV absorbers. The new coatings with VOC contents at or near zero g/l generally did not perform as well for freeze/thaw properties, mildew/fungus resistance, dirt pick-up, and stain blocking, but the near zero coatings generally performed better when tested for color change and moisture/UV resistance.

Compared to the commercially available stains, the near zero-VOC Opaque Stain did as well or better in grain raising, stain blocking, moisture resistance, coating penetration, UV resistance, and color change. It did poorer in freeze/thaw resistance, dirt pickup resistance, and mildew/fungus resistance.

The near-zero VOC Exterior Semitransparent Stain did as well or better in dry times, grain raising, coating penetration, moisture resistance, UV resistance, and color change. It did worse in mildew/fungus resistance, freeze/thaw resistance, stain blocking, and dirt pickup resistance.

The near zero-VOC Interior Semitransparent Stain did as well or better in freeze/thaw resistance, finish, and dry times. It did worse in grain raising and grain definition.

5.33.6.4. UMR Results:

Exterior Stains

Of the four coatings tested, all were penetrating coatings, one had a VOC content of 250 g/l, and the remaining three were zero VOC. Although there were few exterior stain-specific tests performed, on average, the low VOC coatings performed comparably to the one higher VOC coating on most tests, although there was some variation. For example, one of the zero VOC coatings had no freeze/thaw resistance, yet performed well on abrasion resistance. Because of the small number of stains that were tested and the few stain-specific tests that were performed, the UMR results did not hold as much weight as the other testing and the near-zero complying marketshare convinced ARB staff to retain the existing VOC limit for Stains.

5.33.7. Manufacturer Information

Several complying products are included on Master Painter's Institute (MPI) Approved Products lists because they were certified to meet designated performance standards. MPI approved several Stains that comply with the current 250 g/l limit and meet one of the following standards: MPI #16 (Stain, Exterior, Water Based, Solid Hide); MPI #33 (Stain, for Exterior Wood Decks); MPI #58 (Stain, Interior, for Concrete Floors); and MPI #156 (Stain, Exterior, Water Based Semi-Transparent). Manufacturers of compliant, MPI-approved products include Coronado Paint, ICI Paints, Kelly-Moore, and Rodda Paint. Additional information on manufacturers and products is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

5.33.8. Conclusion

We recommend maintaining the current 250 g/l VOC limit for Stains, based on the complying marketshare, the number of companies making complying products, testing data, and product information from manufacturers. The current VOC limit is lower than the national limits promulgated by the U.S. EPA. The U.S. EPA divides stains into three categories, based on opacity. Clear stains and semitransparent stains both have a VOC limit of 550 g/l, while opaque stains have a limit of 350 g/l (U.S. EPA, 1998). The South Coast AQMD adopted a 100 g/l limit for Exterior Stains while the limit for Interior Stains has remained at 250 g/l. Our recommended limit for Exterior Stains is higher than South Coast AQMD limit, while our recommended limit for Interior Stains is the same as the South Coast AQMD. Our recommended limit is consistent with the limit adopted by the OTC states and the proposed limit for Canada.

ARB staff believes that additional research and testing is needed to develop exterior semistransparent stains that can comply with a 100 g/l VOC limit and perform well throughout California. Based on performance testing results in the AVES report, zero-VOC exterior semitransparent stains generally do not perform as well in freeze/thaw, mildew/fungus resistance, stain blocking, and dirt pickup,

though they generally perform better in color change and moisture/UV resistance. South Coast AQMD did not adopt a 100 g/l limit for interior stains, due to appearance and depth issues related to the use of low-VOC clear wood coatings (SCAQMD, 2003).

According to the ARB survey, exterior Semitransparent Stains with VOC contents below 100 g/l represented close to zero percent of the overall sales volume. Based on these data, ARB staff do not believe that there is sufficient complying marketshare to support a 100 g/l limit for exterior Semitransparent Stains. We also believe that there are enforcement concerns with splitting the Stains category into Interior and Exterior subcategories.

5.34. STONE CONSOLIDANTS

VOC Limit Table (g/l)

USEPA: 600 (WST)	Canada: 400 (WCMS)	OTC: 400 (WCMS)	SCAQMD: 100 (WCMS)	SCM Proposed: 450

5.34.1. Category Definition

A coating that is labeled and formulated for application to stone substrates to repair historical structures that have been damaged by weathering or other decay mechanisms. Stone Consolidants must penetrate into stone substrates to create bonds between particles and consolidate deteriorated material. Stone Consolidants must be specified and used in accordance with ASTM E2167-01 (Standard Guide for Selection and Use of Stone Consolidants). Stone Consolidants are for professional use only and must be labeled as such.

Please note that “Stone Consolidant” is a proposed new category that includes products which were formerly covered by the following two categories in the 2000 SCM:

> Waterproofing Concrete/Masonry Sealer (WCMS): A clear or pigmented film-forming coating that is labeled and formulated for sealing concrete and masonry to provide resistance against water, alkali, acids, ultraviolet light and staining.
>
> “Other”: A default category for products that do not fit in any of the listed coating categories. VOC limits are based on the gloss level of the product.

Waterproofing Concrete/Masonry Sealer has been eliminated from the proposed SCM and the types of products that were previously in these categories would be covered by other categories (e.g., Concrete/Masonry Sealer; Reactive Penetrating Sealer; etc.).

5.34.2. Major Proposed Changes

- Stone Consolidant is a new category that includes products formerly classified under Waterproofing Concrete/Masonry Sealer and "Other".

5.34.3. Coating Description

Stone Consolidants penetrate into stone substrates to help restore the integrity of crumbling or decayed materials. These products are often considered to be concrete treatments, rather than coatings, and are not for general purpose use. The intent of establishing the Stone Consolidant category is to support historical preservation efforts by allowing limited use of these products under the direction of a stone conservation specialist, such as an architect, conservator, or engineer. Stone Consolidants are clear products that are designed to leave the surface appearance unchanged. After the consolidation process is complete, manufacturers often recommend that the substrate be coated with a water repellent to provide protection from the elements. Stone Consolidants can be used on a variety of historical structures, including statues, monuments, and buildings. They are applied by professional contractors or conservators and application methods include sprayer, brush, pipette, and immersion (Price, 1996).

There are a variety of chemistries that are used for consolidation purposes, depending on the type of substrate, method of decay, and environmental exposures. Solventborne products are generally preferred, because it is believed that the solvent can penetrate deeper into the substrate and distribute the consolidant down to the undeteriorated stone. Provided below are descriptions for some of the chemicals commonly used in Stone Consolidants.

Silanes: Silanes have been used extensively for consolidation purposes. They react with water to release VOCs and form silanols, which then undergo a condensation reaction with the substrate to produce a silicone polymer (see Reactive Penetrating Sealers for additional details). The resulting polymer increases the cohesion of the substrate and strengthens the decayed stone (Price, 1996). The VOCs that are released during the chemical reaction (e.g., ethanol or methanol) are known as cure volatiles and they should be included when determining the VOC content of a product.

Some of the silanes used as consolidants also provide some water repellency. Commonly used consolidants are solventborne products that contain ethyl silicates (or silicic ethyl esters) and a neutral catalyst. After the silicate solution is applied to a substrate, the catalyst promotes a reaction between the ethyl silicate and water from the atmosphere to produce a glass-like silicon dioxide gel that binds the stone particles together. This curing process generates ethanol and it may take weeks or months for the reaction to be complete. Methyltrimethoxysilane (MTMOS) and tetraethoxysilane (TEOS) are also used

extensively for consolidation. Examples of silane products include: Conservare H100 and OH100 (Prosoco); Silex OH-100 (KEIM); and Tegovakon V 100 (by Goldschmidt Industrial Specialties).

Epoxy and Acrylic Resins: Solventborne epoxy and acrylic resins have also been used for consolidation purposes, but they are sometimes described as adhesives, rather than consolidants (Selwitz, 1992). Acrylic resins which have been used for stone consolidation include methylacrylate, methyl methacrylate, ethyl methacrylate and butyl methacrylate (Young, 1999). Some conservators have mixed acrylic resin with alkoxysilane to combine the consolidant and adhesive properties (Price, 1996). Examples of resins include: Acryloid B72 or Paraloid B72 (Rohm & Haas); and Impregnating Agent – EP 2101 Eurostac Strengthener (Bresciani Srl).

A wide variety of consolidant materials is needed to accommodate different substrates and site-specific conditions. In addition to the chemicals described above, consolidants have been formulated from vinyls (e.g., polyvinylchloride and polyvinylacetate); polyurethanes; polyesters; perfluoropolyethers; fluosilicates; barium hydroxide; and lime (Young, 1999).

5.34.4. Substrates/Exposures

Stone Consolidants are intended for application to a variety of stone substrates, including limestone, sandstone, marble, travertine, granite, and slate. Many are also suitable for other concrete and masonry substrates (e.g., brick, terra cotta tile, etc.) Products in this category are intended for interior and exterior exposures on horizontal and vertical surfaces.

5.34.5. Survey Results

Stone Consolidant is a new category, so it was not reported separately in the ARB survey. Please refer to the Concrete/Masonry Sealer section for survey data that were reported for Waterproofing Concrete/Masonry Sealer.

For the survey, all of the reported products that were identified specifically as Stone Consolidants were ethyl silicate formulations with VOC levels that exceed 400 g/l, the current SCM limit. In addition to these high-VOC products, there were some inorganic silicate products that are primarily marketed as sealers, but also can have a consolidating effect on certain substrates. These inorganic silicates are zero-VOC products, but they have some substrate limitations as compared to the ethyl silicates. Since these products are primarily marketed as sealers, ARB staff classified them under the new Reactive Penetrating Sealer category, rather than as Stone Consolidants.

Based on the survey, all of the reported Stone Consolidants comply with the proposed VOC limit.

Table 5.34-1: Complying Marketshare & Emission Reductions Stone Consolidant

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume	Emission Reductions (excluding South Coast AQMD) (tons/day)
450	2	100%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.34.6. Conclusion

For the new Stone Consolidant category, we are recommending a VOC limit of 450 g/l, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on information provided by raw material suppliers and coating manufacturers. The proposed VOC limit is higher than the 100 g/l limit contained in South Coast AQMD Rule 1113. However, manufacturers that provide coatings in the South Coast AQMD area can still sell products which exceed the 100 g/l limit, if they participate in South Coast AQMD's averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit. In addition, this is a very small category and the emission reduction losses for this category are negligible for a 450 g/l limit as compared to a 100 g/l limit. The proposed SCM VOC limit is lower than the national limit of 600 g/l promulgated by the U.S. EPA. The proposed limit is higher than the 400 g/l limit adopted by the OTC states and proposed by Canada.

ARB staff is also proposing labeling requirements for Stone Consolidants. Each container must be labeled with the phrases "Stone Consolidant" and "For Professional Use Only". Under the current SCM, labels must also include the VOC content. For Stone Consolidants, the VOC content should be based on the material composition, as recommended for application by the manufacturer. If the manufacturer recommends dilution prior to application, the VOC content on the label must reflect the diluted solution.

5.35. SWIMMING POOL COATINGS

VOC Limit Table (g/l)

USEPA: 600	Canada: 340	OTC: 340	SCAQMD: 340	SCM Proposed: 340

5.35.1. Category Definition

A coating labeled and formulated to coat the interior of swimming pools and to resist swimming pool chemicals. Swimming Pool coatings include coatings used for swimming pool repair and maintenance.

Please note that the Swimming Pool coating category is now a consolidation of the following two categories contained in the 2000 SCM:

> Swimming Pool Coating: A coating labeled and formulated to coat the interior of swimming pools and to resist swimming pool chemicals.
>
> Swimming Pool Repair and Maintenance Coating: A rubber based coating labeled and formulated to be used over existing rubber based coatings for the repair and maintenance of swimming pools.

5.35.2. Major Proposed Changes

- The Swimming Pool coating category now contains those products previously covered by the Swimming Pool Maintenance and Repair category. The definition for the Swimming Pool coating category has been modified accordingly.

5.35.3. Coating Description

Swimming Pool coatings are generally used for protective and aesthetic purposes, and they fall into three main categories; acrylic; chlorinated or synthetic rubber; and epoxy (Poolcenter, 2007). The lower-VOC Swimming Pool coatings reported in the ARB survey were formulated with epoxy, acrylic/acrylic copolymer or urethane/polyurethane resins. All of the chlorinated or synthetic rubber coatings reported had a VOC content of 500 g/l or more. The former category of Swimming Pool Repair and Maintenance, for which no complying products were reported, had resin systems of either chlorinated or synthetic rubber or styrene butadiene. The Swimming Pool Repair and Maintenance category has been combined with the Swimming Pool coating category because there is no need for a higher VOC limit to accommodate repair and maintenance products. In the 2000 SCM, to avoid confusion with existing district rules, we created two categories of swimming pool coatings; Swimming Pool coatings and Swimming Pool Repair and Maintenance coatings, both with a VOC limit of 340 g/l. We recommended at that time that the districts eventually eliminate the Swimming Pool Repair and Maintenance coating category from their architectural

coating rules in anticipation of the current proposed SCM, in which the Swimming Pool Repair and Maintenance category no longer exists.

Compliant epoxy coatings are generally touted as the most durable and long-lasting of the three types of Swimming Pool coatings, the next most durable being the non-compliant chlorinated or synthetic rubber coatings. In general, the acrylic Swimming Pool coatings are considered the least durable, and least costly, of the three main types of Swimming Pool coatings. The coatings are assumed to last approximately 7-10 years, 3-5 years, and 2-3 years, respectively (Poolcenter, 2007).

The majority of the waterborne and solventborne Swimming Pool coatings are multi-component products. Typically, Swimming Pool coatings can be brushed, rolled, or sprayed on the surface to be painted. They are used by both homeowners and professionals on the interior of residential and commercial swimming and wading pools, ponds, and fountains.

In addition to the types of Swimming Pool coatings described above, the South Coast AQMD has reported the use of polyester resins to repair and recoat existing swimming pools. As the polyester resins are field-applied (as opposed to being applied in a facility), the South Coast AQMD has determined that Rule 1162 “Polyester Resin Operations” does not apply, and that the field-applied coatings are subject to Architectural Coatings Rule 1113. Due to their design flexibility, these polyester resins are also being applied to structures other than swimming pools. The South Coast AQMD is currently investigating appropriate methods for determining the VOC content of polyester resins used as architectural coatings.

5.35.4. Substrates/Exposures

Not all Swimming Pool coatings are suitable for use on every swimming pool; manufacturer recommendations vary depending upon the substrate to be coated. Swimming pool surfaces may be concrete, plaster, gunite (pneumatically propelled mortar or concrete), fiberglass, steel, or aluminum. For concrete, gunite, and plaster substrates, an acrylic, chlorinated or synthetic rubber, or epoxy Swimming Pool coating may be used. For fiberglass, steel and aluminum, epoxies are generally recommended (Kelley, 2007).

If a swimming pool has been previously coated, a determination must be made as to what type of coating was applied. If a sample of the existing coating dissolves in denatured alcohol, it is assumed to be a waterborne acrylic coating. Chlorinated or synthetic rubber coatings will dissolve in xylene, and epoxy coatings will not dissolve in either alcohol or xylene. (Kelley, 2007) In general, if a Swimming Pool coating has been previously used on a surface, manufacturers recommend using the same type of coating for subsequent applications. However, ARB staff found several manufacturers whose product data sheets

indicate that their product can be used to prime chlorinated or synthetic rubber coatings, in preparation for an epoxy topcoat.

As with all architectural coatings, proper substrate preparation is essential. After draining the swimming pool, a determination of the soundness of the surface must be made. If the surface to be coated was previously coated with epoxy, any glossy areas must be sanded until dull. Regardless of the previous coating used, sandblasting or sanding to bare substrate may be necessary if the existing coating is severely damaged or very thick. All previously painted pool surfaces must be treated with trisodium phosphate to remove oils, rinsed, and then acid washed to etch the substrate and remove stains. Finally, the acid is washed off, trisodium phosphate is used to neutralize the acid, the pool surface is rinsed again, and allowed to dry.

Swimming Pool coatings are subject to degradation from ultraviolet rays, fluctuating temperatures, pH levels, chemicals, and abrasions, and must be resistant to moisture penetration from constant immersion.

5.35.5. Survey Results

Survey data were provided separately for the Swimming Pool category and the Swimming Pool Repair and Maintenance category. Table 5.35-1a summarizes our estimate of sales and VOC emissions for Swimming Pool coatings, based on the ARB survey. The Swimming Pool coating category is a very minor category with regard to the sales volume as it represents less than 0.02 percent of the total sales volume for architectural coatings in California.

Solventborne Swimming Pool coatings generally have VOC levels less than 340 g/l, the current SCM VOC limit. The overall sales volume for Swimming Pool coatings decreased about 8 percent from 2000 to 2004. The overall sales-weighted average VOC Regulatory value declined about 9 percent from 2000 to 2004.

VOC emissions from Swimming Pool coatings are about 0.04 tpd, which represents approximately 0.04 percent of the total emissions from architectural coatings.

Table 5.35-1a: Survey Data
Swimming Pool

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	25	9,828	48%	0%	22%	78%	0%	304	0.03
WB	12	10,536	52%	0%	25%	75%	0%	199	0.01
Total	**37**	**20,364**		**0%**	**24%**	**76%**	**0%**	**250**	**0.04**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Three products were reported in the category of Swimming Pool Repair and Maintenance, all of which were solventborne, single component formulations based on chlorinated rubber or styrene butadiene resins. None of the reported Swimming Pool Repair and Maintenance coatings complied with the 2000 SCM VOC limit of 340 g/l. The sales-weighted average VOC Regulatory content for the reported products is 588 g/l, an increase of 3 percent from 2000 to 2004. We are unable to comment on the relative increase/decrease in the sales volume of Swimming Pool Repair and Maintenance from 2000 to 2004 as the sales data are protected.

Table 5.35-1b: Survey Data
Swimming Pool Repair and Maintenance

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	3	PD	100%	0%	77%	23%	0%	588	0.01
WB	0	0	-	-	-	-	-	-	-
Total	**3**	**PD**		**0%**	**77%**	**23%**	**0%**	**588**	**0.01**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.35-2 contains the complying marketshare for the revised Swimming Pool category, which reflects data for both Swimming Pool and Swimming Pool Maintenance and Repair coatings. About 89 percent of the combined sales volume complies with the current VOC limit. When considering the number of products reported, approximately 73 percent comply with the current limit.

Table 5.35-2: Complying Marketshare & Emission Reductions Swimming Pool Coatings

Current VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
340	29	89	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.35.6. Manufacturer Information

Product information sheets published by coatings manufacturers indicate that a wide variety of Swimming Pool coatings that meet the current VOC limit are available that possess performance characteristics similar to higher-VOC coatings. Multiple small manufacturers produce complying products, including Ellis Paint Company, Jones-Blair Company, Kelley Technical Coatings, and Tremco, Incorporated. A summary of product information for Swimming Pool and Swimming Pool Repair coatings is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

5.35.7. Conclusion

We recommend maintaining the current 340 g/l VOC limit for Swimming Pool coatings, based on the complying marketshare and product information from manufacturers. The high complying marketshare demonstrates widespread use of existing low-VOC technology for formulating Swimming Pool coatings. The current VOC limit is lower than the national limit promulgated by the U.S. EPA. The current VOC limit is consistent with the limits adopted by the South Coast AQMD and the OTC states, and the proposed limit for Canada.

We recommend elimination of the Swimming Pool Repair and Maintenance coating category, effective January 1, 2010. At that time, products formerly categorized as Swimming Pool Repair and Maintenance would be categorized as Swimming Pool coatings. Elimination of this category will not change the VOC limit for Swimming Pool Repair and Maintenance coatings.

5.36. TRAFFIC MARKING

VOC Limit Table (g/l)

USEPA: 150	Canada: 150	OTC: 150	SCAQMD: 100	SCM Proposed: 100

5.36.1. Category Definition

A coating labeled and formulated for marking and striping streets, highways, or other traffic surfaces including, but not limited to, curbs, berms, driveways, parking lots, sidewalks, and airport runways.

5.36.2. Major Proposed Changes

- The proposed VOC limit for Traffic Marking coatings would decrease from 150 g/l to 100 g/l.

5.36.3. Coating Description

Traffic Marking coatings are primarily used to mark roadways, streets, and parking lots. They are also used for zone marking in industrial plants and sport venues. These coatings can be applied in small patches with a roller or brush, but are typically applied with air-atomized machines, airless sprayers and conventional sprayers. Traffic Marking coatings can have flat, glossy, and/or reflective properties depending on their desired use. Direct reflectance can be improved with the addition of glass beads to enhance visibility for applications such as airport runways and highway systems. Since most Traffic Marking coatings are used on roads and require specialty equipment, they are most often applied by the California Department of Transportation (Caltrans), local highway maintenance crews, striping contractors, municipalities, shopping center management, airport contractors, plant maintenance personnel, and other industries that desire the use of striping or marking. However, these coatings are also sold in hardware stores and do-it-yourself centers and can be applied by homeowners or business owners for curbs, driveways, sport courts, or anything requiring zone marking or traffic marking. Typically Traffic Marking coatings are single component waterborne products with acrylic resins, but resin types also include vinyl copolymers, alkyds, chlorinated rubbers, polyvinyl acetates and cellulosics. There are also multi-component products which contain methyl methacrylate (MMA) resin that creates a strong exothermic reaction. These products are used for high-traffic areas.

ARB staff contacted personnel from Caltrans to determine potential impacts associated with the proposed 100 g/l VOC limit. Caltrans is a large user of Traffic Marking coatings and Caltrans staff has indicated that they can meet the proposed 100 g/l VOC limit with their regular traffic coatings (Caltrans, 2007). Most cities and counties generally follow Caltrans specifications for their traffic

coatings. The Caltrans "pre-qualified products" list for Traffic Paint Coatings would not be adversely impacted by the proposed VOC limit (Caltrans, 2007a). All of the listed products are high solids products that were tested and approved by the Caltrans Transportation Laboratory. ARB staff found that the published VOC levels for these products are substantially lower than the proposed SCM limit.

Some areas of California (e.g., the Northern Coast) have the type of climate where moisture and cold weather can inhibit the proper application of Traffic Marking coatings. To help minimize application failure, Caltrans has opted to apply coatings in these areas only during good weather (Caltrans, 2007c). This may limit them to only a few months per year in this type of climate, but it prevents application failures by giving the paint sufficient time to dry. In Northern Coast areas near Crescent City, Caltrans previously used acetone-based products, but they eventually phased these products out, due to flammability and occasional machine plugging. Machine plugging can be caused by a multitude of problems ranging from the type of solvent, lack of solvent, temperature, humidity, or other factors.

When Caltrans performs Traffic Marking maintenance or repairs within cities and counties, they usually do so without road closures (Caltrans, 2007c). Therefore, the coatings must dry quickly. If a waterborne product is applied, roughly 5 minutes of drying time is required to ensure minimal tracking. In cities or counties with high traffic loads, 5 minute drying is not effective and higher-VOC products or faster-drying coatings may be needed to meet the demands of the area. Solid thermoplastics, which are not considered coatings under the SCM, are an alternative to liquid Traffic Marking coatings. Thermoplastics come in 50 pound bags that contain pigments, fillers, and other ingredients. During application, this bag is poured into a machine that melts the bagged components at about 400 degrees F. Upon hitting the ground, the molten material cools instantly, which minimizes dry times, reduces or eliminates tracking, and emits minimal if any VOCs because it doesn't contain any solvents (Caltrans, 2007c). This type of coating application requires equipment and thermoplastic materials that can be relatively expensive for counties or cities, as compared to liquid traffic coatings.

5.36.4. Substrates/Exposures

Traffic Marking coatings can be used indoors and outdoors at a variety of locations (roadways, curbs, inside factories, gaming surfaces, airports, etc.). They are applied to concrete, asphalt, stone, masonry, brick, and cinder block substrates that are exposed to pedestrian and vehicle traffic. Usually, these products cannot be applied to substrates that have excessive dirt, debris, and oil/gasoline residues. Application temperatures vary, but most are applied in ambient temperatures ranging from 50-110 ˚F. Some can be applied with temperatures dropping to 40 ˚F and rising to as high as 120 ˚F. In general, it is

recommended to apply when the temperature is at least 5 degrees F above the dew point. Since these coatings are intended for roadways that are exposed to vehicle traffic, they are usually designed to be resistant to a variety of items, including tire marks, skidding, antifreeze, motor oil, diesel fuel, gasoline, calcium chloride, and transmission fluid.

5.36.5. Survey Results

Table 5.36-1 summarizes our estimate of sales and VOC emissions for Traffic Marking coatings, based on the ARB survey. In 2004, the sales volume for Traffic Marking coatings was approximately 2.2 million gallons which represents 2 percent of the total California sales volume for architectural coatings. The sales volume for Traffic Marking coatings declined about one-third from 2000 to 2004. We believe this is due to the increased use of melted thermoplastic materials which are not classified as architectural coatings. Thermoplastics last longer and perform better on roadways with high traffic volumes. Another difference between 2000 and 2004 is the significant decrease in dual-use products (i.e., products that can be used for both interior and exterior applications). In 2000, 68 percent of the sales volume was classified as dual use, but this declined to 4 percent in 2004 when most products were classified for exterior use only.

Waterborne Traffic Marking coatings represent 85 percent of the sales volume and have a sales-weighted average VOC level of 93 g/l, which is below the proposed 100 g/l VOC limit for this category. The overall sales-weighted average VOC level for Traffic Marking coatings decreased 13 percent from 2000 to 2004.

VOC emissions from Traffic Marking coatings are about 1.7 tpd, which represents approximately 2 percent of the total emissions from architectural coatings. Since most of the sales volume is waterborne, most of the emissions (78 percent) are from waterborne coatings. Solventborne coatings make up only 15 percent of the sales volume, but they contribute about 22 percent of the emissions.

Table 5.36-1: Survey Data
Traffic Marking

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	48	329,369	15%	0%	100%	0%	0%	147	0.36
WB	198	1,885,082	85%	0%	96%	4%	0%	93	1.31
Total	**246**	**2,214,451**		**0%**	**96%**	**4%**	**0%**	**101**	**1.67**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.36-2 contains the complying marketshare for Traffic Marking coatings, based on the ARB survey. This table shows that 74 percent of the sales volume complies with the proposed VOC limit.

Implementing the proposed 100 g/l limit would achieve 0.09 tpd in VOC emission reductions for the non-South Coast AQMD portion of California, on an annual average basis. This is a 5 percent reduction in emissions for Traffic Marking coatings.

Table 5.36-2: Complying Marketshare & Emission Reductions Traffic Marking

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
100	158	74%	0.09

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Of the 25 companies that reported in this category, 19 offered Traffic Marking coatings that comply with the proposed limit. Ten companies that produce compliant coatings are considered to be small businesses, because they have fewer than 250 employees.

5.36.6. Manufacturer Information

The Master Painters Institute (MPI) has two pertinent categories for Traffic Marking coatings: MPI #32 (Traffic Marking Paint, Alkyd) and MPI #97 (Traffic Marking Paint, Latex). Only products on the approved list for MPI #97 can comply with the proposed 100 g/l VOC limit. A list of the reported products from the ARB Survey and MPI-approved products that can meet the proposed VOC limit is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm). Three of the products reported in the survey qualify for the MPI Green Performance Standards.

5.36.7. Conclusion

We recommend a 100 g/l VOC limit for Traffic Marking coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare, the number of companies making compliant products, and product information from manufacturers. The proposed VOC limit is lower than the limits adopted by the U.S. EPA and the OTC states and the proposed limit for Canada. The proposed limit is consistent with the limit adopted by the South Coast AQMD.

5.37. TUB AND TILE REFINISH

VOC Limit Table (g/l)

USEPA: 450	Canada: N/A	OTC: N/A	SCAQMD: N/A	SCM Proposed: 420

5.37.1. Category Definition

A clear or opaque coating that is labeled and formulated exclusively for refinishing the surface of a bathtub, shower, sink, or countertop. Tub and Tile Refinish coatings must meet all of the following criteria:

- The coating must have a scratch hardness of 3H or harder and a gouge hardness of 4H or harder. This must be determined on bonderite 1000, in accordance with ASTM D3363-05 (Standard Test Method for Film Hardness by Pencil Test); and
- The coating must have a weight loss of 20 milligrams or less after 1000 cycles. This must be determined with CS-17 wheels on bonderite 1000, in accordance with ASTM D4060-07 (Standard Test Methods for Abrasion Resistance of Organic Coatings by the Taber Abraser); and
- The coating must withstand 1000 hours or more of exposure with few or no #8 blisters. This must be determined on unscribed bonderite, in accordance with ASTM D4585-99 (Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation) and ASTM D714-02e1 (Standard Test Method for Evaluating Degree of Blistering of Paints); and
- The coating must have an adhesion rating of 4B or better after 24 hours of recovery. This must be determined on unscribed bonderite, in accordance with ASTM D4585-99 (Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation) and ASTM D3359-02 (Standard Test Methods for Measuring Adhesion by Tape Test).

Please note that “Tub and Tile Refinish” is a proposed new category that includes products which were formerly considered to be in the “Other” category for the 2000 SCM.

Under the U.S. EPA Architectural Coating regulation, Tub and Tile Refinish products may be subject to the VOC limit for Industrial Maintenance coatings. Alternatively, they could be covered by the small container exemption or the tonnage exemption (EPA, 1998a).

5.37.2. Major Proposed Changes

- Tub and Tile Refinish is a new category that includes products formerly classified under the “Other” default category.

5.37.3. Coating Description

Tub and Tile Refinish coatings include primers and topcoats that are used to refurbish bathtubs, showers, sinks, countertops, and other tile and porcelain surfaces. These products are designed to provide a hard surface that can withstand abrasion and immersion in hot water. However, they are not generally recommended for pools or hot tubs. Most products provide a glossy sheen, but some leave a satin finish. Tub and Tile Refinish coatings can either be applied by professional contractors or homeowners. Contractors can obtain specialized training from manufacturers of these coatings and many contractors operate franchise businesses that are licensed by coating manufacturers. For the "do-it-yourself" market, some manufacturers sell refinishing kits that include cleaners, etching solutions, primers, and topcoats. Manufacturers generally recommend that the coatings be applied with a sprayer, but they can also be applied with a brush or roller.

Most of the products identified by ARB staff are multi-component, solventborne formulations with acrylic urethane topcoats and epoxy primers. Other types of products include multi-component, solventborne formulations with amine resins and single component, solventborne, urethane primers. Products are available in solventborne formulations that have VOC contents less than 420 g/l.

5.37.4. Substrates/Exposures

Tub and Tile Refinish coatings are intended for interior applications on substrates that include porcelain, fiberglass, ceramic tile, formica, and cultured marble. These products are exposed to frequent moisture, including submersion in hot water.

5.37.5. Survey Results

Tub and Tile Refinish coating is a new category, so it was not reported separately in the ARB survey. Manufacturers of Tub and Tile Refinish coatings are in a niche market that has not traditionally been targeted for participation in the Architectural Coating Surveys. In addition, some manufacturers may have thought that the "do-it-yourself" refinishing kits should qualify as "consumer products", rather than architectural coatings. For these reasons, only a small number of Tub and Tile Refinish products were reported in the ARB survey, primarily in the "Other" category. ARB staff does not believe that these data are necessarily representative of the overall market in California. Using survey data and information provided by industry representatives, ARB staff estimates that sales are between 3,000 - 16,000 gallons per year and VOC emissions are between 0.02 - 0.08 tpd (ARB, 2006).

In the past, it was assumed that most of the sales for Tub and Tile Refinish products consist of small containers that would be exempt from the SCM VOC

limits. However, the limited survey data indicate that this may not be the case. In addition, many manufacturers limit their sales to professional refinishing contractors only and they offer their products in container sizes ranging from one pint up to 55 gallons.

5.37.6. Manufacturer Information

ARB staff identified the following manufacturers of Tub and Tile Refinish products that meet the proposed VOC limit: North American Polymer Co., Ltd.; Pandalai Coatings Company; Specialty Coatings & Chemicals, Inc.; and XIM Products.

5.37.7. Conclusion

ARB staff recommends that a new category be established for Tub and Tile Refinish coatings to clarify how these products should be classified and regulated. ARB staff does not believe that it is technologically feasible for Tub and Tile Refinish products to be formulated to meet the VOC limit for the “Other” category. In addition, it does not appear that the products being sold in California are primarily being sold in small containers. The proposed definition for the Tub and Tile Refinish category includes strict performance requirements to help prevent this category from becoming a loophole for Nonflats and other categories. While U.S. EPA considers Tub and Tile Refinish products to be covered by Industrial Maintenance, ARB staff does not believe that this is appropriate.

For the new Tub and Tile Refinish category, we are recommending a VOC limit of 420 g/l, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the number of companies making complying products and information provided by manufacturers. The proposed SCM VOC limit is lower than the national limit of 450 g/l promulgated by the United States Environmental Protection Agency (U.S. EPA). Tub and Tile Refinishing is not currently listed in architectural coating rules for the South Coast AQMD, the OTC states, or Canada.

Establishment of the Tub and Tile Refinish category is being proposed for clarification purposes, rather than for obtaining emission reductions. While some products would need to be reformulated to meet the proposed 420 g/l limit, the resulting emission reductions would be relatively negligible.

5.38. WATERPROOFING MEMBRANES

VOC Limit Table (g/l)

USEPA: 600	Canada: 400	OTC: 400	SCAQMD: 100	SCM Proposed: 250

5.38.1. Category Definition

A clear or opaque coating that is labeled and formulated for application to concrete and masonry surfaces to provide a seamless waterproofing membrane that prevents any penetration of liquid water into the substrate. Waterproofing Membranes are intended for the following waterproofing applications: below-grade surfaces, between concrete slabs, inside tunnels, inside concrete planters, and under flooring materials. Waterproofing Membranes must meet the following criteria:

- Coating must by applied in a single coat of at least 25 mils (0.025 inch) dry film thickness; and
- Coatings must meet or exceed the requirements contained in ASTM Standard C836-06 (Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course).

The Waterproofing Membrane category does not include topcoats that are included in the Concrete/Masonry Sealer category (e.g., parking deck topcoats, pedestrian deck topcoats, etc.).

Please note that “Waterproofing Membrane” is a proposed new category that includes products which were formerly covered by the following two categories in the 2000 SCM:

> Waterproofing Concrete/Masonry Sealer: A clear or pigmented film-forming coating that is labeled and formulated for sealing concrete and masonry to provide resistance against water, alkali, acids, ultraviolet light and staining.
>
> Waterproofing Sealer: A coating labeled and formulated for application to a porous substrate for the primary purpose of preventing the penetration of water.

These two categories were eliminated from the proposed SCM and the types of products that were previously in these categories would be covered by the following: Basement Specialty Coating; Concrete/Masonry Sealer; Wood Coatings; Industrial Maintenance; Primer, Sealer, Undercoater; Reactive Penetrating Sealer; Stone Consolidant; and Waterproofing Membrane.

Under the U.S. EPA Architectural Coating regulation, Waterproofing Membranes would be covered by the “Waterproofing Sealers and Treatments” category.

5.38.2. Major Proposed Changes

- Waterproofing Membrane is a new category for high-build, high-performance products. It includes products that were formerly included in the Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer categories.
- For products that were formerly in the Waterproofing Concrete/Masonry Sealer category, the proposed VOC limit decreases from 400 g/l to 250 g/l.
- For products that were formerly in the Waterproofing Sealer category, the proposed VOC limit is the same.

5.38.3. Coating Description

These products are applied to concrete and masonry to provide a seamless waterproofing coating for both interior and exterior exposures. These coatings can be applied for a variety of waterproofing uses, such as:

- Between concrete slabs (e.g., parking decks, roof decks, bridges)
- Below-grade exterior walls, foundations, basements
- Inside tunnels
- Inside concrete planters
- Underneath tile flooring

The Waterproofing Membrane category is intended for non-wearing surfaces (e.g., between slabs) and it does <u>not</u> include products that are used to coat the surface of parking decks, roof decks, bridges, etc. Those types of deck coatings are covered under the Concrete/Masonry Sealer category.

Waterproofing Membrane products accounted for 27% of the reported sales volume for Waterproofing Concrete/Masonry Sealers and 4% of the sales volume for Waterproofing Sealers. They also accounted for 42% of the VOC emissions for Waterproofing Concrete/Masonry Sealers and 0% of the VOC emissions for Waterproofing Sealers. Most Waterproofing Membrane products are either single component, moisture-cure, elastomeric polyurethanes or single component bituminous coatings. There are also some multi-component elastomeric coatings. Many products are applied as high-build coatings with wet film thicknesses ranging from 40 mils to more than 100 mils. Coatings are generally applied by professional contractors and application methods include: brush, squeegee, trowel, roller, or spray. Resin types include: acrylic, amines/amides, asphaltic/bituminous, polyurethane, and styrene-butadiene. Single component, solventborne products are available with VOC contents below 250 g/l and they represent approximately 56 percent of the sales volume for the Waterproofing Membrane group (excluding small containers). Products with VOC contents at or below 100 g/l represent six percent of the reported sales volume for large containers, but they appeared to have various application limitations. Single component waterborne products with VOC contents below 100 g/l have limitations which include: they are only suitable for above-grade

applications; they require unique, specialized application equipment; or they are intended for use with mesh or a mat. Most of the reported solventborne products with VOC contents below 100 g/l also had limitations, including: the products are hot-applied asphaltic coatings that require the use of heating kettles; or the products are intended for above-grade applications only.

5.38.4. Substrates/Exposures

Waterproofing Membranes are intended for application to concrete and masonry substrates in non-wear locations (e.g., between concrete slabs; on exterior below-grade surfaces; inside tunnels; inside planters; under flooring; etc.). Products in this category provide a waterproofing seal to prevent water intrusion and they can be applied to wet surfaces. The products are not designed to be resistant to abrasion from pedestrian traffic or vehicle traffic.

5.38.5. Survey Results

Waterproofing Membrane is a new category; therefore, it was not reported separately in ARB's 2005 Architectural Coating Survey. Please refer to the Concrete/Masonry Sealer section for survey data that were reported for Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer (ARB, 2006).

Table 5.38-1 contains the complying marketshare for the proposed new Waterproofing Membrane category, based on the ARB survey. This table reflects combined data for Waterproofing Membrane products that were reported under two previous categories: Waterproofing Concrete/Masonry Sealer and Waterproofing Sealer. Based on reported sales volume, 68 percent of the reported Waterproofing Membrane coatings comply with the proposed VOC limit of 250 g/l. Based on the number of products reported, 65 percent of the products comply with the proposed limit. Of the eight companies that reported in this category, seven offered Waterproofing Membrane coatings that comply with the proposed limit.

Table 5.38-1: Complying Marketshare & Emission Reductions
Waterproofing Membrane

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
250	24	68%	0.09

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.38.6 Conclusion

We are recommending a new Waterproofing Membrane category with a VOC limit of 250 g/l, effective January 1, 2010. This proposed limit will apply to the

higher-build (>25 mil) products that comply with the requirements in the Waterproofing Membrane definition provided above. Thinner coatings that provide a waterproofing membrane, but do not comply with the above definition, will be covered by the new Concrete/Masonry Sealer category and will need to comply with a VOC limit of 100 g/l. The proposed limit for Waterproofing Membranes is consistent with the VOC limit for Industrial Maintenance coatings. It is expected that there may be some overlap between these two categories for products that are used in water/wastewater facilities and other applications that are covered by the Industrial Maintenance definition. Therefore, we believe that a consistent VOC limit makes the SCM more enforceable.

For Waterproofing Membrane products that were previously classified as "Waterproofing Sealers" (250 g/l), the VOC limit remains the same. For products that were previously classified as "Waterproofing Concrete/Masonry Sealers" (400 g/l), the proposed limit will be a significant decrease. ARB staff's analysis supports the conclusion that the proposed limit is technologically and commercially feasible.

In the South Coast AQMD, it is expected that Waterproofing Membrane products could fall under Industrial Maintenance or Waterproofing Sealer, both of which have a VOC limit of 100 g/l. The proposed SCM VOC limit is higher than the South Coast AQMD limit. However, manufacturers that provide coatings in the South Coast AQMD can still sell products which exceed the 100 g/l limit, if they participate in the South Coast AQMD averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit. South Coast AQMD also grants a VOC exemption for the use of tertiary-Butyl Acetate to help manufacturers formulate Industrial Maintenance coatings that will meet the 100 g/l limit. The proposed SCM does not include a VOC exemption for tertiary-Butyl Acetate.

ARB staff believes that additional research is needed to verify the performance of 100 g/l Waterproofing Membranes in a way that protects the infrastructure throughout California. The South Coast AQMD area has a mild climate, so climatic conditions are less of a concern. However, in other areas of California, the infrastructure is exposed to more extreme climates (e.g., mountainous areas with freezing temperatures; coastal areas with persistent cold temperatures, salt spray, high humidity, etc.). ARB staff believes that additional research is needed to develop products that perform well in these areas. Therefore, ARB staff believes that the current 250 g/l VOC limit is most appropriate at this time.

5.39. WOOD COATINGS

VOC Limit Table (g/l)

USEPA: 400-725	Canada: 350-725	OTC: 350-725	SCAQMD: 275	SCM Proposed: 275

5.39.1. Category Definition

Coatings labeled and formulated for application to wood substrates only. The Wood Coatings category includes the following clear and semi-transparent coatings: lacquers; varnishes; sanding sealers; penetrating oils; clear stains; wood conditioners used as undercoats; and wood sealers used as topcoats. The Wood Coatings category also includes the following opaque wood coatings: opaque lacquers; opaque sanding sealers; and opaque lacquer undercoaters. The Wood Coatings category does not include the following: clear sealers that are labeled and formulated for use on concrete/masonry surfaces; or coatings intended for substrates other than wood. Wood Coatings must be labeled “For Wood Substrates Only”.

Please note that “Wood Coatings” is a new category that is a consolidation of the following four categories that were contained in the 2000 SCM:

> Clear Brushing Lacquer: Clear wood finishes, excluding clear lacquer sanding sealers, formulated with nitrocellulose or synthetic resins to dry by solvent evaporation without chemical reaction and to provide a solid, protective film, which are intended exclusively for application by brush, and which are labeled as specified in subsection 4.1.5.
>
> Lacquer: A clear or opaque wood coating, including clear lacquer sanding sealers, formulated with cellulosic or synthetic resins that dry by evaporation without chemical reaction and to provide a solid, protective film.
>
> Sanding Sealer: A clear or semi-transparent wood coating labeled and formulated for application to bare wood to seal the wood and to provide a coat that can be abraded to create a smooth surface for subsequent applications of coatings. A sanding sealer that also meets the definition of a lacquer is not included in this category, but is included in the lacquer category.
>
> Varnish: A clear or semi-transparent wood coating, excluding lacquers and shellacs, formulated to dry by chemical reaction on exposure to air. Varnishes may contain small amounts of pigment to color a surface, or to control the final sheen or gloss of the finish.

5.39.2. Major Proposed Changes

- Wood Coatings is a new category to replace Clear Brushing Lacquers, Lacquers, Sanding Sealers, and Varnishes.
- The category definition has been revised to include penetrating oils, clear stains, lacquer undercoaters, varnish stains, wood conditioners used as undercoats, and wood sealers used as topcoats.
- Clear waterproofing sealers applied to wood substrates that were previously included in the Waterproofing Sealers category and clear stains previously included in the Stains category are now in the Wood Coatings category.
- For products that were formerly categorized as Clear Brushing Lacquers (680 g/l), Lacquers (550 g/l), Sanding Sealers (350 g/l), and Varnishes (350 g/l), the proposed VOC limits decrease to 275 g/l.
- For products that were formerly categorized as Waterproofing Sealers, the proposed VOC Limit increases from 250 g/l to 275 g/l.
- For products that were formerly categorized as Stains, the proposed VOC Limit increases from 250 g/l to 275 g/l.

5.39.3. Coating Description

We are proposing a single category that combines several categories under Wood Coatings, because the current definitions for Lacquer and Varnish describe traditional solventborne technology that is not necessarily accurate for both waterborne and solventborne products.

Wood Coatings are used for decorative purposes and to provide some protection from abrasion, staining, moisture, dirt, and common chemicals. Wood Coatings cover a wide range of applications and functions. Clear Wood Coatings include lacquers, sanding sealers, penetrating oils, varnishes, stain controllers/wood conditioners, clear stains, and waterproofing sealers. Most opaque Wood Coatings are lacquers and lacquer undercoaters, but opaque sanding sealers and opaque conversion varnishes are also available. Provided below is a description of the various applications, primarily based on the products reported in ARB's 2005 Architectural Coating Survey.

Lacquers: Clear lacquers are used for protective and decorative purposes. They are film-forming coatings that protect wood from abrasion, staining, moisture, dirt, and common chemicals. Clear lacquers leave a smooth, high-gloss finish that allows the natural wood grain and color to show through. Pigments can also be added to the coating to produce a variety of different colors. Opaque lacquer topcoats and undercoats are similar to clear lacquers, but contain opaque pigments that obscure the wood grain and texture. These coatings leave an opaque finish with various levels of gloss.

Clear lacquers are usually applied by professionals and are generally sprayed on because they dry very quickly. Brushing is not recommended, since brush marks may be left in the finish due to fast-evaporating solvents. Clear brushing lacquers are specifically formulated with slower drying solvents, making application easier for do-it-yourself homeowners. Clear brushing lacquers dry quickly but leave enough open time to get a smooth, streak-free finish. None of the clear brushing lacquers reported in the survey meet the proposed 275 g/l limit, but at least one major manufacturer has developed complying waterborne products.

Traditional lacquers are single component solventborne coatings composed of nitrocellulose (or cellulose nitrate), which is made by mixing cellulose from wood or cotton pulp with nitric and sulfuric acid. Nitrocellulose lacquers dry completely by evaporation of the solvent, leaving a hard, brittle finish. These solventborne formulations have rewetting capabilities, which means that subsequent coats of lacquer will partially redissolve the previous dry coat, making the coating easy to repair. Traditional clear lacquers also have an amber cast that darkens with time. Nitrocellulose derivatives, including ethyl cellulose, cellulose acetate, and cellulose acetate butyrate (CAB), may also be used. Nitrocellulose or its derivatives can be modified with acrylic, alkyd, or polyester resins. CAB acrylic lacquer is one of the more common cellulosic coatings. There are a few traditional clear lacquer products that can meet the proposed 275 g/l limit. Two opaque solventborne cellulosic lacquer undercoaters reported in the survey had VOC contents below the proposed 275 g/l limit.

Catalyzed lacquer is another common type of lacquer. These coatings can be solventborne or waterborne and dry by both evaporation and chemical reaction. Pre-catalyzed lacquer consists of two components that are mixed prior to being sold, while components of post-catalyzed lacquer are mixed immediately before application. Catalyzed lacquer often contains nitrocellulose, amino resins (urea formaldehyde or melamine formaldehyde), alkyd resins, and an acid catalyst. Once applied, curing can take several days to several weeks and catalyzed lacquer will provide more resistances than traditional lacquer. Catalyzed finishes are more difficult to repair and refinish because they do not have rewetting capabilities. Similarly to traditional lacquers, very few catalyzed clear lacquers meet the proposed limit. None of the catalyzed opaque lacquers reported in the survey meet the proposed VOC limit, but they could be sold under the small container exemption.

Waterborne clear lacquers most commonly contain acrylic resins, or a combination of acrylic and polyurethane. Almost all clear lacquers that have VOC contents below the proposed VOC limit of 275 g/l are waterborne acrylics or waterborne acrylic/polyurethane dispersions. For waterborne clear lacquers, 93 percent of the sales volume complies with the proposed VOC limit. When considering the number of products reported, 88 percent of the clear lacquer products meet the proposed limit.

Opaque lacquer undercoaters can often be used as a finish coat or can be topcoated with an opaque or clear lacquer. Applying a clear nitrocellulose-based lacquer over an opaque lacquer or lacquer undercoater can present problems due to its rewetting capabilities. Lacquer thinner from the clear topcoat can partially dissolve some of the colorant pigment from the opaque undercoat. These pigments can "float" into the clear coat and change the color of the coating (R.J. McGlennon, 2006). Many opaque lacquer sanding sealers and undercoaters meet the proposed 275 g/l limit. Almost all of these are waterborne formulations that contain acrylic resins.

Sanding Sealers: Sanding sealers are applied to bare or stained wood to seal the wood and provide a coat that can be easily sanded to create a smooth surface for subsequent applications of coatings. Sanding sealers can minimize grain raise, block stain bleed into the topcoat, and prevent the finish from penetrating into the wood surface. They dry quickly, thus reducing the time it takes to finish a project. Some sanding sealers can be used as a sealer prior to the application of a finish topcoat or as both a sealer and finish.

Typically, sanding sealers are brushed, sprayed, or rolled on, but can be applied to floors with a T-bar, trowel, or lambswool applicator. A T-bar is an applicator that is shaped like a "T" with a long handle and a rounded metal bar at the end that can swivel. The bar has a cover made of a synthetic material that is used to spread the coating over the floor. The sanding sealer is sanded smooth and leaves a matte or low-gloss, transparent finish that is usually topcoated with a varnish, lacquer or other film-forming coatings. Sanding sealers are applied by homeowners and professional contractors.

Sanding sealers usually contain additives that make the coating easier to sand. These include waxes, metallic soaps, and other lubricating materials. Zinc stearate is a metallic soap that is used as a lubricant, flattening agent, coupling agent, waterproofing agent, or viscosity modifier. Additives that make the coating easy to sand can also prevent adequate adhesion of the clear finish topcoat, especially urethane and polyurethane topcoats. Vinyl is a common resin used in sanding sealers because it helps seal the wood from moisture and creates a smooth surface for the topcoat. Common solventborne resins include vinyl toluene, alkyd, urethane and polyurethane. Alkyds are often modified with vinyl toluene or urethane. The majority of waterborne sanding sealers contain acrylic resins, while some contain urethane and polyurethane. Many lacquer sanding sealers are formulated with cellulosic resins to be compatible with lacquer topcoats. Sanding sealers can also contain driers, other additives, and solvents, such as mineral spirits. Most sanding sealers are single component, but some may be two-component to increase durability, especially on high-wear surfaces. All sanding sealers that meet the 275 g/l limit are waterborne acrylics and urethane/polyurethanes.

Penetrating Oils: Penetrating oils are natural wood finishes that are used on bare wood surfaces to help protect wood from weather damage and to enhance the natural characteristics of the wood. They provide a durable finish that helps wood withstand moisture and the graying and fading effects of the sun. Little surface preparation is required before application. These are single component coatings that are sprayed, wiped, rolled, or brushed on by homeowners. If spraying, back-brushing is recommended to achieve good penetration. Penetrating oils leave a matte finish that can darken the color of the wood, but does not mask wood color, grain, or texture. Penetrating oil finishes are clear and do not contain any pigment that would change the color of the wood.

These products contain drying oils, usually tung or linseed oil. Drying oils are reactive finishes that penetrate the wood surface and solidify upon exposure to the air. Clear, penetrating oil finishes commonly contain water repellents, such as paraffin wax or wax-like chemicals, to prevent wood from absorbing water, which causes the wood to crack, warp, and split. They usually contain mildewcides or UV stabilizers to help prevent discoloration or damage from the sun. Penetrating oil finishes may also contain alkyds or other resins. Penetrating oils include teak and Danish oils. Some penetrating oil products meet the proposed 275 g/l VOC limit. Because these products penetrate the wood substrate and do not leave a film, they were usually included in the Stain category. These products are now included in the Wood Coatings category because they do not contain any pigments that change the color of the wood surface.

Varnishes: Clear or semitransparent varnishes are used to protect wood without hiding the natural color or grain pattern. They are single- or multi-component coatings that may be brushed, sprayed, or rolled on. Brushing is the preferred method over spraying because varnishes usually set up slowly and have a tendency to run if applied too heavily. A T-bar or lambswool applicator is commonly used to apply varnish to floors. Varnishes are applied by homeowners and professional contractors, and leave a smooth finish with various levels of gloss. Two-component varnishes, including conversion varnishes, are usually applied by professionals, due to the need for exact mixing ratios and the toxicity of the coating components.

There are many types of varnishes. The most common varnish is composed of a resin and a drying oil. Drying oils, usually linseed, tung or soya, penetrate the wood surface and solidify upon exposure to the air. Synthetic resins are often preferred over natural resins because of their better performance and reliable supply. Solventborne varnishes commonly contain alkyd, urethane, polyurethane, polyester, or phenolic resins, while waterborne varnishes usually contain acrylic, polyurethane, or a blend of the two. Some waterborne varnishes may contain alkyd dispersions. Polyurethane has become very common, due to its durability and resistance to abrasion. Two-component polyurethane coatings are especially known for their excellent properties and resistances. Epoxy resins

are also used in some varnishes for wood floors because they provide a durable, chemical-resistant finish.

Other varnish formulations contain a resin, oil, solvent or water, metallic driers, antiskinning agents, and other additives. Long oil varnishes, which contain a higher percentage of oil, are more flexible and soft and are usually applied to exterior surfaces that are subjected to temperature extremes. Short oil varnishes, with lower concentrations of oil, are usually applied indoors. Spar varnish, a long oil varnish used to protect surfaces in environments exposed to moisture and UV radiation on exterior surfaces, is often composed of alkyd- or urethane-modified tung or soya oil and phenolic resins. Conversion varnishes, or catalyzed varnishes, are similar to post-catalyzed lacquer. Both are two-component coatings that are usually composed of alkyd and amino resins, and require an acid catalyst that is added immediately prior to application. Varnishes can also cure through moisture absorption or exposure to heat or UV radiation. Moisture-cured urethane is a common clear coating used on wood surfaces, which dries when its components react with atmospheric moisture to form the finished cross-linked polymer film.

Conventional solventborne oil-modified urethanes have long been a popular choice for coating wood flooring and various other wood surfaces, but are decreasing in use, due to their higher VOC content. Waterborne two-component urethanes and polyurethane dispersion (PUD)/acrylic blend varnishes are both used as alternatives to traditional oil-modified urethane coatings. Waterborne two-component polyurethane systems are formulated with VOC contents at or below 275 g/l. PUD/acrylic blend varnishes dry entirely by evaporation without any crosslinking. Higher levels of PUD give better abrasion, mar, and scuff resistance, while blending a PUD with styrene acrylic improves chemical resistance. Oil-modified urethane alternatives to conventional oil-modified urethanes have also been formulated. These coatings have either a high solids content, exempt solvents, or replace solvents with water. The typical waterborne oil-modified urethane varnish has a VOC content of 200 g/l (Caldwell, 2005). Some alkyd formulations can also meet the proposed 275 g/l VOC limit.

Semitransparent varnishes contain pigments that color the surface of the wood without concealing the wood grain. Semitransparent varnishes leave a protective film, unlike semitransparent stains. Varnish stains are considered to be semitransparent varnishes because they leave a film on the wood surface. Most varnishes that meet the 275 g/l limit are waterborne. They contain acrylic, vinyl acrylic, urethane/polyurethane, and alkyd resins.

Opaque conversion varnishes, or catalyzed varnishes, have similar formulations to post-catalyzed lacquers, but do not contain nitrocellulose. Both are two-component coatings that are usually composed of alkyd and amino resins, and require an acid catalyst that is added immediately prior to application. None of

the opaque conversion varnishes reported in the survey meet the proposed limit, but they could be sold under the small container exemption.

Stain Controllers: Stain controllers or wood conditioners are applied to new or bare wood surfaces to prevent uneven absorption of semitransparent stains. These products were reported under the Primers, Sealers, and Undercoaters category, but ARB staff is proposing that they be included in the new Wood Coatings category. Stain controllers are single component coatings that are brushed or wiped onto the surface of the wood. Excess coating that does not penetrate the substrate is wiped off, leaving a matte finish. Stain is usually applied within two hours, while the stain controller is still wet. If allowed to dry, the stain controller will inhibit the absorption of stain and the surface must be sanded before the stain is applied. Waterborne stain controllers are usually sanded off the surface because they do not penetrate the wood as readily as solventborne products. Solventborne stain controllers are usually composed of oils, while waterborne products usually contain synthetic resins. Almost all stain controllers have VOC contents above the proposed 275 g/l limit. One waterborne stain controller reported in the survey meets the proposed limit.

Waterproofing Sealers: Waterproofing sealers are applied to bare wood to prevent the substrate from absorbing water, which causes the wood to crack, warp, and split. These coatings are all single component coatings that are sprayed, wiped, rolled, or brushed on. Back brushing is recommended, if spraying, to achieve good penetration. Excess is often wiped off with a cloth, leaving a flat finish with little or no sheen. These coatings are applied by homeowners or professional contractors. Waterproofing sealers do not contain any pigments that would help protect the wood surface from degradation caused by UV radiation. Instead, UV stabilizers are usually included in waterproofing sealers to protect the wood surface. They may also contain mildewcides to protect wood from discoloration caused by the growth of mildew. Solventborne waterproofing sealers often contain drying oils such as tung or linseed oil, alkyd, or phenolic resins. Waterborne products usually contain acrylic resins. Waterborne waterproofing sealers are usually formulated with VOC contents below the 275 g/l proposed limit, while solventborne products usually have VOC contents above the proposed limit.

5.39.4. Substrates/Exposures

Lacquers are used on interior wood surfaces in kitchens, entryways, bedrooms, bathrooms, living rooms, and offices in residential and commercial areas. They are most commonly applied to wood cabinets, doors, molding, trim, paneling, fixtures, and floors. Many lacquers may also be applied to metal or other substrates where a clear coating is desired. These coatings are not covered by the Wood Coatings category. Instead, they are categorized as Nonflat or Nonflat high gloss coatings, depending on the gloss level. All solventborne and most waterborne lacquers cannot be used outdoors because they have little resistance

to moisture and UV radiation. Catalyzed lacquers provide some resistance to abrasion, heat, water, solvents, and household chemicals.

Sanding sealers are generally used indoors in residential and commercial areas. Some can be applied outdoors in protected areas where there is little exposure to UV radiation and moisture. They are applied to bare or stained wood surfaces such as floors, doors, trim, paneling, and cabinets. Sanding sealers cannot be applied to surfaces previously finished with a film-forming coating like a varnish or a non-penetrating stain. Most sanding sealers are compatible with a specific finishing system. Lacquer sanding sealers are formulated for application under lacquers, while stearated or vinyl sanding sealers are often not compatible with urethane or polyurethane coatings. Sanding sealers have little resistance to the environment, as any resistances are provided by subsequent applications of varnish or lacquer.

Penetrating oils are applied indoors or outdoors in residential and commercial areas. These coatings are used on a variety of exterior wood surfaces, including decks, shakes, shingles, siding, boat docks, and fences. They are also used on a variety of interior wood surfaces including cabinets, floors, paneling, trim, doors, molding, and stairs. Penetrating oil finishes usually provide some resistance to moisture and UV radiation.

Varnishes are usually applied to wood on a variety of interior and exterior surfaces in residential and commercial areas. They are used on floors, cabinets, doors, trim, and paneling. Many varnishes, especially polyurethanes, can also be applied to various other wood surfaces where a clear, protective coating is desired. These coatings can be applied over a sanding sealer or directly to bare or stained wood surfaces. Most have excellent resistance to chemicals, abrasion, marring, heat, solvents, water, and stains. Some varnishes are not durable enough to be applied to floors. Exterior varnishes will usually have some resistance to UV radiation to protect the wood surface from degradation. Without UV absorbers, film-forming varnishes applied to exterior surfaces will tend to crack and flake off because they have little or no pigment to prevent UV rays from penetrating the wood surface. Multiple coats of exterior varnishes need to be applied to increase UV resistance and they also need to be reapplied frequently to extend the life of the coating.

Stain controllers or wood conditioners are applied to interior and exterior wood surfaces wherever penetrating stains are to be applied. They are applied to soft or porous wood substrates that have the potential for uneven stain penetration. Stain controllers do not have any resistances.

Waterproofing sealers are applied in residential areas to exterior wood decks, porches, fences, boat docks, siding, paneling, shakes, and shingles. These coatings have some resistance to UV radiation and mildew growth.

Opaque Wood Coatings usually cannot be used outdoors, because they have little resistance to moisture and UV radiation. Opaque catalyzed lacquers and varnishes provide resistance to abrasion, heat, water, solvents, stains and household chemicals. Some are not durable enough to be applied to floors.

5.39.5. Survey Results

5.39.5.1. Clear Lacquers: Table 5.39-1a summarizes our estimate of sales and VOC emissions for Clear Lacquers, including clear lacquer sanding sealers, based on the ARB survey. Clear Lacquers are a medium-sized category with regard to sales volume. In 2004, the sales volume for Clear Lacquers in California was approximately 959,000 gallons, which represents just less than 1 percent of the total California sales volume for architectural coatings.

Waterborne products represent 14 percent of the sales volume for Clear Lacquers. Solventborne products represent 86 percent of the sales volume for Clear Lacquers and generally have VOC levels greater than 550 g/l, the current SCM VOC limit. The sales volume for solventborne Lacquers (clear and opaque) has increased approximately 150 percent from 2000 to 2004. This change is also reflected in the overall sales for all Lacquers, which increased almost 190 percent. The major reasons for the significant increase in sales volumes are the introduction of new products and the submittal of data by new companies and divisions. The overall sales-weighted average VOC Regulatory value for all Lacquers decreased 20 percent from 2000 to 2004.

VOC emissions from Clear Lacquers are about three tpd, which represents approximately three percent of the total emissions from architectural coatings. Because most of the products sold are solventborne, most of the emissions are from solventborne products.

Table 5.39-1a: Survey Data
Lacquers – Clear Only

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	440	825,911	86%	100%	0%	0%	1%	576	2.83
WB	115	133,132	14%	89%	1%	10%	19%	268	0.17
Total	**555**	**959,044**		**98%**	**0%**	**1%**	**4%**	**533**	**3.00**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

5.39.5.2. Opaque Lacquers: Table 5.39-1b summarizes our estimate of sales and VOC emissions for Opaque Lacquers, based on the ARB survey. In 2004, the sales volume for Opaque Lacquers in California was approximately 333,000 gallons. Waterborne Opaque Lacquers represent 66 percent of the

sales volume. Solventborne products represent 34 percent of the sales volume and generally have VOC levels less than 550 g/l, the current SCM VOC limit.

VOC emissions from Opaque Lacquers are about 0.6 tpd, which represents less than 1 percent of the total emissions from architectural coatings. Although waterborne products account for most of the sales volume, most of the emissions are from solventborne products.

Table 5.39-1b: Survey Data
Lacquers – Opaque Only

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	126	111,944	34%	100%	0%	0%	0%	531	0.51
WB	48	220,583	66%	74%	0%	26%	0%	80	0.09
Total	**174**	**332,527**		**83%**	**0%**	**17%**	**0%**	**232**	**0.60**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

5.39.5.3. Clear Brushing Lacquers: Table 5.39-1c summarizes our estimate of sales and VOC emissions for Clear Brushing Lacquers, based on the ARB survey. Clear Brushing Lacquers are a very small category with regard to sales volume.

All Clear Brushing Lacquers are interior solventborne coatings, with 24 percent sold in small containers. VOC emissions from Clear Brushing Lacquers are about 0.5 tpd, which represents approximately 0.6 percent of the total emissions from architectural coatings.

Table 5.39-1c: Survey Data
Clear Brushing Lacquers

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	4	PD	100%	100%	0%	0%	24%	666	0.53
WB	0	0	-	-	-	-	-	-	-
Total	**4**	**PD**		**100%**	**0%**	**0%**	**24%**	**666**	**0.53**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

5.39.5.4. Sanding Sealers: Table 5.39-1d summarizes our estimate of sales and VOC emissions for Sanding Sealers, based on the ARB survey. In 2004, the sales volume for Sanding Sealers in California was approximately 84,000 gallons, which represents less than 0.1 percent of the total California

sales volume for architectural coatings. Only one opaque Sanding Sealer product was reported in the ARB survey.

Waterborne Sanding Sealers represent 28 percent of the sales volume. Solventborne products represent 72 percent of the sales volume and they generally have VOC levels greater than 350 g/l, the current SCM VOC limit. A large number of solventborne products are sold in small containers. The sales volume for solventborne and waterborne Sanding Sealers increased almost 200 percent from 2000 to 2004. This increase was primarily due to the introduction of new products and increased sales for existing products. In addition, ARB staff improved quality control efforts to ensure that Sanding Sealers were not included in the Primer, Sealer, and Undercoater category. The overall sales-weighted average VOC Regulatory value for Sanding Sealers decreased 11 percent from 2000 to 2004.

VOC emissions from Sanding Sealers are about 0.4 tpd, which represents approximately 0.4 percent of the total emissions from architectural coatings. Because most of the products sold are solventborne, most of the emissions are from solventborne products.

Table 5.39-1d: Survey Data
Sanding Sealers - Clear

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	39	60,457	72%	100%	0%	0%	73%	516	0.35
WB	15	23,816	28%	100%	0%	0%	2%	170	0.01
Total	**54**	**84,273**		**100%**	**0%**	**0%**	**53%**	**418**	**0.37**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

5.39.5.5. Varnishes – Clear: Table 5.39-1e summarizes our estimate of sales and VOC emissions for Clear Varnishes, based on the ARB survey. In 2004, the sales volume for Clear Varnishes in California was approximately 971,000 gallons, which represents slightly less than 1 percent of the total California sales volume for architectural coatings.

Waterborne Clear Varnishes represent 28 percent of the sales volume. Solventborne products represent 72 percent of the sales volume and generally have VOC levels greater than 350 g/l, the current SCM VOC limit. The majority of solventborne Clear Varnishes are sold in small containers. The sales volume for solventborne Clear Varnishes decreased approximately 3 percent from 2000 to 2004. This change is also reflected in the overall sales of Clear Varnishes, which decreased 11 percent. The overall sales-weighted average VOC Regulatory value for Clear Varnishes increased 6 percent from 2000 to 2004.

VOC emissions from Clear Varnishes are about four tpd, which represents approximately four percent of the total emissions from architectural coatings. Because most of the products sold are solventborne, most of the emissions are from solventborne products.

Table 5.39-1e: Survey Data
Varnishes - Clear

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	430	694,415	72%	71%	12%	17%	68%	458	3.63
WB	188	276,280	28%	89%	8%	2%	11%	243	0.29
Total	**618**	**970,695**		**76%**	**11%**	**13%**	**52%**	**397**	**3.92**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

5.39.5.6. Varnishes – Semitransparent: Table 5.39-1f summarizes our estimate of sales and VOC emissions for Semitransparent Varnishes, based on the ARB survey. In 2004, the sales volume for Semitransparent Varnishes in California was approximately 89,000 gallons, which represents less than 0.1 percent of the total California sales volume for architectural coatings. The ARB survey did not have a category for opaque varnishes, so the Semitransparent Varnishes category actually included a small number of products that were opaque products. Sales data for these products are protected, so they are not provided separately.

Waterborne Semitransparent Varnishes represent three percent of the sales volume. Solventborne products represent 97 percent of the sales volume and generally have VOC levels greater than 350 g/l, the current SCM VOC limit. The sales volume for solventborne Semitransparent Varnishes increased 48 percent from 2000 to 2004, while the overall sales volume increased 54 percent. Almost all solventborne Semitransparent Varnishes are sold in small containers. The overall sales-weighted average VOC Regulatory value remained approximately the same from 2000 to 2004.

VOC emissions from Semitransparent Varnishes are about 0.4 tpd, which represents almost 0.5 percent of the total emissions from architectural coatings. Because the majority of the products sold are solventborne, most emissions are from solventborne products.

Table 5.39-1f: Survey Data
Varnishes - Semitransparent

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day) [4]
SB	85	86,302	97%	99%	1%	0%	97%	439	0.43
WB	38	3,001	3%	11%	89%	0%	4%	260	0.00
Total	**123**	**89,303**		**96%**	**4%**	**0%**	**94%**	**433**	**0.43**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.39-2 contains the complying marketshare for Wood Coatings, based on the ARB survey. For Clear Wood Coatings, this table reflects combined data for products that were reported under the following categories: Clear Brushing Lacquers; Lacquers; Primers, Sealers, and Undercoaters (stain controllers); Sanding Sealers; Stains (clear only); Varnishes (Clear and Semitransparent); and Waterproofing Sealers. For Opaque Wood Coatings, this table reflects combined data for products that were reported under Lacquers, Sanding Sealers, and Varnishes (Semitransparent).

This table shows that about 50 percent of the sales volume for Wood Coatings complies with the proposed VOC limit. When considering the number of products reported, 25% of the reported products comply with the proposed limit. Of the 47 companies that reported in this category, 33 offered Wood Coatings that comply with the proposed limit.

Table 5.39-2 shows that implementing the proposed 275 g/l limit would achieve approximately 1.4 tpd in VOC emission reductions for the non-South Coast AQMD portion of California, on an annual average basis.

Table 5.39-2: Complying Marketshare & Emission Reductions
Wood Coatings

	Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
Clear	275	256	48%	1.21
Opaque	275	51	66%	0.20
All	275	307	50%	1.41

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.39.6. Product Testing Results

5.39.6.1. Consumer Reports: Consumers Union tested 11 waterborne and 12 solventborne varnishes meant for application to wood floors by do-it-yourself homeowners (Consumer Reports, 2002). All products contained polyurethane, a common resin designed to resist surface wear. Both types of varnish were subjected to various liquids known to cause damage to floor finishes, including vodka, wine, coffee, cola, and common surface cleaners, such as liquid detergent, ammonia, and white vinegar. The waterborne Flecto (Rustoleum) Varathane Waterborne Gloss was the only finish able to resist all types of liquids, as well as provide excellent UV resistance. It had a smooth finish, free of brush marks, bubbles, and other flaws, and scored a good rating in the abrasion resistance test. Rustoleum currently markets two waterborne Varathane floor finishes, Diamond Floor Finish (270 g/l) and Diamond Polyurethane (275 g/l), both of which meet the proposed VOC limit. In the Consumers Union testing, all waterborne products were able to withstand intense exposure to ultraviolet light without changing color, while solventborne products left an amber finish that darkened with time. Solventborne varnishes were better able to resist wear and scratches, and less dirt became embedded in the finish. Waterborne varnishes all had faster dry times and were easier to clean up. Zinsser's Pro Finisher Waterborne Polyurethane Satin (214 g/l) also rated well.

5.39.6.2. AVES Report: South Coast AQMD awarded AVES, an affiliate of ATC Associates Inc., a contract to develop architectural coatings with a VOC content at or near zero g/l for a variety of coating categories, including waterproofing sealers, lacquers, varnishes, and sanding sealers (AVES, 2001). These coatings were then tested next to three commercially available coatings from each category. Three new low-VOC coating systems were also tested and each system was comprised of a semitransparent stain, a sanding sealer, and either two coats of varnish, two coats of lacquer, or three coats of lacquer. All of the coatings were tested for performance, repair, and refinishing. In general, the new coatings with VOC contents at or near zero g/l performed as well as the commercially available coatings.

Lacquer: The new zero-VOC lacquer was composed of a water reducible, air-dry polyurethane and acrylic copolymer. It was found to be equivalent to the commercial lacquers (which included a nitrocellulose lacquer) in wet film thickness, gloss, grain raising, orange peel, adhesion, color, and sprayability, and equivalent or better in terms of depth and hot/cold check. The new lacquer was superior in the color change test, but inferior in the freeze/thaw test.
Dry times were similar to the commercial waterborne lacquers, but slower than the nitrocellulose lacquer. The zero-VOC lacquer was also equivalent to the commercial waterborne lacquers in print resistance (tendency of a film to take on the imprint of an object that is placed on it), flow, and sag, but the nitrocellulose lacquer did the best in print resistance and sag.

Varnish: The varnish was composed of a two-part, chemically-cured, water-reducible, air-dry epoxy coating. It was found to be equivalent to the commercial varnishes in wet film thickness, orange peel, print resistance, color, hot/cold check, and sprayability. While it was superior in grain raising, color change, and sag, it was inferior in flow and freeze/thaw tests. The zero-VOC varnish had similar dry times to the waterborne varnish, but took longer to dry than the solventborne commercial varnish. The solventborne varnish also had a higher gloss and superior depth than the other varnishes.

Sanding Sealer: The sanding sealer was composed of a water reducible, air-dry acrylic copolymer. It was found to be equivalent to the commercial sanding sealers in flow and sprayability. A minimal amount of grain raising occurred, which was equivalent to or worse than the commercial products. It also performed as well as the commercial sanding sealers in the freeze/thaw test. The zero-VOC sanding sealer tested better for color change.

Comparative Repair/Refinishing: Three popular commercially available coating systems were tested side-by-side with zero-VOC lacquer and varnish topcoat systems to compare repair and refinishing. All coating systems were composed of a semitransparent stain, sanding sealer, and topcoat. The same technique was used to repair a single scratch in all coating systems tested. The scratch area was lightly sanded to improve adhesion. Then a topcoat was brushed on and allowed to dry, followed by a second coat that was sprayed on. The new zero-VOC varnish system showed the best overall appearance after repair, while the zero-VOC lacquer system was the easiest to repair and had the best gloss after repair.

5.39.6.3. UMR Results: In 2005, the UMR Coatings Institute at the University of Missouri - Rolla conducted a coatings testing project for the South Coast AQMD (UMR, 2006). The project included tests on products classified as Clear Wood Finishes. UMR tested some general coating properties, including: percent nonvolatile; stability; viscosity; freeze/thaw resistance; dry time; and gloss. They also tested performance properties, including: friction coefficient; stain resistance; mar resistance; taber abrasion; accelerated weathering (QUV); flow and leveling; and sag. All testing was done in accordance with ASTM standards, unless otherwise noted or agreed upon by the South Coast AQMD. All paints were supplied to the UMR Coatings Institute by South Coast AQMD.

For Clear Wood Finishes, they tested six film-forming products, four waterborne low-VOC products (VOC $\leq$275 g/l) and two solventborne high-VOC products (VOC >275 g/l and $\leq$450 g/l). On average, all of the low-VOC coatings performed comparably on most tests to the high-VOC coatings. The low-VOC coatings performed somewhat poorer compared to the high-VOC coatings in gloss retention on aluminum after being exposed to UV light and condensation cycles. However, on wood, they performed comparably to the high-VOC coatings.

5.39.7. Manufacturer Information

Several complying products are included on Master Painter's Institute (MPI) Approved Products lists because they have been certified to meet designated performance standards. MPI approved several Wood Coatings that comply with the proposed 275 g/l limit and meet one of the following standards: MPI #6 (Primer, Latex for Exterior Wood [Stain Controller]); MPI #39 (Primer, Latex for Interior Wood [Stain Controller]); MPI #128 (Varnish, Water Based, Clear, Satin); MPI #129 (Varnish, Water Based, Clear, Semi-Gloss); MPI #130 (Varnish, Water Based, Clear, Gloss); and MPI #181 (Varnish, Water Based, Clear, Eggshell-Like, MPI Gloss Level 3). Manufacturers of compliant, MPI-approved products include Cloverdale Paint, ICI Paints, Frazee Paint, Insl-X, PPG, Pratt & Lambert, and Rodda Paint. Additional information on manufacturers and products is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

5.39.8. Comments

5.39.8.1. Labeling. Some coating manufacturers did not agree that Wood Coatings must be labeled "For Wood Substrates Only" because their coatings are applied to other substrates besides wood. Under the SCM, coatings that are applied to non-wood surfaces would be covered by other categories (e.g., Nonflat). ARB staff does not believe that coatings applied to non-wood surfaces require the same 275 g/l VOC limit as coatings applied to wood. Therefore, staff proposed that the Wood Coatings category be limited to wood substrates, to prevent the category from becoming a loophole for Nonflats and other categories. One company agreed with ARB that it was not necessary to include non-wood substrates. ARB staff is not proposing that the Wood Coatings category include products applied to non-wood substrates (e.g., metals, plastics, and other synthetic materials).

5.39.8.2. Definition of Wood Substrate. One coating manufacturer wanted composite wood decking to be included as a wood substrate because it is composed of wood and synthetic material. Composite wood is usually better protected from damage due to moisture, UV rays, and insects, but can degrade over time due to natural wood fibers it contains. Clear coatings or stains can be used on wood composite material to better protect composite wood from degradation. ARB staff is proposing that the definition of wood include substrates that contain exposed wood.

Some coating manufacturers wanted the definition of wood to include wood-like substrates (e.g., particle board, Formica, chip board, composite wood decking, etc.) ARB staff found that the majority of manufacturers list wood as the primary substrate. A very small number of manufacturers list wood-like substrates. These include particle board, wood composite, hardboard, and cork. ARB staff

developed a definition for wood products that includes various wood-like substrates.

5.39.8.3. Specialized Varnishes. ARB staff met with industry to discuss their concerns regarding the future VOC limit for some specialized varnishes. Some manufacturers make conversion varnishes and tung oil based varnishes that have difficulty meeting the proposed 275 g/l limit. These products are generally used by professionals and they are sold in relatively small volumes. In California, these products have been sold in small containers because they exceed the current 350 g/l SCM VOC limit that has been in effect for 10-15 years. In the OTC states, there is a Conversion Varnishes category with a 725 g/l VOC limit and the manufacturers are concerned that OTC states will adopt ARB's proposed 275 g/l limit. The manufacturers claimed that their coatings are specialty products that cannot be reformulated to meet the proposed 275 g/l limit and they requested that the SCM include a new specialty category that gives them a VOC limit higher than the current 350 g/l limit. ARB staff agrees that these formulations have unique characteristics that cannot be duplicated at lower VOC contents with current technology. However, the proposed SCM still contains the small container exemption that would continue to allow these products to be sold in California. In addition, ARB staff does not believe that it is necessary to develop a new high-VOC specialty category, because it would be a relaxation of an existing VOC limit that has been in effect in California for some time. Regarding their concerns about the OTC states, ARB staff believes that the proposed limit is feasible for California, but the manufacturers will need to work with the OTC states to resolve their issues for products sold outside of California.

5.39.8.4. Lacquer Blushing. Industry representatives requested that the SCM retain a "lacquer blushing" provision. Lacquers that contain acetone can experience "blushing", which is a defect that makes the film look milky or white. Blushing can be caused by rapid evaporation of solvent or by the presence of excessive moisture that can become trapped in the lacquer film. Blushing can also be caused by solvent or resin incompatibility. Under certain atmospheric conditions, acetone can evaporate more quickly than other solvents in a lacquer and this can result in blushing. This defect can be prevented by slowing down the drying process with a retarder solvent that dries more slowly than acetone.

The 2000 SCM contained a special provision that allowed for the use of retarder solvents in Lacquers that contained acetone. Under this provision, a person could add solvent to an acetone-based Lacquer, during days with relative humidity greater than 70 percent and temperatures below 65 degrees F, as long as the VOC content did not exceed 550 g/l prior to the addition of the solvent.

In the proposed SCM, products that were formerly classified as Lacquers would be included in the new Wood Coatings category and the proposed VOC limit would decrease from 550 g/l to 275 g/l. ARB staff reviewed survey data to

determine what types of lacquer formulations would comply with the proposed 275 g/l limit. Products that contained acetone accounted for only 0.4 percent of the complying sales volume (excluding small containers). Since the vast majority of compliant products do not contain acetone, the lacquer blushing provision no longer seems necessary and it has been proposed for elimination.

ARB staff also reviewed product data sheets for lacquers that comply with the proposed 275 g/l limit. Generally, manufacturers do not recommend any thinning and they state that their products can be applied when the humidity is below 85 percent and the temperature is above 50 degrees F or 5 degrees F above the dew point. This would indicate that these products are suitable for application under relatively cool and humid conditions, without the need for additional solvent. Therefore, it does not appear that the lacquer blushing provision is needed.

5.39.9. Conclusion

We recommend a 275 g/l VOC limit for Wood Coatings, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare, the number of companies making complying products, product information from manufacturers, and test results. The proposed VOC limit is lower than the limits adopted by the U.S. EPA and the OTC states, and the proposed limits for Canada. The U.S. EPA divides wood coatings into several categories, including Lacquers at 680 g/l, Sanding Sealers at 550 g/l, Varnishes at 450 g/l, Conversion Varnishes at 725 g/l, and Stain Controllers at 720 g/l (U.S. EPA, 1998). The proposed limit is consistent with the limit adopted by the South Coast AQMD.
It is important to note that the vast majority of products reported in the survey with VOC limits below 275 g/l are waterborne. Few solventborne products meet the proposed VOC limit so they would either have to be reformulated, replaced by waterborne products, or use the small container exemption.

5.40. WOOD PRESERVATIVES

VOC Limit Table (g/l)

USEPA: 550 (clear/semitransparent); 350 (opaque)	Canada: N/A	OTC: 350	SCAQMD: 350	SCM Proposed: 350

5.40.1. Category Definition

A coating labeled and formulated to protect exposed wood from decay or insect attack, that is registered with both the U.S. EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (7 United States Code (U.S.C.) Section 136, et seq.) and with the California Department of Pesticide Regulation.

5.40.2. Major Proposed Changes

- None.

5.40.3. Coating Description

Wood Preservatives perform a variety of functions, including: protecting wood against discoloration and decay caused by mildew and other fungi; protecting wood against damage caused by wood-destroying insects; reducing discoloration caused by extractive bleeding in certain highly colored wood species; and minimizing iron stains from the reaction of iron with tannins in the wood. Wood Preservatives are often used as a pretreatment for wood before staining or painting, which improves paint adhesion and helps prevent peeling and flaking of the coating. Wood Preservatives are also used as a supplemental treatment for wood that has been pressure treated with commercial preservatives (Feist, 1996).

Wood Preservatives are single component coatings that are brushed, sprayed, wiped, or rolled on to bare wood. The wood is often dipped into the coating to maximize penetration. Wood Preservatives leave a matte finish that can darken the color of the wood, but does not mask wood grain or texture. Certain products will turn the wood green or brown, but these are usually applied to below-ground wood. Wood Preservatives can be applied by homeowners, but those that contain highly toxic pesticides are applied by professional contractors. Often, after wood is pressure treated in a factory, construction crews apply Wood Preservatives to fresh-cut ends at the construction site (Groenier, 2006).

Wood can also be pressure treated with Wood Preservatives in factories during the manufacturing process. Factory coating applications are not subject to architectural coating rules. The products that are used during the factory process, such as alkaline copper quaternary (ACQ) and copper boron azole (CBA), are used under controlled conditions by trained professionals. Other Wood Preservatives are only for industrial use and cannot be used on wood in residential areas because of their toxicity (Groenier, 2006).

Most Wood Preservatives are solventborne because they penetrate the wood substrate much more easily than waterborne products. Solventborne products contain alkyd resins and/or drying oils, and a solvent such as mineral spirits. Waterborne products usually contain acrylic or alkyd resins. Wood Preservatives contain one of many fungicides or mildewcides such as zinc or copper naphthenate, borates, 3-iodo-2-propynyl butyl carbamate, or copper-8-quinolinolate (Ibach, 1999). Wood Preservatives commonly contain water repellents, usually paraffin wax or wax-like chemicals, to prevent wood from absorbing water, which causes the wood to crack, warp, and split. They can also contain UV stabilizers to prevent damage from the sun (Feist, 1996).

5.40.4. Substrates/Exposures

Wood Preservatives are used outdoors in residential and commercial areas, in places where wood is exposed to moisture or insects. They are applied to above- or below-ground wood siding, shakes, shingles, decks, doors, trim, and fences. Some products may not be applied to wood below-ground, as they do not adequately protect wood from decay or insects.

5.40.5. Survey Results

Table 5.40-1 summarizes our estimate of sales and VOC emissions for Wood Preservatives, based on the ARB survey. In 2004, the sales volume for Wood Preservatives in California was approximately 174,000 gallons, which represents less than 0.2 percent of the total California sales volume for architectural coatings.

Waterborne Wood Preservatives represent only 6 percent of the sales volume. Solventborne products represent 94 percent of the sales volume and generally have VOC levels under 350 g/l, the current SCM VOC limit. The overall sales volume for Wood Preservatives decreased approximately 2 percent from 2000 to 2004. The overall sales-weighted average VOC Regulatory value decreased 6 percent from 2000 to 2004.

VOC emissions from Wood Preservatives are about 0.6 tpd, which represents approximately 0.7 percent of the total emissions from architectural coatings. Because most of the sales volume is solventborne, most of the emissions are from solventborne products.

Table 5.40-1: Survey Data
Wood Preservatives

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	19	164,236	94%	0%	100%	0%	8%	327	0.61
WB	11	9,610	6%	0%	100%	0%	14%	292	0.00
Total	**30**	**173,846**		**0%**	**100%**	**0%**	**9%**	**325**	**0.62**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.40-2 contains the complying marketshare for Wood Preservatives, based on the ARB survey. This table shows that 98 percent of the sales volume complies with the current VOC limit. When considering the number of products reported, 90 percent of the products comply with the current limit. Of the 11 companies that reported in this category, 7 offered Wood Preservatives that comply with the current limit.

Table 5.40-2: Complying Marketshare & Emission Reductions
Wood Preservatives

Existing VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
350	26	98%	0.00

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

5.40.6. Manufacturer Information

The Master Painter's Institute (MPI) Approved Products list for wood preservatives contains four products, two of which comply with the existing VOC limit. MPI standard #37 (Preservative, for Exterior Wood) contains compliant products manufactured by Columbia Paint and Spectra-Tone. Additional information on manufacturers and products is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm).

5.40.7. Conclusion

We recommend maintaining a 350 g/l VOC limit for Wood Preservatives, based on the complying marketshare, the number of companies making complying products, and product information from manufacturers. The current VOC limit is lower than the national limit adopted by the U.S. EPA for this category.
The U.S. EPA divides wood preservatives into three categories. Below ground and clear/semitransparent wood preservatives have a VOC limit of 550 g/l, while opaque wood preservatives have a VOC limit of 350 g/l (U.S. EPA, 1998). The current limit is consistent with the limit adopted by the South Coast AQMD and the OTC states. Canada is proposing that Wood Preservatives be under the jurisdiction of their Pest Management Regulatory Agency, rather than being regulated as architectural coatings.

5.41. ZINC-RICH PRIMERS

VOC Limit Table (g/l)

USEPA: 500 (Metallic Pigmented)	Canada: 500 (Metallic Pigmented)	OTC: 500 (Metallic Pigmented)	SCAQMD: 100	SCM Proposed: 340

5.41.1. Category Definition

A coating that meets all of the following specifications:

- Coating contains at least 65 percent metallic zinc powder or zinc dust by weight of total solids; and

- Coating is formulated for application to metal substrates to provide a firm bond between the substrate and subsequent applications of coatings; and
- Coating is intended for professional use only and is labeled as such.

5.41.2. Major Proposed Changes

- Zinc-Rich Primer is a new category for coatings that were formerly covered by Metallic Pigmented.
- The proposed VOC Limit would decrease from 500 g/l to 340 g/l.

5.41.3. Coating Description

Zinc-Rich Primers were formerly part of the Metallic Pigmented category. Zinc-Rich Primers are used to protect steel surfaces from corrosion. Regular coatings resist corrosion by forming a barrier between the metal and the atmosphere, but Zinc-Rich Primers provide corrosion protection via electrochemical reactions. They are sacrificial coatings that provide corrosion control similar to how a galvanic cell creates electricity, through electron migration (or redox reactions) between metals. In the presence of water, all oxidation is confined to the zinc which serves as the anode, while the steel substrate behaves entirely as a cathode and remains unaffected (Hare, 1998a).

Little corrosion risk exists, as long as the zinc coating remains bonded to the steel and the cathodic protection is correctly applied, monitored, and maintained. For pipeline coatings, it appears that corrosion is usually the consequence of coatings disbonding from the substrate due to impact. Disbonding may also occur when rocks or stones constitute a barrier to the cathodic protection (Roche, 2006).

Organic and Inorganic Zinc-Rich Primers can be either single component or multi-component. Single component coatings made up only about a fifth of the products reported in the ARB survey. In general, organic zinc-rich coatings are usually solventborne, single component, and are based on organic resins, such as epoxies, urethanes, vinyls, chlorinated rubber, and alkyds. Inorganic zinc-rich coatings can be waterborne or solventborne, are generally multi-component, and are based on inorganic silicate binders such as alkyl silicates or alkali silicates (Tator, 2006).

Inorganic Zinc-Rich Primers come in two parts: a small quantity of a clear silicate resin and a large volume of zinc powder. The mixed coating must be spray applied. Ideally, the coating is properly mixed and each zinc dust particle is coated with the resin, but this can be difficult considering the concentration of zinc per volume of resin. Therefore, suitable mixing equipment is required and the painters must be properly trained (Tator, 2006). Inorganic Zinc-Rich Primers do not necessarily have to be topcoated and can provide steel protection equal to that of organic Zinc-Rich Primers that are topcoated. However, they are less

tolerant of poor surface preparation. Since most inorganic coatings are alkali or alkyl silicates, they react with carbon dioxide in the presence of water and produce carbonic acid that reduces the alkalinity of the coating. This reaction and the formation of acidic (and sometimes alkaline) compounds on the coating can destroy the integrity of the primer and induce premature failure (Hare, 1998b; Hare 1998c). According to Caltrans, low-VOC inorganic Zinc-Rich Primers can prematurely fail, due to improper curing and acidic conditions (Caltrans, 2007a).

Organic Zinc-Rich Primers contain a variety of resins, such as epoxy/polyamide, urethane, vinyl, or chlorinated rubber. Generally, they can be applied by brush, roller or spray. If not topcoated, they will not protect the steel as well as an inorganic primer, but will offer the same degree of protection if they are topcoated. Organic Zinc-Rich Primers are forgiving of poor surface preparation and are commonly topcoated with polyurethane and epoxies (Tator, 2006). Caltrans generally uses organic Zinc-Rich Primers for touch-ups and galvanizing repair over inorganic and organic zinc coatings (Caltrans, 2007b; Caltrans, 2007c). According to Caltrans, effective organic Zinc-Rich Primers are not available below 100 g/l (Caltrans, 2007a).

Waterborne Inorganic Zinc-Rich Primers may experience stability problems during storage because zinc dust can react with water to make hydrogen, similar to the reactions that can occur in waterborne aluminum roof coatings. All of the waterborne Zinc-Rich Primers reported in the ARB Survey are multi-component products that are mixed at the job site, rather than being pre-mixed and stored. While waterborne products are of particular concern, stability problems can occur in organic or inorganic products with single component or multi-component formulations. These problems can be caused by the intrusion of water or other contaminants that contribute to oxidation within the zinc pail and induce adverse gas formation (Hare, 1998b; Caltrans, 2007b; Caltrans, 2007c).

Proper dispersion of the zinc pigment is a key issue for both single component and multi-component products. Single component Zinc-Rich Primers can experience settling or sedimentation problems during storage and shipping. Multi-component products can result in coarse finishes or clogged spray tips if the zinc dust is not properly screened and mixed prior to application (Hare, 1998b).

5.41.4. Substrates/Exposures

Zinc-Rich Primers are used both indoors and outdoors on iron or steel at industrial facilities, bridges, or other locations where resistance to corrosion is needed. These coatings are applied to bare metal and abrasive blasting is usually recommended to prepare the substrate prior to application.

Zinc-Rich Primers are generally applied to substrates that are subject to long-term atmospheric exposure. They can also be exposed to immersion in water,

wastewater, or chemical solutions. However, they are not recommended for wet environments that are outside the pH range of 5 to 10, because the zinc dust can be highly reactive. Acids and alkalis may react with the zinc dust, which can result in pinholes, voids, and scratches (Tator, 2006). For immersion applications, it is typically suggested that the primer be topcoated with a product that is compatible with the immersion liquid.

Application must be done when surface temperature is at least 5 degrees F above the dew point and the humidity is at an acceptable level. Some Zinc-Rich Primers require at least 40% relative humidity or higher for curing and settling, especially with self-curing primers. Prior to topcoating for either immersion applications or enhanced protection, it is typical to mist the Zinc-Rich Primer with water to increase the humidity and ensure a better cure.

KTA-Tator conducted a review of the life cycle costs for zinc-rich coating systems used in moderate industrial environments (Helsel, 2007). They compared single-coat inorganic Zinc-Rich Primers with ten other systems, including: 2-coat systems (Zinc-Rich Primer and topcoat); 3-coat systems (Zinc-Rich Primer, intermediate coat, and topcoat); hot dip galvanizing; galvanizing with topcoat; and metallizing/thermal spray coating systems. When compared to the other systems, they found that the single-coat inorganic Zinc-Rich Primer and the 2-coat system were considered cost effective for both shop-applied and field-applied applications, if regular maintenance painting is conducted. However, other factors could influence the use of the single-coat Zinc-Rich Primer on prominent structures (such as bridges) without a topcoat. This could include aesthetics such as color and salting from the corrosion of the coating or climatic factors that make it unsuitable to use the Zinc-Rich Primer without a top-coat (Helsel, 2007). Typically, repair maintenance over old zinc primers is done with organic primers because they are more forgiving and have better adhesion on ill-prepared surfaces (Hare, 1998c). Therefore, both organic and inorganic Zinc-Rich Primers can be integral components that contribute to effective long-term corrosion protection on steel and other metal substrates.

5.41.5. Survey Results

Table 5.41-1 summarizes our estimate of sales and VOC emissions for Zinc-Rich Primers, based on the ARB survey. For the purposes of the survey, Zinc-Rich Primers were included in the Metallic Pigmented category and they were not considered to be a separate category. Therefore, the survey data provided below is a subset of the data reported for Metallic Pigmented. In 2004, the sales volume for Zinc-Rich Primers in California was almost 23,000 gallons, which represents less than 0.1 percent of the total California sales volume for architectural coatings. This sales volume includes the volume of the zinc dust that is sold as one of the components in multi-component products.

VOC emissions from Zinc-Rich Primers are about 0.1 tpd, which represents less than 0.1 percent of the total emissions from architectural coatings. Almost 100 percent of the emissions from this category are attributed to solventborne products but they only account for 78 percent of the sales volume.

Table 5.41-1: Survey Data
Zinc-Rich Primers

	Number of Products	Sales in CA (gals/year) [1]	% SB/ WB	% Int	% Ext	% Dual	% in Small Containers[2]	SWA VOC (g/l)[3]	VOC Emissions (tons/day)[4]
SB	62	17,508	78%	0%	15%	85%	5%	368	0.07
WB	6	5,048	22%	0%	1%	99%	0%	10	0.00
Total	**68**	**22,556**		**0%**	**12%**	**88%**	**4%**	**288**	**0.07**

(ARB, 2006)
1. Statewide sales volume in California in 2004, including SCAQMD (gallons per year).
2. Percentage of sales volume in small containers, one quart or less.
3. Sales-Weighted Average VOC Regulatory (grams VOC per liter of coating, less water and exempt compounds).
4. Statewide VOC Emissions, including SCAQMD (tpd). Does not include emissions from thinning solvents, cleanup solvents, or additives.

Table 5.41-2 contains the complying marketshare for Zinc-Rich Primers, based on the ARB survey. Approximately 54 percent of the sales volume complies with the proposed 340 g/l VOC limit and the estimated emission reductions are about 0.01 tpd.

Table 5.41-2: Complying Marketshare & Emission Reductions
Zinc-Rich Primer

Proposed VOC Limit (g/l)	Number of Complying Products	Complying Marketshare (%) by Volume [1]	Emission Reductions (excluding South Coast AQMD) (tons/day) [2]
340	30	54%	0.01

1. Complying Marketshare: Percentage of sales volume that complies with the VOC limit. The Complying Marketshare does not include small containers that are exempt from VOC limits.
2. Emission Reductions: Estimated reductions in VOC emissions that will result from implementation of the SCM VOC limit. Emission Reduction calculations do not include small containers that are exempt from VOC limits.

Of the 11 companies that reported in this category, 7 companies offered Zinc-Rich Primers that comply with the proposed limit. Of these seven companies, three are considered to be small businesses because they have fewer than 250 employees.

5.41.6. Manufacturers Information

The Master Painters Institute (MPI) has developed approved product lists for the following standards: MPI #18 (Primer, Zinc Rich, Organic); MPI #19 (Primer, Zinc Rich, Inorganic); and MPI #20 (Primer, Zinc Rich, Epoxy). They've also established MPI #200 (Primer, Zinc Rich, Moisture Cured), but have not yet published a list of approved products. A list of compliant Zinc-Rich Primers, including those reported in the survey and MPI-approved products is provided on ARB's website (http://www.arb.ca.gov/coatings/arch/docs.htm). One of the

products reported in the survey qualifies for the MPI Green Performance Standards, which indicates a more environmentally-friendly coating.

5.41.7. Manufacturer and Industry Issues

Some manufacturers and industry representatives have expressed concerns about the proposed Zinc-Rich Primer category. Below are some of the key issues that have been brought to our attention.

Issue: The NPCA does not believe that the Zinc-Rich Primer category should have a VOC limit lower than 340 g/l.

Response: ARB staff agrees. The South Coast AQMD has adopted a 100 g/l VOC limit for Zinc-Rich Primers, but ARB staff does not believe that this limit is necessarily appropriate throughout the remainder of California due to differing climatic conditions. Caltrans has stated that a VOC limit of 340 g/l is appropriate, based on their experiences with these types of coatings. They believe that some, if not most, manufacturers can comply with a 340 g/l limit and produce quality products (Caltrans, 2007a). ARB staff reviewed the Caltrans pre-qualified product list for both inorganic and organic Zinc-Rich Primers, and determined that the proposed 340 g/l limit will not have an adverse impact on the listed coatings (Caltrans, 2007a; Caltrans, 2007b; Caltrans, 2007c). At 340 g/l, both inorganic and organic Zinc-Rich Primers are effective, technologically feasible, and have a high complying marketshare. According to Caltrans, the use of 100 g/l Zinc-Rich Primers is possible and may be applicable in Southern California, but it is not necessarily effective elsewhere. Recently, Caltrans witnessed the failure of multi-million dollar coating projects, due to the improper curing of 100 g/l waterborne, inorganic Zinc-Rich Primers (Caltrans, 2007a).

5.41.8. Conclusion

We recommend a 340 g/l VOC limit for Zinc-Rich Primers, effective January 1, 2010. The proposed VOC limit is technologically and commercially feasible by January 1, 2010, based on the complying marketshare, the number of companies making compliant products, and product information from manufacturers. The proposed limit is lower than the limit adopted by the U.S. EPA and the OTC states, and the proposed limit for Canada. For these agencies Zinc-Rich Primers are covered by the Metallic Pigmented category with a 500 g/l VOC limit.

The proposed VOC limit is higher than the 100 g/l South Coast AQMD limit. However, manufacturers that provide coatings in the South Coast AQMD can still sell products which exceed the 100 g/l limit, if they participate in the averaging program. The proposed SCM does not contain an averaging provision, so all manufacturers will be subject to the same limit. In addition, the SCM needs to be technologically feasible throughout California. Since Zinc-Rich Primers are often

applied to critical infrastructure, it is vital that they meet the performance specifications established by public agencies. Based on our discussions with Caltrans and others, ARB staff believes that additional research is needed to verify the performance of 100 g/l Zinc-Rich Primers in a way that protects the infrastructure throughout California. The South Coast AQMD area has a mild climate, so climatic conditions are less of a concern. However, in other areas of California, the infrastructure is exposed to more extreme climates (e.g., mountainous areas with freezing temperatures; coastal areas with persistent cold temperatures, salt spray, high humidity, etc.).

ARB staff believes that additional research is needed to develop 100g/l products that perform well throughout California. Research is also needed to address potential safety issues associated with the production of hydrogen gas, caused by chemical reactions with zinc dust and water. Therefore, ARB staff believes that the proposed 340 g/l VOC limit is most appropriate at this time.

5.42. REFERENCES

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CHAPTER 6. ENVIRONMENTAL IMPACTS

6.A. BACKGROUND

Both the California Environmental Quality Act (CEQA) and ARB policy require ARB to evaluate the potential adverse environmental impacts of proposed projects. For the 2000 SCM, staff prepared a formal environmental impact report (EIR), which is incorporated by reference herein (ARB, 2000). The EIR included an analysis of environmental impacts that could potentially result from the implementation of the 2000 SCM throughout California (excluding the South Coast AQMD). Staff investigated the potential for environmental impacts in six main areas: air quality; water demand and quality; public services; transportation and circulation; solid and hazardous waste; and health hazards. The analysis concluded that implementing the 2000 SCM would have no significant adverse impacts, but would have a net air quality benefit.

The intent of the proposed SCM is to reduce the public's exposure to ozone and particulate matter (PM) by reducing emissions of volatile organic compounds (VOC), which are precursors to both ozone and PM. An additional consideration is the impact the proposed SCM may have on the environment. Based on available information, the ARB has determined that no significant adverse environmental impacts should occur as a result of districts adopting the proposed SCM. This chapter summarizes the potential impacts that the proposed SCM may have on air quality, wastewater treatment, hazardous waste disposal, and hazards to human health. For a more detailed discussion on these topics, please refer to the EIR for the 2000 SCM (ARB, 2000). Staff believes that districts can use the information in this chapter and the EIR from the 2000 SCM to support their environmental impact analyses when they adopt local rules based on the proposed SCM.

6.B. ANALYSIS OF REASONABLY FORESEEABLE ENVIRONMENTAL IMPACTS OF THE METHODS OF COMPLIANCE

6.B.1. Air Quality Impacts

No State or federal ambient air quality standards have been set for VOCs because they are not classified as criteria pollutants. However, VOCs are regulated because they contribute to the formation of ozone, PM_{10} and $PM_{2.5}$, which are criteria pollutants. VOCs are also transformed into organic aerosols in the atmosphere, contributing to lower visibility levels. Although health-based standards have not been established for VOCs, health effects can occur from exposures to high concentrations of VOCs due to interference with oxygen uptake. In general, ambient VOC concentrations in the atmosphere are suspected to cause coughing, sneezing, headaches, weakness, laryngitis and bronchitis, even at low concentrations.

The California Clean Air Act requires air districts that have been designated nonattainment for the State ambient air quality standard for ozone to prepare and submit plans for attaining and maintaining the standard. In addition, the federal Clean Air Act requires air districts designated nonattainment for the federal ambient air quality standards to prepare air quality management plans to demonstrate attainment with the federal standards. In some air districts, substantial additional emission reductions will be necessary if attainment is to be achieved.

Numerous VOCs have also been identified as toxic air contaminants and are regulated through the ARB's Toxic Air Contaminant Control Program. Benzene, for example, one hydrocarbon component of VOC emissions, is known to be a human carcinogen and has been identified as a toxic air contaminant.

The adoption and implementation of this SCM is expected to produce substantial long-term VOC emission reductions, and staff has concluded that adverse air quality impacts associated with this SCM will be insignificant. Adverse air quality impacts are considered to be significant if the proposed SCM would: conflict with or obstruct implementation of the applicable air quality plan; violate any air quality standard or contribute to an existing or projected air quality violation; expose sensitive receptors to substantial pollutant concentrations; expose off-site receptors to significant concentrations of hazardous air pollutants; result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment; diminish an existing air quality rule or future compliance requirement resulting in a significant increase in air pollutants; or create objectionable odors affecting a substantial number of people. No significant adverse air quality impacts are anticipated; therefore, no mitigation measures are necessary.

Based on the analysis of potential direct and indirect air quality effects of implementing this SCM, it is concluded that once the lower-VOC content limits are implemented the overall air quality effects of the SCM will be a VOC emission reduction of approximately 15 tpd by the year 2012.

Historically, some members of industry identified seven areas of potential concern that they believe could result in increased indirect VOC emissions due to a requirement to lower the VOC content of architectural coatings. These are:

The use of lower-VOC coatings will result in a thicker film coating

Some industry representatives have asserted that low-VOC coatings are formulated with high-solids contents and are difficult to handle during application, resulting in a thick film when applied. A thicker film indicates that a smaller surface area is covered with a given amount of material, thereby increasing VOC emissions per unit area covered, as compared to higher-VOC coatings. Review of manufacturers' product data sheets shows currently available low-VOC

coatings are not necessarily formulated with higher solids contents, and low-VOC coatings do not result in a significant reduction in coverage area. Although high-solids, low-VOC coatings are being used, the recommended film thickness for these coatings is similar to that for higher-VOC coatings. Thus, a lower-VOC coating would cover the same surface area as a higher-VOC coating, resulting in fewer VOC emissions.

The use of lower-VOC coatings will result in excessive thinning of the coating

Excessive thinning is not expected to be a problem because many coatings currently in use comply with the SCM limits. Additionally, the VOC limit for architectural coatings is expected to be met primarily with the use of waterborne formulations. Even if some thinning occurs, thinning would likely be done with water. As a result, concerns about significant adverse air quality impacts are unfounded.

The use of lower-VOC coatings requires the use of additional primer for proper adhesion to the substrate

Manufacturers' product data sheets show that substrate preparation is similar for lower-VOC coatings and for higher-VOC coatings, therefore the time and materials necessary to prepare a surface for coating is approximately equivalent for high- and low-VOC coatings. More priming is not needed because lower-VOC coatings possess comparable coverage to higher-VOC coatings, and have similar adhesion qualities and resistance to stains, chemicals and corrosion.

Lower-VOC coatings will require the use of more coats

The claim has been made by some industry representatives that the proposed lower-VOC limits would yield products that result in inferior coverage, resulting in the use of more low-VOC coatings to provide the same coverage as their higher-VOC counterparts. Product data sheets provided by manufacturers listing coverage rates do not indicate that lower-VOC architectural coatings provide less coverage than higher-VOC architectural coatings. Both lower-VOC and higher-VOC coatings have comparable coverage and performance. With comparable coverage and equivalent durability qualities, more coats of low-VOC coatings should not be required.

The use of lower-VOC coatings will require more frequent recoating, touch-up, and repair work

Based on the durability characteristics information contained in manufacturers' product data sheets, lower-VOC coatings and higher-VOC coatings have comparable durability characteristics. Low-VOC architectural coatings have been used successfully for many years and are considered to be as durable and long lasting as higher-VOC coatings. Therefore, it is not anticipated that lower-

VOC coatings will require more frequent recoating. Because qualities of the low-VOC coatings are comparable to the higher-VOC coatings, it is not anticipated that more touch-up and repair work will be needed.

The use of lower-VOC coatings will result in product substitution by end-users

There are currently available low-VOC architectural coatings with performance characteristics comparable to higher-VOC architectural coatings. Therefore, it is not anticipated that end-users will substitute products from a higher-VOC category. The SCM prohibits the application of certain coatings in specific settings, and the type of performance desired in some settings would prohibit the use of certain coatings in those settings. Products within a given architectural coating category may differ from those of another category to a significant degree, making substitution difficult and therefore less likely. The SCM also requires that when a coating can be used in more than one coating category, the lower limit of the two categories is applicable.

The use of lower-VOC coatings may result in coatings with higher reactivity

When using the Maximum Incremental Reactivity (MIR) scale as the basis for comparing reactivities of VOCs, it is true that on a per gram basis, some VOCs used in waterborne coatings are more reactive than some VOCs used in solventborne coatings. For example, using the MIR scale as a basis, a typical VOC used in waterborne coatings, such as propylene glycol, is two to three times more reactive than a typical solventborne coating component such as mineral spirits. Toluene and xylenes, also commonly used in solventborne coatings, are approximately three times as reactive, on a gram for gram basis, as propylene glycol. So while some of the components of waterborne coatings are of a higher reactivity than some components of solventborne coatings, the reverse is also true. In addition, very small amounts of VOCs are used in waterborne coatings, while large amounts are used in solventborne coatings. Therefore, the reactivity of a waterborne coating on an ozone per gallon of product or gallon of solids basis is much lower than that of a solventborne coating. Because it is anticipated that manufacturers will incorporate the use of water and exempt solvents when formulating coatings to meet the lower-VOC limits of the proposed SCM, we have concluded that the total reactivity of the lower-VOC architectural coatings will be less than the reactivity of the higher-VOC architectural coatings.

6.B.2. Human Health Hazards

It is expected that future compliant coatings will contain less hazardous materials, or nonhazardous materials, as compared to solventborne coatings, resulting in a net benefit. The human health impacts analysis performed in the EIR for the 2000 SCM examined the potential increased long-term (carcinogenic and chronic) and short-term (acute) human health impacts associated with the use of various replacement solvents in compliant coating formulations. It was

concluded that the general public and coating applicators would not be exposed to either long-term or short-term health risks due to the application of compliant coatings as a result of the SCM.

ARB staff also considered the potential health impacts that might result from the increased use of tertiary butyl acetate (TBAc) in architectural coatings. TBAc has a strong odor that precludes its use in interior architectural coatings and it has a low flash-point making it unsuitable for coatings that have high flash point requirements. TBAc also has low water-solubility and fast evaporation, making it unsuitable for use in water-based coatings. However, it could be used in industrial coatings, wood lacquers, and epoxies (Pourreau, 2006).

In 2004, the U.S. EPA exempted TBAc from their list of VOCs because they determined that TBAc had low photochemical reactivity and low potential for adverse environmental impacts. In areas that have adopted a VOC exemption for TBAc, users are required to report emissions but they do not have a limit on the amount of TBAc used. Most of California has not exempted TBAc, due to questions of its toxicity. California's Office of Environmental Health Hazard Assessment (OEHHA) is concerned that long-term toxicity data are significantly lacking for TBAc, and that TBAc is metabolized into tert-butanol (TBA) (ARB, 2006a). After analyzing a National Toxicology Program bioassay for tert-butanol, OEHHA has concluded that the data are sufficient to conclude that tert-butanol is an animal carcinogen, and may be considered to pose a potential cancer risk to humans (ARB, 2006b).

ARB staff is not proposing to exempt TBAc in this proposed SCM, because of OEHHA's concerns regarding toxicity. In addition, staff does not believe that the use of TBAc is required to comply with the SCM. Since TBAc is not miscible with water, it would only be used as an exempt solvent for solventborne coatings. Even though nearly 90% of architectural coatings are waterborne, there are still solventborne architectural coatings used by do-it-yourselfers and contractors without the use of respirators. ARB staff is concerned that these users could potentially experience adverse health impacts if they use products containing TBAc without the proper protective equipment. ARB staff exempted TBAc in ARB's Automotive Refinish Coatings SCM because all of the coatings applied in that industry are to be applied using respirators. Similarly, the South Coast Air Quality Management District (SCAQMD) exempted TBAc for Industrial Maintenance coatings only, because Industrial Maintenance coatings are typically applied by professionals using respirators. In addition, some industry representatives said they needed TBAc to comply with the SCAQMD's 100 g/l VOC limit for some types of Industrial Maintenance products. ARB is not proposing a 100 g/l limit for Industrial Maintenance coatings, and industry is already complying with the 250 g/l limit without the use of TBAc. While ARB is not proposing a TBAc exemption, districts may exempt TBAc for certain applications. ARB staff encourages districts to conduct their own analyses to determine whether or not the use of TBAc would pose unacceptable exposures.

6.B.3. Potential Water Resources Impacts

The State Water Resources Control Board (SWRCB) and nine regional water quality control boards (RWQCB) are responsible for protecting surface and groundwater supplies in California, regulating waste disposal, and requiring cleanup of hazardous conditions (California Water §§13000 - 13999.16). In particular, the SWRCB establishes water-related policies and approves water quality control plans, which are implemented and enforced by the RWQCBs. These agencies also regulate discharges to State waters through federal National Pollution Discharge Elimination System (NPDES) permits. Discharges to publicly owned treatment works (POTW) are regulated through federal pre-treatment requirements enforced by the POTWs.

The proposed SCM is not expected to adversely impact water quality since the use of less toxic exempt solvents is expected to result in equivalent or lesser water quality impacts than currently used solvents. Water resources impacts are considered significant if they cause changes in the course of water movements or of drainage or surface runoff patterns; substantially degrade water quality; deplete water resources; significantly increase toxic inflow to public waste water treatment facilities; or interfere with groundwater recharge efforts. No significant adverse impacts are anticipated, therefore, no mitigation measures are necessary.

ARB's assessment for the proposed SCM is based upon the analyses performed in the EIR for the 2000 SCM (ARB, 2000). The EIR performed in 2000 indicated that the increased water demand associated with implementation of the SCM is *de minimus*. The SCM is also not expected to adversely impact water quality because the use of exempt solvents is expected to result in equivalent or lesser water quality impacts than currently used solvents due to the exempt solvents being less toxic. Further, because currently available compliant coatings are already based on waterborne technology, no additional water quality impacts from future compliant waterborne coatings are expected because these coatings are also expected to be waterborne. Finally, the SCM is not expected to promote the use of compliant coatings formulated with hazardous solvents that could create water quality impacts.

6.B.4. Hazardous Waste Disposal

The Department of Toxic Substances Control (DTSC) is the lead agency in California for hazardous waste management. DTSC enforces California's Hazardous Waste Control laws, issues permits to hazardous waste facilities, and mitigates contaminated hazardous waste sites. In California, leftover liquid waterborne and solventborne coatings are considered a hazardous waste and must be disposed of with a facility that is registered with DTSC. Hazardous

materials as defined in 40 CFR 261.20 and California Title 22 Article 9 (including listed substances, 40 CFR 261.30) are disposed of in Class I landfills.

After collection at household hazardous waste collection sites, waterborne coatings may be consolidated for reuse. Consolidation of waterborne paint is a key way to reuse waterborne paint that is in good condition, and may effectively reduce the volume of waterborne paint for disposal by 50 percent or more. Some communities use this consolidated waterborne paint in anti-graffiti campaigns. Post-consumer paints can also be used in reprocessed recycled paints, resulting in high quality recycled paints.

Because waterborne paint is not considered a household hazardous waste when dried, small quantities of waterborne paint deemed not recyclable can be allowed to dry and disposed of in the household trash container, which is transferred to municipal solid waste landfills (Cal/EPA, 2007).

Solventborne paint is generally not a good candidate for reuse because of complexity and incompatibility as well as other paint formulation considerations. Cement kilns can use waste solventborne paints as a fuel source provided they have a high enough british thermal unit (BTU) value. If the collected solventborne paint is not suitable for use as a fuel source, it must be disposed of as a household hazardous waste through a licensed contractor (NPCA, 2007).

Solventborne coatings require the use of additional other hazardous materials (paint thinner, mineral spirits or turpentine) for cleanup and thinning, and thus generates more hazardous waste for disposal. Additionally, solventborne coatings and their associated cleaners and thinners are fire hazards due to their flammability, and rags used to clean up solventborne paints can easily catch fire, or even spontaneously combust, if stored improperly.

The solid waste/hazardous waste analysis performed in the EIR for the 2000 SCM examined increased disposal of compliant coatings due to the possibility of shorter shelf or pot lives or lesser freeze/thaw capabilities. Adverse solid waste/hazardous waste impacts associated with the SCM are expected to be insignificant.

6.B.5. Other Environmental Impacts

ARB staff has determined that there will be no significant adverse impacts to the following environmental resources in California as a result of implementing the SCM (ARB, 2000):

- Public Services
- Transportation/Circulation
- Land Use and Planning
- Population and Housing

- Geophysical
- Biological Resources
- Energy and Mineral Resources
- Noise
- Aesthetics
- Cultural Resources
- Recreation

6.C. REASONABLY FORESEEABLE FEASIBLE MITIGATION MEASURES

ARB is required to do an analysis of reasonably foreseeable mitigation measures. We have concluded that no significant adverse environmental impacts should occur from implementation of the proposed SCM. As a result, no mitigation measures would be necessary.

6.D. ALTERNATIVES TO THE PROPOSED SCM

As alternatives to the proposed SCM, ARB staff evaluated taking no action and delaying the effective dates. ARB staff determined that neither of these alternatives would be as effective at reducing VOC emissions from architectural coatings as the proposed SCM. The no action alternative was rejected because it would not achieve emission reductions necessary to attain the State and federal ambient air quality standards. The delayed effective date alternative was rejected because compliant coatings are currently available or will be available before the proposed effective dates of the SCM.

6.E. COMMUNITY HEALTH AND ENVIRONMENTAL JUSTICE

The ARB is committed to evaluating community impacts of proposed regulations, including environmental justice concerns. ARB's goal is to reduce or eliminate any disproportionate impacts of air pollution on low-income and minority populations so that all individuals in California can live, work, and play in a healthful environment. The proposed SCM is not expected to result in significant negative impacts in any community. The result of the proposed SCM will be reduced exposure to VOCs for all California communities, including those with large populations of low-income and minority residents.

6.F. REFERENCES

Air Resources Board. "Final Program Environmental Impact Report Suggested Control Measure for Architectural Coatings." June, 2000. (ARB, 2000)

Air Resources Board. Staff Report. "Environmental Impact Assessment of Tertiary –Butyl Acetate". Online, Internet at http://www.arb.ca.gov/research/reactivity/tbacf.pdf January 2006. (ARB, 2006a)

Air Resources Board. Staff Report. "Environmental Impact Assessment of Tertiary –Butyl Acetate Appendix A-1 Response to Public Comments". Online, Internet at http://www.arb.ca.gov/research/reactivity/tbaca1.pdf January 2006. (ARB, 2006b)

California Environmental Protection Agency (Cal/EPA), Letter from Linda S. Adams, Secretary for Environmental Protection, to Mr. David Allaway, Oregon Department of Environmental Quality regarding Regulation of Waste Latex Paints in California. June 13, 2007. (Cal/EPA, 2007)

National Paint and Coatings Association. "Leftover Paint: Protocol for Management of Post Consumer Paint" Online, Internet at http://www.paint.org/protocol/index.cfm (NPCA, 2007)

CHAPTER 7. ECONOMIC IMPACTS

7.A. BACKGROUND

This chapter discusses the economic impacts we anticipate from implementation of the proposed SCM VOC limits. ARB staff quantified the economic impacts to the extent feasible, but economic impact analyses can be inherently imprecise by nature. Therefore, some projections are necessarily qualitative or semi-quantitative, based on general observations about the architectural coatings industry. The economic impacts analysis for the proposed SCM provides a general picture of the economic impacts that typical businesses might encounter, but staff recognizes that individual companies may experience impacts different than those projected in this analysis.

The overall projected impacts are summarized first, followed by a more detailed discussion of specific aspects of the economic impacts in the sections listed below:

- Summary of Economic Impacts
- General Approach
- Sources and Treatment of Cost Data
- Annual Cost and Cost Effectiveness
- Impact to Businesses
- Impact to Consumers
- Mitigation of Potential Impacts Through Additional Regulatory Flexibility

It is important to note that we conducted the economic impacts analysis despite the fact that the analysis is not required under the California Administrative Procedure Act (APA) for suggested control measures such as the staff's proposal. The analysis uses methodologies and assumptions similar to those used to support adoption of the 1998 U.S. EPA National Architectural Coatings Rule, the 1999 SCAQMD Rule 1113 (SCAQMD, 1999), and ARB's 2000 Suggested Control Measure (SCM) for Architectural Coatings. Moreover, the analysis uses virtually the same methodology adopted by the Board in approving all consumer product rulemakings since 1990 (ARB, 1990; ARB, 1991; ARB, 1997; ARB, 1999; ARB, 2004).

7.B. SUMMARY OF ECONOMIC IMPACTS

Overall, most affected businesses will be able to absorb the costs of the proposed VOC limits and requirements with no significant adverse impacts on their profitability. Profitability impacts were estimated by calculating the decline in the return on owner's equity (ROE). Assuming that coating manufacturers will have to absorb all costs associated with the SCM, the proposed SCM is expected to result in an average ROE decline of 2.1 percent, which is not

considered to be a significant impact on the profitability of affected businesses. However, the proposed VOC limits may impose economic hardship on some small businesses with very little or no margin of profitability.

Overall, we expect the proposed SCM to have no significant impact on employment; business creation, elimination or expansion; or business competitiveness in California. We also expect no significant adverse fiscal impacts on any local or State agencies.

We estimate the total cost of the proposed SCM to affected architectural coatings manufacturers to be approximately 4 million dollars per year in nonrecurring costs and 8.3 million dollars in annual recurring costs. This corresponds to a total annualized cost of 12.3 million dollars per year in 2007 dollars.

Our analysis shows that the cost-effectiveness of the proposed limits is similar to the cost-effectiveness of the SCAQMD's Rule 1113 and the existing consumer product regulations, as well as other existing ARB regulatory programs. We estimate that the overall cost-effectiveness of the proposed SCM ranges from a net savings to $13.90 per pound of VOC reduced, with an overall cost-effectiveness of $1.12 per pound of VOC reduced in 2007 dollars. This cost-effectiveness is comparable in magnitude to those reported for other ARB consumer product regulations and measures, which generally have fallen within a range of no cost to about $6.90 per pound of VOC reduced. The 2000 architectural coatings SCM had an overall cost effectiveness of $3.20 per pound of VOC reduced.

To project the maximum potential impacts on consumers, we assume the opposite scenario relative to the business impacts analysis. That is, rather than determining whether businesses can absorb all costs incurred and not have a significant impact on their profitability, we assume for the consumer impacts analysis that manufacturers and retailers pass on all the costs to the consumers by raising the price of those coatings that need to be reformulated. With this assumption, we project a maximum cost increase ranging from a net savings to $6.82 per reformulated gallon, with an average increase of about 30 cents per gallon. Based on an assumed 4X multiplier (i.e., the distributor doubles the purchase price from the manufacturer, and the retailer doubles the purchase price from the distributor), the maximum retail price increase ranges from a net savings to about $27.30 per reformulated gallon, with an average increase of about $1.21 per gallon. Assuming the average retail price per gallon of noncompliant coating currently ranges from $11.80 to $38.70 with an average of about $19.20, the maximum retail price increase would range from a net savings to a 47 percent increase, with an average increase of about six percent.

However, it is important to note that most individual consumers buy Flats, Nonflats, and Primers, Sealers and Undercoaters. For these categories, if all costs were passed on to consumers, staff estimates a maximum retail price

increase from a net savings to about $4.40 per reformulated gallon, with an average potential increase of about $1.65 per gallon. Assuming the average retail price per gallon of noncompliant coating currently ranges from $16.90 to $19.40 with an average of about $18.30, the maximum retail price increase would range from a net savings to a 26 percent increase, with an average increase of about nine percent.

It should be noted that consumers who do not wish to purchase these reformulated coatings would still be able to buy the currently available complying coatings at current prices. These products will still be available with no expected price increase. The competition from these existing compliant coatings will likely constrain any price increases for the reformulated coatings. In other words, most manufacturers would not be able to pass on all their costs to the consumers as we assumed in this analysis, thereby making the actual retail price increases likely to be less than our projections.

The results are summarized in Table 7-1.

Table 7-1
Summary of Economic Impacts

Average ROE Decline	2.1%
Total Annual Cost in 2007 Dollars	12.3 million
Overall Cost Effectiveness Range (Dollars per Pound VOC Reduced)	Net savings to $13.90
Overall Average Cost Effectiveness (Dollars per Pound VOC Reduced)	$1.12
Maximum Retail Price Increase Range (Dollars per Gallon)	Net savings to $27.30
Average Maximum Retail Price Increase (Dollars per Gallon)	$1.21
Maximum Retail Price Increase for Flats (Percent Increase per Gallon)	-7%
Maximum Retail Price Increase for Nonflats (Percent Increase per Gallon)	15%
Maximum Retail Price Increase for Primers, Sealers, and Undercoaters (Percent Increase per Gallon)	10%

7.C. GENERAL APPROACH

7.C.1. Legal Requirements

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states.

Because the staff's proposal is a SCM rather than an administrative regulation, the business impacts assessment is not required. However, ARB staff conducted the normally required business impacts assessment to provide the Board and districts a comprehensive evaluation of the potential cost impacts.

Similarly, we also evaluated the SCM's potential impacts to State and local agencies. Normally, State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance. The estimate shall include any nondiscretionary cost or savings to local agencies and the cost or savings in federal funding to the State.

In addition, had the proposal been a regulation, Health and Safety Code section 57005 would have required the ARB to perform an economic impact analysis of submitted alternatives to a proposed regulation before adopting any major regulation. A major regulation is defined as a regulation that will have a potential cost to California business enterprises in an amount exceeding ten million dollars in any single year.

7.C.2. Methodology

The economic impacts analysis consists of several parts. First, because we do not expect the SCAQMD to adopt this SCM, we calculated the total non-SCAQMD annual costs of the proposal. An analysis was conducted to determine the annual costs impacts to manufacturers based on raw material costs of typical complying and noncomplying coatings. A sensitivity analysis was conducted to determine the impacts on the annual costs from assumed changes to resin costs, the primary variable that influences raw material costs. In addition, we estimated the cost to market and distribute coatings that comply with the limits of the proposed SCM based on discussions with manufacturers. The projected annual costs then become the inputs for determining the three main outputs of the analysis: the cost-effectiveness, the business impacts, and the consumer impacts.

The cost-effectiveness is presented to compare the proposal's cost efficiency in reducing a pound of VOC relative to the cost-efficiency of other rules and control measures adopted by the districts and the ARB. The business impact analysis employs two scenarios under which all costs incurred to meet the proposal are absorbed by the coating manufacturers, and then by assuming that all costs incurred are passed on to consumers in the form of increased cost of coatings at the retail level. These two parts of the analysis represent the boundaries of expected impacts, with the actual regulatory impacts from the proposal probably falling somewhere between these two extremes (i.e., some costs are absorbed by the manufacturer, with the remaining costs passed on to consumers). Thus, the actual business impacts and price increases will likely be less than predicted in this analysis. The methodology is explained in detail in Appendix G.

Contractors, raw material suppliers, distributors, and retailers of architectural coatings may also be impacted by the proposed VOC limits.

7.D. SOURCES AND TREATMENT OF COST DATA

The cost analysis relies on various sources of information. Discussions were held with coating manufacturers and resin manufacturers. For cost information specific to manufacturers, we relied on industry responses to the 2007 ARB Economic Impacts Survey. We sent this survey out in April 2007 to all manufacturers who would be impacted by the proposed VOC limits, based on ARB's 2005 Architectural Coatings Survey. From this group of 147 manufacturers, we received 36 responses. This survey elicited manufacturers' best estimates of the costs of meeting the proposal, including their estimates of the nonrecurring and recurring costs involved.

The 2007 ARB Economic Impacts Survey was intentionally broad so manufacturers could report all reasonably expected costs incurred to reformulate products for sale in non-SCAQMD areas of California. The respondents include a variety of large, medium, and small manufacturers, representing about 39 percent of the architectural coatings market in California based on ARB's 2005 Architectural Coatings Survey (ARB, 2006). Table 7-2 is a list of the respondents.

Table 7-2
2007 Economic Impact Survey Respondents

1	3M Company	19	Jones Blair
2	Ace Hardware Paint Division	20	Kelly Moore Paint Co.
3	Bay Systems North America LLC	21	Life Paint Co.
4	Bonakemi	22	Minuteman International - Multi Clean Div.
5	Carlise Coating & Waterproofing Inc.	23	Mortex Mfg. Co. Inc.
6	Connlin Company Inc.	24	Pacific Polymers International Inc.
7	Ellis Paint Company	25	Ponderosa Paint Co. Inc.
8	Epmar Corporation	26	RJ McGlennon Co., Inc.
9	ER Systems Inc.	27	Sherwin Williams
10	Frazee	28	Specialty Coatings and Chemical
11	Gemini Industries, Inc.	29	Technical Roofing Solutions Inc.
12	Griggs Paint of Domcom Enterprises, Inc.	30	The Garland Company Inc.
13	Henry Company	31	United Gilsonite Laboratories
14	Hillyard	32	United States Gypsum
15	Ingels, Inc.	33	Valspar Architectural Coatings
16	Insl-X Products Corp.	34	Waterlox Coatings Corporation
17	Jasco Chemical Corp.	35	XIM Products Inc.
18	JFB Hart Coatings Inc.	36	ZRC Worldwide

Many companies will not be impacted by the proposed SCM. These companies may have already reformulated their products to meet the SCAQMD limits, or do not market products that will be impacted by the proposed limits. Out of the 36

respondents to the survey, 12 reported that they would not incur any costs to meet the proposed SCM.

Sample complying and noncomplying product formulations were developed based on responses to ARB's 2005 Architectural Coatings Survey, product data sheets, and input from manufacturers. To determine the cost from changes in raw materials, we relied on information from chemical manufacturers, distributors of raw materials, and Chemical Market Reporter Magazine. In cases where a price range or multiple prices were found for a particular ingredient, we used the highest price available in the analysis. Finally, in cases where no price information was available for an ingredient, we applied a default value of $1.50 per pound, which is higher than most of the ingredients used in the raw materials costs analysis.

7.E. ANNUAL COSTS AND COST-EFFECTIVENESS OF THE PROPOSED LIMITS

7.E.1. Introduction

In the following analysis, we present the anticipated annual costs and cost-effectiveness of the proposed new limits. Determining the proposal's cost-effectiveness allows us to compare the efficiency of the proposed limits in reducing a pound of VOC relative to other existing regulatory programs. To do this, we applied a well-established methodology for converting compliance costs, both nonrecurring and recurring costs, to an annual basis. We then report the ratio of the annual costs to the annual emission reductions in terms of "dollars (to be) spent per pound of VOC reduced." To put the proposal's cost-effectiveness into proper perspective, we compare the results of our analysis with the cost-effectiveness of other ARB regulations and control measures.

7.E.2. Methodology

The cost-effectiveness of a limit is generally defined as the ratio of total dollars to be spent to comply with the limit (as an annual cost) to the mass reduction of the pollutant(s) to be achieved by complying with that limit (in annual pounds). Annual costs include annualized nonrecurring costs (e.g., total research and development (R&D), product and consumer testing, equipment purchases/modifications, one-time distributional/marketing changes, literature changes, etc.) and annual recurring costs (e.g., increases or decreases in raw material costs, labeling, packaging, recordkeeping & reporting, etc.). Thus, the cost-effectiveness is calculated according to the following general equations:

$$Cost\text{-}Effectiveness = \frac{Annualized\ Nonrecurring\ Costs + Annual\ Recurring\ Costs}{Annual\ Emission\ Reductions}$$

where,

$$Annualized\ Nonrecurring\ Costs = CRF \times \sum (Nonrecurring\ Costs)$$

where,

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

i = discount rate, assumed 5%
n = project horizon, assumed 5 years

$$Annual\ Recurring\ Costs = Non\text{-}Raw\ Material\ Costs + Raw\ Material\ Costs$$

The Capital Recovery Method for annualizing fixed costs is recommended by California Environmental Protection Agency (Cal/EPA) guidelines (Cal/EPA, 1996), and is consistent with the methodology used in previous cost analyses for ARB regulations, including the 2000 SCM for Architectural Coatings (ARB, 2000).

With regard to the discount rate, Cal/EPA recommends 2 percent plus the current yield for a U.S. Treasury Note of similar maturity to the project horizon. Cal/EPA recommends a 5-year project horizon when conducting cost-effectiveness analysis. In 2007, treasury yields have been about 5 percent for a 5 year bond (CNN, 2007), and when adjusted for an inflation rate of 2 percent, the corresponding discount rate is 5 percent.

In this analysis, each proposed limit was analyzed as a separate, stand-alone regulation. This means the annual costs and the cost-effectiveness of each limit are calculated independently. This approach, approved by the Board when it approved the Mid-Term Measures regulation in 1997 (ARB, 1997), represents an expansion and upgrade of previous analyses conducted by the ARB staff in which groups of product categories were evaluated collectively for cost-effectiveness (ARB, 1989; ARB, 1990; ARB, 1991, ARB, 1995). The approach used in this proposal is also significantly different from standardized cost-effectiveness analyses conducted for stationary sources, mobile sources, and other regulated entities. In the typical analysis for those sources, only the cost-effectiveness for the entire regulation is reported, rather than the cost-effectiveness for separate requirements of the regulation (e.g., *see* ARB, 1998).

ARB staff believes treating each proposed limit as a separate regulation is appropriate for several reasons. First, this approach prevents very cost-effective limits (e.g., those with large emission reductions coupled with low costs) from "masking" relatively cost-ineffective limits. Such cost-ineffective limits can then be evaluated for possible elimination or substitution by other proposed limits that are more cost-effective. Another reason for treating each limit independently is that each limit is, in reality, generally independent of all the other limits. For these reasons, our approach for treating each limit separately for cost-effectiveness calculations provides a more conservative and realistic analysis.

As shown earlier, we annualized the nonrecurring costs (i.e., one-time fixed costs such as R&D, equipment purchases, etc.) using the Capital Recovery Method, which is the recommended approach under Cal/EPA guidelines. Using this method, we multiply the estimated total fixed costs to comply with each proposed limit by the Capital Recovery Factor (CRF) to convert these future costs into discounted, equal annual payments in current dollars over the selected project horizon (i.e., the projected useful life of the investment) (Cal/EPA, 1996). We then sum the annualized fixed costs with the annual recurring costs (subtracting out any cost savings due to changes in raw material costs) and divide that sum by the annual emission reductions to calculate the cost-effectiveness of the proposed limits. These calculations and the associated assumptions are presented in more detail in Appendix G.

7.E.3. Results

The total cost of the proposed limits is estimated to be 12.3 million dollars per year in 2007 dollars. As shown in Table 7-3, the cost-effectiveness of individual categories ranges from -$1.37 (a net savings) to a net cost of $13.90 per pound of VOC reduced. The $13.90 per pound value for Floor Coatings is due to the fact that a large number of noncomplying products are sold in small volumes. Because the complying marketshare for Floor Coatings is 85 percent, many manufacturers have already reformulated their coatings to meet the proposed VOC limit. Therefore, staff believes that it is appropriate for the remaining manufacturers to reformulate their products to meet the proposed limit.

The overall average cost-effectiveness of the proposed limits is estimated to be $1.12 per pound of VOC reduced. This compares favorably with the cost-effectiveness of similar regulations.

Table 7-3
Cost-Effectiveness and Maximum Per-Gallon Cost Increases

Coating Category	Individual Cost-Effectiveness for Each Limit (Dollars per Pound VOC Reduced)	Calculated Cost per Gallon to Consumers [1] (Dollars per Gallon)	Cost Increase Per Gallon to Consumers (Dollars per Gallon)
Aluminum Roof	$0.41	$14.63	$1.16
Bituminous Roof	$1.02	$11.84	$6.43
Concrete Masonry Sealer	-$0.36	$14.09	-$0.88
Dry Fog	-$0.52	$34.86	-$3.96
Flat	-$0.69	$17.81	-$0.33
Floor	$13.90	$16.96	$27.30
Mastic Texture	$2.38	$17.72	$8.61
Non Flat	$7.03	$19.44	$4.40
Non Flat High Gloss	-$1.38	$23.96	-$3.39
PSU	$2.73	$16.90	$2.51
Roof	$1.38	$29.94	$1.95
Rust Preventative	-$0.46	$30.30	-$2.51
Specialty PSU	-$0.71	$25.19	-$6.32

Table 7-3 Cost-Effectiveness and Maximum Per-Gallon Cost Increases			
Coating Category	**Individual Cost-Effectiveness for Each Limit (Dollars per Pound VOC Reduced)**	**Calculated Cost per Gallon to Consumers [1] (Dollars per Gallon)**	**Cost Increase Per Gallon to Consumers (Dollars per Gallon)**
Traffic Marking	$4.76	$14.18	$4.00
Waterproofing Membrane	$6.55	$33.38	$17.00
Wood Coatings	-$1.13	$38.70	-$6.34
	Cost-Effectiveness ($ Per Lb VOC Reduced)	**Cost per Gallon ($ Per Gallon)**	**Cost Increase ($ Per Gallon)**
OVERALL RESULTS	**$1.12**	**$19.20**	**$1.21**

1 – Costs per gallon were calculated based on raw material costs, and do not necessarily reflect actual retail prices.

Table 7-4 Cost-Effectiveness of Proposed Limits vs. Similar Control Programs		
Regulation or Control Measure	**Overall Cost-Effectiveness (Dollars per Pound VOC Reduced)**	**Per-Limit Cost-Effectiveness (Dollars per Pound VOC Reduced)**
2007 Architectural Coatings Suggested Control Measure	$1.12	Net savings to $13.90
SCAQMD 2003 Amended Rule 1113	$2.11 to $5.70	Not Determined
2000 Architectural Coatings Suggested Control Measure	$3.20	Net savings to $7.65
2005 Automotive Refinishing Suggested Control Measure	$1.45	Not Determined
SCAQMD 1999 Rule 1113	$2.45	$0.50 to 5.60
1989 AIM Suggested Control Measure	net savings to $6.90	Not Determined
Aerosol Coating Products	$2.85 to $3.20	Not Determined
Mid-Term Measures II Consumer Products	$0.40	$0.00 to $6.30
Mid-Term Measures I Consumer Products	$0.25	$0.00 to $7.10
Phase II Consumer Products	<$0.01 to $1.10	Not Determined

(ARB, 1989; ARB, 1990; ARB, 1991; ARB, 1997; ARB, 1999; ARB, 2004; SCAQMD, 1999; ARB, 2005; ARB, 2000; SCAQMD, 2003)

7.F. ECONOMIC IMPACTS ON BUSINESSES

7.F.1. Potential Impact on California Businesses

The staff's analysis shows that most affected businesses would be able to absorb the costs of the proposed SCM with no significant adverse impacts on their profitability. However, the proposed SCM may impose economic hardship on some businesses with small or no margin of profitability. These businesses, if hard pressed, can seek relief under the variance provision of the local air districts for extensions to their compliance dates. Such extensions may provide sufficient

time to minimize the cost impacts to these businesses. Because the proposed amendments would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment; business creation, elimination or expansion; and business competitiveness in California.

7.F.2. Affected Businesses

This portion of the economic impact analysis is based on a comparison of the return on owners' equity (ROE) for affected businesses before and after inclusion of the cost to comply with the proposed requirements. The data used in this analysis are obtained from publicly available sources, the 2005 ARB Architectural Coatings Survey, and the staff's cost-effectiveness analysis discussed earlier in this chapter.

Any business that manufactures or markets architectural coatings would potentially be affected by the proposed SCM. Also potentially affected are businesses that supply resins, solvents, other ingredients and equipment to these manufacturers or marketers, or distribute, sell or use architectural coatings. The focus of this analysis, however, is on manufacturers, because these businesses would be directly affected by the proposed SCM.

According to the 2005 ARB Survey, 197 companies nationwide manufacture or market architectural coatings in California. Of these 197 companies, 164 manufacture or market coatings in one of the categories with a proposed change in VOC limit. These 164 companies are represented in Table 7-5. Of the 164 companies that manufacture or market coatings in one of the categories with a proposed change in VOC limit, 147 manufacture noncompliant products, according to the 2005 ARB Survey. These 147 companies were the recipients of the economic survey.

Architectural coating manufacturers generated about $19.5 billion in national sales in 2004, of which an estimated $2.4 billion was in California (NPCA, 2007). The bulk of this sales volume was generated by a few companies; ten of the 197 manufacturers account for 81 percent of the volume, with the remaining 187 companies accounting for the remaining 19 percent (ARB, 2006).

The 164 architectural coatings companies that manufactured or marketed non-complying products in California marketed about 56 million gallons of coatings outside the SCAQMD in 2004, of which 15 million gallons were compliant and 41 million gallons were noncompliant (*Id.*). California based companies accounted for 39 percent of compliant gallons, 62 percent of noncompliant gallons, and 56 percent of the overall sales volume for coatings marketed in California as shown in Table 7-5 (*Id.*).

Table 7-5
Sales Volume for Compliant and Non-Compliant Coatings in Categories with a Change in VOC Limit (excluding the South Coast AQMD)

Sales Volume in 2004	California Manufacturers (45)		Non-California Manufacturers (119)		All Manufacturers (164)	
Compliant Products (Gallons)	5,882,182	19%	9,107,287	37%	14,989,469	27%
Non-Compliant Products (Gallons)	25,328,260	81%	15,595,976	63%	40,924,236	73%
Total	**31,210,442**		**24,703,263**		**55,913,705**	

All affected categories of coatings are classified under Standard Industrial Classification (SIC) 2851 or new North American Industry Classification System (NAICS) 325510.

7.F.3. Study Approach

Of the 197 manufacturers or marketers of architectural coatings included in the ARB 2005 Survey, a total of 164 companies manufactured or marketed noncompliant paints and coatings in California in 2004. This study covers these affected businesses. The approach used in evaluating the potential economic impact of the proposed SCM on these businesses is outlined as follows:

(1) A sample of representative businesses of different sizes was selected from the list of 164 affected businesses based on the size of their sales and quantity of noncompliant coatings they manufactured or marketed. Based on the number of employees, revenue and sales volume, three large businesses, 4 medium, and 2 small businesses were included in this analysis.
(2) If applicable, survey reported compliance cost was used, otherwise the compliance cost was estimated for each of these businesses.
(3) Estimated cost was adjusted for federal and State taxes.
(4) The three-year average ROE was calculated, where data were available, for each of these businesses by averaging their ROEs for 2004 through 2006 (Dunn and Bradstreet, 2007). ROE is calculated by dividing the net profit by the net worth. The adjusted cost was then subtracted from net profit data. The results were used to calculate an adjusted three-year average ROE. The adjusted ROE was then compared with the ROE before the subtraction of the adjusted cost to determine the potential impact on the profitability of the businesses. A reduction of more than 10 percent in profitability is considered to indicate a potential for significant adverse economic impacts.

The threshold value of 10 percent has been used consistently by the ARB staff to determine impact severity (ARB, 1990; ARB, 1991; ARB, 1995; ARB, 1998; ARB, 2000; ARB, 2005). This threshold is consistent with the thresholds used by the United States Environmental Protection Agency and others.

7.F.4. Assumptions

The ROEs before and after the subtraction of the adjusted compliance costs were calculated for each size business using financial data for 2004 through 2006. The calculations were based on the following assumptions:

(1) Selected businesses are representative of affected businesses;
(2) All affected businesses are subject to the highest federal and State corporate tax rates of 35 percent and 9.3 percent respectively; and
(3) Affected businesses are not able to increase the prices of their products, nor can they lower their costs of doing business through short-term, cost-cutting measures.

Given the limitation of available data, staff believes these assumptions are reasonable for most businesses at least in the short run; however, they may not be applicable to all businesses.

7.F.5. Results

Typical California businesses are affected by the proposed SCM to the extent that the additional costs imposed by the proposed requirements would change their profitability. A detailed discussion and analysis of these costs is provided in section 7.E.

Staff estimated profitability impacts by calculating the decline in the return on owner's equity (ROE). Assuming that coating manufacturers will have to absorb all of the costs associated with the SCM, the proposed SCM is expected to result in an average ROE decline of 2.1 percent, as shown in Table 7-6, which is not considered to be a significant impact on the profitability of affected businesses.

Table 7-6
Changes in Return on Owner's Equity (ΔROEs)
for Typical Businesses in Architectural Coatings Industry

Size	ΔROE
Large	1.1%
Medium	1.5%
Small	4.7%
Average	**2.1%**

Note: All ΔROEs shown are negative which indicates a decline in profitability.

As shown in Table 7-6, the projected change in profitability of typical businesses in the architectural coatings industry varied widely. The predicted decline in profitability of sample businesses ranged from a high of about 4.7 percent for a typical small business to a low of 1.1 percent for a typical large business. This variation in the impact of the proposed SCM can be attributed mainly to the following factors. First, large businesses incur higher costs due to the quantity of

noncompliant coatings they manufacture or market. Second, small businesses are usually dependent more financially on affected products than large businesses. Finally, the performance of businesses may differ from year to year. Hence, the average 2004 through 2006 financial data used may not be representative of an average-year performance for some businesses.

The estimated changes to ROEs may be high for the following reasons. First, annualized costs of compliance are estimated using, in part, the current prices of raw materials. Raw material prices usually tend to fall as higher demand for these materials induces economy of scale production in the long run. Second, affected businesses probably would not absorb all of the increase in their costs of doing business. They might be able to either pass some of the cost on to consumers in the form of higher prices, reduce their costs, or do both.

7.F.6. Potential Impact on Suppliers

Companies which supply resins, solvents, other chemicals and equipment for use in reformulating architectural coatings would potentially benefit from the proposed SCM as they experience an increase in demand for their products. On the other hand, those companies that supply raw materials for existing noncompliant coatings may experience a decline in demand for their products.

Distributors and retailers may be adversely impacted if the increased costs of coatings dampen demand for architectural coatings. They may also be burdened by the task of ensuring that noncompliant products are not sold past the allowable “sell-through period.” However, given the over two-year lead time before the proposed limits become effective and the proposed three-year sell-through period, distributors and retailers should have ample time to make the appropriate adjustments in their operations to minimize any such impacts.

7.F.7. Potential Impact on Employment

The proposed SCM is not expected to cause a noticeable change in California employment and payroll. According to the 2004 U.S. Census Bureau, California employment in the paint and allied products industry (NAICS 325510/SIC 2851, which includes establishments engaged in manufacturing paints, varnishes, lacquers, enamels and shellac, putties, wood fillers and sealers, paint and varnish removers, paint brush cleaners and allied paint products) was 4,137 in 2004, or about 9 percent of the national employment in the industry. This also represents only about 0.3 percent of the total manufacturing jobs in California. These employees working in 173 establishments generated about $192 million in payroll, accounting for less than 0.3 percent of the total California manufacturing payroll in 2004. Forty-nine establishments had 20 employees or more; the rest had less than 20 employees each (BLS, 2007).

Professional painters and contractors may also be impacted by the proposed SCM. According to 2002 data from the U.S. Census Bureau, California employment of painting and wall covering contractors (NAICS 238320, which includes establishments engaged in interior or exterior painting or interior wall covering. The work performed may include new work, additions, alterations, maintenance, and repairs) was 32,888, or about 14 percent of the national employment in the industry. This represents about 4 percent of the total construction jobs in California. These employees generate about $880 million in payroll (BLS, 2007).

The employment in the paint and coating industry is unlikely to change significantly as a result of the proposed SCM. This is because the proposed SCM, if adopted by the districts, applies only to about 56 percent of the California market for architectural coatings. Thus, its impact will be even smaller than indicated above. In addition, as shown above, most affected manufacturers or marketers would be able to absorb the reformulation costs with no significant impact on their profitability.

7.F.8. Potential Impact on Business Creation, Elimination or Expansion

The proposed SCM should have no noticeable impact on the status of California businesses. This is because the reformulation costs are not expected to impose a significant impact on the profitability of most businesses in California. However, some small businesses with little or no margin of profitability may lack the financial resources to reformulate their products in a timely manner. Should the proposed measures impose significant hardship on these businesses, temporary relief in the form of a compliance date extension under the local districts' variance provision may be warranted.

While some individual businesses may be affected adversely, the proposed SCM may provide business opportunities for existing California businesses or result in the creation of new businesses. California businesses that supply raw materials and equipment or provide consulting services to affected industries may benefit from increased industry spending on reformulation.

7.F.9. Potential Impact on Business Competitiveness

The proposed SCM should have no significant impact on the ability of California businesses to compete with businesses in other states. Because the proposed measures would apply to all businesses that manufacture or market architectural coatings for sale in the non-SCAQMD portion of California regardless of their location, the staff's proposal should not present any economic disadvantages specific to California businesses. Of a total of 197 companies involved in manufacturing or marketing architectural coatings, 45 are located in California.

The competitiveness of small businesses is not likely to be adversely affected by the fact that larger manufacturers can lower their costs because of their economies of scale. This is because smaller businesses in this industry tend to cater to niche markets that are based on competitive factors other than price, thereby making such businesses less sensitive to prices set by larger manufacturers. As noted earlier, 81 percent of the total sales volume of coatings in California is sold by only 10 manufacturers, while the other 187 manufacturers sell 19 percent of the remaining sales volume. Thus, a small portion of the market is comprised of many small and medium businesses, which sell coatings on the basis of coating specialization, brand loyalty, customer service, warranties, and other non-price related factors. A more detailed discussion of how niche-based small manufacturers generally do not compete with larger manufacturers is provided in the staff report for the Alternative Control Program for Consumer Products (ARB, 1994).

Nonetheless, the proposed measures may have an adverse impact on the competitive position of some small, marginal businesses in California if these businesses lack resources to develop commercially acceptable products in a timely manner. As stated above, such impacts can be mitigated to a degree with a justifiable compliance extension under the local districts' variance provision.

7.F.10. Potential Impacts on California State or Local Agencies

Some public agencies would be minimally impacted by the SCM. The California Prison Industry Authority (PIA) manufactures and markets products for use in State service, but none of their products fall under the proposed SCM (PIA, 2007). The Department of General Services (DGS) encourages the use of recycled coatings, which fall into a category that does not have a proposed new limit. Other State or local agencies that use architectural coatings in their ordinary course of business such as the California Department of Transportation, will have the same variety of coatings available to purchase as any other industrial, commercial, or household consumer in California. Based on the above, we have determined that the proposed limits will not create costs or savings, as defined in Government Code section 11346.5(a)(6), to any State agency or in federal funding to the State, costs or mandate to any local agency or school district whether or not reimbursable by the State pursuant to Part 7 (commencing with section 17500) Division 4, Title 2 of the Government Code, or other nondiscretionary savings to local agencies.

7.G. POTENTIAL IMPACTS ON CALIFORNIA CONSUMERS

If businesses are unable to reduce their costs of doing business, they would pass their cost increases on to consumers. Staff estimates an average potential increase of about $1.21 per gallon, if all costs were passed on to the consumer. Currently, the average cost per gallon for consumers is about $19.20. Therefore, the maximum increase in the cost per gallon could be about six percent.

However, it is important to note that most individual consumers buy Flats, Nonflats, and Primers, Sealers and Undercoaters. For these categories, if all costs were passed on to consumers, staff estimates an average potential increase of about $1.65 per gallon. Currently, the average cost per gallon for consumers for these categories is about $18.30. Therefore, the maximum increase in the cost per gallon could be about nine percent.

As noted earlier, consumers who do not wish to purchase these reformulated coatings would still be able to buy the currently available complying coatings at lower prices. The competition from these existing compliant coatings will likely constrain any price increases for the reformulated coatings. In other words, most manufacturers would not be able to pass on all their costs to the consumers as we assumed in this analysis, thereby making the actual retail price increases likely to be less than our projections.

7.H. MITIGATION OF POTENTIAL IMPACTS THROUGH ADDITIONAL REGULATORY FLEXIBILITY

Businesses may be able to mitigate their cost impacts with a justified variance from local district enforcement of the SCM to extend their compliance dates. In addition, with over two years to reformulate and an additional three years of allowable sell-through to eliminate noncompliant inventory, businesses should have ample time to make the necessary plans and adjustments in their operations to minimize the impacts from the SCM.

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CHAPTER 8. FUTURE ACTIVITIES

In addition to the current revisions proposed for the SCM, staff has identified several long-term efforts for architectural coatings. Brief discussions of these proposed long-term efforts follow.

8.A. ARCHITECTURAL COATINGS SURVEY

Staff currently plans to conduct another architectural coatings survey in 2011 to gather data from calendar year 2010. Staff expects the survey to be similar to the survey conducted in 2005 to gather data from calendar year 2004. This survey will reflect the products that have been reformulated to meet the VOC limits that took effect in the South Coast AQMD from 2005 to 2008, and the proposed SCM limits that take effect in 2010.

8.B. TECHNOLOGY ASSESSMENTS FOR PROPOSED LIMITS

ARB staff plans to conduct technology assessments for each coating category with a lower proposed VOC limit. These assessments will be conducted one year prior to the effective date of the lowered limits. The affected categories include:

- Aluminum Roof
- Bituminous Roof
- Concrete/Masonry Sealer
- Driveway Sealer
- Dry Fog
- Flat
- Floor
- Mastic Texture
- Nonflat
- Nonflat – High Gloss
- Primers, Sealers, and Undercoaters
- Reactive Penetrating Sealer
- Roof
- Rust Preventative
- Specialty Primers, Sealers, and Undercoaters
- Traffic Marking
- Waterproofing Membrane
- Wood Coatings
- Zinc-Rich Primer

Staff believes the proposed limits are feasible, based on all the evidence that we examined. Staff is committing to these technology assessments because it is standard practice for the ARB to ensure that unanticipated problems do not arise.

8.C. REACTIVITY-BASED LIMITS

Staff expects to explore the feasibility of reactivity-based limits in the future. Successful development of such limits relies heavily on receiving detailed, product-specific ingredient data from the next architectural coatings survey.

8.D. VOC TEST METHOD IMPROVEMENT

In 2005, the ARB contracted with the California Polytechnic State University at San Luis Obispo, California (Cal Poly) to develop an improved volatile organic compound (VOC) test method for architectural coatings. Currently, U.S. EPA Method 24 is used to test the VOC content of coatings. It is widely accepted that Method 24 is not reliable for the analysis of low VOC waterborne coatings, nor is it suitable for determining the VOC content of solventborne coatings with high levels of exempt compounds. In both cases, Method 24 is unreliable because it indirectly measures VOCs in these coatings.

There are also concerns with Method 24 when it comes to testing the VOC content of multi-component coatings, reactive diluent-containing coatings, high solids coatings, and low solids coatings. The intent of the project is to develop a test method, or suite of test methods, that can be used for all the major types of architectural coatings, whether they are low VOC waterborne, high VOC waterborne, low VOC solventborne, high VOC solventborne, low exempt containing solventborne, high exempt containing solventborne, high build, low build, single component, multi-component, low solids, high solids, film-forming, or penetrating, and in as many of the 40 or so regulatory architectural coating categories as possible.

For several of the solventborne types of coatings, Method 24 works well. For the remaining coatings, Cal Poly will be developing a direct VOC test method, or methods, most likely based on ASTM D6886, a test method that Cal Poly developed.

Staff anticipates the project to be completed in 2008. Cal Poly has collected samples from manufacturers representing many of the various types and categories of coatings described above. Cal Poly will continue to develop and refine the test method(s) in 2007. Several air quality districts, other agencies, and industry laboratories have volunteered to participate in “shadowing” Cal Poly’s testing, to help validate the method(s). Staff expects that to occur in 2007, with a final report to ARB in 2008.

APPENDIX A:

PROPOSED AMENDMENTS TO THE SUGGESTED CONTROL MEASURE FOR ARCHITECTURAL COATINGS

California Air Resources Board (ARB)
Suggested Control Measure for Architectural Coatings

1. APPLICABILITY

1.1 Except as provided in subsection 3 ~~1.2~~, this rule is applicable to any person who supplies, sells, offers for sale, or manufactures any architectural coating for use within the District, as well as any person who applies or solicits the application of any architectural coating within the District.

2. SEVERABILITY

2.1 Each provision of this rule shall be deemed severable, and in the event that any provision of this rule is held to be invalid, the remainder of this rule shall continue in full force and effect.

3. EXEMPTIONS

3.1~~1.2~~ This rule does not apply to:

3.1.1 ~~1.2.1~~ Any architectural coating that is supplied, sold, offered for sale, or manufactured for use outside of the District or for shipment to other manufacturers for reformulation or repackaging.
3.1.2 ~~1.2.2~~ Any aerosol coating product.
~~1.2.3 Any architectural coating that is sold in a container with a volume of one liter (1.057 quart) or less.~~

3.2 With the exception of section 7, this rule does not apply to any architectural coating that is sold in a container with a volume of one liter (1.057 quart) or less.

4 ~~2~~. DEFINITIONS

4.1 ~~2.0~~ Adhesive: Any chemical substance that is applied for the purpose of bonding two surfaces together other than by mechanical means.

4.2 ~~2.1~~ Aerosol Coating Product: A pressurized coating product containing pigments or resins that dispenses product ingredients by means of a propellant, and is packaged in a disposable can for hand-held application, or for use in specialized equipment for ground traffic/marking applications.

4.3 Aluminum Roof Coating: A coating labeled and formulated exclusively for application to roofs and containing at least 84 grams of elemental aluminum pigment per liter of coating (at least 0.7 pounds per gallon).

Pigment content shall be determined in accordance with SCAQMD Method 318-95, incorporated by reference in subsection 8.5.4.

~~2.2 Antenna Coating: A coating labeled and formulated exclusively for application to equipment and associated structural appurtenances that are used to receive or transmit electromagnetic signals.~~

~~2.3 Antifouling Coating: A coating labeled and formulated for application to submerged stationary structures and their appurtenances to prevent or reduce the attachment of marine or freshwater biological organisms. To qualify as an antifouling coating, the coating must be registered with both the U.S. EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Section 136, *et seq*.) and with the California Department of Pesticide Regulation.~~

4.4 ~~2.4~~ Appurtenance: Any accessory to a stationary structure coated at the site of installation, whether installed or detached, including but not limited to: bathroom and kitchen fixtures; cabinets; concrete forms; doors; elevators; fences; hand railings; heating equipment, air conditioning equipment, and other fixed mechanical equipment or stationary tools; lampposts; partitions; pipes and piping systems; rain gutters and downspouts; stairways, fixed ladders, catwalks, and fire escapes; and window screens.

4.5 ~~2.5~~ Architectural Coating: A coating to be applied to stationary structures or their appurtenances at the site of installation, to portable buildings at the site of installation, to pavements, or to curbs. Coatings applied in shop applications or to non-stationary structures such as airplanes, ships, boats, railcars, and automobiles, and adhesives are not considered architectural coatings for the purposes of this rule.

4.6 Basement Specialty Coating: A clear or opaque coating that is labeled and formulated for application to concrete and masonry surfaces to provide a hydrostatic seal for basements and other below-grade surfaces. Basement Specialty Coatings must meet the following criteria:

4.6.1 Coating must be capable of withstanding at least 10 psi of hydrostatic pressure, as determined in accordance with ASTM D7088-04, which is incorporated by reference in subsection 8.5.12; and

4.6.2 Coating must be resistant to mold and mildew growth and must achieve a microbial growth rating of 8 or more, as determined in accordance with ASTM D3273-00 and ASTM D3274-95, incorporated by reference in subsection 8.5.19.

4.7 ~~2.6~~ Bitumens: Black or brown materials including, but not limited to, asphalt, tar, pitch, and asphaltite that are soluble in carbon disulfide, consist mainly of hydrocarbons, and are obtained from natural deposits or as residues

from the distillation of crude petroleum or coal.

4.8 ~~2.7~~ Bituminous Roof Coating: A coating which incorporates bitumens that is labeled and formulated exclusively for roofing.

4.9 ~~2.8~~ Bituminous Roof Primer: A primer which incorporates bitumens that is labeled and formulated exclusively for roofing and intended for the purpose of preparing a weathered or aged surface or improving the adhesion of subsequent surfacing components.

4.10~~2.9~~ Bond Breaker: A coating labeled and formulated for application between layers of concrete to prevent a freshly poured top layer of concrete from bonding to the layer over which it is poured.

~~2.10 Clear Brushing Lacquers: Clear wood finishes, excluding clear lacquer sanding sealers, formulated with nitrocellulose or synthetic resins to dry by solvent evaporation without chemical reaction and to provide a solid, protective film, which are intended exclusively for application by brush, and which are labeled as specified in subsection 4.1.5.~~

~~2.11 Clear Wood Coating: Clear and semi-transparent coatings, including lacquers and varnishes, applied to wood substrates to provide a transparent or translucent solid film.~~

4~~2~~.11 Coating: A material applied onto or impregnated into a substrate for protective, decorative, or functional purposes. Such materials include, but are not limited to, paints, varnishes, sealers, and stains.

4~~2~~.12 Colorant: A concentrated pigment dispersion in water, solvent, and/or binder that is added to an architectural coating after packaging in sale units to produce the desired color.

4~~2~~.13 Concrete Curing Compound: A coating labeled and formulated for application to freshly poured concrete to perform one or more of the following functions:
4.13.1 R~~r~~etard the evaporation of water; or
4.13.2 Harden or dustproof the surface of freshly poured concrete.

4.14 Concrete/Masonry Sealer: A clear or opaque coating that is labeled and formulated primarily for application to concrete and masonry surfaces to perform one or more of the following functions:
4.14.1 Prevent penetration of water; or
4.14.2 Provide resistance against abrasion, alkalis, acids, mildew, staining, or ultraviolet light; or
4.14.3 Harden or dustproof the surface of aged or cured concrete.

4.15 Driveway Sealer: A coating labeled and formulated for application to worn asphalt driveway surfaces to perform one or more of the following functions:
4.15.1 Fill cracks; or
4.15.2 Seal the surface to provide protection; or
4.15.3 Restore or preserve the appearance.

4.16~~2.15~~ Dry Fog Coating: A coating labeled and formulated only for spray application such that overspray droplets dry before subsequent contact with incidental surfaces in the vicinity of the surface coating activity.

4.17~~2.16~~ Exempt Compound: A compound identified as exempt under the definition of Volatile Organic Compound (VOC), subsection 4.63~~2.60~~. Exempt compounds content of a coating shall be determined by U.S. EPA Method 24 or South Coast Air Quality Management District (SCAQMD) Method 303-91 (Revised ~~February~~ 1993), incorporated by reference in subsection 8.5.8~~6.5.10~~.

4.18~~2.17~~ Faux Finishing Coating: A coating labeled and formulated to meet one or more of the following criteria:
4.18.1 ~~as a stain or~~ A glaze or textured coating used to create artistic effects including, but not limited to~~,~~: dirt, suede, old age, smoke damage, and simulated marble and wood grain~~.~~; or
4.18.2 A decorative coating used to create a metallic, iridescent, or pearlescent appearance that contains at least 48 grams of pearlescent mica pigment or other iridescent pigment per liter of coating as applied (at least 0.4 pounds per gallon); or
4.18.3 A decorative coating used to create a metallic appearance that contains less than 48 grams of elemental metallic pigment per liter of coating as applied (less than 0.4 pounds per gallon), when tested in accordance with SCAQMD Method 318-95, incorporated by reference in subsection 8.5.4; or
4.18.4 A decorative coating used to create a metallic appearance that contains greater than 48 grams of elemental metallic pigment per liter of coating as applied (greater than 0.4 pounds per gallon) and which requires a clear topcoat to prevent the degradation of the finish under normal use conditions. The metallic pigment content shall be determined in accordance with SCAQMD Method 318-95, incorporated by reference in subsection 8.5.4; or
4.18.5 A clear topcoat to seal and protect a Faux Finishing coating that meets the requirements of subsection 4.18.1, 4.18.2, 4.18.3, or 4.18.4. These clear topcoats must be sold and used solely as part of a Faux Finishing coating system, and must be labeled in accordance with subsection 6.1.4.

4.19~~2.18~~ Fire-Resistive Coating: A coating labeled and formulated to protect ~~the~~ structural integrity by increasing the fire endurance of interior or exterior steel and other structural materials. The Fire Resistive category includes sprayed fire resistive materials and intumescent fire resistive coatings that are used to bring structural materials ~~, that has been fire tested and rated by a testing agency approved by building code officials for use in bringing assemblies of structural materials~~ into compliance with federal, state, and local building code requirements. ~~The fire-resistive coating and the testing agency must be approved by building code officials. The fire-resistant coating~~ Fire Resistive coatings shall be tested in accordance with ASTM Designation E 119-~~98~~ 07, incorporated by reference in subsection 8~~6~~.5.2. Fire Resistive coatings and testing agencies must be approved by building code officials.

4.20~~2.19~~ Fire-Retardant Coating: A coating labeled and formulated to retard ignition and flame spread, that has been fire tested and rated by a testing agency approved by building code officials for use in bringing building and construction materials into compliance with federal, state and local building code requirements. The fire-retardant coating and the testing agency must be approved by building code officials. The fire-retardant coating shall be tested in accordance with ASTM Designation E 84-07, incorporated by reference in subsection 8~~6~~.5.1.

Effective January 1, 2010, the Fire Retardant coating category is eliminated and coatings with fire retardant properties will be subject to the VOC limit of their primary category (e.g., Flat, Nonflat, etc.).

4.21~~2.20~~ Flat Coating: A coating that is not defined under any other definition in this rule and that registers gloss less than 15 on an 85-degree meter or less than 5 on a 60-degree meter according to ASTM Designation D 523-89 (1999), incorporated by reference in subsection 8~~6~~.5.3.

4.22~~2.21~~ Floor Coating: An opaque coating that is labeled and formulated for application to flooring, including, but not limited to, decks, porches, steps, garage floors, and other horizontal surfaces which may be subject to foot traffic.

~~2.22 Flow Coating: A coating labeled and formulated exclusively for use by electric power companies or their subcontractors to maintain the protective coating systems present on utility transformer units.~~

4.23~~2.23~~ Form-Release Compound: A coating labeled and formulated for application to a concrete form to prevent the freshly poured concrete from bonding to the form. The form may consist of wood, metal, or some material other than concrete.

4.24 Gonioapparent: A change in appearance with a change in the angle of illumination or the angle of view, as defined according to ASTM E-284-06b, incorporated by reference in subsection 8.5.13.

4.25~~2.24~~ Graphic Arts Coating or Sign Paint: A coating labeled and formulated for hand-application by artists using brush, airbrush, or roller techniques to indoor and outdoor signs (excluding structural components) and murals including lettering enamels, poster colors, copy blockers, and bulletin enamels.

4.26~~2.25~~ High-Temperature Coating: A high performance coating labeled and formulated for application to substrates exposed continuously or intermittently to temperatures above 204°C (400°F).

4.27~~2.26~~ Industrial Maintenance Coating: A high performance architectural coating, including primers, sealers, undercoaters, intermediate coats, and topcoats, formulated for application to substrates, including floors, exposed to one or more of the following extreme environmental conditions listed in subsections 4.27.1 ~~2.26.1~~ through 4.27.5 ~~2.26.5~~, and labeled as specified in subsection 6.1.5 ~~4.1.4~~:

4.27.1 ~~2.26.1~~ Immersion in water, wastewater, or chemical solutions (aqueous and non-aqueous solutions), or chronic exposure of interior surfaces to moisture condensation; or

4.27.2 ~~2.26.2~~ Acute or chronic exposure to corrosive, caustic or acidic agents, or to chemicals, chemical fumes, or chemical mixtures or solutions; or

4.27.3 ~~2.26.3 Repeated~~ Frequent exposure to temperatures above 121°C (250°F); or

4.27.4 ~~2.26.4 Repeated (f~~Frequent~~)~~ heavy abrasion, including mechanical wear and ~~repeated (~~frequent~~)~~ scrubbing with industrial solvents, cleansers, or scouring agents; or

4.27.5 ~~2.26.5~~ Exterior exposure of metal structures and structural components.

~~2.27 Lacquer: A clear or opaque wood coating, including clear lacquer sanding sealers, formulated with cellulosic or synthetic resins to dry by evaporation without chemical reaction and to provide a solid, protective film.~~

4.28~~2.28~~ Low Solids Coating: A coating containing 0.12 kilogram or less of solids per liter (1 pound or less of solids per gallon) of coating material as recommended for application by the manufacturer. The VOC content for Low Solids Coatings shall be calculated in accordance with subsection 4.64.

4.29~~2.29~~ Magnesite Cement Coating: A coating labeled and formulated for application to magnesite cement decking to protect the magnesite cement substrate from erosion by water.

4.30 Manufacturer's Maximum Thinning Recommendation: The maximum recommendation for thinning that is indicated on the label or lid of the coating container.

4.31~~2.30~~ Mastic Texture Coating: A coating labeled and formulated to cover holes and minor cracks and to conceal surface irregularities, and is applied in a single coat of at least 10 mils (at least 0.010 inch) dry film thickness.

4.32 Medium Density Fiberboard (MDF): A composite wood product, panel, molding, or other building material composed of cellulosic fibers (usually wood) made by dry forming and pressing of a resinated fiber mat.

4.33 Metallic: Similar to the appearance of a gonioapparent material, as defined herein, containing metal flakes.

4.34~~2.31~~ Metallic Pigmented Coating: A coating that is labeled and formulated to provide a metallic appearance. Metallic Pigmented coatings must contain ~~containing~~ at least 48 grams of elemental metallic pigment (excluding zinc) per liter of coating as applied (at least 0.4 pounds per gallon), when tested in accordance with SCAQMD Method 318-95, incorporated by reference in subsection 8~~6~~.5.4. The Metallic Pigmented Coating category does not include coatings applied to roofs or Zinc-Rich Primers.

4.35~~2.32~~ Multi-Color Coating: A coating that is packaged in a single container and that is labeled and formulated to exhibit~~s~~ more than one color when applied in a single coat.

4.36~~2.33~~ Nonflat Coating: A coating that is not defined under any other definition in this rule and that registers a gloss of 15 or greater on an 85-degree meter and 5 or greater on a 60-degree meter according to ASTM Designation D 523-89 (1999), incorporated by reference in subsection 8~~6~~.5.3.

4.37~~2.34~~ Nonflat - High Gloss Coating: A nonflat coating that registers a gloss of 70 or ~~above~~ greater on a 60-degree meter according to ASTM Designation D 523-89 (1999), incorporated by reference in subsection 8~~6~~.5.3. Nonflat – High Gloss coatings must be labeled in accordance with subsection 6.1.10.

~~2.35 Nonindustrial Use: Nonindustrial use means any use of architectural coatings except in the construction or maintenance of any of the following:~~

~~facilities used in the manufacturing of goods and commodities; transportation infrastructure, including highways, bridges, airports and railroads; facilities used in mining activities, including petroleum extraction; and utilities infrastructure, including power generation and distribution, and water treatment and distribution systems.~~

4.38 Particleboard: A composite wood product panel, molding, or other building material composed of cellulosic material (usually wood) in the form of discrete particles, as distinguished from fibers, flakes, or strands, which are pressed together with resin.

4.39 Pearlescent: Exhibiting various colors depending on the angles of illumination and viewing, as observed in mother-of-pearl.

4.40 Plywood: A panel product consisting of layers of wood veneers or composite core pressed together with resin. Plywood includes panel products made by either hot or cold pressing (with resin) veneers to a platform.

4.41~~2.36~~ Post-Consumer Coating: ~~A finished coating that would have been disposed of in a landfill, having completed its usefulness to a consumer, and does not include manufacturing wastes.~~ Finished coatings generated by a business or consumer that have served their intended end uses, and are recovered from or otherwise diverted from the waste stream for the purpose of recycling.

4.42~~2.37~~ Pre-Treatment Wash Primer: A primer that contains a minimum of 0.5 percent acid, by weight, when tested in accordance with ASTM Designation D 1613-06, incorporated by reference in subsection 8~~6~~.5.5, that is labeled and formulated for application directly to bare metal surfaces to provide corrosion resistance and to promote adhesion of subsequent topcoats.

~~2.38 Primer: A coating labeled and formulated for application to a substrate to provide a firm bond between the substrate and subsequent coats.~~

4.43 Primer, Sealer, and Undercoater: A coating labeled and formulated for one or more of the following purposes:

4.43.1. To provide a firm bond between the substrate and the subsequent coatings; or

4.43.2. To prevent subsequent coatings from being absorbed by the substrate; or

4.43.3. To prevent harm to subsequent coatings by materials in the substrate; or

4.43.4. To provide a smooth surface for the subsequent application of coatings; or

4.43.5. To provide a clear finish coat to seal the substrate; or
4.43.6. To block materials from penetrating into or leaching out of a substrate.

~~2.39 Quick-Dry Enamel: A nonflat coating that is labeled as specified in subsection 4.1.8 and that is formulated to have the following characteristics:~~

~~2.39.1 Is capable of being applied directly from the container under normal conditions with ambient temperatures between 16 and 27°C (60 and 80°F);~~
~~2.39.2 When tested in accordance with ASTM Designation D 1640-95, incorporated by reference in subsection 6.5.6, sets to touch in 2 hours or less, is tack free in 4 hours or less, and dries hard in 8 hours or less by the mechanical test method; and~~
~~2.39.3 Has a dried film gloss of 70 or above on a 60 degree meter.~~

~~2.40 Quick-Dry Primer, Sealer, and Undercoater: A primer, sealer, or undercoater that is dry to the touch in 30 minutes and can be recoated in 2 hours when tested in accordance with ASTM Designation D 1640- 95, incorporated by reference in subsection 6.5.6.~~

4.44 Reactive Penetrating Sealer: A clear or pigmented coating that is labeled and formulated for application to above-grade concrete and masonry substrates to provide protection from water and waterborne contaminants, including but not limited to, alkalis, acids, and salts. Reactive Penetrating Sealers must penetrate into concrete and masonry substrates and chemically react to form covalent bonds with naturally occurring minerals in the substrate. Reactive Penetrating Sealers line the pores of concrete and masonry substrates with a hydrophobic coating, but do not form a surface film. Reactive Penetrating Sealers must meet all of the following criteria:

4.44.1 The Reactive Penetrating Sealer must improve water repellency at least 80 percent after application on a concrete or masonry substrate. This performance must be verified on standardized test specimens, in accordance with one or more of the following standards, incorporated by reference in subsection 8.5.20: ASTM C67-07, or ASTM C97-02, or ASTM C140-06; and
4.44.2 The Reactive Penetrating Sealer must not reduce the water vapor transmission rate by more than 2 percent after application on a concrete or masonry substrate. This performance must be verified on standardized test specimens, in accordance with ASTM E96/E96M-05, incorporated by reference in subsection 8.5.21; and
4.44.3 Products labeled and formulated for vehicular traffic surface chloride screening applications must meet the performance criteria listed

in the National Cooperative Highway Research Report 244 (1981), incorporated by reference in subsection 8.5.22; and

Reactive Penetrating Sealers must be labeled in accordance with subsection 6.1.8.

4.45~~2.41~~ Recycled Coating: An architectural coating formulated such that ~~not less than 50 percent of the total weight consists of secondary and post-consumer coating, with not less than 10 percent of the total weight consisting of post-consumer coating.~~ it contains a minimum of 50% by volume post-consumer coating, with a maximum of 50% by volume secondary industrial materials or virgin materials.

4.46~~2.42~~ Residential: ~~Residence~~ Areas where people reside or lodge, including, but not limited to, single and multiple family dwellings, condominiums, mobile homes, apartment complexes, motels, and hotels.

4.47~~2.43~~ Roof Coating: A non-bituminous coating labeled and formulated ~~exclusively~~ for application to roofs for the primary purpose of preventing water penetration, ~~of the substrate by water or~~ reflecting ~~heat and~~ ultraviolet light, or reflecting solar radiation. ~~Metallic pigmented roof coatings which qualify as metallic pigmented coatings shall not be considered to be in this category, but shall be considered to be in the metallic pigmented coatings category~~.

4.48~~2.44~~ Rust Preventative Coating: A coating formulated ~~exclusively for nonindustrial use~~ to prevent the corrosion of metal surfaces for one or more of the following applications: ~~and labeled as specified in subsection 4.1.6.~~

4.48.1 Direct-to-metal coating; or
4.48.2 Coating intended for application over rusty, previously coated surfaces.

The Rust Preventative category does not include the following:
4.48.3 Coatings that are required to be applied as a topcoat over a primer; or
4.48.4 Coatings that are intended for use on wood or any other non-metallic surface.

Rust Preventative coatings are for metal substrates only and must be labeled as such, in accordance with the labeling requirements in subsection 6.1.6.

~~2.45 Sanding Sealer: A clear or semi-transparent wood coating labeled and formulated for application to bare wood to seal the wood and to provide a~~

~~coat that can be abraded to create a smooth surface for subsequent applications of coatings. A sanding sealer that also meets the definition of a lacquer is not included in this category, but is included in the lacquer category.~~

~~2.46 Sealer: A coating labeled and formulated for application to a substrate for one or more of the following purposes: to prevent subsequent coatings from being absorbed by the substrate, or to prevent harm to subsequent coatings by materials in the substrate.~~

4.49~~2.47~~ Secondary ~~Coating (Rework)~~ Industrial Materials: ~~A fragment of a finished coating or a finished coating from a manufacturing process that has converted resources into a commodity of real economic value, but does not include excess virgin resources of the manufacturing process.~~ Products or by-products of the paint manufacturing process that are of known composition and have economic value but can no longer be used for their intended purpose.

4.50 Semitransparent Coating: A coating that contains binders and colored pigments and is formulated to change the color of the surface, but not conceal the grain pattern or texture.

4.51~~2.48~~ Shellac: A clear or opaque coating formulated solely with the resinous secretions of the lac beetle (*Laciffer lacca*), ~~thinned with alcohol,~~ and formulated to dry by evaporation without a chemical reaction.

4.52~~2.49~~ Shop Application: Application of a coating to a product or a component of a product in or on the premises of a factory or a shop as part of a manufacturing, production, or repairing process (e.g., original equipment manufacturing coatings).

4.53~~2.50~~ Solicit: To require for use or to specify, by written or oral contract.

4.54~~2.51~~ Specialty Primer, Sealer, and Undercoater: A coating ~~labeled as specified in subsection 4.1.7 and~~ that is formulated for application to a substrate to ~~seal~~ block water-soluble stains resulting from: fire damage;~~,~~ smoke damage; or water damage.~~; to condition excessively chalky surfaces, or to block stains. An excessively chalky surface is one that is defined as having a chalk rating of four or less as determined by ASTM Designation D 4214-98, incorporated by reference in subsection 6.5.7.~~

Specialty Primers, Sealers, and Undercoaters must be labeled in accordance with subsection 6.1.7.

4.55~~2.52~~ Stain: A ~~clear,~~ semitransparent~~,~~ or opaque coating labeled and formulated to change the color of a surface but not conceal the grain

pattern or texture.

4.56 Stone Consolidant: A coating that is labeled and formulated for application to stone substrates to repair historical structures that have been damaged by weathering or other decay mechanisms. Stone Consolidants must penetrate into stone substrates to create bonds between particles and consolidate deteriorated material. Stone Consolidants must be specified and used in accordance with ASTM E2167-01, incorporated by reference in subsection 8.5.23.

Stone Consolidants are for professional use only and must be labeled as such, in accordance with the labeling requirements in subsection 6.1.9.

4.57~~2.53~~ Swimming Pool Coating: A coating labeled and formulated to coat the interior of swimming pools and to resist swimming pool chemicals. Swimming pool coatings include coatings used for swimming pool repair and maintenance.

~~2.54 Swimming Pool Repair and Maintenance Coating: A rubber based coating labeled and formulated to be used over existing rubber based coatings for the repair and maintenance of swimming pools.~~

~~2.55 Temperature-Indicator Safety Coating: A coating labeled and formulated as a color-changing indicator coating for the purpose of monitoring the temperature and safety of the substrate, underlying piping, or underlying equipment, and for application to substrates exposed continuously or intermittently to temperatures above 204°C (400°F).~~

4.58~~2.57~~ Tint Base: An architectural coating to which colorant is added after packaging in sale units to produce a desired color.

4.59~~2.58~~ Traffic Marking Coating: A coating labeled and formulated for marking and striping streets, highways, or other traffic surfaces including, but not limited to, curbs, berms, driveways, parking lots, sidewalks, and airport runways.

4.60 Tub and Tile Refinish Coating: A clear or opaque coating that is labeled and formulated exclusively for refinishing the surface of a bathtub, shower, sink, or countertop. Tub and Tile Refinish coatings must meet all of the following criteria:

4.60.1 The coating must have a scratch hardness of 3H or harder and a gouge hardness of 4H or harder. This must be determined on bonderite 1000, in accordance with ASTM D3363-05, incorporated by reference in subsection 8.5.15.; and
4.60.2 The coating must have a weight loss of 20 milligrams or less after

1000 cycles. This must be determined with CS-17 wheels on bonderite 1000, in accordance with ASTM D4060-07, incorporated by reference in subsection 8.5.16; and

4.60.3 The coating must withstand 1000 hours or more of exposure with few or no #8 blisters. This must be determined on unscribed bonderite, in accordance with ASTM D4585-99, and ASTM D714-02e1, incorporated by reference in subsection 8.5.17; and

4.60.4 The coating must have an adhesion rating of 4B or better after 24 hours of recovery. This must be determined on unscribed bonderite, in accordance with ASTM D4585-99 and ASTM D3359-02, incorporated by reference in subsection 8.5.14.

~~2.58 Undercoater: A coating labeled and formulated to provide a smooth surface for subsequent coatings.~~

~~2.59 Varnish: A clear or semi-transparent wood coating, excluding lacquers and shellacs, formulated to dry by chemical reaction on exposure to air. Varnishes may contain small amounts of pigment to color a surface, or to control the final sheen or gloss of the finish.~~

4.61 Veneer: Thin sheets of wood peeled or sliced from logs for use in the manufacture of wood products such as plywood, laminated veneer lumber, or other products.

4.62 Virgin Materials: Materials that contain no post-consumer coatings or secondary industrial materials.

4.63~~2.60~~ Volatile Organic Compound (VOC): Any volatile compound containing at least one atom of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and excluding the following:

4.63.1~~2.60.1~~ methane;

methylene chloride (dichloromethane);
1,1,1-trichloroethane (methyl chloroform);
trichlorofluoromethane (CFC-11);
dichlorodifluoromethane (CFC-12);
1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113);
1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-114);
chloropentafluoroethane (CFC-115);
chlorodifluoromethane (HCFC-22);
1,1,1-trifluoro-2,2-dichloroethane (HCFC-123);
2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124);
1,1-dichloro-1-fluoroethane (HCFC-141b);
1-chloro-1,1-difluoroethane (HCFC-142b);
trifluoromethane (HFC-23);
pentafluoroethane (HFC-125);

1,1,2,2-tetrafluoroethane (HFC-134);
1,1,1,2-tetrafluoroethane (HFC-134a);
1,1,1-trifluoroethane (HFC-143a);
1,1-difluoroethane (HFC-152a);
cyclic, branched, or linear completely methylated siloxanes;
the following classes of perfluorocarbons:
4.63.1.1~~(A)~~ cyclic, branched, or linear, completely fluorinated alkanes;
4.63.1.2~~(B)~~ cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;
4.63.1.3~~(C)~~ cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and
4.63.1.4~~(D)~~ sulfur-containing perfluorocarbons with no unsaturations and with the sulfur bonds only to carbon and fluorine; and

4.63.2~~2.60.2~~ the following low-reactive organic compounds which have been exempted by the U.S. EPA:
acetone;
ethane;
parachlorobenzotrifluoride (1-chloro-4-trifluoromethyl benzene);
perchloroethylene; and
methyl acetate.

4.64 VOC Actual: VOC Actual is the weight of VOC per volume of coating and it is calculated with the following equation:

$$\text{VOC Actual} = \frac{(W_s - W_w - W_{ec})}{(V_m)}$$

Where:

VOC Actual	=	the grams of VOC per liter of coating (also known as "Material VOC")
W_s	=	weight of volatiles, in grams
W_w	=	weight of water, in grams
W_{ec}	=	weight of exempt compounds, in grams
V_m	=	volume of coating, in liters

4.65~~2.61~~ VOC Content: The weight of VOC per volume of coating~~, calculated according to the procedures specified in subsection 6.1~~. VOC Content is VOC Regulatory, as defined in subsection 4.66, for all coatings except those in the Low Solids category. For coatings in the Low Solids category, the VOC Content is VOC Actual, as defined in subsection 4.64. If the coating is a multi-component product, the VOC content is VOC Regulatory as mixed or catalyzed. If the coating contains silanes, siloxanes, or other ingredients that generate ethanol or other VOCs during the curing process, the VOC content must include the VOCs emitted during curing.

4.66 VOC Regulatory: VOC Regulatory is the weight of VOC per volume of coating, less the volume of water and exempt compounds. It is calculated with the following equation:

$$\text{VOC Regulatory} = \frac{(W_s - W_w - W_{ec})}{(V_m - V_w - V_{ec})}$$

Where:

VOC Regulatory	=	grams of VOC per liter of coating, less water and exempt compounds (also known as "Coating VOC")
W_s	=	weight of volatiles, in grams
W_w	=	weight of water, in grams
W_{ec}	=	weight of exempt compounds, in grams
V_m	=	volume of coating, in liters
V_w	=	volume of water, in liters
V_{ec}	=	volume of exempt compounds, in liters

~~2.62 Waterproofing Sealer: A coating labeled and formulated for application to a porous substrate for the primary purpose of preventing the penetration of water.~~

~~2.63 Waterproofing Concrete/Masonry Sealer: A clear or pigmented film-forming coating that is labeled and formulated for sealing concrete and masonry to provide resistance against water, alkalis, acids, ultraviolet light, and staining.~~

4.67 Waterproofing Membrane: A clear or opaque coating that is labeled and formulated for application to concrete and masonry surfaces to provide a seamless waterproofing membrane that prevents any penetration of liquid water into the substrate. Waterproofing Membranes are intended for the following waterproofing applications: below-grade surfaces, between concrete slabs, inside tunnels, inside concrete planters, and under flooring materials. Waterproofing Membranes must meet the following criteria:

4.67.1 Coating must be applied in a single coat of at least 25 mils (at least 0.025 inch) dry film thickness; and

4.67.2 Coatings must meet or exceed the requirements contained in ASTM C836-06, incorporated by reference in subsection 8.5.18.

The Waterproofing Membrane category does not include topcoats that are included in the Concrete/Masonry Sealer category (e.g., parking deck topcoats, pedestrian deck topcoats, etc.).

4.68 Wood Coatings: Coatings labeled and formulated for application to wood substrates only. The Wood Coatings category includes the following clear and semitransparent coatings: lacquers; varnishes; sanding sealers;

penetrating oils; clear stains; wood conditioners used as undercoats; and wood sealers used as topcoats. The Wood Coatings category also includes the following opaque wood coatings: opaque lacquers; opaque sanding sealers; and opaque lacquer undercoaters. The Wood Coatings category does not include the following: clear sealers that are labeled and formulated for use on concrete/masonry surfaces; or coatings intended for substrates other than wood.

Wood Coatings must be labeled "For Wood Substrates Only", in accordance with subsection 6.1.11.

4.69~~2.64~~ Wood Preservative: A coating labeled and formulated to protect exposed wood from decay or insect attack, that is registered with both the U.S. EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (7 United States Code (U.S.C.) Section 136, *et seq.*) and with the California Department of Pesticide Regulation.

4.70 Wood Substrate: A substrate made of wood, particleboard, plywood, medium density fiberboard, rattan, wicker, bamboo, or composite products with exposed wood grain. Wood Products do not include items comprised of simulated wood.

4.71 Zinc-Rich Primer: A coating that meets all of the following specifications:

4.71.1 Coating contains at least 65 percent metallic zinc powder or zinc dust by weight of total solids; and

4.71.2 Coating is formulated for application to metal substrates to provide a firm bond between the substrate and subsequent applications of coatings; and

4.71.3 Coating is intended for professional use only and is labeled as such, in accordance with the labeling requirements in subsection 6.1.12.

5~~3~~. STANDARDS

5~~3~~.1 **VOC Content Limits:** Except as provided in subsections 5~~3~~.2~~,~~ or 5~~3~~.3, ~~3.8, 3.9, and 3.10,~~ no person shall:

5.1.1~~(i)~~ manufacture, blend, or repackage for sale within the district;

5.1.2~~(ii)~~ supply, sell, or offer for sale within the district; or

5.1.3~~(iii)~~ solicit for application or apply within the district, any architectural coating with a VOC content in excess of the corresponding limit specified in Table 1, after the specified effective date in Table 1. Limits are expressed as VOC Regulatory, thinned to the manufacturer's maximum thinning recommendation, excluding any colorant added to tint bases.

5~~3~~.2 **Most Restrictive VOC Limit:** ~~If anywhere on the container of any~~

~~architectural coating, or any label or sticker affixed to the container, or in any sales, advertising, or technical literature supplied by a manufacturer or anyone acting on their behalf, any representation is made that indicates that the coating meets the definition of or is recommended for use for more than one of the coating categories listed in Table 1, then the most restrictive VOC content limit shall apply.~~ If a coating is recommended for use in more than one of the specialty coating categories listed in Table 1, the most restrictive (or lowest) VOC content limit shall apply. This requirement applies to: usage recommendations that appear anywhere on the coating container, anywhere on any label or sticker affixed to the container, or in any sales, advertising, or technical literature supplied by a manufacturer or anyone acting on their behalf. This provision does not apply to the specialty coating categories specified in Table 2 ~~subsections 3.2.1 through 3.2.15.~~

~~3.2.1 Lacquer coatings (including lacquer sanding sealers).~~
~~3.2.2 Metallic pigmented coatings.~~
~~3.2.3 Shellacs.~~
~~3.2.4 Fire-retardant coatings.~~
~~3.2.5 Pretreatment wash primers.~~
~~3.2.6 Industrial maintenance coatings.~~
~~3.2.7 Low solids coatings.~~
~~3.2.8 Wood preservatives.~~
~~3.2.9 High temperature coatings.~~
~~3.2.10 Temperature-indicator safety coatings.~~
~~3.2.11 Antenna coatings.~~
~~3.2.12 Antifouling coatings.~~
~~3.2.13 Flow coatings.~~
~~3.2.14 Bituminous roof primers.~~
~~3.2.15 Specialty primers, sealers, and undercoaters.~~

5~~3~~.3 **Sell-Through of Coatings:** A coating manufactured prior to the effective date specified for that coating in Table 1 may be sold, supplied, or offered for sale for up to three years after the specified effective date. In addition, a coating manufactured before the effective date specified for that coating in Table 1 may be applied at any time, both before and after the specified effective date, so long as the coating complied with the standards in effect at the time the coating was manufactured. This subsection 5~~3~~.3 does not apply to any coating that does not display the date or date-code required by subsection 6~~4~~.1.1.

5~~3~~.4 **Painting Practices:** All architectural coating containers used to apply the contents therein to a surface directly from the container by pouring, siphoning, brushing, rolling, padding, ragging or other means, shall be closed when not in use. These architectural coating containers include, but are not limited to, drums, buckets, cans, pails, trays or other

application containers. Containers of any VOC-containing materials used for thinning and cleanup shall also be closed when not in use.

5~~3~~.5 **Thinning:** No person who applies or solicits the application of any architectural coating shall apply a coating that is thinned to exceed the applicable VOC limit specified in Table 1.

~~3.6 **Rust Preventative Coatings:** Effective January 1, 2004, no person shall apply or solicit the application of any rust preventative coating for industrial use, unless such a rust preventative coating complies with the industrial maintenance coating VOC limit specified in Table 1.~~

5.6~~3.7~~ **Coatings Not Listed in Table 1:** For any coating that does not meet any of the definitions for the specialty coating~~s~~ categories listed in Table 1, the VOC content limit shall be determined by classifying the coating as a Flat ~~coating or a~~, Nonflat, or Nonflat – High Gloss coating, based on its gloss, as defined in subsections 4.21, 4.36, and 4.37~~2.20, 2.33, and 2.34~~ and the corresponding Flat, ~~or~~ Nonflat, or Nonflat – High Gloss VOC limit in Table 1 shall apply.

~~3.8 **Industrial Maintenance Coatings:**~~

~~3.8.1 After January 1, 2004, a manufacturer, seller, or user may petition the APCO to apply an industrial maintenance coating with a VOC content up to 340 g/l if all of the following conditions are met:~~

~~3.8.1.1 The industrial maintenance coating is to be applied in a district located within the North Central Coast, San Francisco Bay Area, or North Coast Air Basins.~~

~~3.8.1.2 The petition submitted to the APCO contains the following information, as applicable: job requirements and description, volume of coating, maximum VOC content, and a certification that a complying coating meeting the job performance requirements is not available.~~

~~3.8.1.3 If the APCO grants written approval, such approval shall contain volume and VOC limit conditions. Until written approval is granted by the APCO and received by the petitioner, all provisions of this rule shall apply.~~

~~3.8.2 The APCO shall not approve any petition under subsection 3.8.1 if the approvals previously granted by the APCO during the calendar year, when combined with the petition under consideration, would result in excess VOC emissions for that calendar year which would be greater than 5 percent of the annual emission reduction achieved within the district from implementing the January 1, 2004, VOC limit for industrial maintenance coatings~~.

~~3.8.3 Coatings subject to this provision shall be sold only if an approved petition (or a copy of it) is provided prior to the sale. Coatings subject to this provision shall not be available to the general public.~~

~~3.9 **Lacquers:** Notwithstanding the provisions of subsection 3.1, a person or facility may add up to 10 percent by volume of VOC to a lacquer to avoid blushing of the finish during days with relative humidity greater than 70 percent and temperature below 65°F, at the time of application, provided that the coating contains acetone and no more than 550 grams of VOC per liter of coating, less water and exempt compounds, prior to the addition of VOC.~~

~~3.10 **Averaging Compliance Option:** On or after January 1, 2003, in lieu of compliance with the specified limits in Table 1 for floor coatings; industrial maintenance coatings; primers, sealers, and undercoaters; quick-dry primers, sealers, and undercoaters; quick-dry enamels; roof coatings; rust preventative coatings; stains; waterproofing sealers, as well as flats and non-flats (excluding recycled coatings), manufacturers may average designated coatings such that their actual cumulative emissions from the averaged coatings are less than or equal to the cumulative emissions that would have been allowed under those limits over a compliance period not to exceed one year. Such manufacturers must also comply with the averaging provisions contained in Appendix A, as well as maintain and make available for inspection records for at least three years after the end of the compliance period. This subsection 3.10 and Appendix A shall cease to be effective on January 1, 2005, after which averaging will no longer be allowed.~~

6~~4~~. CONTAINER LABELING REQUIREMENTS

6~~4~~.1 Each manufacturer of any architectural coating subject to this rule shall display the information listed in subsections 6~~4~~.1.1 through 6~~4~~.1.~~8~~12 on the coating container (or label) in which the coating is sold or distributed.

6~~4~~.1.1 **Date Code:** The date the coating was manufactured, or a date code representing the date, shall be indicated on the label, lid, or bottom of the container. If the manufacturer uses a date code for any coating, the manufacturer shall file an explanation of each code with the Executive Officer of the ARB.

6~~4~~.1.2 **Thinning Recommendations:** A statement of the manufacturer's recommendation regarding thinning of the coating shall be indicated on the label or lid of the container. This requirement does not apply to the thinning of architectural coatings with water. If thinning of the coating prior to use is not necessary, the recommendation must

specify that the coating is to be applied without thinning.

6~~4~~.1.3 **VOC Content:** ~~Each container of any coating subject to this rule shall display either the maximum or the actual~~ specific ~~VOC content of the coating, as supplied, including the maximum thinning as recommended by the manufacturer. VOC content shall be displayed in grams of VOC per liter of coating. VOC content displayed shall be calculated using product formulation data, or shall be determined using the test methods in subsection 6.2. The equations in subsection 6.1 shall be used to calculate VOC content.~~

Each container of any coating subject to this rule shall display one of the following values in grams of VOC per liter of coating:

6.1.3.1 Maximum VOC Content as determined from all potential product formulations; or
6.1.3.2 VOC Content as determined from actual formulation data; or
6.1.3.3 VOC Content as determined using the test methods in subsection 8.2.

If the manufacturer does not recommend thinning, the container must display the VOC Content, as supplied. If the manufacturer recommends thinning, the container must display the VOC Content including the maximum amount of thinning solvent recommended by the manufacturer. If the coating is a multi-component product, the container must display the VOC content as mixed or catalyzed. If the coating contains silanes, siloxanes, or other ingredients that generate ethanol or other VOCs during the curing process, the VOC content must include the VOCs emitted during curing. VOC Content shall be determined as defined in subsections 4.64, 4.65, and 4.66.

6.1.4 **Faux Finishing Coatings:** Effective January 1, 2010, the labels of all Faux Finishing coatings shall prominently display the statement "This product can only be sold or used as part of a Faux Finishing coating system".

6.1.5~~4.1.4~~ **Industrial Maintenance Coatings:** ~~In addition to the information specified in subsection 4.1.1, 4.1.2, and 4.1.3, each manufacturer of any industrial maintenance coating subject to this rule~~ The labels of all Industrial Maintenance coatings shall prominently display the statement "For industrial use only" or "For professional use only". ~~on the label or lid of the container in which the coating is sold or distributed one or more of the descriptions listed in subsections 4.1.4.1 through 4.1.4.3.~~

~~4.1.4.1 "For industrial use only."~~
~~4.1.4.2 "For professional use only."~~
~~4.1.4.3 "Not for residential use or Not intended for residential use."~~

~~4.1.5 **Clear Brushing Lacquers:** Effective January 1, 2003, the labels of all clear brushing lacquers shall prominently display the statements "For brush application only," and "This product must not be thinned or sprayed."~~

6.1.6~~4.1.6~~ **Rust Preventative Coatings:** ~~Effective January 1, 2003,~~ The ~~the~~ labels of all rust preventative coatings shall prominently display the statement "For Metal Substrates Only."

6.1.7~~4.1.7~~ **Specialty Primers, Sealers, and Undercoaters:** ~~Effective January 1, 2003,~~ Until January 1, 2012, the labels of all specialty primers, sealers, and undercoaters shall prominently display one or more of the descriptions listed in subsection 6.1.7.1~~4.1.7.1~~ through 6.1.7.3~~4.1.7.5~~.

~~4.1.7.1 For blocking stains.~~
6.1.7.1~~4.1.7.2~~ For fire-damaged substrates.
6.1.7.2~~4.1.7.3~~ For smoke-damaged substrates.
6.1.7.3~~4.1.7.4~~ For water-damaged substrates.
~~4.1.7.5 For excessively chalky substrates.~~

~~4.1.8 **Quick Dry Enamels:** Effective January 1, 2003, the labels of all quick dry enamels shall prominently display the words "Quick Dry" the dry hard time.~~

6.1.8 **Reactive Penetrating Sealers:** Effective January 1, 2010, the labels of all Reactive Penetrating Sealers shall prominently display the statement "Reactive Penetrating Sealer".

6.1.9 **Stone Consolidants:** Effective January 1, 2010, the labels of all Stone Consolidants shall prominently display the statement "Stone Consolidant - For Professional Use Only".

6.1.10~~4.1.9~~ **Nonflat - High Gloss Coatings:** ~~Effective January 1, 2003,~~ The ~~the~~ labels of all Nonflat - High Gloss coatings shall prominently display the words "High Gloss."

6.1.11 **Wood Coatings:** Effective January 1, 2010, the labels of all Wood Coatings shall prominently display the statement "For Wood Substrates Only".

6.1.12 **Zinc Rich Primers**: Effective January 1, 2010, the labels of all Zinc Rich Primers shall prominently display the statement "For Professional Use Only".

7~~5~~. REPORTING REQUIREMENTS

~~5.1 **Clear Brushing Lacquers:** Each manufacturer of clear brushing lacquers shall, on or before April 1 of each calendar year beginning in the year 2004, submit an annual report to the Executive Officer of the ARB. The report shall specify the number of gallons of clear brushing lacquers sold in the State during the preceding calendar year, and shall describe the method used by the manufacturer to calculate State sales.~~

~~5.2 **Rust Preventative Coatings:** Each manufacturer of Rust Preventative coatings shall, on or before April 1 of each calendar year beginning in the year 2004, submit an annual report to the Executive Officer of the ARB. The report shall specify the number of gallons of Rust Preventative coatings sold in the State during the preceding calendar year, and shall describe the method used by the manufacturer to calculate State sales.~~

~~5.3 **Specialty Primers, Sealers, and Undercoaters:** Each manufacturer of Specialty Primers, Sealers, and Undercoaters shall, on or before April 1 of each calendar year beginning in the year 2004, submit an annual report to the Executive Officer of the ARB. The report shall specify the number of gallons of Specialty Primers, Sealers, and Undercoaters sold in the State during the preceding calendar year, and shall describe the method used by the manufacturer to calculate State sales.~~

~~5.4 **Toxic Exempt Compounds:** For each architectural coating that contains perchloroethylene or methylene chloride, the manufacturer shall, on or before April 1 of each calendar year beginning with the year 2004, report to the Executive Officer of the ARB the following information for products sold in the State during the preceding year:~~

~~5.4.1 the product brand name and a copy of the product label with legible usage instructions;~~
~~5.4.2 the product category listed in Table 1 to which the coating belongs;~~
~~5.4.3 the total sales in California during the calendar year to the nearest gallon;~~
~~5.4.4 the volume percent, to the nearest 0.10 percent, of perchloroethylene and methylene chloride in the coating.~~

~~5.5 **Recycled Coatings:** Manufacturers of Recycled coatings must submit a letter to the Executive Officer of the ARB certifying their status as a Recycled Paint Manufacturer. The manufacturer shall, on or before April 1~~

~~of each calendar year beginning with the year 2004, submit an annual report to the Executive Officer of the ARB. The report shall include, for all Recycled coatings, the total number of gallons distributed in the State during the preceding year, and shall describe the method used by the manufacturer to calculate State distribution.~~

~~5.6 **Bituminous Coatings:** Each manufacturer of Bituminous Roof coatings or Bituminous Roof Primers shall, on or before April 1 of each calendar year beginning with the year 2004, submit an annual report to the Executive Officer of ARB. The report shall specify the number of gallons of Bituminous Roof coatings or Bituminous Roof Primers sold in the State during the preceding calendar year, and shall describe the method used by the manufacturer to calculate State sales.~~

7.1 **Sales Data:** A responsible official from each manufacturer shall upon request of the Executive Officer of the ARB, or his or her delegate, provide data concerning the distribution and sales of architectural coatings. The responsible official shall within 180 days provide information including, but not limited to:

7.1.1 the name and mailing address of the manufacturer;
7.1.2 the name, address and telephone number of a contact person;
7.1.3 the name of the coating product as it appears on the label and the applicable coating category;
7.1.4 whether the product is marketed for interior or exterior use or both;
7.1.5 the number of gallons sold in California in containers greater than one liter (1.057 quart) and equal to or less than one liter (1.057 quart);
7.1.6 the VOC Actual content and VOC Regulatory content in grams per liter. If thinning is recommended, list the VOC Actual content and VOC Regulatory content after maximum recommended thinning. If containers less than one liter have a different VOC content than containers greater than one liter, list separately. If the coating is a multi-component product, provide the VOC content as mixed or catalyzed;
7.1.7 the names and CAS numbers of the VOC constituents in the product;
7.1.8 the names and CAS numbers of any compounds in the product specifically exempted from the VOC definition, as listed in subsection 4.63.1 or 4.63.2;
7.1.9 whether the product is marketed as solventborne, waterborne, or 100% solids;
7.1.10 description of resin or binder in the product;
7.1.11 whether the coating is a single-component or multi-component product;
7.1.12 the density of the product in pounds per gallon;

7.1.13 the percent by weight of: solids, all volatile materials, water, and any compounds in the product specifically exempted from the VOC definition, as listed in subsection 4.63.1 or 4.63.2; and

7.1.14 the percent by volume of: solids, water, and any compounds in the product specifically exempted from the VOC definition, as listed in subsection 4.63.1 or 4.63.2.

7.2 All sales data listed in subsections 7.1.1 to 7.1.14 shall be maintained by the responsible official for a minimum of three years. Sales data submitted by the responsible official to the Executive Officer of the ARB may be claimed as confidential, and such information shall be handled in accordance with the procedures specified in Title 17, California Code of Regulations Sections 91000-91022.

8~~6~~ COMPLIANCE PROVISIONS AND TEST METHODS

8~~6~~.1 **Calculation of VOC Content:** For the purpose of determining compliance with the VOC content limits in Table 1, the VOC content of a coating shall be determined as defined in subsection 4.64, 4.65, or 4.66 ~~by using the procedures described in subsection 6.1.1 or 6.1.2, as appropriate~~. The VOC content of a tint base shall be determined without colorant that is added after the tint base is manufactured. If the manufacturer does not recommend thinning, the VOC Content must be calculated for the product as supplied. If the manufacturer recommends thinning, the VOC Content must be calculated including the maximum amount of thinning solvent recommended by the manufacturer. If the coating is a multi-component product, the container must display the VOC content as mixed or catalyzed. If the coating contains silanes, siloxanes, or other ingredients that generate ethanol or other VOCs during the curing process, the VOC content must include the VOCs emitted during curing.

~~6.1.1 With the exception of low solids coatings, determine the VOC content in grams of VOC per liter of coating thinned to the manufacturer's maximum recommendation, excluding the volume of any water and exempt compounds. Determine the VOC content using equation 1 as follows:~~

$$\text{VOC Content} = \frac{(W_s - W_w - W_{ec})}{(V_m - V_w - V_{ec})} \qquad (1)$$

~~Where:~~

~~VOC Content = grams of VOC per liter of coating~~

~~W_s = weight of volatiles, in grams~~

~~W_w = weight of water, in grams~~

~~W_{ec} = weight of exempt compounds, in grams~~

~~V_m = volume of coating, in liters~~

~~V_w = volume of water, in liters~~

~~V_{ec} = volume of exempt compounds, in liters~~

~~6.1.2 For low solids coatings, determine the VOC content in units of grams of VOC per liter of coating thinned to the manufacturer's maximum recommendation, including the volume of any water and exempt compounds. Determine the VOC content using equation 2 as follows:~~

~~$$\text{VOC Content}_{ls} = \frac{(Ws - Ww - Wec)}{(Vm)} \qquad (2)$$~~

~~Where:~~

~~VOC Content_{ls} = the VOC content of a low solids coating in grams of VOC per liter of coating~~

~~W_s = weight of volatiles, in grams~~

~~W_w = weight of water, in grams~~

~~W_{ec} = weight of exempt compounds, in grams~~

~~V_m = volume of coating, in liters~~

8~~6~~.2 **VOC Content of Coatings:** To determine the physical properties of a coating in order to perform the calculations in subsection 4.64 or 4.66 ~~6.1~~, the reference method for VOC content is U.S. EPA Method 24, incorporated by reference in subsection 8.5.9~~6.5.11~~, except as provided in subsections 8~~6~~.3 and 8~~6~~.4. An alternative method to determine the VOC content of coatings is SCAQMD Method 304-91 (Revised ~~February~~ 1996), incorporated by reference in subsection 8.5.10~~6.5.12~~. The exempt compounds content shall be determined by SCAQMD Method 303-91 (Revised ~~August 1996~~ 1993), BAAQMD Method 43 (Revised 1996), or BAAQMD Method 41 (Revised 1995), as applicable, incorporated by reference in subsections 8.5.8~~6.5.10~~, 8.5.6, and 8.5.7, respectively. To determine the VOC content of a coating, the manufacturer may use U.S. EPA Method 24, or an alternative method as provided in subsection 8~~6~~.3, formulation data, or any other reasonable means for predicting that the coating has been formulated as intended (e.g., quality assurance checks, record keeping). However, if there are any inconsistencies between the results of a Method 24 test and any other means for determining VOC content, the Method 24 test results will govern, except when an alternative method is approved as specified in subsection 8~~6~~.3. The District Air Pollution Control Officer (APCO) may require the manufacturer to conduct a Method 24 analysis.

8~~6~~.3 **Alternative Test Methods:** Other test methods demonstrated to provide results that are acceptable for purposes of determining compliance with subsection 8~~6~~.2, after review and approved in writing by the staffs of the District, the ARB, and the U.S. EPA, may also be used.

8~~6~~.4 **Methacrylate Traffic Marking Coatings:** Analysis of methacrylate

multicomponent coatings used as traffic marking coatings shall be conducted according to a modification of U.S. EPA Method 24 (40 CFR 59, subpart D, Appendix A), incorporated by reference in subsection 8.5.11~~6.5.13~~. This method has not been approved for methacrylate multicomponent coatings used for other purposes than as traffic marking coatings or for other classes of multicomponent coatings.

8~~6~~.5 **Test Methods:** The following test methods are incorporated by reference herein, and shall be used to test coatings subject to the provisions of this rule:

8~~6~~.5.1 **Flame Spread Index:** The flame spread index of a fire-retardant coating shall be determined by ASTM ~~Designation~~ E 84-07, "Standard Test Method for Surface Burning Characteristics of Building Materials" (see section ~~2~~4, Fire-Retardant Coating).

8~~6~~.5.2 **Fire Resistance Rating:** The fire resistance rating of a fire-resistive coating shall be determined by ASTM ~~Designation~~ E 119-07, "Standard Test Methods for Fire Tests of Building Construction Materials" (see section ~~2~~4, Fire-Resistive Coating).

8~~6~~.5.3 **Gloss Determination:** The gloss of a coating shall be determined by ASTM ~~Designation~~ D 523-89 (1999), "Standard Test Method for Specular Gloss" (see section ~~2~~4, Flat Coating, Nonflat Coating, and Nonflat - High Gloss Coating~~, and Quick-Dry Enamel~~).

8~~6~~.5.4 **Metal Content of Coatings:** The metallic content of a coating shall be determined by SCAQMD Method 318-95, "Determination of Weight Percent Elemental Metal in Coatings by X-Ray Diffraction," *SCAQMD Laboratory Methods of Analysis for Enforcement Samples* (see section ~~2~~4, Aluminum Roof, Faux Finishing, and Metallic Pigmented Coating).

8~~6~~.5.5 **Acid Content of Coatings:** The acid content of a coating shall be determined by ASTM ~~Designation~~ D 1613-06, "Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products" (see section ~~2~~4, Pre-treatment Wash Primer).

~~6.5.6 **Drying Times:** The set-to-touch, dry-hard, dry-to-touch, and dry-to-recoat times of a coating shall be determined by ASTM Designation D 1640-95, "Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature" (see section 2, Quick-Dry Enamel and Quick-Dry Primer, Sealer, and Undercoater). The tack-free time of a quick-dry enamel coating shall be determined by the Mechanical Test Method of ASTM~~

~~Designation D 1640-95.~~

~~6.5.7 **Surface Chalkiness:** The chalkiness of a surface shall be determined using ASTM Designation D 4214-98, "Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films" (see section 2, Specialty Primer, Sealer, and Undercoater).~~

8.5.6~~6.5.8~~ **Exempt Compounds--Siloxanes:** Exempt compounds that are cyclic, branched, or linear completely methylated siloxanes, shall be analyzed as exempt compounds for compliance with section ~~6~~8 by BAAQMD Method 43, "Determination of Volatile Methylsiloxanes in Solvent-Based Coatings, Inks, and Related Materials," *BAAQMD Manual of Procedures*, Volume III, adopted 11/6/96 (see section ~~2~~4, Volatile Organic Compound, and subsection ~~6~~8.2).

8.5.7~~6.5.9~~ **Exempt Compounds--Parachlorobenzotrifluoride (PCBTF)**: The exempt compound parachlorobenzotrifluoride, shall be analyzed as an exempt compound for compliance with section ~~6~~8 by BAAQMD Method 41, "Determination of Volatile Organic Compounds in Solvent Based Coatings and Related Materials Containing Parachlorobenzotrifluoride," *BAAQMD Manual of Procedures*, Volume III, adopted 12/20/95 (see section~~2~~4, Volatile Organic Compound, and subsection ~~6~~8.2).

8.5.8~~6.5.10~~ **Exempt Compounds:** The content of compounds exempt under U.S. EPA Method 24 shall be analyzed by SCAQMD Method 303-91 (Revised 1993), "Determination of Exempt Compounds," *SCAQMD Laboratory Methods of Analysis for Enforcement Samples* (see section ~~2~~4, Volatile Organic Compound, and subsection ~~6~~8.2).

8.5.9~~6.5.11~~ **VOC Content of Coatings:** The VOC content of a coating shall be determined by U.S. EPA Method 24 as it exists in appendix A of 40 *Code of Federal Regulations* (CFR) part 60, "Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings" (see subsection ~~6~~8.2).

8.5.10~~6.5.12~~ **Alternative VOC Content of Coatings:** The VOC content of coatings may be analyzed either by U.S. EPA Method 24 or SCAQMD Method 304-91 (Revised 1996), "Determination of Volatile Organic Compounds (VOC) in Various Materials," *SCAQMD Laboratory Methods of Analysis for Enforcement Samples* (see subsection ~~6~~8.2).

8.5.11~~6.5.13~~ **Methacrylate Traffic Marking Coatings:** The VOC content of methacrylate multicomponent coatings used as traffic marking

coatings shall be analyzed by the procedures in 40 CFR part 59, subpart D, appendix A, "Determination of Volatile Matter Content of Methacrylate Multicomponent Coatings Used as Traffic Marking Coatings" ~~(September 11, 1998)~~ (see subsection ~~6~~8.4).

8.5.12 **Hydrostatic Pressure for Basement Specialty Coatings**: ASTM D7088-04, "Standard Practice for Resistance to Hydrostatic Pressure for Coatings Used in Below Grade Applications Applied to Masonry" (see section 4, Basement Specialty Coating).

8.5.13 **Gonioapparent Characteristics for Coatings**: ASTM E-284-07, "Standard Terminology of Appearance" (see section 4, Gonioapparent).

8.5.14 **Tub and Tile Refinish Coating Adhesion:** ASTM D 4585-99, "Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation" and ASTM D3359-02, "Standard Test Methods for Measuring Adhesion by Tape Test" (see section 4, Tub and Tile Refinish Coating).

8.5.15 **Tub and Tile Refinish Coating Hardness**: ASTM D 3363-05, "Standard Test Method for Film Hardness by Pencil Test" (see section 4, Tub and Tile Refinish Coating).

8.5.16 **Tub and Tile Refinish Coating Abrasion Resistance**: ASTM D 4060-07, "Standard Test Methods for Abrasion Resistance of Organic Coatings by the Taber Abraser" (see section 4, Tub and Tile Refinish Coating).

8.5.17 **Tub and Tile Refinish Coating Water Resistance**: ASTM D 4585-99, "Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation" and ASTM D714-02e1, "Standard Test Method for Evaluating Degree of Blistering of Paints" (see section 4, Tub and Tile Refinish Coating).

8.5.18 **Waterproofing Membrane**: ASTM C836-06, "Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course" (see section 4, Waterproofing Membrane).

8.5.19 **Mold and Mildew Growth for Basement Specialty Coatings**: ASTM D3273-00, "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber" and ASTM D3274-95, "Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation"

(see section 4, Basement Specialty Coating).

8.5.20 **Reactive Penetrating Sealer Water Repellency:** ASTM C67-07, "Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile"; or ASTM C97-02, "Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone"; or ASTM C140-06, "Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units" (see section 4, Reactive Penetrating Sealer).

8.5.21 **Reactive Penetrating Sealer Water Vapor Transmission:** ASTM E96/E96M-05, "Standard Test Method for Water Vapor Transmission of Materials" (see section 4, Reactive Penetrating Sealer).

8.5.22 **Reactive Penetrating Sealer - Chloride Screening Applications:** National Cooperative Highway Research Report 244 (1981), "Concrete Sealers for the Protection of Bridge Structures" (see section 4, Reactive Penetrating Sealer).

8.5.23 **Stone Consolidants:** ASTM E2167-01, "Standard Guide for Selection and Use of Stone Consolidants" (see section 4, Stone Consolidant).

Table 1
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS

Limits are expressed as VOC Regulatory, ~~in grams of VOC per liter[a] of coating~~ thinned to the manufacturer's maximum thinning recommendation, excluding ~~the volume of any water, exempt compounds, or~~ any colorant added to tint bases. ~~"Manufacturer's maximum recommendation" means the maximum recommendation for thinning that is indicated on the label or lid of the coating container.~~

Coating Category	~~Effective 1/1/2003~~	~~Effective 1/1/2004~~	Effective 1/1/2010	Effective 1/1/2012
Flat Coatings	~~100~~		50	
Nonflat Coatings	~~150~~		100	
Nonflat - High Gloss Coatings	~~250~~		150	
Specialty Coatings				
Aluminum Roof Coatings			400	
~~Antenna Coatings~~	~~530~~			
~~Antifouling Coatings~~	~~400~~			
Basement Specialty Coatings			400	
Bituminous Roof Coatings	~~300~~		50	
Bituminous Roof Primers	~~350~~		350	
Bond Breakers	~~350~~		350	
~~Clear Wood Coatings~~ ~~• Clear Brushing Lacquers~~ ~~• Lacquers (including lacquer sanding sealers)~~ ~~• Sanding Sealers (other than lacquer sanding sealers)~~ ~~• Varnishes~~	 ~~680~~ ~~550~~ ~~350~~ ~~350~~			
Concrete Curing Compounds	~~350~~		350	
Concrete/Masonry Sealers			100	
Driveway Sealers			50	
Dry Fog Coatings	~~400~~		150	
Faux Finishing Coatings	~~350~~		350	
Fire Resistive Coatings	~~350~~		350	
~~Fire Retardant Coatings:~~ ~~• Clear~~ ~~• Opaque~~	 ~~650~~ ~~350~~			
Floor Coatings	~~250~~		100	

Table 1
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS

Limits are expressed as VOC Regulatory, ~~in grams of VOC per liter[a] of coating~~ thinned to the manufacturer's maximum thinning recommendation, excluding ~~the volume of any water, exempt compounds, or~~ any colorant added to tint bases. ~~"Manufacturer's maximum recommendation" means the maximum recommendation for thinning that is indicated on the label or lid of the coating container.~~

Coating Category	~~Effective 1/1/2003~~	~~Effective 1/1/2004~~	Effective 1/1/2010	Effective 1/1/2012
~~Flow Coatings~~	~~420~~			
Form-Release Compounds	~~250~~		250	
Graphic Arts Coatings (Sign Paints)	~~500~~		500	
High Temperature Coatings	~~420~~		420	
Industrial Maintenance Coatings		~~250~~	250	
Low Solids Coatings[a~~b~~]	~~120~~		120	
Magnesite Cement Coatings	~~450~~		450	
Mastic Texture Coatings	~~300~~		100	
Metallic Pigmented Coatings	~~500~~		500	
Multi-Color Coatings	~~250~~		250	
Pre-Treatment Wash Primers	~~420~~		420	
Primers, Sealers, and Undercoaters	~~200~~		100	
~~Quick-Dry Enamels~~	~~250~~			
~~Quick-Dry Primers, Sealers, and Undercoaters~~	~~200~~			
Reactive Penetrating Sealers			350	
Recycled Coatings	~~250~~		250	
Roof Coatings	~~250~~		50	
Rust Preventative Coatings	~~400~~			250
Shellacs: • Clear • Opaque	 ~~730~~ ~~550~~		 730 550	
Specialty Primers, Sealers, and Undercoaters	~~350~~			100
Stains	~~250~~		250	
Stone Consolidants			450	
Swimming Pool Coatings	~~340~~		340	
~~Swimming Pool Repair and Maintenance Coatings~~	~~340~~			
~~Temperature Indicator Safety~~	~~550~~			

Table 1
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS

Limits are expressed as VOC Regulatory, ~~in grams of VOC per liter[a] of coating~~ thinned to the manufacturer's maximum thinning recommendation, excluding ~~the volume of any water, exempt compounds, or~~ any colorant added to tint bases. ~~"Manufacturer's maximum recommendation" means the maximum recommendation for thinning that is indicated on the label or lid of the coating container.~~

Coating Category	~~Effective 1/1/2003~~	~~Effective 1/1/2004~~	Effective 1/1/2010	Effective 1/1/2012
~~Coatings~~				
Traffic Marking Coatings	~~150~~		100	
Tub and Tile Refinish Coatings			420	
Waterproofing Membranes			250	
~~Waterproofing Sealers~~	~~250~~			
~~Waterproofing Concrete/Masonry Sealers~~	~~400~~			
Wood Coatings			275	
Wood Preservatives	~~350~~		350	
Zinc-Rich Primers			340	

~~a Conversion factor: one pound VOC per gallon (U.S.) = 119.95 grams VOC per liter.~~
a~~b~~. Limit is expressed as VOC Actual. ~~Units are grams of VOC per liter (pounds of VOC per gallon) of coating, including water and exempt compounds.~~

Table 2
MOST RESTRICTIVE LIMIT EXCEPTIONS FOR SPECIALTY COATINGS

Coatings That Meet the Definitions in Section 4 for This Category and That Are Used as Provided in the Applicable Definition	Are Not Subject to the Most Restrictive VOC Limit Requirement When They Are Also Recommended for These Uses
Aluminum Roof Coatings	Bituminous Roof Primers; Bituminous Roof Coatings; Industrial Maintenance Coatings; or Roof Coatings
Basement Specialty Coatings	Concrete/Masonry Sealers; Floor Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Bituminous Roof Primers	Bituminous Roof; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Roof Coatings; or

Table 2 MOST RESTRICTIVE LIMIT EXCEPTIONS FOR SPECIALTY COATINGS	
Coatings That Meet the Definitions in Section 4 for This Category and That Are Used as Provided in the Applicable Definition	**Are Not Subject to the Most Restrictive VOC Limit Requirement When They Are Also Recommended for These Uses**
	Specialty Primers, Sealers, and Undercoaters
Concrete Curing Compounds	Concrete/Masonry Sealers; Floor Coatings; Industrial Maintenance Coatings; or Primers, Sealers, and Undercoaters
Concrete/Masonry Sealers	Driveway Sealers
Faux Finishing Coatings	Primers, Sealers, and Undercoaters; Stains; or Wood Coatings
Fire Resistive Coatings	Industrial Maintenance; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Floor Coatings	Driveway Sealers
Graphic Arts Coatings	Faux Finishing Coatings
High Temperature Coatings	Fire Resistive Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Rust Preventative Coatings; Specialty Primers, Sealers, and Undercoaters; or Zinc-Rich Primers
Industrial Maintenance Coatings	Concrete/Masonry Sealers; Floor Coatings; Mastic Texture Coatings; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Low Solids Coatings	All categories in Table 1
Magnesite Cement Coatings	Concrete/Masonry Sealers or Floor Coatings
Metallic Pigmented Coatings	Aluminum Roof Coatings; Bituminous Roof Coatings; Bituminous Roof Primers; Faux Finishing Coatings; Fire Resistive Coatings; High Temperature Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Roof Coatings; Rust Preventative Coatings; Specialty Primers, Sealers, and Undercoaters; or Tub and Tile Refinish Coatings
Pre-Treatment Wash Primers	Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; or Rust Preventative Coatings
Reactive Penetrating Sealer	Concrete/Masonry Sealers; Floor Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Recycled Coatings	Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Rust Preventative Coatings	Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters

Table 2 MOST RESTRICTIVE LIMIT EXCEPTIONS FOR SPECIALTY COATINGS	
Coatings That Meet the Definitions in Section 4 for This Category and That Are Used as Provided in the Applicable Definition	**Are Not Subject to the Most Restrictive VOC Limit Requirement When They Are Also Recommended for These Uses**
Shellacs	All categories in Table 1
Stone Consolidant	Concrete/Masonry Sealers; Floor Coatings; Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Reactive Penetrating Sealer; or Specialty Primers, Sealers, and Undercoaters
Swimming Pool Coatings	Concrete/Masonry Sealers; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Traffic Marking Coatings	Driveway Sealers
Tub and Tile Refinish Coatings	Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Waterproofing Membranes	Concrete/Masonry Sealers; Floor Coatings; Primers, Sealers, and Undercoaters; or Specialty Primers, Sealers, and Undercoaters
Wood Coatings	Floor Coatings; Primers, Sealers, and Undercoaters; Specialty Primers, Sealers, and Undercoaters; or Stains
Wood Preservatives	Primers, Sealers, and Undercoaters; Specialty Primers, Sealers, and Undercoaters; Stains; or Wood Coatings
Zinc-Rich Primers	Industrial Maintenance Coatings; Primers, Sealers, and Undercoaters; Rust Preventative Coatings; or Specialty Primers, Sealers, and Undercoaters

~~APPENDIX A:~~
~~AVERAGING PROVISION~~

~~A. AVERAGING PROVISION~~

~~A.1 The manufacturer shall demonstrate that actual emissions from the coatings being averaged are less than or equal to the allowable emissions, for the specified compliance period using the following equation:~~

$$\sum_{i=1}^{n} GiMi \leq \sum_{i=1}^{n} GiViLi$$

~~Where:~~

$\sum_{i=1}^{n} GiMi$ = ~~Actual Emissions~~

$\sum_{i=1}^{n} GiViLi$ = ~~Allowable Emissions~~

~~Gi = Total Gallons of Product (i) subject to Averaging;~~

~~Mi = Material VOC Content of Product (i), in pounds per gallon;~~

$$Mi = \frac{Ws - Ww - Wec}{Vm}$$

~~Vi = Percent by Volume Solids and VOC in Product (i);~~

$$Vi = \frac{Vm - Vw - Vec}{Vm}$$

~~Where: Ws, Ww, Wec, Vm, Vw, and Vec are defined in subsection 6.1, except that in this Appendix weights are in pounds and volumes are in gallons.~~

~~For Non-Zero VOC Coatings:~~

$$Vi = \frac{\text{Material VOC (also known as VOC Actual)}}{\text{Coating VOC (also known as VOC Regulatory)}}$$

~~Where : Coating VOC~~ $= \frac{Ws - Ww - Wec}{Vm - Vw - Vec}$

~~For Zero VOC Coatings:~~
~~Vi = Percent Solids by Volume~~
~~Li = Regulatory VOC Content Limit for Product (i), in pounds per gallon (as listed in Table 1)~~

~~The averaging is limited to coatings that are designated by the manufacturer. Any coating not designated in the averaging Program shall comply with the VOC limit in Table 1. The manufacturer shall not include any quantity of coatings that it knows or should have known will not be used in the State, if statewide coatings data are used. If district-specific coatings data are used, the manufacturer shall not include any quantity of coatings that it knows or should have known will not be used in the district.~~

~~A.2 AVERAGING PROGRAM (PROGRAM)~~

~~At least six months prior to the start of the compliance period, manufacturers shall submit an Averaging Program to the Executive Officer of the Air Resources Board. As used in this Appendix A, "Executive Officer" means the Executive Officer of the Air Resources Board. Averaging may not be implemented until the Program is approved in writing by the Executive Officer.~~

~~Within 45 days of submittal of a complete Program, the Executive Officer shall either approve or disapprove the Program. The Program applicant and the Executive Officer may agree to an extension of time for the Executive Officer to take action on the Program~~.

~~A.3 GENERAL REQUIREMENTS~~

~~The Program shall include all necessary information for the Executive Officer to make a determination as to whether the manufacturer may comply with the averaging requirements over the specified compliance period in an enforceable manner. Such information shall include, but is not limited to, the following:~~

~~A.3.1 An identification of the contact persons, telephone numbers, and name of the manufacturer who is submitting the Program.~~

~~A.3.2 An identification of each coating that has been selected by the manufacturer for inclusion in this program that exceeds the applicable VOC limit in Table 1, its VOC content specified in units of both VOC actual and VOC regulatory, and the designation of the coating category.~~

~~A.3.3 A detailed demonstration showing that the projected actual emissions will not exceed the allowable emissions for a single compliance period that the Program will be in effect. In addition, the demonstration shall include VOC content information for each coating that is below the compliance limit in Table 1. The demonstration shall use the equation specified in subsection A.1 of this Appendix for projecting the actual emissions and allowable emissions during each compliance period. The demonstration shall~~

~~also include all VOC content levels and projected volume within the State for each coating listed in the Program during each compliance period. The requested data can be summarized in a matrix form.~~

~~A.3.4 A specification of the compliance period(s) and applicable reporting dates. The length of the compliance period shall not be more than one year or less than six months.~~

~~A.3.5 An identification and description of all records to be made available to the Executive Officer upon request, if different than those identified under subsection A.3.6.~~

~~A.3.6 An identification and description of specific records to be used in calculating emissions for the Program and subsequent reporting, and a detailed explanation as to how those records will be used by the manufacturer to verify compliance with the averaging requirements.~~

~~A.3.7 A statement, signed by a responsible party for the manufacturer, that all information submitted is true and correct, and that records will be made available to the Executive Officer upon request.~~

~~A.4 REPORTING REQUIREMENTS~~

~~A.4.1 For every single compliance period, the manufacturer shall submit a mid-term report listing all coatings subject to averaging during the first half of the compliance period, detailed analysis of the actual and allowable emissions at the end of the mid-term, and an explanation as to how the manufacturer intends to achieve compliance by the end of the compliance period. The report shall be signed by the responsible party for the manufacturer, attesting that all information submitted is true and correct. The mid-term report shall be submitted within 45 days after the midway date of the compliance period. A manufacturer may request, in writing, an extension of up to 15 days for submittal of the mid-term report.~~

~~A.4.2 Within 60 days after the end of the compliance period or upon termination of the Program, whichever is sooner, the manufacturer shall submit to the Executive Officer a report listing all coatings subject to averaging during the compliance period, providing a detailed demonstration of the balance between the actual and allowable emissions for the compliance period, any identification and description of specific records used by the manufacturer to verify compliance with the averaging requirement, and any other information requested by the Executive Officer to determine whether the manufacturer complied with the averaging requirements over the specified compliance period. The report shall be signed by the responsible party for the manufacturer, attesting that all information submitted is true and correct, and that~~

~~records will be made available to the Executive Officer upon request. A manufacturer may request, in writing, an extension of up to 30 days for submittal of the final report.~~

~~A.5 RENEWAL OF A PROGRAM~~

~~A Program automatically expires at the end of the compliance period. The manufacturer may request a renewal of the Program by submitting a renewal request that shall include an updated Program, meeting all applicable Program requirements. The renewal request will be considered conditionally approved until the Executive Officer makes a final decision to deny or approve the renewal request based on a determination of whether the manufacturer is likely to comply with the averaging requirements. The Executive Officer shall base such determination on all available information, including but not limited to, the mid-term and the final reports of the preceding compliance period. The Executive Officer shall make a decision to deny or approve a renewal request no later than 45 days from the date of the final report submittal, unless the manufacturer and the Executive Officer agree to an extension of time for the Executive Officer to take action on the renewal request.~~

~~A.6 MODIFICATION OF A PROGRAM~~

~~A manufacturer may request a modification of the Program at any time prior to the end of the compliance period. The Executive Officer shall take action to approve or disapprove the modification request no longer than 45 days from the date of its submittal. No modification of the compliance period shall be allowed. A Program need not be modified to specify additional coatings to be averaged that are below the applicable VOC limits.~~

~~A.7 TERMINATION OF A PROGRAM~~

~~A.7.1 A manufacturer may terminate its Program at any time by filing a written notification to the Executive Officer. The filing date shall be considered the effective date of the termination, and all other provisions of this rule including the VOC limits shall immediately thereafter apply. The manufacturer shall also submit a final report 60 days after the termination date. Any exceedance of the actual emissions over the allowable emissions over the period that the Program was in effect shall constitute a separate violation for each day of the entire compliance period.~~

~~A.7.2 The Executive Officer may terminate a Program if any of the following circumstances occur:~~

~~A.7.2.1 The manufacturer violates the requirements of the approved Program, and at the end of the compliance period, the actual emissions exceed the allowable emissions.~~

~~A.7.2.2 The manufacturer demonstrates a recurring pattern of violations and has consistently failed to take the necessary steps to correct those violations.~~

~~A.8 CHANGE IN VOC LIMITS~~

~~If the VOC limits of a coating listed in the Program are amended such that its effective date is less than one year from the date of adoption, the affected manufacturer may base its averaging on the prior limits of that coating until the end of the compliance period immediately following the date of adoption.~~

~~A.9 LABELING~~

~~Each container of any coating that is included in averaging program, and that exceeds the applicable VOC limit in Table 1 shall display the following statement: "This product is subject to architectural coatings averaging provisions in California." A symbol specified by the Executive Officer may be used as a substitute.~~

~~A.10 VIOLATIONS~~

~~The exceedance of the allowable emissions for any compliance period shall constitute a separate violation for each day of the compliance period. However, any violation of the requirements of the Averaging Provision of this rule, which the violator can demonstrate, to the Executive Officer, did not cause or allow the emission of an air contaminant and was not the result of negligent or knowing activity may be considered a minor violation.~~

~~A.11 SUNSET OF AVERAGING PROVISION~~

~~The averaging provision set forth in Appendix A shall cease to be effective on~~
~~January 1, 2005, after which averaging will no longer be allowed.~~

APPENDIX B:

2000 SUGGESTED CONTROL MEASURE FOR ARCHITECTURAL COATINGS

California Air Resources Board (ARB)
Suggested Control Measure for Architectural Coatings

1. APPLICABILITY

1.1 Except as provided in subsection 1.2, this rule is applicable to any person who supplies, sells, offers for sale, or manufactures any architectural coating for use within the District, as well as any person who applies or solicits the application of any architectural coating within the District.

1.2 This rule does not apply to:

1.2.1 Any architectural coating that is sold or manufactured for use outside of the District or for shipment to other manufacturers for reformulation or repackaging.
1.2.2 Any aerosol coating product.
1.2.3 Any architectural coating that is sold in a container with a volume of one liter (1.057 quart) or less.

2. DEFINITIONS

2.0 Adhesive: Any chemical substance that is applied for the purpose of bonding two surfaces together other than by mechanical means.

2.1 Aerosol Coating Product: A pressurized coating product containing pigments or resins that dispenses product ingredients by means of a propellant, and is packaged in a disposable can for hand-held application, or for use in specialized equipment for ground traffic/marking applications.

2.2 Antenna Coating: A coating labeled and formulated exclusively for application to equipment and associated structural appurtenances that are used to receive or transmit electromagnetic signals.

2.3 Antifouling Coating: A coating labeled and formulated for application to submerged stationary structures and their appurtenances to prevent or reduce the attachment of marine or freshwater biological organisms. To qualify as an antifouling coating, the coating must be registered with both the U.S. EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Section 136, *et seq*.) and with the California Department of Pesticide Regulation.

2.4 Appurtenance: Any accessory to a stationary structure coated at the site of installation, whether installed or detached, including but not limited to: bathroom and kitchen fixtures; cabinets; concrete forms; doors; elevators; fences; hand railings; heating equipment, air conditioning equipment, and other fixed mechanical equipment or stationary tools; lampposts; partitions; pipes and piping systems; rain gutters and downspouts; stairways, fixed ladders, catwalks, and fire escapes; and window screens.

2.5 Architectural Coating: A coating to be applied to stationary structures or their appurtenances at the site of installation, to portable buildings at the site of installation, to pavements, or to curbs. Coatings applied in shop applications or to non-stationary structures such as airplanes, ships, boats, railcars, and automobiles, and adhesives are not considered architectural coatings for the purposes of this rule.

2.6 Bitumens: Black or brown materials including, but not limited to, asphalt, tar, pitch, and asphaltite that are soluble in carbon disulfide, consist mainly of hydrocarbons, and are obtained from natural deposits or as residues from the distillation of crude petroleum or coal.

2.7 Bituminous Roof Coating: A coating which incorporates bitumens that is labeled and formulated exclusively for roofing.

2.8 Bituminous Roof Primer: A primer which incorporates bitumens that is labeled and formulated exclusively for roofing.

2.9 Bond Breaker: A coating labeled and formulated for application between layers of concrete to prevent a freshly poured top layer of concrete from bonding to the layer over which it is poured.

2.10 Clear Brushing Lacquers: Clear wood finishes, excluding clear lacquer sanding sealers, formulated with nitrocellulose or synthetic resins to dry by solvent evaporation without chemical reaction and to provide a solid, protective film, which are intended exclusively for application by brush, and which are labeled as specified in subsection 4.1.5.

2.11 Clear Wood Coatings: Clear and semi-transparent coatings, including lacquers and varnishes, applied to wood substrates to provide a transparent or translucent solid film.

2.12 Coating: A material applied onto or impregnated into a substrate for protective, decorative, or functional purposes. Such materials include, but are not limited to, paints, varnishes, sealers, and stains.

2.13 Colorant: A concentrated pigment dispersion in water, solvent, and/or binder that is added to an architectural coating after packaging in sale units to produce the desired color.

2.14 Concrete Curing Compound: A coating labeled and formulated for application to freshly poured concrete to retard the evaporation of water.

2.15 Dry Fog Coating: A coating labeled and formulated only for spray application such that overspray droplets dry before subsequent contact with incidental surfaces in the vicinity of the surface coating activity.

2.16 Exempt Compound: A compound identified as exempt under the definition of Volatile Organic Compound (VOC), subsection 2.60. Exempt compounds

content of a coating shall be determined by U.S. EPA Method 24 or South Coast Air Quality Management
District (SCAQMD) Method 303-91 (Revised February 1993), incorporated by reference in subsection 6.5.10.

2.17 Faux Finishing Coating: A coating labeled and formulated as a stain or glaze to create artistic effects including, but not limited to, dirt, old age, smoke damage, and simulated marble and wood grain.

2.18 Fire-Resistive Coating: An opaque coating labeled and formulated to protect the structural integrity by increasing the fire endurance of interior or exterior steel and other structural materials, that has been fire tested and rated by a testing agency approved by building code officials for use in bringing assemblies of structural materials into compliance with federal, state, and local building code requirements. The fire-resistive coating and the testing agency must be approved by building code officials. The fire-resistant coating shall be tested in accordance with ASTM Designation E 119-98, incorporated by reference in subsection 6.5.2.

2.19 Fire-Retardant Coating: A coating labeled and formulated to retard ignition and flame spread, that has been fire tested and rated by a testing agency approved by building code officials for use in bringing building and construction materials into compliance with federal, state and local building code requirements. The fire-retardant coating and the testing agency must be approved by building code officials. The fire-retardant coating shall be tested in accordance with ASTM Designation E 84-99, incorporated by reference in subsection 6.5.1.

2.20 Flat Coating: A coating that is not defined under any other definition in this rule and that registers gloss less than 15 on an 85-degree meter or less than 5 on a 60-degree meter according to ASTM Designation D 523-89 (1999), incorporated by reference in subsection 6.5.3.

2.21 Floor Coating: An opaque coating that is labeled and formulated for application to flooring, including, but not limited to, decks, porches, steps, and other horizontal surfaces which may be subject to foot traffic.

2.22 Flow Coating: A coating labeled and formulated exclusively for use by electric power companies or their subcontractors to maintain the protective coating systems present on utility transformer units.

2.23 Form-Release Compound: A coating labeled and formulated for application to a concrete form to prevent the freshly poured concrete from bonding to the form. The form may consist of wood, metal, or some material other than concrete.

2.24 Graphic Arts Coating or Sign Paint: A coating labeled and formulated for hand-application by artists using brush or roller techniques to indoor and outdoor signs (excluding structural components) and murals including lettering enamels, poster colors, copy blockers, and bulletin enamels.

2.25 High-Temperature Coating: A high performance coating labeled and formulated for application to substrates exposed continuously or intermittently to temperatures above 204°C (400°F).

2.26 Industrial Maintenance Coating: A high performance architectural coating, including primers, sealers, undercoaters, intermediate coats, and topcoats, formulated for application to substrates exposed to one or more of the following extreme environmental conditions listed in subsections 2.26.1 through 2.26.5, and labeled as specified in subsection 4.1.4:

2.26.1 Immersion in water, wastewater, or chemical solutions (aqueous and non-aqueous solutions), or chronic exposure of interior surfaces to moisture condensation;
2.26.2 Acute or chronic exposure to corrosive, caustic or acidic agents, or to chemicals, chemical fumes, or chemical mixtures or solutions;
2.26.3 Repeated exposure to temperatures above 121°C (250°F);
2.26.4 Repeated (frequent) heavy abrasion, including mechanical wear and repeated (frequent) scrubbing with industrial solvents, cleansers, or scouring agents; or
2.26.5 Exterior exposure of metal structures and structural components.

2.27 Lacquer: A clear or opaque wood coating, including clear lacquer sanding sealers, formulated with cellulosic or synthetic resins to dry by evaporation without chemical reaction and to provide a solid, protective film.

2.28 Low Solids Coating: A coating containing 0.12 kilogram or less of solids per liter (1 pound or less of solids per gallon) of coating material.

2.29 Magnesite Cement Coating: A coating labeled and formulated for application to magnesite cement decking to protect the magnesite cement substrate from erosion by water.

2.30 Mastic Texture Coating: A coating labeled and formulated to cover holes and minor cracks and to conceal surface irregularities, and is applied in a single coat of at least
10 mils (0.010 inch) dry film thickness.

2.31 Metallic Pigmented Coating: A coating containing at least 48 grams of elemental metallic pigment per liter of coating as applied (0.4 pounds per gallon), when tested in accordance with SCAQMD Method 318-95, incorporated by reference in subsection 6.5.4.

2.32 Multi-Color Coating: A coating that is packaged in a single container and that exhibits more than one color when applied in a single coat.

2.33 Nonflat Coating: A coating that is not defined under any other definition in this rule and that registers a gloss of 15 or greater on an 85-degree meter and 5 or greater on a 60-degree meter according to ASTM Designation D 523-89 (1999), incorporated by reference in subsection 6.5.3.

2.34 Nonflat - High Gloss Coating: A nonflat coating that registers a gloss of 70 or above on a 60-degree meter according to ASTM Designation D 523-89 (1999), incorporated by reference in subsection 6.5.3.

2.35 Nonindustrial Use: Nonindustrial use means any use of architectural coatings except in the construction or maintenance of any of the following: facilities used in the manufacturing of goods and commodities; transportation infrastructure, including highways, bridges, airports and railroads; facilities used in mining activities, including petroleum extraction; and utilities infrastructure, including power generation and distribution, and water treatment and distribution systems.

2.36 Post-Consumer Coating: A finished coating that would have been disposed of in a landfill, having completed its usefulness to a consumer, and does not include manufacturing wastes.

2.37 Pre-Treatment Wash Primer: A primer that contains a minimum of 0.5 percent acid, by weight, when tested in accordance with ASTM Designation D 1613-96, incorporated by reference in subsection 6.5.5, that is labeled and formulated for application directly to bare metal surfaces to provide corrosion resistance and to promote adhesion of subsequent topcoats.

2.38 Primer: A coating labeled and formulated for application to a substrate to provide a firm bond between the substrate and subsequent coats.

2.39 Quick-Dry Enamel: A nonflat coating that is labeled as specified in subsection 4.1.8 and that is formulated to have the following characteristics:

2.39.1 Is capable of being applied directly from the container under normal conditions with ambient temperatures between 16 and 27°C (60 and 80°F);

2.39.2 When tested in accordance with ASTM Designation D 1640-95, incorporated by reference in subsection 6.5.6, sets to touch in 2 hours or less, is tack free in
4 hours or less, and dries hard in 8 hours or less by the mechanical test method; and

2.39.3 Has a dried film gloss of 70 or above on a 60 degree meter.

2.40 Quick-Dry Primer, Sealer, and Undercoater: A primer, sealer, or undercoater that is dry to the touch in 30 minutes and can be recoated in 2 hours when tested in accordance with ASTM Designation D 1640- 95, incorporated by reference in subsection 6.5.6.

2.41 Recycled Coating: An architectural coating formulated such that not less than 50 percent of the total weight consists of secondary and post-consumer coating, with not less than
10 percent of the total weight consisting of post-consumer coating.

2.42 Residence: Areas where people reside or lodge, including, but not limited to, single and multiple family dwellings, condominiums, mobile homes, apartment complexes, motels, and hotels.

2.43 Roof Coating: A non-bituminous coating labeled and formulated exclusively for application to roofs for the primary purpose of preventing penetration of the substrate by water or reflecting heat and ultraviolet radiation. Metallic pigmented roof coatings which qualify as metallic pigmented coatings shall not be considered to be in this category, but shall be considered to be in the metallic pigmented coatings category.

2.44 Rust Preventative Coating: A coating formulated exclusively for nonindustrial use to prevent the corrosion of metal surfaces and labeled as specified in subsection 4.1.6.

2.45 Sanding Sealer: A clear or semi-transparent wood coating labeled and formulated for application to bare wood to seal the wood and to provide a coat that can be abraded to create a smooth surface for subsequent applications of coatings. A sanding sealer that also meets the definition of a lacquer is not included in this category, but is included in the lacquer category.

2.46 Sealer: A coating labeled and formulated for application to a substrate for one or more of the following purposes: to prevent subsequent coatings from being absorbed by the substrate, or to prevent harm to subsequent coatings by materials in the substrate.

2.47 Secondary Coating (Rework): A fragment of a finished coating or a finished coating from a manufacturing process that has converted resources into a commodity of real economic value, but does not include excess virgin resources of the manufacturing process.

2.48 Shellac: A clear or opaque coating formulated solely with the resinous secretions of the lac beetle (*Laciffer lacca*), thinned with alcohol, and formulated to dry by evaporation without a chemical reaction.

2.49 Shop Application: Application of a coating to a product or a component of a product in or on the premises of a factory or a shop as part of a manufacturing, production, or repairing process (e.g., original equipment manufacturing coatings).

2.50 Solicit: To require for use or to specify, by written or oral contract.

2.51 Specialty Primer, Sealer, and Undercoater: A coating labeled as specified in subsection 4.1.7 and that is formulated for application to a substrate to seal fire, smoke or water damage; to condition excessively chalky surfaces, or to block stains. An excessively chalky surface is one that is defined as having a chalk rating of four or less as determined by ASTM Designation D 4214-98, incorporated by reference in subsection 6.5.7.

2.52 Stain: A clear, semitransparent, or opaque coating labeled and formulated to change the color of a surface but not conceal the grain pattern or texture.

2.53 Swimming Pool Coating: A coating labeled and formulated to coat the interior of swimming pools and to resist swimming pool chemicals.

2.54 Swimming Pool Repair and Maintenance Coating: A rubber based coating labeled and formulated to be used over existing rubber based coatings for the repair and maintenance of swimming pools.

2.55 Temperature-Indicator Safety Coating: A coating labeled and formulated as a color-changing indicator coating for the purpose of monitoring the temperature and safety of the substrate, underlying piping, or underlying equipment, and for application to substrates exposed continuously or intermittently to temperatures above 204°C (400°F).

2.56 Tint Base: An architectural coating to which colorant is added after packaging in sale units to produce a desired color.

2.57 Traffic Marking Coating: A coating labeled and formulated for marking and striping streets, highways, or other traffic surfaces including, but not limited to, curbs, berms, driveways, parking lots, sidewalks, and airport runways.

2.58 Undercoater: A coating labeled and formulated to provide a smooth surface for subsequent coatings.

2.59 Varnish: A clear or semi-transparent wood coating, excluding lacquers and shellacs, formulated to dry by chemical reaction on exposure to air. Varnishes may contain small amounts of pigment to color a surface, or to control the final sheen or gloss of the finish.

2.60 Volatile Organic Compound (VOC): Any volatile compound containing at least one atom of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and excluding the following:

2.60.1 methane;
methylene chloride (dichloromethane);
1,1,1-trichloroethane (methyl chloroform);
trichlorofluoromethane (CFC-11);
dichlorodifluoromethane (CFC-12);
1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113);
1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-114);
chloropentafluoroethane (CFC-115);
chlorodifluoromethane (HCFC-22);
1,1,1-trifluoro-2,2-dichloroethane (HCFC-123);
2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124);
1,1-dichloro-1-fluoroethane (HCFC-141b);
1-chloro-1,1-difluoroethane (HCFC-142b);

trifluoromethane (HFC-23);
pentafluoroethane (HFC-125);
1,1,2,2-tetrafluoroethane (HFC-134);
1,1,1,2-tetrafluoroethane (HFC-134a);
1,1,1-trifluoroethane (HFC-143a);
1,1-difluoroethane (HFC-152a);
cyclic, branched, or linear completely methylated siloxanes;
the following classes of perfluorocarbons:
(A) cyclic, branched, or linear, completely fluorinated alkanes;
(B) cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;
(C) cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and
(D) sulfur-containing perfluorocarbons with no unsaturations and with the sulfur bonds only to carbon and fluorine; and

2.60.2 the following low-reactive organic compounds which have been exempted by the U.S. EPA:
acetone;
ethane;
parachlorobenzotrifluoride (1-chloro-4-trifluoromethyl benzene);
perchloroethylene; and
methyl acetate.

2.61 VOC Content: The weight of VOC per volume of coating, calculated according to the procedures specified in subsection 6.1.

2.62 Waterproofing Sealer: A coating labeled and formulated for application to a porous substrate for the primary purpose of preventing the penetration of water.

2.63 Waterproofing Concrete/Masonry Sealer: A clear or pigmented film-forming coating that is labeled and formulated for sealing concrete and masonry to provide resistance against water, alkalis, acids, ultraviolet light, and staining.

2.64 Wood Preservative: A coating labeled and formulated to protect exposed wood from decay or insect attack, that is registered with both the U.S. EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (7 United States Code (U.S.C.) Section 136, *et seq.*) and with the California Department of Pesticide Regulation.

3. STANDARDS

3.1 **VOC Content Limits:** Except as provided in subsections 3.2, 3.3, 3.8, 3.9, and 3.10, no person shall: (i) manufacture, blend, or repackage for sale within the district;
(ii) supply, sell, or offer for sale within the district; or (iii) solicit for application or apply within the district, any architectural coating with a VOC content in excess of the corresponding limit specified in Table 1, after the specified effective date in Table 1.

3.2 **Most Restrictive VOC Limit:** If anywhere on the container of any architectural coating, or any label or sticker affixed to the container, or in any sales, advertising, or technical literature supplied by a manufacturer or anyone acting on their behalf, any representation is made that indicates that the coating meets the definition of or is recommended for use for more than one of the coating categories listed in Table 1, then the most restrictive VOC content limit shall apply. This provision does not apply to the coating categories specified in subsections 3.2.1 through 3.2.15.

3.2.1 Lacquer coatings (including lacquer sanding sealers).
3.2.2 Metallic pigmented coatings.
3.2.3 Shellacs.
3.2.4 Fire-retardant coatings.
3.2.5 Pretreatment wash primers.
3.2.6 Industrial maintenance coatings.
3.2.7 Low-solids coatings.
3.2.8 Wood preservatives.
3.2.9 High temperature coatings.
3.2.10 Temperature-indicator safety coatings.
3.2.11 Antenna coatings.
3.2.12 Antifouling coatings.
3.2.13 Flow coatings.
3.2.14 Bituminous roof primers.
3.2.15 Specialty primers, sealers, and undercoaters.

3.3 **Sell-Through of Coatings:** A coating manufactured prior to the effective date specified for that coating in Table 1 may be sold, supplied, or offered for sale for up to three years after the specified effective date. In addition, a coating manufactured before the effective date specified for that coating in Table 1 may be applied at any time, both before and after the specified effective date, so long as the coating complied with the standards in effect at the time the coating was manufactured. This subsection 3.3 does not apply to any coating that does not display the date or date-code required by subsection 4.1.1.

SCM Clarification - New subsection "3.3.1"
(See June 7, 2001 letter to all districts by Mike Kenny, ARB Executive Officer)

3.3.1 A coating included in an approved Averaging Program that does not comply with the specified limit in Table 1 may be sold, supplied, or offered for sale for up to three years after the end of the compliance period specified in the approved Averaging Program. In addition, such a coating may be applied at any time, both during and after the compliance period. This subsection 3.3.1 does not apply to any coating that does not display on the container either the statement: "This product is subject to architectural coatings averaging provisions in California," or a substitute symbol specified by the Executive Officer of the ARB. This subsection 3.3.1 shall remain in effect until January 1, 2008.

3.4 **Painting Practices:** All architectural coating containers used to apply the contents therein to a surface directly from the container by pouring, siphoning, brushing, rolling, padding, ragging or other means, shall be closed when not in

use. These architectural coating containers include, but are not limited to, drums, buckets, cans, pails, trays or other application containers. Containers of any VOC-containing materials used for thinning and cleanup shall also be closed when not in use.

3.5 **Thinning:** No person who applies or solicits the application of any architectural coating shall apply a coating that is thinned to exceed the applicable VOC limit specified in
Table 1.

3.6 **Rust Preventative Coatings:** Effective January 1, 2004, no person shall apply or solicit the application of any rust preventative coating for industrial use, unless such a rust preventative coating complies with the industrial maintenance coating VOC limit specified in Table 1.

3.7 **Coatings Not Listed in Table 1:** For any coating that does not meet any of the definitions for the specialty coatings categories listed in Table 1, the VOC content limit shall be determined by classifying the coating as a flat coating or a nonflat coating, based on its gloss, as defined in subsections 2.20, 2.33, and 2.34 and the corresponding flat or nonflat VOC limit shall apply.

3.8 **Industrial Maintenance Coatings:**

3.8.1 After January 1, 2004, a manufacturer, seller, or user may petition the APCO to apply an industrial maintenance coating with a VOC content up to 340 g/l if all of the following conditions are met:

3.8.1.1 The industrial maintenance coating is to be applied in a district located within the North Central Coast, San Francisco Bay Area, or North Coast Air Basins.

3.8.1.2 The petition submitted to the APCO contains the following information, as applicable: job requirements and description, volume of coating, maximum VOC content, and a certification that a complying coating meeting the job performance requirements is not available.

3.8.1.3 If the APCO grants written approval, such approval shall contain volume and VOC limit conditions. Until written approval is granted by the APCO and received by the petitioner, all provisions of this rule shall apply.

3.8.2 The APCO shall not approve any petition under subsection 3.8.1 if the approvals previously granted by the APCO during the calendar year, when combined with the petition under consideration, would result in excess VOC emissions for that calendar year which would be greater than 5 percent of the annual emission reduction achieved within the district from implementing the January 1, 2004, VOC limit for industrial maintenance coatings.

3.8.3 Coatings subject to this provision shall be sold only if an approved petition (or a copy of it) is provided prior to the sale. Coatings subject to this provision shall not be available to the general public.

3.9 **Lacquers:** Notwithstanding the provisions of subsection 3.1, a person or facility may add up to 10 percent by volume of VOC to a lacquer to avoid blushing of the finish during days with relative humidity greater than 70 percent and temperature below 65°F, at the time of application, provided that the coating contains acetone and no more than
550 grams of VOC per liter of coating, less water and exempt compounds, prior to the addition of VOC.

3.10 **Averaging Compliance Option:** On or after January 1, 2003, in lieu of compliance with the specified limits in Table 1 for floor coatings; industrial maintenance coatings; primers, sealers, and undercoaters; quick-dry primers, sealers, and undercoaters; quick-dry enamels; roof coatings; rust preventative coatings; stains; waterproofing sealers, as well as flats and non-flats (excluding recycled coatings), manufacturers may average designated coatings such that their actual cumulative emissions from the averaged coatings are less than or equal to the cumulative emissions that would have been allowed under those limits over a compliance period not to exceed one year. Such manufacturers must also comply with the averaging provisions contained in Appendix A, as well as maintain and make available for inspection records for at least three years after the end of the compliance period. This subsection 3.10 and Appendix A shall cease to be effective on January 1, 2005, after which averaging will no longer be allowed.

4. CONTAINER LABELING REQUIREMENTS

4.1 Each manufacturer of any architectural coating subject to this rule shall display the information listed in subsections 4.1.1 through 4.1.8 on the coating container (or label) in which the coating is sold or distributed.

4.1.1 **Date Code:** The date the coating was manufactured, or a date code representing the date, shall be indicated on the label, lid, or bottom of the container. If the manufacturer uses a date code for any coating, the manufacturer shall file an explanation of each code with the Executive Officer of the ARB.

4.1.2 **Thinning Recommendations:** A statement of the manufacturer's recommendation regarding thinning of the coating shall be indicated on the label or lid of the container. This requirement does not apply to the thinning of architectural coatings with water. If thinning of the coating prior to use is not necessary, the recommendation must specify that the coating is to be applied without thinning.

4.1.3 **VOC Content:** Each container of any coating subject to this rule shall display either the maximum or the actual VOC content of the coating, as supplied, including the maximum thinning as recommended by the

manufacturer. VOC content shall be displayed in grams of VOC per liter of coating. VOC content displayed shall be calculated using product formulation data, or shall be determined using the test methods in subsection 6.2. The equations in subsection 6.1 shall be used to calculate VOC content.

4.1.4 **Industrial Maintenance Coatings:** In addition to the information specified in subsection 4.1.1, 4.1.2, and 4.1.3, each manufacturer of any industrial maintenance coating subject to this rule shall display on the label or lid of the container in which the coating is sold or distributed one or more of the descriptions listed in subsections 4.1.4.1 through 4.1.4.3.

4.1.4.1 "For industrial use only."
4.1.4.2 "For professional use only."
4.1.4.3 "Not for residential use or Not intended for residential use."

4.1.5 **Clear Brushing Lacquers:** Effective January 1, 2003, the labels of all clear brushing lacquers shall prominently display the statements "For brush application only," and "This product must not be thinned or sprayed."

4.1.6 **Rust Preventative Coatings:** Effective January 1, 2003, the labels of all rust preventative coatings shall prominently display the statement "For Metal Substrates Only."

4.1.7 **Specialty Primers, Sealers, and Undercoaters:** Effective January 1, 2003, the labels of all specialty primers, sealers, and undercoaters shall prominently display one or more of the descriptions listed in subsection 4.1.7.1 through 4.1.7.5.

4.1.7.1 For blocking stains.
4.1.7.2 For fire-damaged substrates.
4.1.7.3 For smoke-damaged substrates.
4.1.7.4 For water-damaged substrates.
4.1.7.5 For excessively chalky substrates.

4.1.8 **Quick Dry Enamels:** Effective January 1, 2003, the labels of all quick dry enamels shall prominently display the words "Quick Dry" the dry hard time.

4.1.9 **Nonflat - High Gloss Coatings:** Effective January 1, 2003, the labels of all nonflat - high gloss coatings shall prominently display the words "High Gloss."

5. REPORTING REQUIREMENTS

5.1 **Clear Brushing Lacquers:** Each manufacturer of clear brushing lacquers shall, on or before April 1 of each calendar year beginning in the year 2004, submit an annual report to the Executive Officer of the ARB. The report shall specify the

number of gallons of clear brushing lacquers sold in the State during the preceding calendar year, and shall describe the method used by the manufacturer to calculate State sales.

5.2 **Rust Preventative Coatings:** Each manufacturer of rust preventative coatings shall, on or before April 1 of each calendar year beginning in the year 2004, submit an annual report to the Executive Officer of the ARB. The report shall specify the number of gallons of rust preventative coatings sold in the State during the preceding calendar year, and shall describe the method used by the manufacturer to calculate State sales.

5.3 **Specialty Primers, Sealers, and Undercoaters:** Each manufacturer of specialty primers, sealers, and undercoaters shall, on or before April 1 of each calendar year beginning in the year 2004, submit an annual report to the Executive Officer of the ARB. The report shall specify the number of gallons of specialty primers, sealers, and undercoaters sold in the State during the preceding calendar year, and shall describe the method used by the manufacturer to calculate State sales.

5.4 **Toxic Exempt Compounds:** For each architectural coating that contains perchloroethylene or methylene chloride, the manufacturer shall, on or before April 1 of each calendar year beginning with the year 2004, report to the Executive Officer of the ARB the following information for products sold in the State during the preceding year:

5.4.1 the product brand name and a copy of the product label with legible usage instructions;
5.4.2 the product category listed in Table 1 to which the coating belongs;
5.4.3 the total sales in California during the calendar year to the nearest gallon;
5.4.4 the volume percent, to the nearest 0.10 percent, of perchloroethylene and methylene chloride in the coating.

5.5 **Recycled Coatings:** Manufacturers of recycled coatings must submit a letter to the Executive Officer of the ARB certifying their status as a Recycled Paint Manufacturer. The manufacturer shall, on or before April 1 of each calendar year beginning with the year 2004, submit an annual report to the Executive Officer of the ARB. The report shall include, for all recycled coatings, the total number of gallons distributed in the State during the preceding year, and shall describe the method used by the manufacturer to calculate State distribution.

5.6 **Bituminous Coatings:** Each manufacturer of bituminous roof coatings or bituminous roof primers shall, on or before April 1 of each calendar year beginning with the
year 2004, submit an annual report to the Executive Officer of ARB. The report shall specify the number of gallons of bituminous roof coatings or bituminous roof primers sold in the State during the preceding calendar year, and shall describe the method used by the manufacturer to calculate State sales.

6. COMPLIANCE PROVISIONS AND TEST METHODS

6.1 **Calculation of VOC Content:** For the purpose of determining compliance with the VOC content limits in Table 1, the VOC content of a coating shall be determined by using the procedures described in subsection 6.1.1 or 6.1.2, as appropriate. The VOC content of a tint base shall be determined without colorant that is added after the tint base is manufactured.

6.1.1 With the exception of low solids coatings, determine the VOC content in grams of VOC per liter of coating thinned to the manufacturer's maximum recommendation, excluding the volume of any water and exempt compounds. Determine the VOC content using equation 1 as follows:

$$\text{VOC Content} = \frac{(W_s - W_w - W_{ec})}{(V_m - V_w - V_{ec})} \qquad (1)$$

Where:
VOC Content = grams of VOC per liter of coating
W_s = weight of volatiles, in grams
W_w = weight of water, in grams
W_{ec} = weight of exempt compounds, in grams
V_m = volume of coating, in liters
V_w = volume of water, in liters
V_{ec} = volume of exempt compounds, in liters

6.1.2 For low solids coatings, determine the VOC content in units of grams of VOC per liter of coating thinned to the manufacturer's maximum recommendation, including the volume of any water and exempt compounds. Determine the VOC content using equation 2 as follows:

$$\text{VOC Content}_{ls} = \frac{(W_s - W_w - W_{ec})}{(V_m)} \qquad (2)$$

Where:
VOC Content$_{ls}$ = the VOC content of a low solids coating in grams of VOC per liter of coating
W_s = weight of volatiles, in grams
W_w = weight of water, in grams
W_{ec} = weight of exempt compounds, in grams
V_m = volume of coating, in liters

6.2 **VOC Content of Coatings:** To determine the physical properties of a coating in order to perform the calculations in subsection 6.1, the reference method for VOC content is
U.S. EPA Method 24, incorporated by reference in subsection 6.5.11, except as provided in subsections 6.3 and 6.4. An alternative method to determine the VOC content of coatings is SCAQMD Method 304-91 (Revised February 1996),

incorporated by reference in subsection 6.5.12. The exempt compounds content shall be determined by SCAQMD Method 303-91 (Revised August 1996), incorporated by reference in subsection 6.5.10. To determine the VOC content of a coating, the manufacturer may use U.S. EPA Method 24, or an alternative method as provided in subsection 6.3, formulation data, or any other reasonable means for predicting that the coating has been formulated as intended (e.g., quality assurance checks, record keeping). However, if there are any inconsistencies between the results of a Method 24 test and any other means for determining VOC content, the Method 24 test results will govern, except when an alternative method is approved as specified in subsection 6.3. The District Air Pollution Control Officer (APCO) may require the manufacturer to conduct a Method 24 analysis.

6.3 **Alternative Test Methods:** Other test methods demonstrated to provide results that are acceptable for purposes of determining compliance with subsection 6.2, after review and approved in writing by the staffs of the District, the ARB, and the U.S. EPA, may also be used.

6.4 **Methacrylate Traffic Marking Coatings:** Analysis of methacrylate multicomponent coatings used as traffic marking coatings shall be conducted according to a modification of U.S. EPA Method 24 (40 CFR 59, subpart D, Appendix A), incorporated by reference in subsection 6.5.13. This method has not been approved for methacrylate multicomponent coatings used for other purposes than as traffic marking coatings or for other classes of multicomponent coatings.

6.5 **Test Methods:** The following test methods are incorporated by reference herein, and shall be used to test coatings subject to the provisions of this rule:

6.5.1 **Flame Spread Index:** The flame spread index of a fire-retardant coating shall be determined by ASTM Designation E 84-99, “Standard Test Method for Surface Burning Characteristics of Building Materials” (see section 2, Fire-Retardant Coating).

6.5.2 **Fire Resistance Rating:** The fire resistance rating of a fire-resistive coating shall be determined by ASTM Designation E 119-98, “Standard Test Methods for Fire Tests of Building Construction Materials” (see section 2, Fire-Resistive Coating).

6.5.3 **Gloss Determination:** The gloss of a coating shall be determined by ASTM Designation D 523-89 (1999), “Standard Test Method for Specular Gloss” (see section 2, Flat Coating, Nonflat Coating, Nonflat - High Gloss Coating, and Quick-Dry Enamel).

6.5.4 **Metal Content of Coatings:** The metallic content of a coating shall be determined by SCAQMD Method 318-95, “Determination of Weight Percent Elemental Metal in Coatings by X-Ray Diffraction,” *SCAQMD Laboratory Methods of Analysis for Enforcement Samples* (see section 2, Metallic Pigmented Coating).

6.5.5 **Acid Content of Coatings:** The acid content of a coating shall be determined by ASTM Designation D 1613-96, "Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products" (see section 2, Pre-treatment Wash Primer).

6.5.6 **Drying Times:** The set-to-touch, dry-hard, dry-to-touch, and dry-to-recoat times of a coating shall be determined by ASTM Designation D 1640-95, "Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature" (see section 2, Quick-Dry Enamel and Quick-Dry Primer, Sealer, and Undercoater). The tack-free time of a quick-dry enamel coating shall be determined by the Mechanical Test Method of ASTM Designation D 1640-95.

6.5.7 **Surface Chalkiness:** The chalkiness of a surface shall be determined using ASTM Designation D 4214-98, "Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films" (see section 2, Specialty Primer, Sealer, and Undercoater).

6.5.8 **Exempt Compounds--Siloxanes:** Exempt compounds that are cyclic, branched, or linear completely methylated siloxanes, shall be analyzed as exempt compounds for compliance with section 6 by BAAQMD Method 43, "Determination of Volatile Methylsiloxanes in Solvent-Based Coatings, Inks, and Related Materials," *BAAQMD Manual of Procedures*, Volume III, adopted 11/6/96 (see section 2, Volatile Organic Compound, and subsection 6.2).

6.5.9 **Exempt Compounds--Parachlorobenzotrifluoride (PCBTF)**: The exempt compound parachlorobenzotrifluoride, shall be analyzed as an exempt compound for compliance with section 6 by BAAQMD Method 41, "Determination of Volatile Organic Compounds in Solvent Based Coatings and Related Materials Containing Parachlorobenzotrifluoride," *BAAQMD Manual of Procedures*, Volume III, adopted 12/20/95 (see section 2, Volatile Organic Compound, and subsection 6.2).

6.5.10 **Exempt Compounds:** The content of compounds exempt under U.S. EPA Method 24 shall be analyzed by SCAQMD Method 303-91 (Revised 1993), "Determination of Exempt Compounds," *SCAQMD Laboratory Methods of Analysis for Enforcement Samples* (see section 2, Volatile Organic Compound, and subsection 6.2).

6.5.11 **VOC Content of Coatings:** The VOC content of a coating shall be determined by U.S. EPA Method 24 as it exists in appendix A of 40 *Code of Federal Regulations* (CFR) part 60, "Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings" (see subsection 6.2).

6.5.12 **Alternative VOC Content of Coatings:** The VOC content of coatings may be analyzed either by U.S. EPA Method 24 or SCAQMD Method 304-91 (Revised 1996), "Determination of Volatile Organic Compounds (VOC) in Various Materials," *SCAQMD Laboratory Methods of Analysis for Enforcement Samples* (see subsection 6.2).

6.5.13 **Methacrylate Traffic Marking Coatings:** The VOC content of methacrylate multicomponent coatings used as traffic marking coatings shall be analyzed by the procedures in 40 CFR part 59, subpart D, appendix A, "Determination of Volatile Matter Content of Methacrylate Multicomponent Coatings Used as Traffic Marking Coatings" (September 11, 1998) (see subsection 6.4).

Table 1
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS

Limits are expressed in grams of VOC per liter[a] of coating thinned to the manufacturer's maximum recommendation, excluding the volume of any water, exempt compounds, or colorant added to tint bases. "Manufacturer's maximum recommendation" means the maximum recommendation for thinning that is indicated on the label or lid of the coating container.

Coating Category	Effective 1/1/2003	Effective 1/1/2004
Flat Coatings	100	
Nonflat Coatings	150	
Nonflat - High Gloss Coatings	250	
Specialty Coatings		
Antenna Coatings	530	
Antifouling Coatings	400	
Bituminous Roof Coatings	300	
Bituminous Roof Primers	350	
Bond Breakers	350	
Clear Wood Coatings • Clear Brushing Lacquers • Lacquers (including lacquer sanding sealers) • Sanding Sealers (other than lacquer sanding sealers) • Varnishes	 680 550 350 350	
Concrete Curing Compounds	350	
Dry Fog Coatings	400	
Faux Finishing Coatings	350	
Fire Resistive Coatings	350	
Fire-Retardant Coatings: • Clear • Opaque	 650 350	
Floor Coatings	250	
Flow Coatings	420	
Form-Release Compounds	250	
Graphic Arts Coatings (Sign Paints)	500	

Table 1 Continued

Coating Category	Effective 1/1/2003	Effective 1/1/2004
High Temperature Coatings	420	
Industrial Maintenance Coatings		250
Low Solids Coatings[b]	120	
Magnesite Cement Coatings	450	
Mastic Texture Coatings	300	
Metallic Pigmented Coatings	500	
Multi-Color Coatings	250	
Pre-Treatment Wash Primers	420	
Primers, Sealers, and Undercoaters	200	
Quick-Dry Enamels	250	
Quick-Dry Primers, Sealers, and Undercoaters	200	
Recycled Coatings	250	
Roof Coatings	250	
Rust Preventative Coatings	400	
Shellacs: • Clear • Opaque	 730 550	
Specialty Primers, Sealers, and Undercoaters	350	
Stains	250	
Swimming Pool Coatings	340	
Swimming Pool Repair and Maintenance Coatings	340	
Temperature-Indicator Safety Coatings	550	
Traffic Marking Coatings	150	
Waterproofing Sealers	250	
Waterproofing Concrete/Masonry Sealers	400	
Wood Preservatives	350	

a Conversion factor: one pound VOC per gallon (U.S.) = 119.95 grams VOC per liter.
b Units are grams of VOC per liter (pounds of VOC per gallon) of coating, including water and exempt compounds.

APPENDIX A:
AVERAGING PROVISION

A. AVERAGING PROVISION

A.1 The manufacturer shall demonstrate that actual emissions from the coatings being averaged are less than or equal to the allowable emissions, for the specified compliance period using the following equation:

$$\sum_{i=1}^{n} GiMi \leq \sum_{i=1}^{n} GiViLi$$

Where:

$$\sum_{i=1}^{n} GiMi = \text{Actual Emissions}$$

$$\sum_{i=1}^{n} GiViLi = \text{Allowable Emissions}$$

Gi = Total Gallons of Product (i) subject to Averaging;

Mi = Material VOC Content of Product (i), in pounds per gallon;

$$Mi = \frac{Ws - Ww - Wec}{Vm}$$

Vi = Percent by Volume Solids and VOC in Product (i);

$$Vi = \frac{Vm - Vw - Vec}{Vm}$$

Where: Ws, Ww, Wec, Vm, Vw, and Vec are defined in subsection 6.1, except that in this Appendix weights are in pounds and volumes are in gallons.

For Non - Zero VOC Coatings:

$$Vi = \frac{\text{Material VOC (also known as VOC Actual)}}{\text{Coating VOC (also known as VOC Regulatory)}}$$

Where: $\text{Coating VOC} = \frac{Ws - Ww - Wec}{Vm - Vw - Vec}$

For Zero VOC Coatings:

Vi = Percent Solids by Volume

Li = Regulatory VOC Content Limit for Product (i), in pounds per gallon (as listed in Table 1)

The averaging is limited to coatings that are designated by the manufacturer. Any coating not designated in the averaging Program shall comply with the VOC limit in Table 1. The manufacturer shall not include any quantity of coatings that it knows or should have known will not be used in the State, if statewide coatings data are used. If district-specific coatings data are used, the manufacturer shall not include any quantity of coatings that it knows or should have known will not be used in the district.

SCM Clarification - New Section "A.1.1"
(See June 7, 2001 letter to all districts by Mike Kenny, ARB Executive Officer)

A.1.1 In addition to the requirements specified in subsection A.1, manufacturers shall not include in an Averaging Program any coating with a VOC content in excess of the following maximum VOC contents, for the applicable categories.

Averaging Category	VOC Limit (Li)[1] grams/liter	Maximum VOC Content grams/liter
Flat	100	250
Nonflat (Excludes High Gloss)	150	250
Floor	250	400
Industrial Maintenance	250	420
Primer, Sealer, Undercoater	200	350
Quick Dry Primer, Sealer, Undercoater	200	450
Quick Dry Enamel	250	400
Roof	250	300
Bituminous Roof	300	300
Rust Preventative	400	400
Stains	250	350
Waterproofing sealers	250	400

1. As listed in Table 1. Used when determining allowable emissions in subsection A.1.

A.2 AVERAGING PROGRAM (PROGRAM)

At least six months prior to the start of the compliance period, manufacturers shall submit an Averaging Program to the Executive Officer of the Air Resources Board. As used in this Appendix A, "Executive Officer" means the Executive Officer of the Air Resources Board. Averaging may not be implemented until the Program is approved in writing by the Executive Officer.

Within 45 days of submittal of a complete Program, the Executive Officer shall either approve or disapprove the Program. The Program applicant and the Executive Officer may agree to an extension of time for the Executive Officer to take action on the Program.

A.3 GENERAL REQUIREMENTS

The Program shall include all necessary information for the Executive Officer to make a determination as to whether the manufacturer may comply with the averaging requirements over the specified compliance period in an enforceable manner. Such information shall include, but is not limited to, the following:

A.3.1 An identification of the contact persons, telephone numbers, and name of the manufacturer who is submitting the Program.

A.3.2 An identification of each coating that has been selected by the manufacturer for inclusion in this program that exceeds the applicable VOC limit in
Table 1, its VOC content specified in units of both VOC actual and VOC regulatory, and the designation of the coating category.

A.3.3 A detailed demonstration showing that the projected actual emissions will not exceed the allowable emissions for a single compliance period that the Program will be in effect. In addition, the demonstration shall include VOC content information for each coating that is below the compliance limit in Table 1. The demonstration shall use the equation specified in subsection A.1 of this Appendix for projecting the actual emissions and allowable emissions during each compliance period. The demonstration shall also include all VOC content levels and projected volume within the State for each coating listed in the Program during each compliance period. The requested data can be summarized in a matrix form.

A.3.4 A specification of the compliance period(s) and applicable reporting dates. The length of the compliance period shall not be more than one year or less than six months.

A.3.5 An identification and description of all records to be made available to the Executive Officer upon request, if different than those identified under subsection A.3.6.

A.3.6 An identification and description of specific records to be used in calculating emissions for the Program and subsequent reporting, and a detailed explanation as to how those records will be used by the manufacturer to verify compliance with the averaging requirements.

A.3.7 A statement, signed by a responsible party for the manufacturer, that all information submitted is true and correct, and that records will be made available to the Executive Officer upon request.

A.4 REPORTING REQUIREMENTS

A.4.1 For every single compliance period, the manufacturer shall submit a mid-term report listing all coatings subject to averaging during the first

half of the compliance period, detailed analysis of the actual and allowable emissions at the end of the mid-term, and an explanation as to how the manufacturer intends to achieve compliance by the end of the compliance period. The report shall be signed by the responsible party for the manufacturer, attesting that all information submitted is true and correct. The mid-term report shall be submitted within 45 days after the midway date of the compliance period. A manufacturer may request, in writing, an extension of up to 15 days for submittal of the mid-term report.

A.4.2 Within 60 days after the end of the compliance period or upon termination of the Program, whichever is sooner, the manufacturer shall submit to the Executive Officer a report listing all coatings subject to averaging during the compliance period, providing a detailed demonstration of the balance between the actual and allowable emissions for the compliance period, any identification and description of specific records used by the manufacturer to verify compliance with the averaging requirement, and any other information requested by the Executive Officer to determine whether the manufacturer complied with the averaging requirements over the specified compliance period. The report shall be signed by the responsible party for the manufacturer, attesting that all information submitted is true and correct, and that records will be made available to the Executive Officer upon request. A manufacturer may request, in writing, an extension of up to 30 days for submittal of the final report.

A.5 RENEWAL OF A PROGRAM

A Program automatically expires at the end of the compliance period. The manufacturer may request a renewal of the Program by submitting a renewal request that shall include an updated Program, meeting all applicable Program requirements. The renewal request will be considered conditionally approved until the Executive Officer makes a final decision to deny or approve the renewal request based on a determination of whether the manufacturer is likely to comply with the averaging requirements. The Executive Officer shall base such determination on all available information, including but not limited to, the mid-term and the final reports of the preceding compliance period. The Executive Officer shall make a decision to deny or approve a renewal request no later than 45 days from the date of the final report submittal, unless the manufacturer and the Executive Officer agree to an extension of time for the Executive Officer to take action on the renewal request.

A.6 MODIFICATION OF A PROGRAM

A manufacturer may request a modification of the Program at any time prior to the end of the compliance period. The Executive Officer shall take action to approve or disapprove the modification request no longer than 45 days from the date of its submittal. No modification of the compliance period shall be allowed.

A Program need not be modified to specify additional coatings to be averaged that are below the applicable VOC limits.

A.7 TERMINATION OF A PROGRAM

A.7.1 A manufacturer may terminate its Program at any time by filing a written notification to the Executive Officer. The filing date shall be considered the effective date of the termination, and all other provisions of this rule including the VOC limits shall immediately thereafter apply. The manufacturer shall also submit a final report 60 days after the termination date. Any exceedance of the actual emissions over the allowable emissions over the period that the Program was in effect shall constitute a separate violation for each day of the entire compliance period.

A.7.2 The Executive Officer may terminate a Program if any of the following circumstances occur:

A.7.2.1 The manufacturer violates the requirements of the approved Program, and at the end of the compliance period, the actual emissions exceed the allowable emissions.

A.7.2.2 The manufacturer demonstrates a recurring pattern of violations and has consistently failed to take the necessary steps to correct those violations.

A.8 CHANGE IN VOC LIMITS

If the VOC limits of a coating listed in the Program are amended such that its effective date is less than one year from the date of adoption, the affected manufacturer may base its averaging on the prior limits of that coating until the end of the compliance period immediately following the date of adoption.

A.9 LABELING

Each container of any coating that is included in averaging program, and that exceeds the applicable VOC limit in Table 1 shall display the following statement: "This product is subject to architectural coatings averaging provisions in California." A symbol specified by the Executive Officer may be used as a substitute.

A.10 VIOLATIONS

The exceedance of the allowable emissions for any compliance period shall constitute a separate violation for each day of the compliance period. However, any violation of the requirements of the Averaging Provision of this rule, which the violator can demonstrate, to the Executive Officer, did not cause or allow the emission of an air contaminant and was not the result of negligent or knowing activity may be considered a minor violation.

A.11 SUNSET OF AVERAGING PROVISION

The averaging provision set forth in Appendix A shall cease to be effective on January 1, 2005, after which averaging will no longer be allowed.

APPENDIX C:

AIR QUALITY STANDARDS AND NONATTAINMENT AREAS

AIR QUALITY STANDARDS

C.1. Current Ozone and Particulate Matter Standards

To protect California's population from the harmful effects of ozone and PM, federal and State air quality standards for these contaminants have been established. These standards are shown in Table C-1.

The ARB adopted new PM standards in June of 2002, responding to requirements of the Children's Environmental Health Protection Act (Senate Bill 25, Escutia 1999). This Act requires the evaluation of all health-based ambient air quality standards to determine if the standards adequately protect human health, particularly that of infants and children. The subsequent review of the PM standards resulted in the recommendation of more health-protective ambient air quality standards for PM_{10} and a new standard for $PM_{2.5}$. The new PM standards became effective in 2003.

For ozone, the ARB approved a new eight-hour standard of 0.070 ppm and retained the one-hour ozone standard of 0.09 ppm in April 2005. These updated standards resulted from an extensive review of the scientific literature, which indicated that significant harmful health effects could occur among both adults and children if exposed to levels above these standards.

Table C-1
Ambient Air Quality Standards for Ozone, PM_{10}, and $PM_{2.5}$

Pollutant	Averaging Time	State Standard	National Standard
Ozone	1 Hour	0.09 ppm (180 $\mu g/m^3$)	----
	8 Hour	0.070 ppm (137 $\mu g/m^3$)	0.08 ppm (157 $\mu g/m^3$)
PM_{10}	24 Hour	50 $\mu g/m^3$	150 $\mu g/m^3$
	Annual Arithmetic Mean	20 $\mu g/m^3$	----
$PM_{2.5}$	24 Hour	----	35 $\mu g/m^3$
	Annual Arithmetic Mean	12 $\mu g/m^3$	15 $\mu g/m^3$

C.2. California Clean Air Act

The California Clean Air Act (CCAA) was enacted in 1988 and has the fundamental goal that all areas of California are to attain the State ambient air quality standard for ozone by the earliest practicable date. The State eight-hour ozone standard is set by the ARB, and is more stringent than the federal eight-hour ozone standard. As specified in the CCAA, the ARB has designated areas of California to be in "attainment" or "nonattainment" for the State ozone standard. Local districts that are nonattainment for the State ozone standard are required by the CCAA to prepare plans, which must be designed to achieve and maintain the standard by the earliest practicable date. In developing their plans

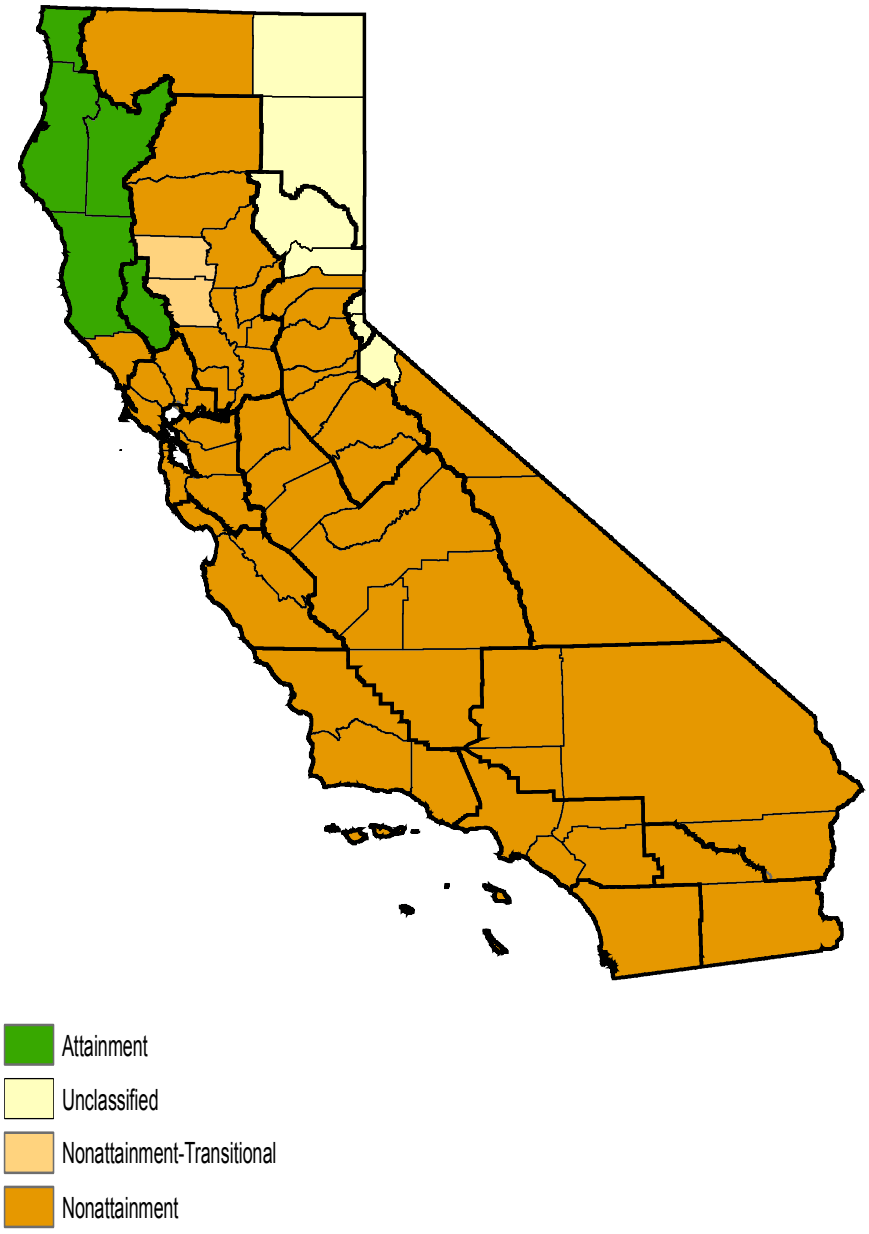
each district determines which measures are necessary to include, as well as the specific details of each included measure.

C.3. Status of Air Quality – State Standards

State law indicates that the California Legislature intends progress toward clean air to be made as quickly as possible. The CCAA specifically declares that it is the intent of the Legislature that the state air quality standards be achieved "...by the earliest practicable date..." (Health and Safety Code, sections 40910 and 40913(a)). Unhealthy levels of ozone and PM are not limited to urban areas, but can be found in nearly every county in California as seen in Figures C-1, C-2, and C-3. These figures highlight areas that exceed the State ambient air quality standards (i.e. "nonattainment areas").

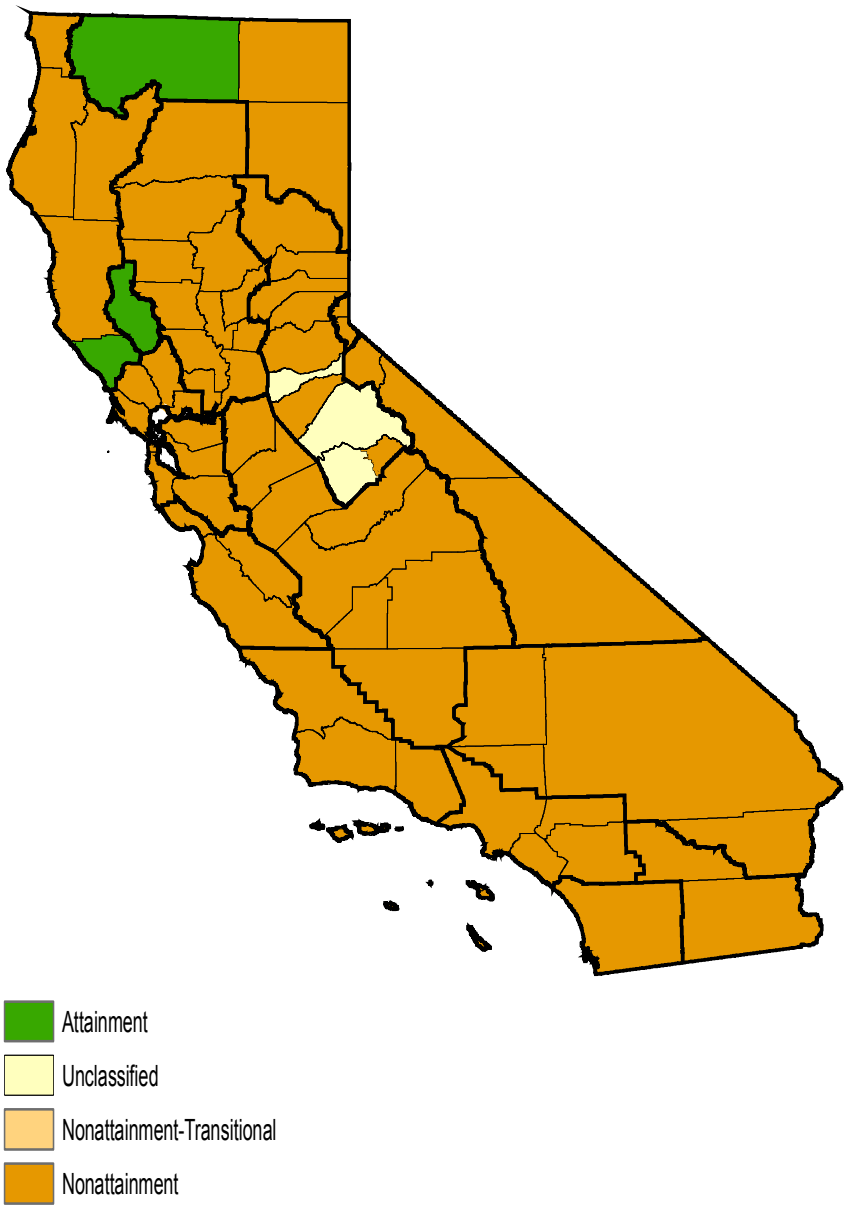
The 35 districts in California have air quality planning responsibilities. Of the 35 districts, 30 are nonattainment for the State 1-hour/8-hour ozone standard, 31 are nonattainment for the State 24-hour/annual PM_{10} standard, and 11 are nonattainment for the State annual $PM_{2.5}$ standard. For the State ozone and PM_{10} standards, a district is designated "nonattainment" for ozone if it does not meet either the 1-hour or 8-hour standard and "nonattainment" for PM_{10} if it does not meet either the 24-hour or annual standard. Table C-2 lists the districts that have been designated "nonattainment" because they exceed State standards for ozone or PM. Of the 30 ozone nonattainment districts, all but eight already have an architectural coatings rule. These eight districts are the Great Basin Unified, Amador County, Calaveras County, Mariposa County, Tuolumne County, Northern Sierra, Siskiyou County, and Glenn County Districts. Some of these districts are impacted by upwind districts and will have no requirements to adopt an architectural coating rule based on the proposed SCM. Of the 31 PM_{10} nonattainment districts, all but ten have an architectural rule. These ten districts include the above eight ozone nonattainment districts with the exception of Amador County and Siskiyou County and the addition of the North Coast Unified, Mendocino County, Modoc County, and Lassen County Districts. The only $PM_{2.5}$ nonattainment district without an architectural rule is the Northern Sierra AQMD.

Figure C-1
2006 Area Designations for State Ambient Air Quality Standard for Ozone



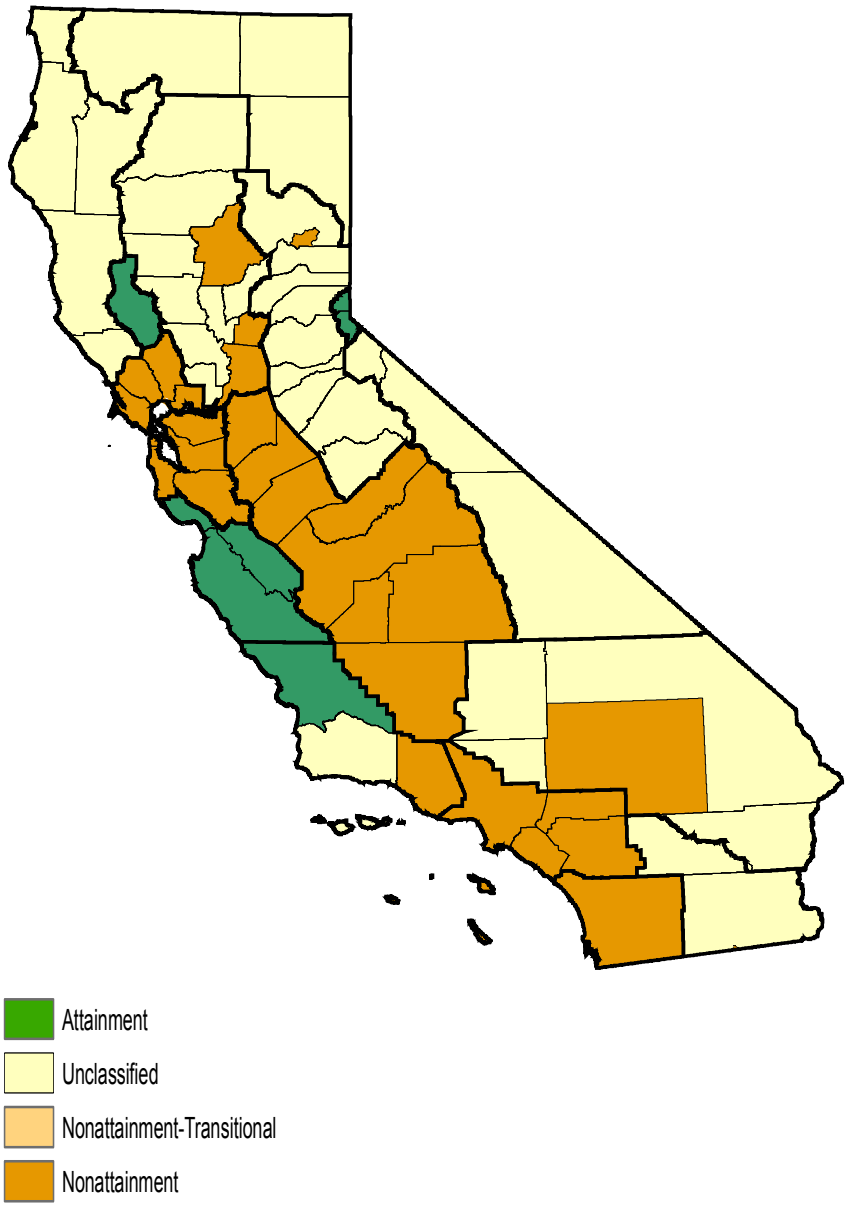
(ARB, 2006b)

Figure C-2
2006 Area Designations for State Ambient Air Quality Standard for PM_{10}



(ARB, 2006b)

Figure C-3
2006 Area Designations for State Ambient Air Quality Standard for $PM_{2.5}$



(ARB, 2006b)

Table C-2
2006 State Nonattainment Areas for Ozone, PM_{10}, and $PM_{2.5}$

	State Nonattainment Air Basin	Air District	County	Ozone	PM_{10}	$PM_{2.5}$
1	Great Basin Valley	Great Basin Unified APCD	Alpine		X	
			Inyo	X	X	
			Mono	X	X	
2	Lake Tahoe	Placer County APCD	Placer (eastern portion)		X	
		El Dorado County AQMD	El Dorado (eastern portion)		X	
3	Mojave Desert	Mojave Desert AQMD	San Bernardino (central portion)	X	X	X
		Kern County APCD	Kern (eastern portion)	X	X	
		South Coast AQMD	Riverside (eastern portion)	X	X	
		Antelope Valley AQMD	Los Angeles (northeast portion)	X	X	
4	Mountain Counties	Amador County APCD	Amador	X		
		Calaveras County APCD	Calaveras	X	X	
		Mariposa County APCD	Mariposa	X	X[2]	
		Tuolumne County APCD	Tuolumne	X		
		El Dorado County AQMD	El Dorado (western portion)	X	X	
		Placer County APCD	Placer (central portion)	X	X	
		Northern Sierra AQMD	Nevada	X	X	
			Plumas		X	X[4]
			Sierra		X	
5	North Central Coast	Monterey Bay Unified APCD	Santa Cruz	X	X	
			Monterey	X	X	
			San Benito	X	X	
6	North Coast	Northern Sonoma County APCD	Sonoma (northern portion)	X		
		North Coast Unified AQMD	Del Norte		X	
			Humboldt		X	
			Trinity		X	
		Mendocino AQMD	Mendocino		X	
7	Northeast Plateau	Siskiyou County APCD	Siskiyou	X		
		Modoc APCD	Modoc		X	
		Lassen APCD	Lassen		X	

Table C-2
2006 State Nonattainment Areas for Ozone, PM_{10}, and $PM_{2.5}$

	State Nonattainment Air Basin	Air District	County	Ozone	PM_{10}	$PM_{2.5}$
8	Sacramento Valley	Butte County AQMD	Butte	X	X	X
		Colusa County APCD	Colusa	X[1]	X	
		Glenn County APCD	Glenn	X[1]	X	
		Shasta County AQMD	Shasta	X	X	
		Feather River AQMD	Sutter	X	X	
			Yuba	X	X	
		Tehama County APCD	Tehama	X	X	
		Sacramento Metro AQMD	Sacramento	X	X	X
		Placer County APCD	Placer (western portion)	X	X	X
		Yolo-Solano AQMD	Solano (eastern portion)	X	X	
			Yolo	X	X	
9	Salton Sea	South Coast AQMD	Riverside (central portion)	X	X	
		Imperial County APCD	Imperial	X	X	X[3]
10	San Diego	San Diego County APCD	San Diego	X	X	X
11	San Francisco Bay Area	Bay Area AQMD	Alameda	X	X	X
			Contra Costa	X	X	X
			Marin	X	X	X
			Napa	X	X	X
			San Francisco	X	X	X
			San Mateo	X	X	X
			Santa Clara	X	X	X
			Solano (western portion)	X	X	X
			Sonoma (southern portion)	X	X	X
12	San Joaquin Valley [5]	San Joaquin Valley APCD	Fresno	X	X	X
			Kern (western portion)	X	X	X
			Kings	X	X	X
			Madera	X	X	X
			Merced	X	X	X
			San Joaquin	X	X	X
			Stanislaus	X	X	X
			Tulare	X	X	X

Table C-2
2006 State Nonattainment Areas for Ozone, PM_{10}, and $PM_{2.5}$

	State Nonattainment Air Basin	Air District	County	Ozone	PM_{10}	$PM_{2.5}$
13	South Central Coast	San Luis Obispo County APCD	San Luis Obispo	X	X	
		Santa Barbara County APCD	Santa Barbara	X	X	
		Ventura County APCD	Ventura (continental portion)	X	X	X
14	South Coast	South Coast AQMD	Los Angeles (western portion)	X	X	X
			Orange	X	X	X
			Riverside (western portion)	X	X	X
			San Bernardino (southwestern portion)	X	X	X

(ARB, 2006a; 2006b)

1. Nonattainment-Transitional
2. Yosemite National Park Only
3. City of Calexico Only
4. Portola Valley Only
5. In April 2007, the Governing Board of the San Joaquin Valley Air District voted to ask the U.S. EPA to designate the air basin as "Extreme" nonattainment for ozone. This designation would create a deadline of 2024 for the basin to meet the federal 8-hour ozone standard.

In many of the nonattainment districts, substantial additional emission reductions will be necessary in order to achieve and maintain the State ozone standard. The SCM will be available for adoption by the above districts in order to reduce VOC emissions and attain or maintain the State ozone and PM standards.

C.3. Status of Air Quality – Federal Standards

Federal law also indicates that the U.S. Congress intends progress toward clean air to be made as quickly as possible. The federal Clean Air Act declares that the federal air quality standards are to be achieved "...as expeditiously as practicable..." (Federal Clean Air Act, sections 172(a)(2), 181(a), and 188(c)).

Thirty-five counties or portions of counties are designated as nonattainment for the federal 8-Hour Ozone standard with attainment dates ranging from 2007 to 2021. Table C-3 lists the districts that have been designated "nonattainment" because they exceed federal standards for ozone. The San Joaquin Valley and South Coast air basins are expected to have until 2023 to attain the federal standard, by invoking the "bump-up" provision in the federal Clean Air Act.

For particulate matter, the South Coast Air Basin and the San Joaquin Valley Air Basin are the only two areas in the State that exceed the annual federal PM 2.5 standard. These areas are required by federal law to develop SIPs describing how they will attain the standards by 2015. The U.S. EPA further requires that all necessary emission reductions be achieved one calendar year sooner – by 2014

– in recognition of the annual average form of the standard. The Owens Valley is the only federal PM10 nonattainment area. It did not meet its December 31, 2006 attainment date and must submit plan revisions by December 31, 2007 detailing how it will reach attainment.

Table C-3
8-Hour Federal Ozone Nonattainment Areas

	Federal Nonattainment Area	Air District	County	Federal 8-Hr Ozone Designation (Attainment Year)
1	Amador and Calaveras Counties (Central Mountain)	Amador County APCD	Amador	Subpart 1 (2009)
		Calaveras County APCD	Calaveras	
2	Chico	Butte County AQMD	Butte	Subpart 1 (2009)
3	Imperial County	Imperial County APCD	Imperial	Marginal (2007)
4	Kern County (Eastern Kern)	Kern County APCD	Kern (eastern portion)	Subpart 1 (2009)
5	Los Angeles South Coast Air Basin	South Coast AQMD	Los Angeles (western portion)	Severe-17 (2021)
			Orange	
			Riverside (western portion)	
			San Bernardino (southwestern portion)	
6	Los Angeles – San Bernardino Counties (Western Mojave)	Antelope Valley AQMD	Los Angeles (northeastern portion)	Moderate (2010)
		Mojave Desert AQMD	San Bernardino (central portion)	
7	Mariposa and Tuolumne Counties (Southern Mountain)	Mariposa County APCD	Mariposa	Subpart 1 (2009)
		Tuolumne County APCD	Tuolumne	
8	Nevada County (Western Part)	Northern Sierra AQMD	Nevada (western portion)	Subpart 1 (2009)
9	Riverside County (Coachella Valley)	South Coast AQMD	Riverside (central portion)	Serious (2013)
10	Sacramento Metro	El Dorado County AQMD	El Dorado (western portion)	Serious (2013)
		Placer County APCD	Placer (western portion)	
		Sacramento Metro AQMD	Sacramento	
		Yolo-Solano AQMD	Solano (eastern portion)	
			Yolo	
11	San Diego	San Diego County APCD	San Diego	Subpart 1 (2009)

Table C-3
8-Hour Federal Ozone Nonattainment Areas

	Federal Nonattainment Area	Air District	County	Federal 8-Hr Ozone Designation (Attainment Year)
12	San Francisco Bay Area	Bay Area AQMD	Alameda	Marginal (2007)
			Contra Costa	
			Marin	
			Napa	
			San Francisco	
			San Mateo	
			Santa Clara	
			Solano (western portion)	
			Sonoma (southern portion)	
13	San Joaquin Valley	San Joaquin Valley APCD	Fresno	Serious (2013)
			Kern (western portion)	
			Kings	
			Madera	
			Merced	
			San Joaquin	
			Stanislaus	
			Tulare	
14	Sutter County (Sutter Buttes)	Feather River AQMD	Sutter (Sutter Buttes portion)	Subpart 1 (2009)
15	Ventura County	Ventura County APCD	Ventura (continental portion)	Moderate (2010)
	15 Federal Nonattainment Areas	**20 Air Districts**	**35 Counties**	

(U.S. EPA, 2007)

C.5. Improving Air Quality

Over the past 40 years, air pollution control agencies in California have been working diligently to improve air quality. Much of the effort was directed towards the more traditional sources of air pollution such as mobile sources (e.g., cars, trucks, etc.) and stationary sources (e.g., factories, power plants, etc.)
While there have been dramatic gains in reducing emissions from these traditional sources, there is a need for further reductions from other sources of emissions, including architectural coatings, to continue to make progress toward meeting the State and Federal ambient air quality standards and protecting the public health of California citizens. Emissions from all other sources, including architectural coatings, have become more significant as emissions from the traditional sources are further reduced. Therefore, the emissions from these sources must be evaluated for further reductions.

Architectural coatings comprise an important source of emissions in California because they are widely distributed, emit VOCs when used, and contribute to the air pollution problem in California. Although each container of paint may seem to be a small source of emissions, when the total number of users in California is aggregated, the total VOC emissions become significant. Implementation of the proposed SCM will continue the progress toward meeting California's air quality goals.

C.6. State Implementation Plan Commitments

For areas with unhealthy levels of air pollutants, clean air laws require districts to develop plans to describe how they will attain ambient air quality standards. The CCAA requires districts that have been designated nonattainment for the State ambient air quality standards to prepare and submit plans for attaining and maintaining the standards (see Health and Safety Code §40910 *et seq*.). In addition, the federal Clean Air Act requires that districts designated nonattainment for the federal ambient air quality standards prepare State Implementation Plans (SIPs) to demonstrate attainment with the federal standards. SIPs are a compilation of several documents, including new and previously submitted plans, programs (e.g., monitoring, modeling, permitting, etc.), district rules, State regulations and federal controls. State law makes ARB the lead agency for submittal of California's SIPs. Local air districts and other agencies (e.g., Bureau of Automotive Repair) prepare SIP elements and submit them to ARB for review and approval. ARB forwards the compiled SIP revisions to U.S. EPA for approval.

There are 15 non-attainment areas for the federal ozone standard and 2 non-attainment areas for the PM2.5 standard. For these areas, Ozone SIPs and PM2.5 SIPs must be adopted and sent to the U.S. EPA by June 2007 and April 2008, respectively. The SIPs must show how each area will attain the federal standards. To do this, the SIPs will identify the amount of emissions that must be reduced in each area to meet the standard and the emission controls needed to reduce the necessary emissions. Emission reductions from district rules, including architectural coatings rules, are an essential part of California's effort to attain air quality standards for ozone.

Six local air districts in two federal ozone nonattainment areas included control measures for architectural coatings in their draft or final 2007 Ozone SIPs. These districts are:

- El Dorado AQMD[1]
- Feather River AQMD[1]
- Placer County APCD[1]
- Sacramento Metropolitan AQMD[1]
- San Joaquin Valley Unified APCD[2]
- Yolo-Solano AQMD[1]

1. The Sacramento Federal Ozone Nonattainment Area includes all of Sacramento and Yolo Counties, portions of Placer and El Dorado Counties, eastern Solano County and southern Sutter County.
2. San Joaquin Valley Unified APCD adopted its ozone SIP in April 2007

Table C-4 lists the emission reduction commitments for architectural coatings in the draft or final 2007 Ozone SIPs for each district.

Table C-4
2007 Ozone SIP Commitments For VOC Emission Reductions From Architectural Coating Measures

District	Implementation Year	2012 ROG Planning Inventory[2] (tpd)	Emission Reductions in 2012 (tpd)	% Reductions
El Dorado County AQMD[1]	2012	0.38	0.06	16%
Feather River AQMD	Pre-2012	0.02	0.003	15%
Placer County APCD[3]	2013	0.89	0.13	15%
Sacramento Metropolitan AQMD	2012	4.12	0.62	15%
San Joaquin Valley Unified APCD	2012	9.7	2.0	21%
Yolo-Solano County AQMD	2011	0.96	0.14	15%
TOTAL:		**16.1**	**2.95**	**18%**

1. El Dorado County had not yet adopted the 2000 SCM limits at the time that the draft 2007 SIP was developed. Therefore, their SIP Commitment value is actually larger, but for the purpose of this table we are only including the 2007 SCM commitment.
2. The 2012 ROG Planning Inventory is based on ARB's 2001 Architectural Coating Survey and does not reflect the data from ARB's 2005 Architectural Coating Survey that was used to develop the proposed SCM.
3. For Placer County, values represent the 2018 ROG Planning Inventory and the 2018 Emission Reductions.

ARB staff believes that the proposed SCM will achieve reductions that are in line with emission reductions claimed by districts in their draft 2007 Ozone SIPs (see Table C-5). The proposed SCM is expected to achieve about a 28 percent emission reduction. The values in Table C-5 assume that the emissions from architectural coatings are approximately 95 tpd statewide, on an annual average basis, not including emissions from thinning and clean-up (ARB, 2006c). Statewide emissions are apportioned to districts, based on population. Districts outside of the South Coast AQMD represent 56% of the State's population which corresponds to 53 tpd of VOC emissions from architectural coating usage. The South Coast AQMD is not expected to adopt the proposed SCM because its architectural coatings Rule 1113 includes VOC limits that are, in most cases, at least as stringent as the proposed SCM. Since the non-South Coast districts are the primary target for adoption of the SCM, we are only estimating emission reductions for those districts. The emission reductions from the SCM are estimated to be about 4.3 tpd for the six districts with SIP commitments and about 10.7 tpd from the remaining non-South Coast districts for a total estimated emission reduction of 15 tpd, in the non-South Coast AQMD portion of the State.

Table C-5
Comparison of Estimated Emission Reductions From the Proposed SCM and the 2007 Ozone SIP Commitments

	[A]	[B] =[A]*[95 tpd]	[C]	[D] = [B]*[C]	[E] = [A]/[56%]	[F] =[E]*[15 tpd]
Districts with SIP Commitments	**% of CA Population[2]**	**Emission Inventory (TPD in 2004)[3]**	**SIP Commitment (%)**	**SIP Commitment (TPD in 2004)**	**% of Total SCM Reductions**	**Reductions From SCM (TPD in 2004)**
El Dorado (part)[1]	0.50%	0.48	16%	0.08	0.89%	0.13
Feather River	0.40%	0.38	15%	0.06	0.71%	0.11
Placer County	0.80%	0.76	15%	0.11	1.43%	0.21
Sacramento Metro	3.70%	3.52	15%	0.53	6.61%	0.99
San Joaquin	9.80%	9.31	21%	1.96	17.50%	2.63
Yolo-Solano	0.90%	0.86	15%	0.13	1.61%	0.24
TOTAL:	**16.1%**	**15.3**		**2.9**		**4.3**

1. El Dorado County had not yet adopted the 2000 SCM limits at the time that the draft 2007 SIP was developed. Therefore, their SIP Commitment value includes reductions from the 2000 SCM and the proposed 2007 SCM.
2. The "% of CA Population" may not represent the entire district population. For some districts in the Sacramento Nonattainment Area, only a portion of the district population is included for SIP planning purposes.
3. Emission Inventory data are based on data from ARB's 2005 Architectural Coating Survey. These data are for coatings only and do not include emissions from thinning solvents, cleanup solvents, or additives.

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APPENDIX D:

SUMMARY OF CURRENT VOC LIMITS

NOTE: This summary is provided for comparison purposes ONLY. Please refer to the official rule language for compliance purposes.

Table D-1: Summary of Architectural Coating Rules and VOC Limits[1] in California

Agency	U.S. EPA	CARB	Antelope	Bay Area	Butte	Colusa	El Dorado	Fea-ther River	Imperial	Kern	Mojave	Monterey	Northern Sonoma	Pla-cer	Sacra-mento	San Diego	San Joaquin	San Luis Obispo	Santa Barbara	Sha-sta	South Coast	The-hama	Ventura	Yolo-Solano
Rule Reference	63 FR 176: 48848	SCM	1113	8-3	230	2.26	215	3.15	424	410.1	1113	426	485	218	442	67	4601	433	323	3:31	1113	4:39	74.2	2.14
Adopted	Sep 98	Jun 77	Jul 97	Mar 78	July 79	1979	Sep 94	June 91	Nov 82	Apr 72	Feb 79	May 79	Apr-02	Jun 79	Dec 78	Nov 77	Apr 91	Mar-02	Oct 71	May-02	Sep 77	Aug-02	Jun 79	Nov-01
Last Amended	Feb 00	Jun 00	Mar-03	Nov 01	Aug-02	Jul-02	Sep 94	Nov-02	Feb-05	Sep-06	Feb-03	Apr-02		Dec-01	May-01	Dec-01	Oct-01		Nov-01		Jun-06		Nov-01	
Antenna	530	530	530	530	530	530		530	530	530	530	530	530	530	530	530	530	530	530	530		530	530	530
Anti-Fouling	450	400	400	400	400	400		400	400	400	400	400	400	400	400	400	400	400	400	400		400	400	400
Anti-Graffiti	600						340																	
Bituminous Coatings and Mastics	500																							
Bituminous Roof Coatings		300	300	300	300	300		300	300	300	300	300	300	300	300	300	300	300	300	300		300	300	300
Bituminous Roof Primers		350	350	350	350	350		350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Bond Breakers	600	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Calcimine Recoaters	475																							
Chalkboard Resurfacers	450																							
Concrete Curing Compounds	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	100	350	350	350
Concrete Curing Compounds for Roadways and Bridges																					350			
Concrete Curing and Sealing Compounds	700																							
Concrete Protective	400																							
Concrete Surface Retarders	780																							
Conversion Varnishes	725																							
Dry Fog	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	150	400	400	400
Extreme High Durability	800																							
Faux Finishing/ Glazing (Japans)	700	350	350	350	350	350		350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350

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Rule Reference	63 FR 176: 48848	SCM	1113	8-3	230	2.26	215	3.15	424	410.1	1113	426	485	218	442	67	4601	433	323	3:31	1113	4:39	74.2	2.14
Fire Proofing, Exterior																					350			
Fire Resistive		350	350	350	350	350		350	350	350	350	350	350	350	350	350	350	350	350	350		350	350	350
Fire Retardant, Clear		650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650	650
Fire Retardant, Opaque (Pigmented)		350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Fire Retardant/ Resistive, Clear	850																							
Fire Retardant/ Resistive, Opaque	450																							
Flats	250	100	100	100	100	100	(250)[2]	100	100	100	100	100	100	100	100	100	100	100	100	100	50 [3]	100	100	100
Flats, Specialty							400																	
Floor	400	250	250	250	250	250		250	250	250	250	250	250	250	250	250	250	250	250	250	50	250	250	250
Flow	650	420	420	420	420	420		420	420	420	420	420	420	420	420	420	420	420	420	420		420	420	420
Form Release Compounds	450	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250		250	250	250
Graphic Arts (Sign Paints)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Heat Reactive	420																							
High Temperature Industrial Maintenance							420														420			
High Temperature	650	420	420	420	420	420		420	420	420	420	420	420	420	420	420	420	420	420	420		420	420	420
Impacted Immersion	780																							
Industrial Maintenance	450	250	250	250	250	250	420	250	250	250	250	250	250	250	250	250	250	250	250	250	100 [3]	250	250	250
Lacquers, Clear Brushing		680	680	680	680	680		680	680	680	680	680	680	680	680	680	680	680	680	680	275	680	680	680
Lacquers, Clear or Opaque/ Pigmented (including clear lacquer sanding sealers)	680	550	550	550	550	550	680	550	550	550	550	550	550	550	550	550	550	550	550	550	275	550	550	550
Low Solids Coatings[1]		120	120	120	120	120		120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Low Solids Stains[1]	120						120																	
Low Solids	120						120																	

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Wood Preservatives[1]																								
Magnesite Cement	600	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
Mastic Texture	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Metallic Pigmented	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Multi-Color	580	250	250	250	250	250	420	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Nonferrous Ornamental Metal Lacquers and Surface Protectants	870																							
Nonflat Coatings	380	150	150	150	150	150	(250)[2]	150	150	150	150	150	150	150	150	150	150	150	150	150	50	150	150	150
Nonflat High Gloss Coatings		250	250	250	250	250	(250)[2]	250	250	250	250	250	250	250	250	250	250	250	250	250	50	250	250	250
Nuclear	450																							
Pre-Treatment Wash Primers	780	420	420	420	420	420	675	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420
Primers and Undercoaters	350																							
Primers, Sealers, and Undercoaters		200	200	200	200	200	350	200	200	200	200	200	200	200	200	200	200	200	200	200	100	200	200	200
Quick Dry Enamels	450	250	250	250	250	250	400	250	250	250	250	250	250	250	250	250	250	250	250	250	50	250	250	250
Quick Dry Primers, Sealers, and Undercoaters	450	200	200	200	200	200		200	200	200	200	200	200	200	200	200	200	200	200	200	100	200	200	200
Recycled Coatings		250	250	250	250	250		250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Repair and Maintenance Thermoplastic	650																							
Roof	250	250	250	250	250	250	300	250	250	250	250	250	250	250	250	250	250	250	250	250	50	250	250	250
Roof, Aluminum																					100			
Rust Preventative	400	400	400	400	400	400		400	400	400	400	400	400	400	400	400	400	400	400	400	100	400	400	400
Sanding Sealers																					275			
Sanding Sealers (Non-Lacquer)	550	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350		350	350	350
Sealers	400																							

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(including interior clear wood sealers)																								
Shellacs, Clear	730	730	730	730	730	730	730	730	730	730	730	750	730	730	730	730	730	730	730	730	730	730	730	730
Shellacs, Opaque/ Pigmented	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550
Specialty Primers																					100			
Specialty Primers, Sealers, and Undercoaters		350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350		350	350	350
Stains		250	250	250	250	250		250	250	250	250	250	250	250	250	250	250	250	250	250		250	250	250
Stains, Clear	550																							
Stains, Exterior																					100			
Stains, Interior																					250			
Stains, Semi-transparent	550						350																	
Stains, Opaque	350						350																	
Stain Controllers	720																							
Swimming Pool	600	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340
Swimming Pool Repair & Maintenance		340	340	340	340	340	650	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340
Temperature-Indicator Safety		550	550	550	550	550		550	550	550	550	550	550	550	550	550	550	550	550	550		550	550	550
Thermoplastic Rubber and Mastics	550																							
Traffic	150	150	150	150	150	150	250	150	150	150	150	150	150	150	150	150	150	150	150	150	100	150	150	150
Varnishes	450	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	275	350	350	350
Waterproofing Sealers		250	250	250	250	250	400	250	250	250	250	250	250	250	250	250	250	250	250	250	100	250	250	250
Waterproofing Concrete/ Masonry Sealers		400	400	400	400	400		400	400	400	400	400	400	400	400	400	400	400	400	400	100	400	400	400
Water Proofing Sealers and Treatments	600																							

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Water Proofing Sealers and Treatments, Opaque	600																							
Wood Preservatives		350	350	350	350	350		350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Wood Preservatives, Below Ground	550						350														350			
Wood Preservatives, Clear and Semi-transparent	550						350																	
Wood Preservatives, Opaque	350						350																	
Zinc Rich Industrial Maintenance Primers																					100			
Zone Marking	450																							

Notes:

1. Volatile Organic Compound (VOC) limits are expressed as “VOC Regulatory” or “Coating VOC” (grams of VOC per liter of coating, less water and exempt compounds) for all categories except Low Solids. The VOC limit for Low Solids is expressed as VOC Actual or Material VOC (grams VOC per liter of coating, including water and exempt compounds)
2. Parentheses indicate 250 g/l VOC limits that are based on El Dorado’s default provision, but the limits are not specifically stated in the rule.
3. The South Coast AQMD Rule 1113 VOC limit for Flat coatings becomes effective on 7/1/08. Rule 1113 allows for the use of tertiary Butyl Acetate as an exempt solvent to meet the 100 g/l VOC limit for the Industrial Maintenance category only.
4. The EPA rule states that if a coating is not included in their table of VOC limits, it is classified as either a Flat (250 g/l) or Nonflat (380 g/l) based on the gloss level.
   The ARB 2000 SCM and many district rules state that, if a coating is not included in their table of VOC limits, it is classified as either a Flat (100 g/l) or Nonflat (150 g/l) based on the gloss level.
5. California districts not mentioned in this table are subject to the VOC limits in the U.S. EPA National Architectural Coating Rule

APPENDIX E:

EMISSION REDUCTION CALCULATION METHODOLOGY

Emission Reduction Calculations

ARB staff estimated emission reductions based on 2004 sales data, as reported in the 2005 Survey. For each category with a proposed reduction in VOC limit, ARB staff calculated the expected emission reductions for each product that was reported in that category. For each reported product in the survey,

[Emission Reductions] = [Pre-Limit Emissions] – [Post-Limit Emissions]

where
"Pre-Limit Emissions" are calculated directly from survey data for each product, as reported
"Post-Limit Emissions" are estimates based on the potential impact of the lower VOC limit

ARB staff used the following assumptions and protocols to perform emission reduction calculations:

- When estimating "Post-Limit Emissions", we assumed that the volume percent of solids remained constant for each product after it was reformulated to meet the proposed VOC limit.
- When estimating "Post-Limit Emissions", we assumed that the sales volume remained constant for each product after it was reformulated to meet the proposed VOC limit.
- When estimating "Post-Limit Emissions", we assumed a portion of the VOC in each product was replaced by either water or exempt compounds after the product was reformulated to meet the proposed VOC limit.
- If a product was included in an averaging program and had a high VOC content that exceeded the limit in the 2000 SCM, we did not calculate emission reductions from the product's high VOC content. For high-VOC products in averaging programs, we only calculated emission reductions from the VOC limit in the 2000 SCM down to the proposed VOC limit.
- If a product was noncompliant and had a high VOC content that exceeded the limit in the 2000 SCM, we did not calculate emission reductions from the product's high VOC content. For high-VOC noncompliant products, we only calculated emission reductions from the VOC limit in the 2000 SCM down to the proposed VOC limit.
- If a product was "overcompliant" and had a low VOC content that was below the limit in the 2000 SCM, but above the proposed limit, we only calculated emission reductions from the product's actual VOC content down to the proposed VOC limit.
- If a product was "overcompliant" and had a low VOC content that was already below the proposed limit, no emission reductions were calculated.

- Emission reductions were only calculated for products sold in large containers (greater than one liter), because small containers (one liter or less) are exempt from the SCM VOC limits.

The next section of this appendix contains a document with a detailed explanation of the methodology that was used to calculate emissions and emission reductions.

NOTE: The following document was submitted to the United States Environmental Protection Agency in December, 2005, in response to a request for comments regarding emission reduction calculations methods. This document describes ARB's recommended methodology for calculation of emission reductions.

California Air Resources Board (ARB) Comments

Reference: Federal Register, Vol. 70, No. 168, August 31, 2005, U.S. Environmental Protection Agency (U.S. EPA), "Advance Notice to Solicit Comments, Data and Information for Determining the Emissions Reductions Achieved In Ozone Nonattainment and Maintenance Areas From the Implementation of Rules Limiting the VOC Content of AIM Coatings" (i.e., ANPR)

Background: U.S. EPA is soliciting comments, data and information for determining how to calculate the reductions in volatile organic compound (VOC) emissions achieved in ozone nonattainment and maintenance areas from the implementation of rules which limit the VOC content of architectural coatings (commonly referred to as architectural and industrial maintenance, or AIM, coatings). In response to the ANPR, ARB is submitting a recommended methodology that is detailed below.

ARB's Recommended Methodology for Calculating Emission Reductions

ARB has completed seven surveys of AIM coatings sold in California, and we are currently working on our eighth AIM survey. A summary of the surveys is provided below:

Surveyed Calendar Year	Sales Volume (gallons)	VOC Emissions (pounds) [1]	VOC Emissions per Gallon Sold (lb VOC/gal)
1975	48,206,000	82,417,000	1.71
1980	57,247,000	91,949,000	1.61
1984	58,481,000	97,718,000	1.67
1988	77,876,000	84,124,000	1.08
1990	77,056,000	77,236,000	1.00
1996	87,496,000	72,594,000	0.83
2000	98,455,172	80,104,000	0.81
2004	In progress	-	-

1. Emissions do not include emissions from thinning and cleanup solvents.

The most recent three surveys have collected particularly detailed data, including: VOC ingredient weight percentages; VOC_{ACTUAL} (a.k.a., Material VOC); $VOC_{REGULATORY}$ (a.k.a., Coating VOC); and Volume Percent Solids. ARB and the local air districts have used this survey data to characterize specific

coating categories and conduct detailed analyses of the impacts that may result from lower VOC limits.

Based on our experience, we believe that the methodology for calculating emission reductions is dependent upon the type of data that are available to support the calculation. If detailed survey data are available that include specific product information, a detailed analysis of potential reductions can be conducted for each product. If no detailed data are available, it will be necessary to use a more general approach that relies on emission factors and estimated product parameters, as illustrated in the following table.

	AVAILABLE DATA	EMISSION REDUCTION CALCULATION METHOD
Option 1:	Detailed Product Information is Available, Including: • VOC_{ACTUAL} • $VOC_{REGULATORY}$ • Volume % Solids • Sales Volume	Calculate potential emission reductions for each reported product in each coating category.
Option 2:	Only General Data are Available: • e.g., Nationwide Sales and Population	Calculate overall emission reductions for entire coating category.

Each of these approaches is discussed below.

<u>Option 1: Detailed Emission Inventory</u>

Step 1: Identify the available data.
Conducting a survey of coating manufacturers is one of the best ways to collect detailed data on the AIM coatings being sold in the area of concern. It is important that survey data be representative of the geographic area and the appropriate VOC limits. For example, the most recent survey data from California may not be representative of coatings that are being sold elsewhere in the United States, because California's longstanding VOC limits have been generally lower than those in other states. In addition, coatings that have high sales volumes in California may have lower sales volumes in other parts of the country.

Available data should include a detailed survey with the following information for each reported AIM product:

- VOC_{ACTUAL} (Material VOC)
- $VOC_{REGULATORY}$ (Coating VOC)
- Volume % Solids
- Sales Volume (gallons)

Step 2: Calculate emission reductions for each product. (see Appendix for details)

Emission reductions represent the difference between the VOC emissions before a limit is adopted and the emissions after a limit is adopted.

For each reported product in the survey,
[Emission Reductions] = [Pre-Limit Emissions] – [Post-Limit Emissions]

"Pre-Limit Emissions" can be calculated directly from survey data for each product:

[Pre-Limit Emissions, lbs VOC] = [VOC_{ACTUAL}, lb VOC/gal coating]*[Sales Volume, gals coating]

"Post-Limit Emissions" are estimates based on the potential impact of the lower $VOC_{REGULATORY}$ limit. When the $VOC_{REGULATORY}$ limit is lowered, some coatings will need to be reformulated and, consequently, they will have a new VOC_{ACTUAL} value. It's possible to predict a new VOC_{ACTUAL} value using the following equation:

$$[\text{NEW } VOC_{ACTUAL}] = \frac{[\text{Avg. VOC Density, g/l}]*[VOC_{REGULATORY}\text{ Limit, g/l}]*[\text{Vol. \% Solids}]}{([\text{Avg. VOC Density, g/l}]-[VOC_{REGULATORY}\text{ Limit, g/l}])}$$

where
Average VOC Density = 880 grams/liter
$VOC_{REGULATORY}$ Limit = New $VOC_{REGULATORY}$ Limit, grams/liter
Vol. % Solids = Volume Percent Solids, as reported for each product

[Post-Limit Emissions, lbs VOC] = [NEW VOC_{ACTUAL}, lb VOC/gal coating]*[Sales Volume, gals coating]

Calculation of the predicted new VOC_{ACTUAL} is based on the following assumptions:

- **Maintain constant Volume % Solids.**
  It is assumed that the volume percentage of solids in the reformulated coating will be the same as the volume percentage of solids for the coating reported in the survey. When analyzing our survey data, we have not found a linear correlation between VOC_{ACTUAL} values and volume percentage of solids. This is illustrated in Figure 1, a scatter diagram that shows volume percentage of solids vs. VOC_{ACTUAL} content for Flat and Nonflat architectural coatings. Therefore, we see no need to adjust solids contents when analyzing the effects of lower VOC limits.

Because we are assuming the volume percentage of solids remains constant in the coatings, we use the reported volume of coatings when estimating the "Post-Limit Emissions". There is no need to adjust the reported volume up or down to account for the same amount of overall solids being applied to surfaces.

- **Maintain constant sales volume.**
  As just mentioned, it is assumed that the volume of reformulated coating will be the same as the volume of existing coatings reported in the survey. However, some have argued that this approach underestimates future sales volume, because they believe it takes more low-VOC waterborne coating (e.g., 90%-100% more) to provide the same amount of hiding power as a high-VOC solventborne coating. A gallon of waterborne coating generally contains a lower volume percentage of solids than a gallon of solventborne coating, and it is assumed that less solids means less hiding power. ARB recently sponsored a research project that disproves this claim. The project tested the hiding properties of ten solventborne coatings and twenty waterborne coatings by determining the quantity of coating that was required to provide equivalent hiding. On average, it took approximately 1.3 gallons of waterborne coating and 1.1 gallons of solventborne coating, a difference of only 18%, to provide equivalent hiding when painting a typical room. (Incidentally, the waterborne coating only emitted an average of 0.3 lbs of VOCs, while the solventborne coating emitted 2.9 lbs of VOCs.) Therefore, we believe this study also supports our assumption to keep the coating volume constant. Some results from this research project are provided in Figure 2, which contains graphs that illustrate the gallons of coating required to provide hiding vs. VOC content.

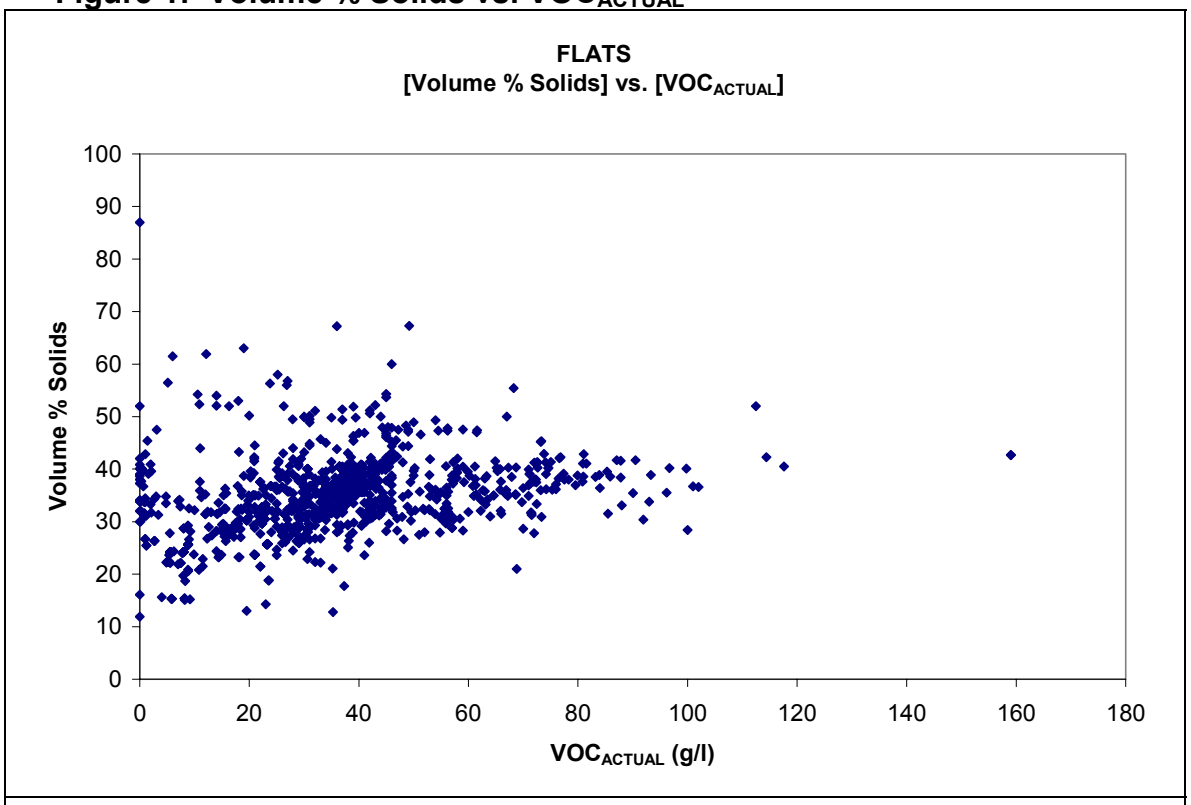
- **Assume a portion of the VOC in the product is replaced by either water or exempt compounds to meet the new $VOC_{REGULATORY}$ limit.**

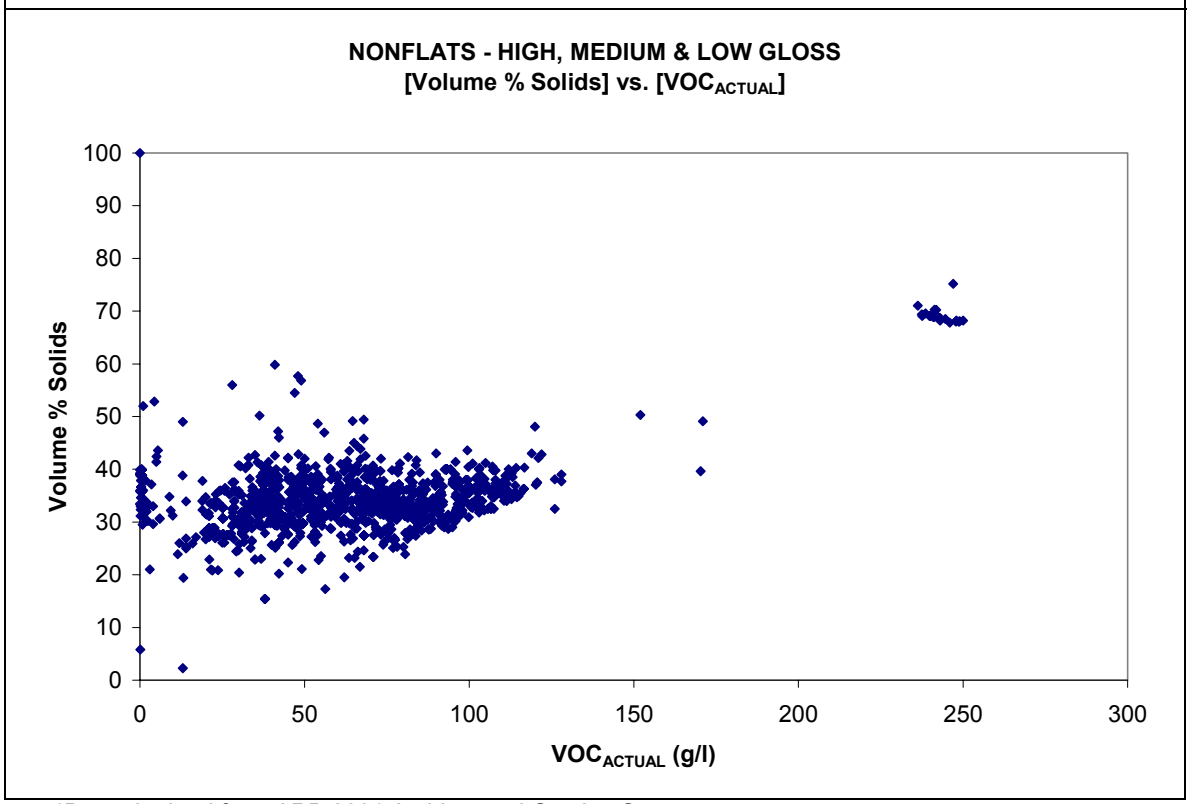
Step 3: Determine Overall Emission Reduction Percentage.

After emission reductions are calculated for each product, add up the individual reductions to determine the overall emission reduction percentage:

$$[\%\ \text{Reduction}] = \frac{([\text{Total Pre-Limit Emissions}] - [\text{Total Post-Limit Emissions}])}{[\text{Total Pre-Limit Emissions}]}$$

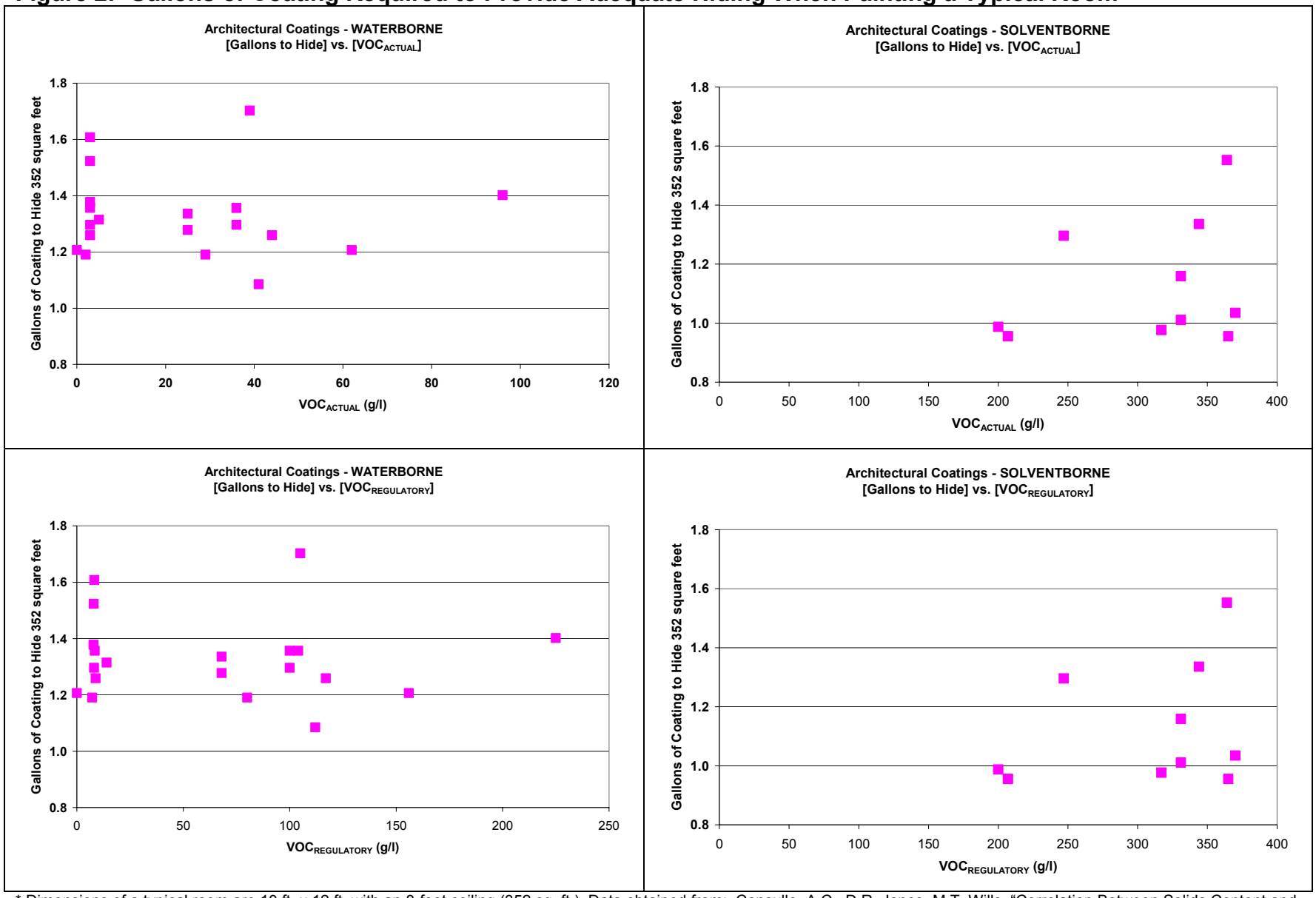
Figure 1: Volume % Solids vs. VOC_{ACTUAL}*





*Data obtained from ARB 2001 Architectural Coating Survey.
Note: Charts do not include coatings with $VOC_{REGULATORY}$ greater than 250 g/l.

Figure 2: Gallons of Coating Required to Provide Adequate Hiding When Painting a Typical Room*



* Dimensions of a typical room are 10 ft. x 12 ft. with an 8-foot ceiling (352 sq. ft.) Data obtained from: Censullo, A.C., D.R. Jones, M.T. Wills, "Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings", Table 14, dated December 2004.

Option 2: General Emission Inventory

Step 1: Identify the available data.
If detailed local survey data are not available, emission reductions can be estimated using general publicly-available information. At a minimum, the available data should include the following, both of which can be obtained from the U.S. Census website:

- Nationwide Sales Volume
- Population or Housing Unit Data (state and national)

Nationwide coating sales volume can be obtained from the following report that is available on the U.S. Census website:

- Current Industrial Report, MA325F – Paint and Allied Products
  http://www.census.gov/industry/1/ma325f04.pdf

  (Note: When using this report, AIM coatings include those titled "Architectural Coatings", "Industrial New Construction and Maintenance Paints", and "Traffic Marking Paints".)

After using the Current Industrial Report to identify total AIM sales nationwide, it's possible to assign a portion of the nationwide sales to an individual state, by using the state's percentage of national population or housing units. Population data and housing unit data can be found on the following U.S. Census website:

- http://www.census.gov/popest/states/tables/NST-EST2003-01.pdf
  http://factfinder.census.gov/home/saff/main.html

Step 2: Determine appropriate emission factors.
Use an emission factor based on pounds VOC emitted per gallon of coating (i.e., VOC_{ACTUAL}.) ARB Architectural Coating Surveys can be used to identify sales-weighted average values for VOC_{ACTUAL} in various categories. Survey reports are readily available online which include data summaries for coating sales that occurred during calendar years 1990, 1996, and 2000. For some categories, the types of coatings that were reported in older ARB surveys may be similar to the types of coatings being sold currently in other states where VOC limits are higher. However, it is important to note that coatings sold in California have historically been subject to more stringent VOC limits than coatings sold elsewhere in the United States. For example, in 1990, Nonflat architectural coatings in California were being regulated with a 250 g/l VOC limit. This limit is significantly lower than the 380 g/l VOC limit that was adopted under the U.S. EPA's 1998 National Volatile Organic Compound Emission Standards for Architectural Coatings, which is currently in place in much of the U.S. Due to these differences, emission factors based on California survey data may be lower than the appropriate factors for other areas of the United States. Alternatively, the summary

table on page 1 of this document can be used to estimate an overall emission factor for architectural coatings.

ARB staff do not recommend using ARB's on-line emission inventory data to determine emission factors on a per capita basis. This data incorporates highly localized information that may not be appropriate for other areas. For example, the growth percentages that are used to develop emission forecasts are specific to different California county government organizations. In addition, California has 35 air districts and these districts can have different architectural coating regulations, which result in different control factors within the emissions inventory. Air districts in California can have one of the following three types of architectural coating rules: (1) A rule that is based on ARB's 2000 Suggested Control Measure; (2) U.S. EPA's 1998 National Volatile Organic Compound Emission Standards for Architectural Coatings; or (3) the South Coast Air Quality Management District's Rule 1113. For these reasons and others, we believe that statewide survey data from actual survey reports are the best source of information when trying to develop general emission factors.

Step 3: Determine appropriate control factors.
The supporting documentation for architectural coating regulations will usually contain the expected percent reduction in VOC emissions that will result when the regulation is implemented (i.e., the control factor.) Sources of control factors include the following:

- ARB Staff Report for the Proposed Suggested Control Measure for Architectural Coatings, Executive Summary; June 6, 2000; http://www.arb.ca.gov/coatings/arch/sreport/vol1-2.pdf
- South Coast Air Quality Management District Rule 1113, amendments adopted on: Nov. 8, 1996; May 14, 1999; and Dec. 5, 2003. SCAQMD staff reports are available at http://www.aqmd.gov

It is also possible to estimate control factors, using a variation of the method discussed previously in Option #1 and the following equations:

$$[\text{Control Factor, \%}] = \frac{[\text{Pre-Limit VOC}_{\text{ACTUAL}}\text{, g/l}]-[\text{NEW VOC}_{\text{ACTUAL}}\text{, g/l}]}{[\text{Pre-Limit VOC}_{\text{ACTUAL}}\text{, g/l}]}$$

where

Pre-Limit VOC_{ACTUAL}, g/l = The VOC_{ACTUAL} value for a typical coating, prior to adoption of a new limit. In some cases, sales-weighted average VOC_{ACTUAL} values can be obtained from ARB survey reports. However, it is important to note that the ARB values may be lower than those found in other parts of the United States.

$$[\text{NEW VOC}_{\text{ACTUAL}}] = \frac{[\text{Avg. VOC Density, g/l}]*[\text{VOC}_{\text{REGULATORY}}\text{ Limit, g/l}]*[\text{Vol. \% Solids}]}{([\text{Avg. VOC Density, g/l}]-[\text{VOC}_{\text{REGULATORY}}\text{ Limit, g/l}])}$$

Average VOC Density = 880 grams/liter
$VOC_{REGULATORY}$ Limit = New $VOC_{REGULATORY}$ Limit, grams/liter
Vol. % Solids = Volume Percent Solids, % for a typical coating. In some cases, sales-weighted average Volume % Solids values can be obtained from ARB survey reports. However, it is important to note that the ARB values may be different than those found in other parts of the United States.

Step 4: Calculate overall emission reductions.

Determine potential emission reductions (see Appendix for details.)
For the entire inventory,
[Emission Reductions, lbs] = [Coating Sales, gals]*[Emission Factor, lb/gal]*[Control Factor, %]

Conclusion: ARB staff believes that the methodology that is used for calculation of emission reductions for AIM coatings should be flexible enough to accommodate the type of data that are available to support the analysis. It is unlikely that there is one method that will be suitable for all regions of the country, because the types of coatings and the available data vary widely depending on location. Therefore, we encourage U.S. EPA to develop guidance on this topic that gives states and regions the flexibility to account for these differences, rather than adopting a rule that would result in a prescriptive approach.

This Appendix contains detailed emission reduction calculations, based on the two approaches discussed in the main document.

Option 1: Detailed Emission Inventory

Step 1: Identify the available data.

Product	VOC_{ACTUAL} (g/l)	$VOC_{REGULATORY}$ (g/l)	Volume % Solids	Sales Volume (gals)
#1	78	190	33%	10,000
#2	110	220	39%	7,500
#3	350	350	55%	5,000
#4	55	140	34%	2,500

Step 2: Calculate emission reductions for each product.

Eqn. 1: [Pre-Limit Emissions, lbs VOC] = [VOC_{ACTUAL}, lb VOC/gal coating]*[Sales Volume, gals coating]

Eqn. 2: $$[\text{NEW } VOC_{ACTUAL}, \text{ g/l}] = \frac{[\text{Dvoc, g/l}]*[VOC_{REGULATORY} \text{ Limit, g/l}]*[\text{Vs}]}{([\text{Dvoc, g/l}]-[VOC_{REGULATORY} \text{ Limit, g/l}])}$$

where

Dvoc = Average VOC Density, which is assumed to be approximately 880 grams/liter

$VOC_{REGULATORY}$ Limit = New $VOC_{REGULATORY}$ Limit, grams/liter

Vs = Volume Percent Solids, %

To convert from units of (grams/liter) to (lbs/gal):

$$[VOC_{ACTUAL}, \frac{\textit{lbs VOC}}{\textit{gal coating}}] = [VOC_{ACTUAL}, \frac{\textit{grams VOC}}{\textit{liter coating}}] * \frac{[1 \text{ lb VOC}]}{[454 \textit{ grams VOC}]} * \frac{[3.785 \text{ liters coating}]}{[1 \text{ gal coating}]}$$

Eqn. 3: [Post-Limit Emissions, lbs VOC] = [NEW VOC_{ACTUAL}, lb VOC/gal]*[Sales Volume, gals coating]

Eqn.4: [Emission Reductions] = [Pre-Limit Emissions] – [Post-Limit Emissions]

Example Calculation for Product #1:

[Pre-Limit Emissions] = [78 grams/liter]*[1 lb/454 grams]*[3.785 liters/gal]*[10,000 gals] = 6,503 lbs VOC

Assume the New $VOC_{REGULATORY}$ Limit is 150 g/l.

$$[\text{NEW } VOC_{ACTUAL}] = \frac{[880 \text{ g/l}]*[150 \text{ g/l}]*[33\%]}{([880 \text{ g/l}]-[150 \text{ g/l}])} = 60 \text{ g/l}$$

[Post-Limit Emissions] = [60 g/l]*[1 lb/454 grams]*[3.785 liters/gallon]*[10,000 gals] = 5,002 lbs VOC

[Emission Reductions] = [6,503] – [5,002] = 1,501 lbs VOC

A summary of the emission reduction calculations for Products #1- #4 is provided below. All products are in the same coating category with a new $VOC_{REGULATORY}$ Limit of 150 g/l.

Product	Pre-Limit Emissions (lbs VOC)	NEW VOC_{ACTUAL} (g/l)	Post-Limit Emissions (lbs VOC)	Emission Reduction (lbs VOC)
#1	6,503	60	5,002	1,501
#2	6,878	71	4,440	2,438
#3	14,590	100	4,169	10,421
#4	1,146	No reductions were calculated for Product #4, because it already complied with the new $VOC_{REGULATORY}$ limit.		0
TOTAL:	29,117			14,360

Step 3: Determine Overall Emission Reduction Percentage.

For these four products, the overall emission reduction percentage:

$$[\%\ \text{Reduction}] = \frac{([29{,}117] - [14{,}360])}{[29{,}117]} = 51\%$$

<u>Option 2: General Emission Inventory</u>

Step 1: Identify the available data.

For example, the following table illustrates how to estimate coating usage data for Arizona:

	United States	Arizona
Population in 2004	285,691,501	5,633,997 (2% of United States)
Housing Units	122,671,734	2,458,231 (2% of United States)
Sales Volume:		
Architectural Coatings	822,186,000 gals	16,443,720 gals
Industrial New Construction and Maintenance Paints - Interior	22,492,000 gals	449,840 gals
Industrial New Construction and Maintenance Paints - Exterior	35,167,000 gals	703,340 gals
Traffic Marking Paints	35,907,000 gals	718,140 gals

Step 2: Determine appropriate emission factors.

Category	Emission Factors*, based on 1990 sales (lb VOC/gal)	Emission Factors*, based on 1996 sales (lb VOC/gal)
Architectural Coatings	0.93	0.74
Industrial New Construction and Maintenance Paints – Interior & Exterior	2.86	2.43
Traffic Marking Paints	0.90	0.93

*Emission factors are based on data reported in ARB Architectural Coating surveys and they do not include emissions from the use of thinning and cleanup solvents.

Example emission calculations are provided below, using emission factors based on ARB 1996 data:

Category	Example Emissions Calculations
Architectural Coatings	[16,443,720 gals]*[0.74 lb/gal] = 12,168,353 lbs
Industrial New Construction and Maintenance Paints – Interior & Exterior	[449,840+703,340 gals]*[2.43 lb/gal] = 2,802,227 lbs
Traffic Marking Paints	[718,140 gals]*[0.93 lb/gal] = 667,870 lbs

Total Pre-Limit Emissions = 12,168,353 + 2,802,227 + 667,870 lbs = 15,638,450 lbs emitted

Step 3: Determine appropriate control factors.

Listed below are the AIM VOC limit reductions from ARB's 2000 Suggested Control Measure. For California, these reductions resulted in a control factor of approximately 20% from a 1996 baseline. However, control factors can vary, depending on the particular emission inventory for an area and the combination of old limits and new limits.

Category	Control Factor = 20%, based on ARB SCM	
	Old Limit	***New Limit***
Flat	250	100
Industrial Maintenance	420	250
Lacquers	680	550
Multi-Color	420	250

Category	**Control Factor = 20%, based on ARB SCM**	
	Old Limit	***New Limit***
Nonflat: High Gloss	250	250
Nonflat: Low Gloss	250	150
Nonflat: Medium Gloss	250	150
Primer, Sealer, Undercoater	350	200
Quick Dry Enamel	400	250
Quick Dry Primer, Sealer, Undercoater	450	200
Roof	300	250
Rust Preventative	420	400
Stains: Clear/Semitransparent & Opaque	350	250
Swimming Pool Repair & Maintenance	650	340
Traffic Marking Paints	250	150
Waterproofing Sealers	400	250

Alternatively, control factors for individual categories can be estimated using the following equations:

$$[\text{Control Factor, \%}] = \frac{[\text{Pre-Limit VOC}_{\text{ACTUAL}}\text{, g/l}]-[\text{NEW VOC}_{\text{ACTUAL}}\text{, g/l}]}{[\text{Pre-Limit VOC}_{\text{ACTUAL}}\text{, g/l}]}$$

where

Pre-Limit VOC_{ACTUAL}, g/l = The VOC_{ACTUAL} value for a typical coating, prior to adoption of a new limit. In some cases, sales-weighted average VOC_{ACTUAL} values can be obtained from ARB survey reports. However, it is important to note that the ARB values may be lower than those found in other parts of the United States.

$$[\text{NEW VOC}_{\text{ACTUAL}}] = \frac{[\text{Avg. VOC Density, g/l}]*[\text{VOC}_{\text{REGULATORY}}\text{ Limit, g/l}]*[\text{Vol. \% Solids}]}{([\text{Avg. VOC Density, g/l}]-[\text{VOC}_{\text{REGULATORY}}\text{ Limit, g/l}])}$$

Average VOC Density = 880 grams/liter
$VOC_{REGULATORY}$ Limit = New $VOC_{REGULATORY}$ Limit, grams/liter
Vol. % Solids = Volume Percent Solids, % for a typical coating. In some cases, sales-weighted average Volume % Solids values can be obtained from ARB survey reports. However, it is important to note that the ARB values may be different than those found in other parts of the United States.

This alternative method has the advantage of being able to provide estimated emission reductions for individual categories, rather than using an overall control factor for all categories. To use this method, it is necessary to identify typical coatings that provide representative values for the Pre-Limit VOC_{ACTUAL} and Volume % Solids. This information can be obtained by working with manufacturers and reviewing product data sheets.

Provided below is an example of estimated control factors for several categories. These factors were estimated using ARB architectural coating survey data, but the same approach can be used by inputting data obtained from manufacturers and different values for the old and new VOC limits.

	ARB SURVEY DATA - 1996 SALES						
Coating Category	**SWA VOC_{REG} (g/l)**	**SWA VOC_{ACTUAL} (g/l)**	**SWA Vol. % Solids**	**Old VOC_{REG} Limit (g/l)**	**New VOC_{REG} Limit (g/l)**	**NEW VOC_{ACTUAL} (g/l)**	**Estd. Control Factor**
Flats	98	40	35%	250	100	39	1%
Industrial Maintenance	300	291	60%	420	250	210	28%
Lacquer – Clear	649	626	20%	680	550	293	53%
Lacquer – Opaque	545	527	27%	680	550	396	25%
Multi-Color	263	163	33%	420	250	115	29%
Nonflat - High Gloss	248	160	40%	250	250	N/A	N/A
Nonflat – Low Gloss	134	61	36%	250	150	65	0%*
Nonflat - Medium Gloss	155	69	37%	250	150	67	3%
Primer, Sealer, Undercoater	170	118	37%	350	200	96	19%
Quick Dry Enamels	403	393	50%	400	250	175	56%
Quick Dry PSUs	303	272	44%	450	200	114	58%
Roof	23	16	45%	300	250	157	0%*
Rust Preventative	371	367	48%	420	400	352	4%
Stains – Clear	285	240	34%	350	250	119	51%
Stains – Semitransparent	401	357	38%	350	250	133	63%
Stains – Opaque	157	82	36%	350	250	126	0%*
Swimming Pool Repair & Maintenance	569	569	29%	650	340	161	72%
Traffic Marking	154	111	58%	250	150	105	6%
Waterproofing Sealers – Clear	347	234	36%	400	250	126	46%
Waterproofing Sealers – Opaque	219	191	47%	400	250	164	14%

* No estimated control factor could be calculated because the predicted "NEW VOC Actual" value was higher than the existing "SWA VOC Actual" value. Calculation of a control factor by this method requires that the "NEW VOC Actual" be lower than the existing "SWA VOC Actual".
"N/A" = Not Applicable because the VOC limit was not changed. Nonflat – High Gloss is included for informational purposes only.

Step 4: Calculate overall emission reductions.

[Emission Reductions, lbs] = [Coating Sales, gals]*[Emission Factor, lb/gal]* [Control Factor, %]

Category	Example Emission Reduction Calculations
Architectural Coatings	[16,443,720 gals]*[0.74 lb/gal]*[20%] = 2,433,671 lbs
Industrial New Construction and Maintenance Paints – Interior & Exterior	[449,840+703,340 gals]*[2.43 lb/gal]*[20%] = 560,446 lbs
Traffic Marking Paints	[718,140 gals]*[0.93 lb/gal]*[20%] = 133,574 lbs

Total Reductions = 2,433,671 + 560,446 + 133,574 lbs = 3,127,691 lbs reduced

Assumptions:
(1) Arizona's current product mix is similar to California's 1996 product mix.
(2) Arizona's current VOC limits are similar to California's pre-2000 SCM limits.
(3) The overall control factor is 20%.

APPENDIX F:

SCM WORKSHOP NOTICES

Air Resources Board

Linda S. Adams
Secretary for Environmental Protection

Robert F. Sawyer, Ph.D., Chair
1001 I Street • P.O. Box 2815
Sacramento, California 95812 • www.arb.ca.gov

Arnold Schwarzenegger
Governor

November 7, 2006

Dear Sir or Madam:

You are invited to participate in a public workshop to discuss proposed changes to the Air Resources Board's (ARB or Board) Suggested Control Measure for Architectural Coatings (SCM). The SCM is a model rule which has been used by California air pollution control districts to develop architectural coating rules. Currently, twenty air districts have rules based on the SCM that was approved by the Board in 2000.

At the workshop ARB staff will discuss the following:

- Project timeline and development activities;
- ARB's architectural coating survey analysis;
- Districts' State Implementation Plan commitments;
- Coating category definitions and other SCM areas of concern; and
- Concept of reactivity-based standards.

The date, time, and location of the workshop are:

Date:	Tuesday, December 12, 2006
Time:	10:00 a.m. to 12:00 p.m.
Location:	Training 2 West and East, 2nd Floor
Address:	Cal/EPA Headquarters 1001 I Street Sacramento, California 95812

If you wish to participate by phone, please contact Lynna Negri at (916) 324-8018 or at lnegri@arb.ca.gov to ensure that adequate phone lines are available. The dial-in number for phone participants is (866) 755-6191, passcode 2181331.

At least one week prior to the workshop, we will post an agenda and handouts on our website at http://www.arb.ca.gov/coatings/arch/arch.htm. To be notified of when these materials are posted, please sign up for the Architectural Coatings ListServe at http://www.arb.ca.gov/listserv/arch-ctgs.htm.

We look forward to your participation in this workshop. If you have special accommodations or language needs, please contact Lynna Negri at (916) 324-8018 or at lnegri@arb.ca.gov. TTY/TTD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service. For public transportation information, please contact Regional Transit at (916) 321-BUSS or view the transportation information on the California Environmental Protection Agency's web site at http://calepa.ca.gov/epabldg/location.htm.

If you have any questions about the workshop, please contact Mr. Jim Nyarady, Manager, Strategy Evaluation Section, at (916) 322-8273 or jnyarady@arb.ca.gov.

Sincerely,

Barbara Fry, Chief
Measures Assessment Branch

cc: Mr. Jim Nyarady, Manager
Strategy Evaluation Section

Air Resources Board

Linda S. Adams
Secretary for Environmental Protection

Robert F. Sawyer, Ph.D., Chair
1001 I Street • P.O. Box 2815
Sacramento, California 95812 • www.arb.ca.gov

Arnold Schwarzenegger
Governor

February 8, 2007

Dear Sir or Madam:

You are invited to participate in a public workshop to discuss proposed changes to the Air Resources Board's (ARB or Board) Suggested Control Measure for Architectural Coatings (SCM). The SCM is a model rule which has been used by California air pollution control districts to develop architectural coating rules. Currently, twenty air districts have rules based on the SCM that was approved by the Board in 2000.

At the workshop ARB staff will discuss the following:

- Project timeline and development activities;
- Preliminary proposed VOC limits; and
- Preliminary proposed revisions to coating category definitions.

The date, time, and location of the workshop are:

Date:	Tuesday, March 13, 2007
Time:	1:30 p.m. to 3:30 p.m.
Location:	Training 1 East and West, 1st Floor
Address:	Cal/EPA Headquarters 1001 I Street Sacramento, California 95812

If you wish to participate by phone, please contact Sarah Penfield at (916) 324-8181 or at spenfiel@arb.ca.gov to ensure that adequate phone lines are available. The dial-in number for phone participants is (866) 755-6191, passcode 2181331.

Prior to the workshop, we will post an agenda and handouts on our website at http://www.arb.ca.gov/coatings/arch/arch.htm. To be notified of when these materials are posted, please sign up for the Architectural Coatings ListServe at http://www.arb.ca.gov/listserv/arch-ctgs.htm.

We look forward to your participation in this workshop. If you have special accommodation needs, please contact ARB's Disability Coordinator at (916) 323-4916. If you are a person with limited English and would like to request interpreter services, please contact ARB's Bilingual Manager at (916) 323-7053. TTY/TTD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service. For public transportation information, please contact Regional Transit at (916) 321-BUSS or view the transportation information on the California Environmental Protection Agency's web site at http://calepa.ca.gov/epabldg/location.htm.

If you have any questions about the workshop, please contact Mr. Jim Nyarady, Manager, Strategy Evaluation Section, at (916) 322-8273 or jnyarady@arb.ca.gov.

Sincerely,

Barbara Fry, Chief
Measures Assessment Branch

cc: Mr. Jim Nyarady, Manager
Strategy Evaluation Section

Air Resources Board

Linda S. Adams
Secretary for Environmental Protection

Robert F. Sawyer, Ph.D., Chair
1001 I Street • P.O. Box 2815
Sacramento, California 95812 • www.arb.ca.gov

Arnold Schwarzenegger
Governor

May 1, 2007

Dear Sir or Madam:

You are invited to participate in a public workshop to discuss proposed changes to the Air Resources Board's (ARB or Board) Suggested Control Measure for Architectural Coatings (SCM). The SCM is a model rule which has been used by California air pollution control districts to develop architectural coating rules. Currently, twenty air districts have rules based on the SCM that was approved by the Board in 2000.

At the workshop ARB staff will discuss the following:

- Project timeline and development activities;
- Draft proposed revisions to the SCM rule language;
- Draft proposed VOC limits; and
- Draft proposed revisions to coating category definitions.

The date, time, and location of the workshop are:

Date:	Wednesday, June 6, 2007
Time:	9:00 a.m. to 12:00 p.m.
Location:	Training 1 East and West, 1st Floor
Address:	Cal/EPA Headquarters 1001 I Street Sacramento, California 95812

If you wish to participate by phone, please contact Sarah Penfield at (916) 324-8181 or at spenfiel@arb.ca.gov to ensure that adequate phone lines are available. The dial-in number for phone participants is (866) 755-6191, passcode 2181331.

Prior to the workshop, we will post an agenda and handouts on our website at http://www.arb.ca.gov/coatings/arch/arch.htm. To be notified of when these materials are posted, please sign up for the Architectural Coatings ListServe at http://www.arb.ca.gov/listserv/arch-ctgs.htm.

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website: http://www.arb.ca.gov.

California Environmental Protection Agency

Printed on Recycled Paper

We look forward to your participation in this workshop. If you have special accommodation needs, please contact ARB's Disability Coordinator at (916) 323-4916. If you are a person with limited English and would like to request interpreter services, please contact ARB's Bilingual Manager at (916) 323-7053. TTY/TTD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service. For public transportation information, please contact Regional Transit at (916) 321-BUSS or view the transportation information on the California Environmental Protection Agency's web site at http://calepa.ca.gov/epabldg/location.htm.

If you have any questions about the workshop, please contact Mr. Jim Nyarady, Manager, Strategy Evaluation Section, at (916) 322-8273 or jnyarady@arb.ca.gov.

Sincerely,

Barbara Fry, Chief
Measures Assessment Branch

cc: Mr. Jim Nyarady, Manager
Strategy Evaluation Section

APPENDIX G:

ECONOMIC ANALYSIS DETAILS

Summary of Economic Analysis Methodology

Summary

The total cost of the proposed SCM to affected businesses is estimated to be $4 million per year in annualized nonrecurring costs and $8.3 million per year in recurring costs. This equates to $12.3 million dollars annually over the project horizon. This represents the cost of raw materials, research and development, equipment, testing, and training to architectural coatings manufacturers.

This appendix covers the methodology used in the Economic Analysis presented in Chapter 7. The methodology is similar to what was used in previous ARB regulations (ARB, 1990; ARB, 1991; ARB, 1997; ARB, 1999; ARB, 2000; ARB, 2003; ARB, 2004; ARB, 2005) and follows guidelines recommended by Cal/EPA for economic analysis (Cal/EPA, 1996).

Methodology

For this analysis, we considered the impact to architectural coatings manufacturers. Although other entities such as distributors, retailers, end users and raw material suppliers may be impacted, coating manufacturers will be the primary entities affected.

First, we analyzed data from the 2005 Architectural Coatings Survey to determine complying and noncomplying volume for the 16 categories that have a proposed change to the VOC limit, and a projected emission reduction of more than .01 tons per day (tpd) outside of the South Coast Air Quality Management District (SCAQMD). We assumed that costs would not be incurred for coatings in a category that did not have a proposed limit. We also determined the number of noncomplying products and the expected emission reductions for each of these categories based on the survey data. These data are summarized in Table G-1.

Table G-1
Survey Data Inputs for Cost Calculations Outside of SCAQMD for Categories with Greater Than .01 TPD Emission Reduction

Coating Category	Proposed Limit (g/l)	Emission Reductions (Tons/Day)	Estimated # of Non-Compliant Products	Estimated # of Non-Compliant Gallons per Year
Aluminum Roof	400	0.19	48	193,566
Bituminous Roof	50	0.17	42	79,722
Concrete Masonry Sealer	100	0.54	243	647,318
Dry Fog	150	0.31	39	120,535
Flat	50	3.12	2,079	19,213,031
Floor	100	0.07	167	100,834

Table G-1
Survey Data Inputs for Cost Calculations Outside of SCAQMD for Categories with Greater Than .01 TPD Emission Reduction

Coating Category	Proposed Limit (g/l)	Emission Reductions (Tons/Day)	Estimated # of Non-Compliant Products	Estimated # of Non-Compliant Gallons per Year
Mastic Texture	100	0.10	22	79,316
Non Flat	100	2.79	2,121	12,649,813
Non Flat High Gloss	150	0.91	362	1,074,079
PSU	100	1.12	323	3,747,874
Roof	50	0.07	87	135,698
Rust Preventative	250	1.57	303	832,567
Specialty PSU	100	2.62	70	859,266
Traffic Marking	100	0.09	87	320,397
Waterproofing Membrane	250	0.09	13	98,848
Wood Coatings	275	1.41	940	736,786
Total		**15.2**	**6,946**	**40,889,649**

We collected data from manufacturers with the 2007 Economic Impacts Survey. This survey was sent to all manufacturers who responded to the 2005 Architectural Coatings Survey who manufactured products in one of the affected categories. This survey collected information on the number of products that would need to be reformulated due to the proposed limits of the SCM and the cost to reformulate those products.

Based on responses to the ARB Economic Survey and discussions with manufacturers, more than half of the non-complying products that will be reformulated will be in response to the proposed limits of the SCAQMD. This is confirmed by comparing the portion of non-complying products in the ARB 2005 survey and the responses to the Economic Survey. For the purposes of this analysis, we assumed that half of the non-complying products would be reformulated due to the proposed limits of the SCM.

From these responses, we sorted the recurring and non-recurring costs by category where applicable, and applied the average of all responses in categories that did receive a specific response. This data is summarized in Table G-2.

Table G-2 Non-Recurring and Recurring Cost from 2007 ARB Economic Impacts Survey		
Coating Category	**ARB Economic Survey Reported Nonrecurring Cost to Reformulate (Dollars per Product)**	**ARB Economic Survey Reported Non-Raw Material Recurring Costs (Dollars per Year per Product)**
Aluminum Roof	11,625	$86,328
Bituminous Roof	17,171	$75,537
Concrete Masonry Sealer	6,068	$437,036
Dry Fog	7,332	$70,142
Flat	3,642	$3,739,082
Floor	14,893	$300,350
Mastic Texture	7,332	$39,567
Nonflat	4,014	$3,814,619
Nonflat High Gloss	4,719	$651,057
PSU	5,681	$580,916
Roof	17,281	$156,470
Rust Preventative	7,332	$544,946
Specialty PSU	4,263	$125,895
Traffic Marking	8,533	$156,470
Waterproofing Membrane	7,332	$23,381
Wood Coatings	5,391	$1,690,590

Based on the ARB survey, product data sheets and discussions with manufacturers, staff determined the ingredients of typical complying and non-complying formulations for the 20 categories. These formulations were sent out to industry for comments.

Data on the raw materials were obtained from chemical manufacturers, distributors of raw materials, Chemical Market Reporter (CMR) Magazine, and discussions with manufacturers. Resin costs are the primary influence on raw materials cost for most coatings and, because there are a variety of resins with differing costs, resins have the most variable impact on raw materials cost. Resin costs were taken from the CMR chemical prices in 2000, and were inflated by the producer price index between 2000 and 2007 for plastic material and resin manufacturers (BLS, 2007).

In cases where there were no data available for an ingredient, a default price of $1.50 per pound was used.

Comparing the difference in raw material costs between typical complying and non-complying formulations gave us the amount of cost or cost savings in raw materials a manufacturer would incur if changing from a typical non-compliant

coating to a typical complying coating. These costs are summarized in Table G-3.

Table G-3
Raw Material Cost Differential Between Complying and Non-Complying Products

Coating Category	Raw Material Cost of a Typical Complying Formulation	Raw Material Cost of a Typical Non-Complying Formulation	Difference of Raw Material Cost of Complying and Non-Complying per Gallon
Aluminum Roof	$3.17	$3.66	-$0.49
Bituminous Roof	$2.57	$2.96	-$0.39
Concrete Masonry Sealer	$2.35	$3.52	-$1.17
Dry Fog	$6.87	$8.71	-$1.85
Flat	$4.13	$4.45	-$0.32
Floor	$5.24	$4.24	$1.00
Mastic Texture	$5.85	$4.43	$1.42
Nonflat	$5.58	$4.86	$0.72
Nonflat High Gloss	$4.35	$5.99	-$1.64
PSU	$4.64	$4.23	$0.42
Roof	$5.54	$7.48	-$1.94
Rust Preventative	$5.98	$7.57	-$1.59
Specialty PSU	$4.53	$6.30	-$1.77
Traffic Marking	$3.79	$3.55	$0.24
Waterproofing Membrane	$12.27	$8.35	$3.90
Wood Coatings	$5.00	$9.67	-$4.67

These costs were multiplied by the non-complying volume to determine the recurring raw material related cost of the proposed limits.

The recurring costs from Table G-2 were multiplied by the number of products that would need to be reformulated for each category. The total annual cost is the sum of the raw material related costs, the recurring non-raw material costs and annualized non-recurring costs. These calculations are summarized in Table G-4.

Table G-4 Calculated Annual Cost				
Coating Category	**Annual Recurring Costs (Raw Material) Dollars per Year**	**Annual Recurring Costs (Non-raw Material) Dollars per Year**	**Annualized Nonrecurring Cost Dollars per Year**	**Total Annual Cost per Year**
Aluminum Roof	-$94,785	$86,328	$64,441.97	$55,985
Bituminous Roof	-$30,718	$75,537	$83,287.43	$128,106
Concrete Masonry Sealer	-$749,150	$437,036	$170,288.94	-$141,826
Dry Fog	-$222,428	$70,142	$33,023	-$119,264
Flat	-$6,189,405	$3,739,082	$874,438	-$1,575,886
Floor	$100,339	$300,350	$287,232	$687,922
Mastic Texture	$112,598	$39,567	$18,629	$170,794
Nonflat	$9,120,928	$3,814,619	$983,224	$13,918,771
Nonflat High Gloss	-$1,758,417	$651,057	$197,285	-$910,076
PSU	$1,563,126	$580,916	$211,915.10	$2,355,957
Roof	-$263,878	$156,470	$173,629	$66,220
Rust Preventative	-$1,324,934	$544,946	$256,566	-$523,423
Specialty PSU	-$1,517,941	$125,895.00	$34,463	-$1,357,584
Traffic Marking	$78,066	$156,470	$85,735	$320,271
Waterproofing Membrane	$385,012	$23,381	$11,008	$419,401
Wood Coatings	-$3,443,964	$1,690,590	$585,185	-$1,168,189
Total	**-$4,235,550**	**$12,492,381**	**$4,070,350**	**$12,327,181**

The cost effectiveness is determined by taking the total annual cost of a category and dividing by the annual emission reduction. Assuming all costs are passed on to consumers, we calculate the cost increase per gallon. The cost increase per gallon to end users is determined by taking the total cost of the category, dividing by the number of non-compliant gallons, and multiplying by a factor of 4X. This represents the assumption that the cost of a product is doubled from the manufacturer to the distributor, and is doubled again from the distributor to the end user. Taking the raw material costs for complying and non-complying products, and using the same 4X multiplier gives cost increase per gallon. This data is summarized in Table G-5.

Table G-5 Calculated Cost-Effectiveness and Cost Increase Per Gallon				
Coating Category	**Individual Cost Effectiveness for Each Limit (Dollars per Pound VOC Reduced)**	**Cost Increase to Consumers per Gallon (4X)**	**Typical Non-Complying Cost per Gallon**	**Typical Complying Cost per Gallon**
Aluminum Roof	$0.41	$1.16	$14.63	$12.67
Bituminous Roof	$1.02	$6.43	$11.84	$10.30
Concrete Masonry Sealer	-$0.36	-$0.88	$14.09	$9.40
Dry Fog	-$0.52	-$3.96	$34.86	$27.47
Flat	-$0.69	-$0.33	$17.81	$16.52
Floor	$13.90	$27.30	$16.96	$20.94
Mastic Texture	$2.37	$8.61	$17.72	$23.40
Non Flat	$7.03	$4.40	$19.44	$22.32
Non Flat High Gloss	-$1.37	-$3.39	$23.96	$17.41
PSU	$2.73	$2.51	$16.90	$18.57
Roof	$1.38	$1.95	$29.94	$22.16
Rust Preventative	-$0.46	-$2.51	$30.30	$23.93
Specialty PSU	-$0.71	-$6.32	$25.19	$18.12
Traffic Marking	$4.76	$4.00	$14.18	$15.16
Waterproofing Membrane	$6.56	$16.97	$33.38	$48.96
Wood Coatings	-$1.13	-$6.34	$38.70	$20.00
Weighted Average	**$1.12**	**$1.21**		

A sensitivity analysis was conducted to determine the impacts on the annual costs from assumed changes to resin costs, the primary variable influence on raw material costs. We conducted this analysis with four different runs, one baseline and three assumed increases in resin prices. As Table G-6 shows, even with an extreme assumption of 50% increase in compliant resin price, the overall cost-effectiveness of the proposed limits are still consistent with the cost effectiveness values for past ARB regulations shown earlier in Table 7-3.

We assumed the resin costs for complying coatings would increase by a certain level. Resin costs are the primary influence on raw materials cost for most coatings and, because there are a variety of resins with differing costs, resins have the most variable impact on raw materials cost. The resin portion of a coating typically represents about 20% to 50% or more of the total raw materials cost of a gallon of coating. With current ingredient prices as the baseline scenario, we conducted complete cost-effectiveness calculations at 10%, 20%, and 50% assumed increases in compliant resin costs. The 10% and 20%

assumed resin price increases are consistent with the socioeconomic impacts analysis conducted by the SCAQMD and confidential comments provided by some manufacturers. To be conservative, we use the 20% resin price increase assumption wherever we refer to the "average" cost-effectiveness of each limit and the overall cost-effectiveness. The 50% assumed resin price increase is intended as an extreme upper boundary for purposes of the sensitivity analysis and is not suggested by any information available to staff as reflective of projected actual resin prices when the proposed limits become effective.

Table G-6
Cost-Effectiveness of Proposed Limits Under Sensitivity Analysis

	Baseline	10% Increase	20% Increase	50% Increase
Coating Category	**RCM = 1.0**	**RCM = 1.1**	**RCM = 1.2**	**RCM = 1.5**
Aluminum Roof	$0.41	$0.41	$0.41	$0.41
Bituminous Roof	$1.02	$1.02	$1.02	$1.02
Concrete Masonry Sealer	-$0.60	-$0.48	-$0.36	-$0.01
Dry Fog	-$0.86	-$0.69	-$0.52	-$0.01
Flat	-$1.76	-$1.23	-$0.69	$0.92
Floor	$13.06	$13.50	$13.94	$15.26
Mastic Texture	$1.80	$2.09	$2.37	$3.24
Non Flat	$4.65	$5.84	$7.03	$10.61
Non Flat High Gloss	-$1.92	-$1.65	-$1.37	-$0.55
PSU	$1.40	$2.06	$2.73	$4.71
Roof	$0.12	$0.75	$1.38	$3.26
Rust Preventative	-$0.80	-$0.63	-$0.46	$0.06
Specialty PSU	-$0.83	-$0.77	-$0.71	-$0.53
Traffic Marking	$3.47	$4.11	$4.76	$6.70
Waterproofing Membrane	$4.70	$5.63	$6.56	$9.34
Wood Coatings	-$1.48	-$1.31	-$1.13	-$0.62
Overall Cost-Effectiveness	**$0.20**	**$0.65**	**$1.11**	**$2.49**

On the following pages, we present typical formulations for complying and non-complying products. As noted earlier, these formulations were developed based on survey data, product datasheets, and input from manufacturers. In cases where an ingredient comprised less than 5% of the total weight of a formulation, the ingredient was changed to "All Other VOCs" or "All Other Solids." The formulations shown have an assumed 20% increase in resin prices for the future complying product.

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Category	**Aluminum Roof**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	43%	30%
VOC Limit (g/l):	500	400
VOC Reg. for Sample Formulation (g/l):	433	302
Density (lbs/gallon):	8.4	8.4

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Asphalt	$0.17		32%	$0.05	30%	$0.05
Calcium Carbonate	$0.17		7%	$0.01	25%	$0.04
Aluminum	$0.90		17%	$0.15	15%	$0.14
All Other Solids	$0.65		3%	$0.02		
Mineral Spirits	$0.50		22%	$0.11	30%	$0.15
Aromatic 100	$0.50		13%	$0.06		
Medium Aliphatic Solvent Naphtha	$0.42		9%	$0.04		
	Sum		100%		100%	

Total Cost, $/Pound	$0.44	$0.38
% Cost Differential Relative to Current Product		-13.4%
Total Cost, $/Gallon	$3.66	$3.17
Total Cost Differential per Gallon Relative to Current Product		-$0.49

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Bituminous Roof**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	28%	0%
VOC Limit (g/l):	300	50
VOC Reg. for Sample Formulation (g/l):	292	0
Density (lbs/gallon):	8.7	8.7

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Asphalt	$0.17		65%	$0.11	40%	$0.07
Cellulose Fiber	$1.50		5%	$0.08		
Clay Bentonite	$2.00				11%	$0.22
All Other Solids	$0.90		2%	$0.02	1%	$0.01
Water	$0.00				48%	$0.00
Stoddard Solvent	$0.50		28%	$0.14		
	Sum		100%		100%	

Total Cost, $/Pound	$0.34	$0.30
% Cost Differential Relative to Current Product		-13.0%
Total Cost, $/Gallon	$2.96	$2.57
Total Cost Differential per Gallon Relative to Current Product		-$0.39

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **Concrete Masonry Sealer (Water Repellent/Weather Resistance)**

Assumed Resin Cost Multiplier (RCM): 1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	25%	3%
VOC Limit (g/l):	400	100
VOC Reg. for Sample Formulation (g/l):	389	84
Density (lbs/gallon):	13.0	11.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	**Typical Non-Compliant** Cost (B) X (D)	**Typical Compliant** Wt% (E)	**Typical Compliant** Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		5%	$0.06	5%	$0.06
Cement	$0.06		25%	$0.02		
Silica	$0.65		20%	$0.13		
Calcium Carbonate	$0.17		20%	$0.03	27%	$0.05
Acrylic Resin	$0.85	1.2	5%	$0.04	25%	$0.25
Water	$0.00				40%	$0.00
Hydrocarbon Solvent (Naphtha)	$0.46		18%	$0.08		
Aromatic Solvent	$0.50		7%	$0.04		
All Other VOCs	$0.60				2%	$0.01
Additives (VOC)	$1.50				1%	$0.02
	Sum		100%		100%	

Total Cost, $/Pound	$0.40	$0.39
% Cost Differential Relative to Current Product		-2.6%
Total Cost, $/Gallon	$5.16	$4.26
Total Cost Differential per Gallon Relative to Current Product		-$0.91

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound

(2) Average unit size = 1 gallons

(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **Concrete Masonry Sealer (Decorative/Stain Resistance)**

Assumed Resin Cost Multiplier (RCM): 1.2

Physical Properties

	Typical Non-Compliant	Typical Compliant
Weight % VOC:	7%	0%
VOC Limit (g/l):	400	100
VOC Reg. for Sample Formulation (g/l):	372	0
Density (lbs/gallon):	8.6	8.4

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	Typical Non-Compliant Wt% (D)	Typical Non-Compliant Cost (B) X (D)	Typical Compliant Wt% (E)	Typical Compliant Cost (B) X (C) X (E)
Acrylic Resin	$0.85		15%	$0.13		
Siloxane Resin	$1.50	1.2			3%	$0.05
Water	$0.00		78%	$0.00	97%	$0.00
Diethylene Glycol Monomethyl Ether	$1.28		5%	$0.06		
All Other VOCs	$1.35		1%	$0.01		
Additives (VOC)	$1.50		1%	$0.02		
Sum			100%		100%	

	Typical Non-Compliant	Typical Compliant
Total Cost, $/Pound	$0.22	$0.06
% Cost Differential Relative to Current Product		-74.7%
Total Cost, $/Gallon	$1.90	$0.47
Total Cost Differential per Gallon Relative to Current Product		-$1.43

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound

(2) Average unit size = 1 gallons

(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **Dry Fog** Assumed Resin Cost Multiplier (RCM) 1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	29%	3%
VOC Limit (g/l):	400	150
VOC Reg. for Sample Formulation (g/l):	400	85
Density (lbs/gallon):	11.5	11.5

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		26%	$0.31	20%	$0.24
Alkyd Resin	$0.71		45%	$0.32		
Vinyl Acrylic Copolymer Resin	$0.71	1.2		$0.00	40%	$0.34
Water	$0.00			$0.00	37%	$0.00
VM&P Naptha	$0.46		28%	$0.13		
All Other VOCs			1%	$0.01	3%	$0.02
	Sum		100%		100%	

Total Cost, $/Pound	$0.76	$0.60
% Cost Differential Relative to Current Product		-21.2%
Total Cost, $/Gallon	$8.71	$6.87
Total Cost Differential per Gallon Relative to Current Product		-$1.85

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Flat**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties

	Typical Non-Compliant	Typical Compliant
Weight % VOC:	4%	2%
VOC Limit (g/l):	100	50
VOC Reg. for Sample Formulation (g/l):	90	47
Density (lbs/gallon):	10.0	10.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	Typical Non-Compliant Wt% (D)	Typical Non-Compliant Cost (B) X (D)	Typical Compliant Wt% (E)	Typical Compliant Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		19%	$0.22	17%	$0.20
Calcium Carbonate	$0.17		16%	$0.03		$0.00
Silicates	$0.65		9%	$0.06	15%	$0.10
Talc	$0.15				16%	$0.02
Vinyl Acrylic Resin	$0.71	1.2	13%	$0.09	9%	$0.08
Water	$0.00		39%	$0.00	41%	$0.00
All Other VOCs			4%	$0.05	2%	$0.02
	Sum		100%		100%	

Total Cost, $/Pound	$0.45	$0.41
% Cost Differential Relative to Current Product		-7.2%
Total Cost, $/Gallon	$4.45	$4.13
Total Cost Differential per Gallon Relative to Current Product		-$0.32

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Floor**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	6%	3%
VOC Limit (g/l):	250	100
VOC Reg. for Sample Formulation (g/l):	180	95
Density (lbs/gallon):	10.0	11.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		14%	$0.17	16%	$0.19
Calcium Carbonate	$0.17		10%	$0.02	14%	$0.02
Acrylic Resin	$0.85	1.2	20%	$0.17	23%	$0.23
Water	$0.00		50%	$0.00	44%	$0.00
All Other VOCs			6%	$0.07	3%	$0.03
	Sum		100%		100%	

Total Cost, $/Pound	$0.42	$0.48
% Cost Differential Relative to Current Product		12.2%
Total Cost, $/Gallon	$4.24	$5.24
Total Cost Differential per Gallon Relative to Current Product		$1.00

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **Mastic Texture** Assumed Resin Cost Multiplier (RCM) 1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	15%	3%
VOC Limit (g/l):	300	100
VOC Reg. for Sample Formulation (g/l):	239	74
Density (lbs/gallon):	9.5	11.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		8%	$0.09	8%	$0.09
Mica	$0.45		20%	$0.09	26%	$0.12
Perlite	$0.45		5%	$0.02		
Acrylic Resin	$0.85	1.2			28%	$0.28
Alkyd Resin	$0.71	1.2	27%	$0.19		
Water	$0.00		25%	$0.00	35%	$0.00
Hydrocarbon Solvent (Naphtha)	$0.46		15%	$0.07		
All Other VOCs					3%	$0.03
	Sum		100%		100%	

Total Cost, $/Pound	$0.47	$0.53
% Cost Differential Relative to Current Product		14.0%
Total Cost, $/Gallon	$4.43	$5.85
Total Cost Differential per Gallon Relative to Current Product		$1.42

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Non Flat**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	6%	4%
VOC Limit (g/l):	150	100
VOC Reg. for Sample Formulation (g/l):	153	104
Density (lbs/gallon):	10.0	10.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		17%	$0.20	21%	$0.25
Silicates	$0.65				8%	$0.05
All Other Solids			3%	$0.02		
Calcium Carbonate	$0.17		7%	$0.01		
Acrylic Resin	$0.85	1.2	23%	$0.19	22%	$0.22
Water	$0.00		44%	$0.00	45%	$0.00
All Other VOCs			6%	$0.05	4%	$0.03
	Sum		100%		100%	

Total Cost, $/Pound	$0.48	$0.56
% Cost Differential Relative to Current Product		15.6%
Total Cost, $/Gallon	$4.83	$5.58
Total Cost Differential per Gallon Relative to Current Product		$0.75

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **Non Flat High Gloss** Assumed Resin Cost Multiplier (RCM) 1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	6%	3%
VOC Limit (g/l):	250	150
VOC Reg. for Sample Formulation (g/l):	154	106
Density (lbs/gallon):	10.0	10.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	Typical Non-Compliant Wt% (D)	Typical Non-Compliant Cost (B) X (D)	Typical Compliant Wt% (E)	Typical Compliant Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		18%	$0.21	11%	$0.13
Acrylic Resin	$0.85	1.2	27%	$0.23	20%	$0.20
Silica	$0.65		5%	$0.03	11%	$0.07
Water	$0.00		44%	$0.00	55%	$0.00
All Other VOCs			6%	$0.12	3%	$0.03
	Sum		100%		100%	

Total Cost, $/Pound	$0.60	$0.44
% Cost Differential Relative to Current Product		-27.3%
Total Cost, $/Gallon	$5.99	$4.35
Total Cost Differential per Gallon Relative to Current Product		-$1.64

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **PSU** Assumed Resin Cost Multiplier (RCM) 1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	4%	2%
VOC Limit (g/l):	200	100
VOC Reg. for Sample Formulation (g/l):	120	60
Density (lbs/gallon):	10.0	10.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		13%	$0.15	15%	$0.18
All Other Solids			6%	$0.07	5%	$0.06
Acrylic Resin	$0.85	1.2	15%	$0.13	18%	$0.18
Talc	$0.15		12%	$0.02	10%	$0.02
Water	$0.00		50%	$0.00	50%	$0.00
All Other VOCs			4%	$0.05	2%	$0.03
	Sum		100%		100%	

Total Cost, $/Pound	$0.42	$0.46
% Cost Differential Relative to Current Product		10.6%
Total Cost, $/Gallon	$4.20	$4.64
Total Cost Differential per Gallon Relative to Current Product		$0.44

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Roof**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	20%	2%
VOC Limit (g/l):	250	50
VOC Reg. for Sample Formulation (g/l):	252	51
Density (lbs/gallon):	10.5	10.5

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		10%	$0.12	10%	$0.12
Zinc Oxide	$2.20		5%	$0.11	5%	$0.11
Acrylic Resin	$0.85	1.2	30%	$0.25	25%	$0.25
Calcium Carbonate	$0.17		35%	$0.06	18%	$0.03
Water	$0.00				40%	$0.00
All Other VOCs			2%	$0.03	2%	$0.02
Aliphatic Hydrocarbons	$0.50		12%	$0.06		
Propylene Glycol	$1.35		6%	$0.08		
	Sum		100%		100%	

Total Cost, $/Pound	$0.71	$0.53
% Cost Differential Relative to Current Product		-26.0%
Total Cost, $/Gallon	$7.48	$5.54
Total Cost Differential per Gallon Relative to Current Product		-$1.94

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **Rust Preventative** Assumed Resin Cost Multiplier (RCM) 1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	33%	5%
VOC Limit (g/l):	400	250
VOC Reg. for Sample Formulation (g/l):	391	127
Density (lbs/gallon):	9.9	10.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		25%	$0.30	23%	$0.27
All Other Solids	$0.65		4%	$0.03		
Alkyd Resin	$0.71		38%	$0.27		
Acrylic resin	$0.85	1.2			28%	$0.28
Water	$0.00				44%	$0.00
Stoddard Solvent	$0.50		31%	$0.16		
All Other VOCs			2%	$0.02	5%	$0.04
	Sum		100%		100%	

Total Cost, $/Pound	$0.77	$0.60
% Cost Differential Relative to Current Product		-21.8%
Total Cost, $/Gallon	$7.57	$5.98
Total Cost Differential per Gallon Relative to Current Product		-$1.59

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Specialty PSU**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	26%	2%
VOC Limit (g/l):	350	100
VOC Reg. for Sample Formulation (g/l):	312	61
Density (lbs/gallon):	10.0	11.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		8%	$0.09	15%	$0.18
Talc	$0.15		37%	$0.06	23%	$0.03
All Other Solids			4%	$0.06	3%	$0.05
Acrylic Resin	$0.85	1.2			14%	$0.14
Alkyd Resin	$0.71		25%	$0.18		
Water	$0.00				43%	$0.00
All Other VOCs			1%	$0.01	2%	$0.01
Mineral Spirits	$0.95		25%	$0.24		
	Sum		100%		100%	

Total Cost, $/Pound	$0.63	$0.41
% Cost Differential Relative to Current Product		-34.6%
Total Cost, $/Gallon	$6.30	$4.53
Total Cost Differential per Gallon Relative to Current Product		-$1.77

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Traffic Marking**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	7%	5%
VOC Limit (g/l):	150	100
VOC Reg. for Sample Formulation (g/l):	110	78
Density (lbs/gallon):	10.0	10.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Titanium Dioxide	$1.18		7%	$0.08	7%	$0.08
Calcium Carbonate	$0.17		52%	$0.09	53%	$0.09
Acrylic Resin	$0.85	1.2	14%	$0.12	16%	$0.16
Water	$0.00		20%	$0.00	19%	$0.00
All Other VOCs			7%	$0.06	5%	$0.04
	Sum		100%		100%	

Total Cost, $/Pound	$0.35	$0.38
% Cost Differential Relative to Current Product		6.9%
Total Cost, $/Gallon	$3.55	$3.79
Total Cost Differential per Gallon Relative to Current Product		$0.24

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **Waterproofing Membrane** Assumed Resin Cost Multiplier (RCM) 1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	32%	20%
VOC Limit (g/l):	400	250
VOC Reg. for Sample Formulation (g/l):	383	240
Density (lbs/gallon):	10.0	10.0

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Butyl Benzyl Phthalate	$1.50				10%	$0.15
Asphalt	$0.17		10%	$0.02		
Carbon Black	$2.29				10%	$0.23
Calcium Carbonate	$0.17		18%	$0.03	20%	$0.03
Polyurethane Resin	$1.50	1.2	40%	$0.60	40%	$0.72
Water	$0.00					
Hydrocarbon Solvent (Naphtha)	$0.46		28%	$0.13	20%	$0.09
All Other VOCs	$1.50		4%	$0.06		
	Sum		100%		100%	

Total Cost, $/Pound	$0.83	$1.22
% Cost Differential Relative to Current Product		46.7%
Total Cost, $/Gallon	$8.35	$12.24
Total Cost Differential per Gallon Relative to Current Product		$3.90

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Lacquer**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	33%	10%
VOC Limit (g/l):	550	275
VOC Reg. for Sample Formulation (g/l):	545	265
Density (lbs/gallon):	8.3	8.7

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Nitrocellulose	$1.50		20%	$0.30		
Acrylic Resins	$0.85	1.2			20%	$0.20
Polyurethane Resins	$1.50	1.2			8%	$0.14
Additives	$1.50		5%	$0.08	4%	$0.06
Water	$0.00			$0.00	58%	$0.00
Acetone	$0.70		42%	$0.29		
Methyl-n-Amyl Ketone	$1.50		10%	$0.15		
Butyl Acetate	$1.50		10%	$0.15		$0.00
All Other VOCs			13%	$0.05	10%	$0.13
Sum			100%		100%	
Total Cost, $/Pound				$1.11		$0.54
% Cost Differential Relative to Current Product						-51.4%
Total Cost, $/Gallon				$9.36		$4.71
Total Cost Differential per Gallon Relative to Current Product						-$4.65

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category	**Varnish**	Assumed Resin Cost Multiplier (RCM)	1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	36%	10%
VOC Limit (g/l):	350	275
VOC Reg. for Sample Formulation (g/l):	349	271
Density (lbs/gallon):	8.1	8.6

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Polyurethane Resins	$1.50	1.2	56%	$0.82	24%	$0.42
Additives	$1.50		8%	$0.12	6%	$0.09
Water	$0.00			$0.00	60%	$0.00
Distillate (Petroleum), Hydrotreated Light	$0.95		14%	$0.13		
Stoddard Solvent	$1.50		10%	$0.15		
Medium Aliphatic Solvent Naphtha	$0.42		10%	$0.04		
All Other VOCs			2%	$0.02	10%	$0.15
	Sum		100%		100%	

Total Cost, $/Pound	$1.28	$0.66
% Cost Differential Relative to Current Product		-48.8%
Total Cost, $/Gallon	$10.39	$5.65
Total Cost Differential per Gallon Relative to Current Product		-$4.74

Assumptions:

(1) Cost of "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.

Category **Opaque Lacquer** Assumed Resin Cost Multiplier (RCM) 1.2

Physical Properties	**Typical Non-Compliant**	**Typical Compliant**
Weight % VOC:	19%	6%
VOC Limit (g/l):	550	275
VOC Reg. for Sample Formulation (g/l):	438	107
Density (lbs/gallon):	8.5	8.5

Formulation and Cost Comparison

Component (A)	Unit Cost ($/lb) (B)	RCM (C)	**Typical Non-Compliant** Wt% (D)	Cost (B) X (D)	**Typical Compliant** Wt% (E)	Cost (B) X (C) X (E)
Nitrocellulose	$1.50		24%	$0.36		
Titanium Dioxide	$1.18		10%	$0.12	10%	$0.12
Additives	$1.50		2%	$0.03	3%	$0.05
Silicates	$0.65		6%	$0.04	6%	$0.04
Acrylic Resin	$0.85	1.2			26%	$0.26
Calcium Carbonate	$0.17		6%	$0.01	7%	$0.01
Water	$0.00				42%	$0.00
Acetone	$0.70		16%	$0.11		
All Other VOCs			12%	$0.12	6%	$0.08
Isobutyl Isobutyrate	$1.50		5%	$0.08		
Butyl Acetate 1-	$1.50		8%	$0.12		
Isobutyl Acetate	$1.50		6%	$0.09		
VM&P Naphtha	$0.46		5%	$0.02		
Sum			100%		100%	

Total Cost, $/Pound	$1.10	$0.56
% Cost Differential Relative to Current Product		-49.4%
Total Cost, $/Gallon	$9.33	$4.72
Total Cost Differential per Gallon Relative to Current Product		-$4.61

Assumptions:

(1) Cost of "All Others" or "Additives" remains at $1.50 per pound
(2) Average unit size = 1 gallons
(3) RCM: Assumed Compliant Resin Cost Multiplier.
RCM = 1.0 unless otherwise specified.