BOARD MEETING DATE: July 12, 2002 AGENDA NO. 23

PROPOSAL: Annual Status Report on Rule 1113 – Architectural Coatings

SYNOPSIS: On August 13, 1999, the Board approved a workplan with goals and objectives, along with specific activities for implementation of Rule 1113 amendments. This annual report describes progress in its implementation over the past year. The following subjects are addressed: (1) meetings with committees; (2) compliance activities associated with implementation; (3) compliance option averaging plans received and reviewed; and (4) zero-VOC products introduced to the architectural coatings market. Finally, several key technology assessments are discussed and a recently completed report is included for review.

COMMITTEE: Stationary Source, May 24, 2002

RECOMMENDED ACTION:

1. Receive and file.

Barry R. Wallerstein, D.Env.
Executive Officer

EC:LT:LL:DB

Background

Following amendments to Rule 1113- Architectural Coatings on May 14, 1999, the Board approved a workplan for implementation and required updates on future technology assessments. This is the third annual progress report discussing ongoing research relative to specific coating categories.

It is important to note that subsequent regulatory actions at state and local levels across the nation have been modeled after Rule 1113. A multi-state commission created on the East Coast by the U.S. Congress, the Ozone Transport Commission (OTC) Stationary/Area Source Committee (SAS), has established the STAPPA/ALAPCO

Architectural and Industrial Maintenance (AIM) Model Rule to serve as the OTC AIM Coatings Model Rule. The VOC limits in the OTC AIM Model Rule are the same in most cases as those in the California Air Resources Board (CARB) Suggested Control Measure (SCM). In the state of California, thirteen air districts (see Appendix A) have amended their coatings regulations based on SCM that includes VOC limits that are as stringent as the interim limits included in Rule 1113 in nearly every category. For reference, Table 1 compares significant coating categories in the District's Rule 1113 to those found in the CARB suggested control measure. A technology assessment has been completed for low- and zero-VOC formulations for four of the categories listed and the results are discussed in this report.

Table 1 - VOC Comparison

Coating Category	SCAQMD VOC Limit (grams/liter) Effective 7/1/02	CARB SCM (grams/liter) Effective 1/1/03
Flat	100	100
Non-flat (High Gloss)*	150	250
Non-flat (all others)	150	150
Floor*	100	250
Industrial Maintenance	250	250**
Primer, Sealer, Undercoater*	200	200
Quick Dry Enamel	250	250
Roof	250	250
Rust Preventative	400	400
Stains*	250	250
Waterproofing Wood Sealers	250	250***

*These coating categories have been evaluated under a technology assessment study conducted by KTA-Tator and are discussed in this report.
** Effective 1/01/2004.
*** Applies to Waterproofing Sealers for all porous substrates.

The contribution of VOC emissions from architectural coatings constitutes one of the most significant non-mobile sources attributable to ozone pollution within the District. VOCs contribute to the formation of ozone and PM_{10} (particulate matter less than 10 microns in size) that are both in excess of national and state ambient air quality standards, adversely affecting human health and the environment. Through the adoption, promulgation and successful implementation of this regulation, the District Governing Board aims to reduce the 1993 annual average of 56.3 Tons/Day of VOCs by 75% in 2010. Following the May 1999 rule amendments, three lawsuits were filed against the District that were subsequently consolidated as one matter by the court. Although the District prevailed in the trial court, on June 24 the Court of Appeal reversed the decision of the trial court, holding that two amendments to address user concerns that were made after the 30-day public comment period began were so significant as to require a continuance of the Board hearing. Thus the 1999 amendments are not currently effective. Staff plans to propose re-adoption of the May 1999 amendments. Limits in effect prior to the May 1999 amendments remain effective.

This report provides information on milestones, accomplishments and issues associated with the implementation of Rule 1113. The concerns of the public and industry representatives are addressed and discussed through rule interpretations, completed and future technological assessments, current and future compliance activities, architectural coating usage surveys and coatings availability studies.

As with previous reports submitted to the Board regarding this rule, the results of coating technology assessments and staff's product availability studies indicate the availability of compliant coatings in the specific categories studied that are viable alternatives to higher VOC products currently being manufactured for use on architectural structures. The necessary coating technology is available today to reduce significant amounts of VOCs that contribute to the overall formation of low level ozone within the Basin.

Meetings
Since the last annual report was received and filed by the Board, many meetings have been held to discuss various aspects of the rule. Teleconferences with CARB were held on numerous occasions discussing Suggested Control Measures (SCM) for architectural coatings and future averaging compliance options as allowed in Rule 1113 and proposed in the SCM.

A Working Group meeting was held on November 15, 2001 followed by a Technical Advisory Meeting (TAC) to discuss rule implementation and to address concerns with future limits. On December 5, 2001 the Rule 1113 TAC held a teleconference reviewing the ongoing technological assessments and other issues relative to Rule 1113. A follow-up teleconference was held on January 31, 2002.

On February 28, 2002 the District held a joint Rule 1113 Working Group and TAC Meeting to review the studies that were nearing completion and to address topics such as compliance with emission limits and the averaging compliance options allowed under section (c)(6) of Rule 1113.

Members of the TAC were invited to participate in site visits to evaluate test panels that have been subject to outdoor weather exposure relative to a contract with the National Technical Systems (NTS). Discussions with the TAC regarding the results contained in the NTS report are continuing.

Another teleconference with the TAC was held on May 17, 2002 to continue dialogue on the completed technological assessments and discuss future technological assessments through coordinated efforts of the AQMD and industry. Reports regarding the tests can be viewed in Appendix B and B1 with summaries given in the technology assessment portion of this report.

Surveys and Site Evaluations

Following submittal of the last annual report to the Board, the District has conducted surveys at paint distribution centers and at randomly selected coating applications projects at various locations throughout the Basin. The intent was to determine what is currently available for purchase at wholesale and retail outlets, and what type of coatings are being specified for construction activities including the coatings actually being used during the application process. The results indicate that nearly all facilities surveyed are offering for sale and distribution within the Basin coatings that not only meet but are lower than current and future VOC limits. Exceptions are those coatings that may have specific rule exemptions or limited rule provisions allowing the sale or application of otherwise non-compliant products. As reported by manufacturers, 349,730 gallons were sold under the small container exemption and 620,917 gallons were sold under the Quick Dry Primer, Sealer and Undercoater category in the year 2001. These account for approximately 2% of the total coatings volume sold in the Basin. It should be noted that the Quick Dry Primer, Sealer and Undercoater category was scheduled not to have an exemption after July 1, 2002. However, the recent court decision affects this timetable.

Additionally, there is an allowance in the rule for the sale or application of a coating manufactured prior to the effective date of the corresponding standard in the Table of Standards for up to three years after the effective date of the standard. This sell-through provision applies to all coatings listed in the Table of Standards and any effective dates applicable to the specific coating. Each architectural coating activity that was noted during staff's surveys was using compliant coatings and in many instances those coatings had VOC concentrations in compliance with or lower than the July 2002 VOC limits of the rule.

As reported in the 2001 Annual Report to the Board, the 1998 CARB Architectural Coatings Survey examined sales data of architectural coatings from over 150 manufacturers. The survey focused on all coating categories of architectural coatings, including non-flats, floor coatings, primers, sealers and undercoaters and stains available in California. The data from the survey, which was summarized in the earlier report, demonstrated that coatings are available in all of these categories and are being used to meet current and future Rule 1113 requirements.

CARB is currently conducting another comprehensive survey to update the latest sales data, which will further evaluate certain niche coatings, including high gloss non-flat coatings. The data collection phase is almost complete, and the results are expected to be published by CARB by the end of this year.

As the July 1, 2002 compliance deadline in Rule 1113 approaches, many manufacturers, coatings specifiers and applicators have been contacting the District inquiring about rule definitions, applicability to specific coating categories and how the rule changes may affect their companies. Appendix C lists the most frequently asked questions and the District's responses.

Averaging Compliance Option

The District, working extensively with members of the architectural coatings industry and other stakeholders, has developed and incorporated an alternative compliance option into Rule 1113, the Averaging Compliance Option (ACO). The purpose of the ACO is to promote compliance flexibility and improved cost efficiency. In the November 8, 1996 amendments to Rule 1113, an Averaging Compliance Option (ACO) was included for the Flats category with subsequent amendments on May 14, 1999 to streamline its implementation and add numerous categories to provide additional compliance flexibility with the future limits.

Over the past year, staff has updated the Averaging Compliance Option Guidance Document to include the additional coating categories specified in Rule 1113 and is currently working with manufacturers to assure that plans submitted under this option are complete and ready for implementation. Eight manufacturers have submitted plans under the ACO seeking approval to allow them to average for the July 2002 limits for specific coating categories. One manufacturer has since withdrawn their ACO program.

Zero-VOC Coatings

As coating technologies continue to advance leading to lower VOC products with improved performance characteristics, many small and large coating manufacturers have managed to produce products for many years that contain no VOCs. Table 2 lists just a few examples of the many zero-VOC coatings currently available from manufacturers. The District also maintains a web page listing those companies that have expressed an interest in having their products included on the page.

Table 2
Zero-VOC Manufacturers
Flats, Non-Flats, Primers, Sealers, Undercoaters
And Industrial Maintenance Coatings

Manufacturer	Coating Categories	Interior	Exterior
American Formulators Manufacturers	F, NF	YES	NO
Benjamin Moore & Co.	PSU, F, NF	YES	NO
Coronado Paint Co.	F, NF, PSU	YES	NO
Devoe Paint (ICI)	PSU, F, NF	YES	NO
Dunn Edwards	F, NF	YES	NO
Dutch Boy Paints	NF	YES	NO
Frazee Industries	PSU, F, NF	YES	NO
Fuhr International, LLC	PSU, F, NF	YES	YES
ICI Paints	PSU, F, NF	YES	YES
Miller Paint	PSU, F, NF	YES	NO
Pittsburgh Paints	F, NF, PSU	YES	NO
Polabrid Coatings	F, NF, PSU	YES	YES
PPA Technologies (VOCFree)	PSU, F, NF	YES	YES
PPG	PSU, F, NF	YES	YES
Richards Paints	F, NF	YES	NO
Sampson Coatings	PSU, F, NF	YES	YES
Sherwin Williams	PSU, F, NF	YES	NO
Spectra-Tone Paint	F, NF	YES	NO
Industrial Maintenance Coatings			
Ameron, Inc.	Various Systems	YES	YES
Corchem Corp	Various Systems	YES	YES
Epmar	Various Systems	YES	YES
Pacific Polymer	Various Systems	YES	YES
Superior Environmental Products Inc.	Various Systems	YES	YES
United Coatings	Various Systems	YES	YES

PSU = Primers, Sealers, and Undercoaters
F = Flats
NF = Non-flat

Technology Assessments

National Technical Systems

During the rule development process that started in 1998, the District contracted with National Technical Systems (NTS) to obtain additional performance data for zero-, low-, and high-VOC coatings. This study was called the Phase II Assessment Study of Architectural Coatings. The overall objective of this multi-year study was to analyze the application and durability characteristics of 94 individual coatings and 44 coating systems. The laboratory portion of this study was completed by May 1999, prior to the rule amendment. District staff thoroughly reviewed the results of the laboratory portion of the Phase II Assessment Study for Architectural Coatings with the TAC. In May 1999, the findings indicated that the zero- and low-VOC products studied show similar and in some cases, better performance properties than the high-VOC coatings. Once the laboratory testing of the coatings was completed, an accelerated weathering study of the coating systems, as well as a real-time 24-month exposure test was initiated to analyze the effect of ambient conditions on the paint systems. The real time exposure testing began in April of 2000 and continued through April 2002 at two sites with variable environmental conditions. One location was in Saugus and the other in El Segundo near the Los Angeles International Airport. At the end of the two-year outdoor test, the results show that zero and low-VOC coatings are similar in weathering and durability characteristics and in many cases have outperformed the higher VOC based counterparts, corroborating the conclusions reached by the laboratory weathering and accelerated outdoor weathering studies.

Included in Appendix B is a demonstration of the findings of the NTS exposure study using gloss loss as an indicator of performance. The results show that zero- and low-VOC non-flat exterior and industrial maintenance coatings loss of gloss were similar and in many instances less than the high-VOC coatings. Certain anomalies exist where specific products tested were not intended for exterior exposure and are noted on the matrices for review.

The District has obtained possession of the panels and in conjunction with the TAC, anticipates the continued evaluation of them at designated outdoor monitoring stations near the original exposure sites to simulate the same conditions.

KTA-Tator

Rule 1113 requires a technology assessment for the future VOC limits for nonflats; primers, sealers, and undercoaters; quick-dry primers, sealers, and undercoaters; quick-dry enamels; waterproofing wood sealers; stains; floor; rust preventative; and industrial maintenance coatings as specified in paragraph (c)(2) by July 1, 2001 and July 1, 2005. In support of the technology assessment requirements, the District has completed the Phase II Assessment Study discussed above. Furthermore, in a continuing effort to compare low and high-VOC coatings in order to further substantiate that available products have characteristics similar to user expectations of higher VOC based products, the District also initiated a contract to study various coatings with KTA-Tator, Inc. The selection of the contractors, the protocol for conducting the study and the coatings evaluated, resulted from discussions and a consensus between the District and the TAC.

This most recent assessment compared high-, low- and zero-VOC formulations for four architectural coating categories: floor coatings, non-flat interior and exterior high gloss paints, interior and exterior primers, sealers and undercoaters and interior stains. The characteristics and performance of 31 coatings on various substrates were studied in the evaluation. Complete test results are shown in Appendix B1 of this report. Staff believes that overall, the results continue to substantiate current and future limits stated in the rule. Low-VOC products are currently available and, in all categories tested, work as well as and in some cases better than the higher-VOC counterparts. It is important to recognize that this study tested only a small portion of the low-VOC products currently available at retail and commercial outlets. While the test results do vary for some of the low-VOC products, all are currently being sold in the market, indicating acceptance by the consumer. The TAC and the District are continuing to discuss the findings of the study.

<u>Essential Public Service Agencies</u>
Following the May 14, 1999 amendments to Rule 1113, the Board directed staff to provide technical oversight and contribute funding to the Essential Public Service Agency (EPSA) technology assessment. District staff formed a committee in September 1999 comprised of representatives from Metropolitan Water District (MWD), Department of Water Resources, Cal Trans and the Department of Water and Power to conduct a technology assessment for the EPSAs.

The scope of the program is to be completed in several phases and is designed to test and evaluate VOC compliant coatings necessary for maintenance and new construction projects for agencies essential to the public. Approximately 100 VOC-compliant industrial maintenance coating systems have already been applied and are undergoing environmental testing over a three to four year period.

The first phase of the program consists of evaluating immersion and atmospheric coating systems. The second phase, in addition to atmospheric and immersion coatings includes the technology assessment of chemical containment and roofing coating systems. Approximately 90% of the coatings in the second phase are already undergoing environmental testing.

Staff plans to present the results of this study to the industry and the Governing Board upon completion.

Southern California Alliance of Publicly Owned Treatment Works (SCAP)
In last year's annual report it was mentioned that SCAP, a coalition of sanitation agencies, decided to separate from the EPSA study to initiate an independent study of coatings to be applied at wastewater treatment plants. In September 2000, SCAP contracted with KTA-Tator to initiate a 2-year laboratory and field study of low-VOC coatings. This study is currently on schedule and should be completed by February 2003. Performance tests have been initiated to evaluate atmospheric and immersion coating systems and when completed will be compared to laboratory results to assess the effectiveness of each coating as applied by SCAP. While the District has not participated in the design of the project, the selection of a contractor or evaluations of the test panels, staff did visit one of the field sites this year to receive a progress report on the study.

Participants in this study include the Los Angeles County Sanitation District, the Orange County Sanitation District, the Eastern Municipal Water District, Las Virgenes Municipal Water District and the City of Los Angeles.

Recommendation
Staff continues to assemble a growing list of compliant and supercompliant coatings that are being used in various applications and settings. Furthermore, the additional technology assessments required by Rule 1113 for certain coating categories have generally verified that they are performing to expectations. Although some industry representatives have reservations regarding the District's position, others have expressed support for staff recommendations. Additionally, the District is committed to continuing to work with interested parties toward future technology coating assessments that include reactivity studies as outlined in the three-year Advanced Air Pollution Research Plan for Fiscal Years 2002-05 that is part of Initiative No. 5 – Strategic Alliance for Advanced Air Pollution Research, adopted by the Board on June 7, 2002. Consequently, staff is recommending that the Board maintain current and future VOC limits as stipulated in the rule. However, staff will need to re-propose the May 1999 amendments that have been set aside by the Court of Appeal on procedural grounds. This recommendation is based on the information available from various technology assessments and on-going studies summarized within. As new information becomes available over the next year, staff will report back to the Board.

Attachments
A. California Air Pollution Control Districts that have Adopted CARB's Suggested Control Measure for Architectural Coatings
B. NTS Study, Gloss Loss Summaries
B1. KTA-Tator Study Final Report
C. Response to Questions

APPENDIX A

California Air Pollution Control Districts That Have Adopted CARB's Suggested Control Measure for Architectural Coatings

California Air Pollution Control Districts That Have Adopted CARBs Suggested Control Measure for Architectural Coatings

Air Pollution Control District	Applicable Regulation	Date of Adoption
Sacramento Metropolitan Air Quality Management District	Rule 442	May 24, 2001
San Joaquin Valley Unified Air Pollution Control District	Rule 4601	October 31, 2001
Ventura County Air Pollution Control District	Rule 74.2	November 13, 2001
Yolo-Solano Air Quality Management District	Rule 2.14	November 14, 2001
Santa Barbara County Air Pollution Control District	Rule 323	November 15, 2001
Bay Area Air Quality Management District	Rule 8-3	November 21, 2001
San Diego County Air Pollution Control District	Rule 67.0	December 12, 2001
Placer County Air Pollution Control District	Rule 218	December 13, 2001
San Luis Obispo County Air Pollution Control District	Rule 433	March 26 2002
Northern Sonoma County Air Pollution Control District	Rule 485	April 9, 2002
Monterey Bay Unified Air Pollution Control District	Rule 426	April 17, 2002
Butte County Air Quality Management District	Rule 240	April 25, 2002
Shasta County Air Quality Management District	Rule 3-31	May 14, 2002

APPENDIX B

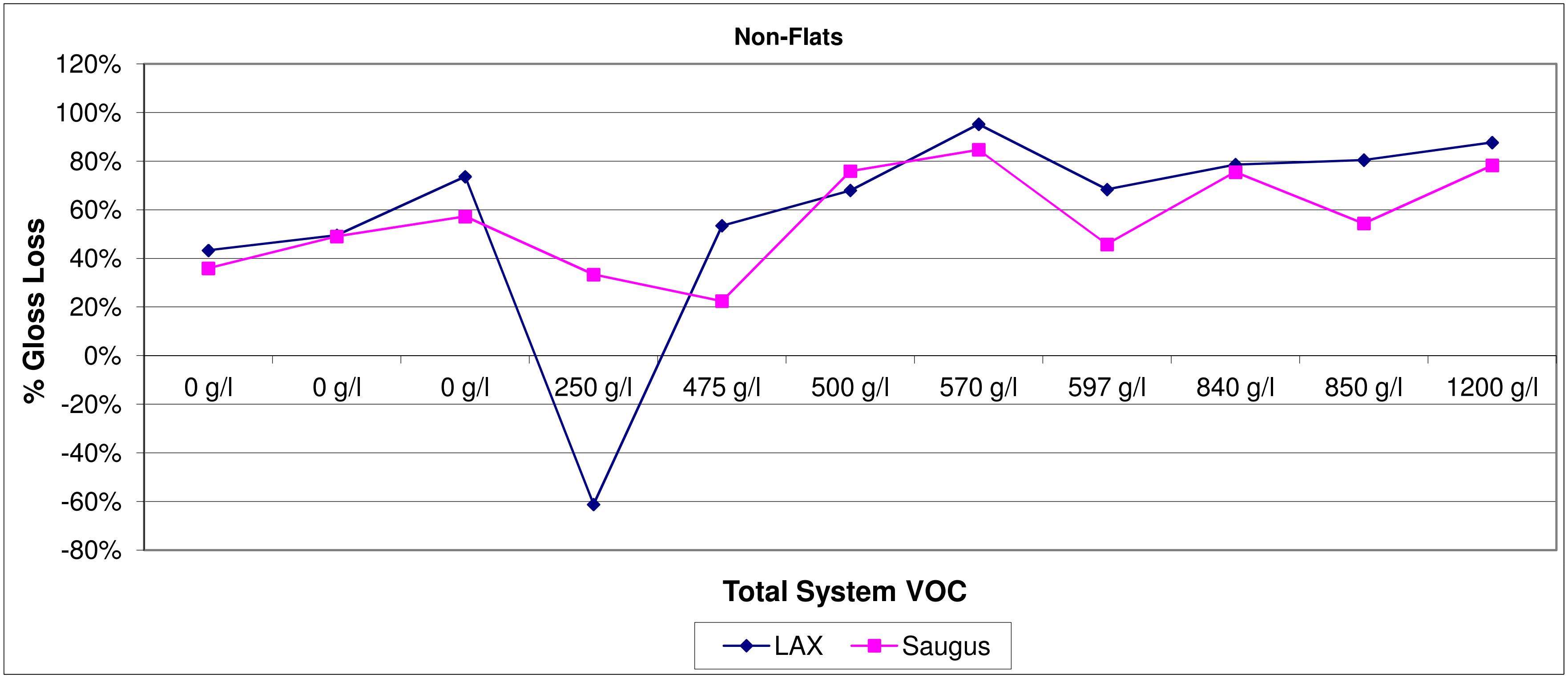
NTS Study
Gloss Loss Summaries

Comparison of NTS Initial and 24 Month Exposure Testing

Non-flat Exterior Coatings*									
NTS #	Indiv. VOC (g/l)	Resin Type	Total Sytem VOC	Los Angeles Site	Los Angeles Site		Saugus Site	Saugus Site	
				Initial	24 Months		Initial	24 Months	
				60^o Gloss	60^o Gloss	Delta Gloss	60^o Gloss	60 ^{o} Gloss	Delta Gloss
W02-Y15-T650	0/0	Acrylic	0 g/l	6.4	3.6	43.3%	6.4	4.1	35.9%
W02-Y09-T650	0/0	Acrylic	0 g/l	5.2	2.6	49.5%	5.3	2.7	49.1%
W02-Y07-T650	0/0	Acrylic	0 g/l	39.5	10.4	73.6%	41.6	17.8	57.2%
W02-Y11-T650	115/135	Acrylic	250 g/l	6.5	10.4	-61.2%	6.6	4.4	33.3%
W02-Y24-T650	225/250	Acrylic	475 g/l	74.4	34.6	53.5%	78.5	60.9	22.4%
W02-Y21-T650	250/250	Acrylic	500 g/l	21.9	7	68.0%	19.9	4.8	75.9%
W02-447-T650	400/170	Modified Alkyd	570 g/l	62.5	3	95.2%	53.6	8.2	84.7%
W02-Y18-T650	350/247	Alkyd/Acrylic	597 g/l	19.0	6	68.3%	17.7	9.6	45.8%
W02-Y01-T651	440/400	Alkyd	840 g/l	76.6	16.4	78.6%	74.3	18.2	75.5%
W02-Y05-T650	450/400	Alkyd	850 g/l	56.3	11	80.4%	56.8	25.9	54.4%
W02-Y06-T650	400/400	Alkyd	1200 g/l	42.1	5.2	87.6%	44.1	9.6	78.2%

*Includes low, medium and high-gloss exterior coatings that register on initial gloss of 5 or greater on a 60-degree meter.

Comparison of NTS Initial and 24 Month Exposure Testing

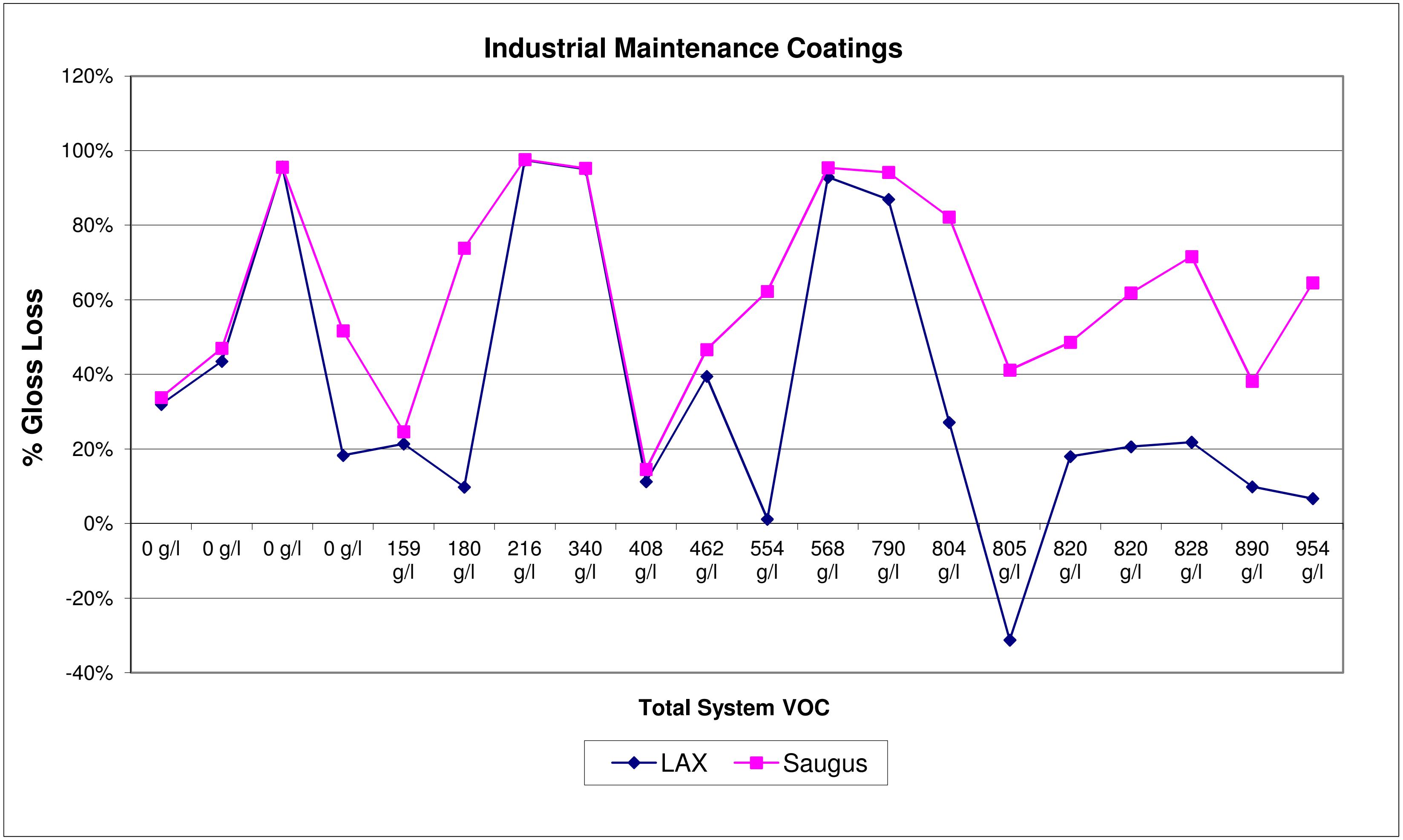


The data point at 250 g/l appears to be an anomaly. However, all data points are included in this chart for completeness purposes. Exclusion of this point does not affect trend.

Comparison of NTS Initial and 24 Month Exposure Testing

Industrial Maintenance Coatings									
NTS #	Indiv. VOC (g/l)	Resin Type	Total Sytem VOC	Los Angeles Site	Los Angeles Site		Saugus Site	Saugus Site	
				Initial	24 Months		Initial	24 Months	
				60^{o} Gloss	60^{o} Gloss	Delta Gloss	60^{o} Gloss	60^{o} Gloss	Delta Gloss
S01-Y34-T660	0/0	Epoxy/Urethane	0 g/l	69.0	46.9	32.0%	70.1	46.4	33.8%
S01-Y33-T660	0/0	Epoxy/Urethane	0 g/l	41.3	23.3	43.5%	48.1	25.5	47.0%
S01-Y32-T660	**0/0**	**Novolac***	**0 g/l**	**34.5**	**1.5**	**95.7%**	**29.2**	**1.3**	**95.6%**
S01-Y31-T660	0/0	Epoxy/Urethane	0 g/l	85.6	69.9	18.3%	84.2	40.7	51.7%
S01-Y28-T660	49/55	Zinc/Urethane	159 g/l	84.5	66.4	21.4%	88.2	66.5	24.6%
S01-Y30-T660	60/120	Acrylic/Acrylic	180 g/l	59.2	53.4	9.8%	47.1	12.3	73.9%
S01-Y28-T660	**216**	**Siloxirane***	**216 g/l**	**86.3**	**2.2**	**97.45%**	**83.4**	**2**	**97.6%**
S01-Y36-T660	**170**	**Epoxy***	**340 g/l**	**50.4**	**2.5**	**95.0%**	**44.4**	**2.1**	**95.3%**
S01-Y37-T660	288/120	Epoxy/Siloxane	408 g/l	91.3	81	11.2%	88.1	75.3	14.5%
S01-Y38-T660	231	Acrylic	462 g/l	3.8	2.3	39.5%	4.5	2.4	46.7%
S01-Y29-T660	138/208	Acrylic/Acrylic	554 g/l	59.2	58.5	1.2%	63.6	24	62.3%
S01-Y43-T660	**284**	**Epoxy***	**568 g/l**	**60.6**	**4.3**	**92.90%**	**59.0**	**2.7**	**95.4%**
S01-Y40-T660	**395**	**Epoxy***	**790 g/l**	**45.2**	**5.9**	**86.93%**	**44.7**	**2.6**	**94.2%**
S01-Y42-T660	419/385	Alkyd/Alkyd	804 g/l	43.7	31.8	27.1%	41.5	7.4	82.2%
S01-Y39-T660	383/422	Alkyd/Alkyd	805 g/l	42.6	55.9	-31.2%	44.2	26	41.2%
S01-Y27-T660	400/420	Epoxy Ester/Silicone Alkyd	820 g/l	75.3	61.7	18.0%	64.8	33.3	48.6%
S01-Y48-T660	400/420	Alkyd/Urethane	820 g/l	93.1	73.9	20.6%	93.0	35.5	61.8%
S01-Y35-T660	417/411	Alkyd/Alkyd	828 g/l	88.3	69	21.8%	87.0	24.7	71.6%
S01-Y41-T660	320/275/295	Zinc/Epoxy/Urethane	890 g/l	80.1	72.2	9.9%	78.9	48.8	38.1%
S01-144-T660	282/284/388	Zinc/Epoxy/Urethane	954 g/l	87.4	81.5	6.7%	93.2	33	64.6%
*** - Coatings not recommended for exterior exposure**									

Comparison of NTS Initial and 24 Month Testing



The data point at 805 g/l appears to be an anomaly. However, all data points are included in this chart for completeness purposes. Exclusion of this data point does not affect overall trend.

APPENDIX B1

KTA-TATOR Study Final Report

INTRODUCTION

On May 14, 1999, the District amended rule 1113 to lower volatile organic compound (VOC) thresholds for many categories of paints and coatings.

During this rulemaking process, the District performed its own technology assessment of zero-and-low-VOC coatings with respect to their availability and performance characteristics for the major coating categories effected by this rule amendment. Based on that assessment, the District determined that its proposed compliance limits and deadlines were achievable. Subsequently, several members of industry emphasized the need for additional performance evaluations for niche categories resulting in this study consisting of floor coatings, non-flat high gloss, primers, sealers and undercoaters and interior stains. Additionally, these coating categories showed different VOC limitations than those listed in the California Air Resources Boards Suggested Control Measure. The Technical Advisory Committee reached a consensus on the study of these particular coating categories.

The results of the new assessment will be used to help evaluate whether any changes to existing Rule 1113 will be required prior to implementation of lower limits for the coating categories included in this study.

As agreed to by the joint industry-government Technical Advisory Committee, the scope of this technology assessment encompassed four (4) architectural coating categories, including:

1. Floor Coatings (<100 g/L and >100g/L)
2. Non-flats – High Gloss (interior and exterior; <150 g/L and >150g/L)
3. Primer, Sealer, and Undercoater (interior and exterior; <200 g/L and >200g/L)
4. Interior Stains (<250 g/L and >250g/L)

To contract this work, the SCAQMD issued a Request for Proposals (RFP No. P2001-24) on October 20, 2000. Based on the requirements of the RFP, KTA-Tator, Inc. (KTA) prepared a formal technical and cost proposal dated November 21, 2000 (PN202369). On March 1, 2001, KTA was awarded Contract No. 01123 for performance of the technology assessment described in the RFP and the KTA proposal. A Contract Extension (through January 31, 2002) was authorized on November 29, 2001 and acknowledged by KTA on November 30, 2001.

This final draft report describes the technology assessment performed for SCAQMD, including the testing protocol, the substrate types, surface preparation and coating application procedures, test descriptions, and the results of the testing. A total of thirty one (31) products (paints/stains) were included in the study.

Four (4) status reports were issued throughout the project (February 28, 2001, April 3, 2001, May 9, 2001, and November 26, 2001). Each report described the progression of work on Tasks 1-4 as outlined in the KTA proposal. Additionally, an original (July 18, 2001) and three updates/revisions (August 2 and 27, 2001 and October 9, 2001) of a draft technical report containing the results of the General Characteristics tests were issued to SCAQMD. The final results of the General Characteristics testing are contained in this report.

EXECUTIVE SUMMARY

KTA-Tator, Inc. has completed the testing portion of the South Coast Air Quality Management District (SCAQMD) Technology Assessment for four architectural coating categories, including floor coatings, non-flat high gloss paints (interior and exterior), primer/sealer/undercoater (interior and exterior) and interior stains. The testing program included characterization of the general properties of the coatings, paints and stains, as well as an evaluation of the performance properties on various substrates.

The purpose of conducting the testing was to determine whether commercially-available architectural coatings, paints and stains that contain a “lower” Volatile Organic Compound (VOC) content possess better, equivalent or worse performance when compared to products with a “higher” VOC content in the same service category.

Summary Tables A-F below provide a *relative* comparison of the various performance properties based on the *published* VOC categories. For each service category and test protocol, the manufacturer/product code(s) for the “lower VOC” coatings tested that performed better than, equivalent to, or worse than the “higher VOC” products in the same service category is/are indicated. It is important to note that this categorization is a relative comparison, and does not infer pass or failure. Specific data is provided in the body of the test report. For convenience, the published VOC content for each product in each service category is presented beneath each Summary Table, along with how the product was grouped (H indicating “Higher VOC” and L indicating “Lower VOC”).

Summary Table A
Performance of “Lower” VOC Floor Coatings (<100 g/L versus >100 g/L)*

Test Protocol	Better than Higher VOC	Equivalent to Higher VOC	Worse than Higher VOC
Adhesion (shear)	C3; E6	None	B2
Adhesion (tensile)	C3	None	B2; E6
Chemical Resistance	**	**	**
Abrasion Resistance	C3	None	B2
Impact Resistance	B2; E6	C3	None
Pencil Hardness	E6	None	B2;C3
Effluorescence Resistance	None	B2; C3	E6

*Based on a performance comparison of three (3) “lower VOC” products versus three (3) “higher” VOC products.
** Performance varied depending on chemical. In most instances, performance is “equivalent to.”

Reference Table A – Floor Coatings

Manufacturer Code	Product Code	Published VOC Content	g/L (</>)	Grouping
A	1	145 g/L	>100	H
B	2	0 g/L	<100	L
C	3	71 g/L	<100	L
D	4	150 g/L	>100	H
D	5	282 g/L	>100	H
E	6	56 g/L	<100	L

Summary Table B
Performance of “Lower” VOC Non-flat High Gloss Interior Paints (<150 g/L versus >150 g/L)*

Test Protocol	Better than Higher VOC	Equivalent to Higher VOC	Worse than Higher VOC
Open Time/Lapping	None	F7; G8; I12	None
Adhesion	None	F7; G8; I12	None
Scrub Resistance	I12	F7; G8	None
Blocking Resistance (ambient temp.)	None	G8; I12	F7
Blocking Resistance (elevated temp.)	None	G8; I12	F7

*Based on a performance comparison of three (3) “lower VOC” products versus three (3) “higher” VOC products

Reference Table B - Non-flat High Gloss Interior Paints

Manufacturer Code	Product Code	Published VOC Content	g/L (</>)	Grouping
F	7	48-90 g/L	<150	L
G	8	120 g/L	<150	L
A	9	220 g/L	>150	H
D	10	194 g/L	>150	H
H	11	<250 g/L	>150	H
I	12	148 g/L	<150	L

Summary Table C
Performance of “Lower” VOC Non-flat High Gloss Exterior Paints (<150 g/L versus >150 g/L)*

Test Protocol	Better than Higher VOC	Equivalent to Higher VOC	Worse than Higher VOC
Open Time/Lapping	None	F7; I12; D14	None
Adhesion	None	F7; I12; D14	None
Scrub Resistance	I12; D14	F7	None
Blocking Resistance (ambient temp.)	None None	F7; I12 (fir) F7 (cedar)	D14 (fir) I12; D14 (cedar)
Blocking Resistance (elevated temp.)	None	F7; I12; D14	None
Weathering	None	F7; D14	I12

*Based on a performance comparison of three (3) “lower VOC” products versus three (3) “higher” VOC products

Reference Table C - Non-flat High Gloss Exterior Paints

Manufacturer Code	Product Code	Published VOC Content	g/L (</>)	Grouping
J	13	<380 g/L	>150	H
F	7	48-90 g/L	<150	L
A	9	220 g/L	>150	H
H	11	<250 g/L	>150	H
I	12	148 g/L	<150	L
D	14	118 g/L	<150	L

Summary Table D

Performance of "Lower" VOC Interior Primer/Sealer/Undercoater (<200 g/L versus >200 g/L)*

Test Protocol	Better than Higher VOC	Equivalent to Higher VOC	Worse than Higher VOC
Grain Raising	None	K16; L17; H18	None
Adhesion	None	K16; L17; H18	None
Sandability	None	L17; H18	K16
Chemical Resistance	None	K16; L17; H18	None

*Based on a performance comparison of three (3) "lower VOC" products versus three (3) "higher" VOC products

Reference Table D - Interior Primer/Sealer/Undercoater

Manufacturer Code	Product Code	Published VOC Content	g/L (</>)	Grouping
A	15	450 g/L	>200	H
K	16	250 g/L max	<200	L
L	17	118 g/L	<200	L
H	18	<200 g/L	<200	L
H	19	<350 g/L	>200	H
D	20	457 g/L	>200	H

Summary Table E

Performance of "Lower" VOC Exterior Primer/Sealer/Undercoater (<200 g/L versus >200 g/L)*

Test Protocol	Better than Higher VOC	Equivalent to Higher VOC	Worse than Higher VOC
Grain Raising	None	H21; D23; M25	None
Adhesion	None	H21; D23; M25	None
Tannin Stain Blocking	None	D23; M25	H21
Weathering	None	H21; D23; M25	None

*Based on a performance comparison of three (3) "lower VOC" product versus three (3) "higher" VOC products

Reference Table E - Exterior Primer/Sealer/Undercoater

Manufacturer Code	Product Code	Published VOC Content	g/L (</>)	Grouping
A	15	450 g/L	>200	H
H	21	<200 g/L	<200	L
H	22	<350 g/L	>200	H
D	23	121 g/L	<200	L
D	24	325 g/L	>200	H
M	25	141 g/L	<200	L

Summary Table F
Performance of "Lower" VOC Interior Stains (<250 g/L versus >250 g/L)*

Test Protocol	Better than Higher VOC	Equivalent to Higher VOC	Worse than Higher VOC
Open Time/Lapping	None	O28; O29; Q31	None
Grain Raising	None	O28; O29; Q31	None
Adhesion	None	O28; O29; Q31	None
Tannin Stain Blocking	None	O28; O29; Q31	None
Scrub Resistance	Maple: O28; O29	Pine: O28; O29 Oak: O28; O29	None

*Based on a performance comparison of three (3) "lower VOC" product versus three (3) "higher" VOC products

Reference Table F – Interior Stains

Manufacturer Code	Product Code	Published VOC Content	g/L (</>)	Grouping
N	26	350 g/L	>250	H
A	27	350 g/L	>250	H
O	28	15 g/L	<250	L
O	29	0 g/L	<250	L
P	30	No data sheet	>250	H*
Q	31	No data sheet	<250	L*

*Determination of "H" or "L" grouping based on the measured VOC content, as no data sheets were supplied, and the VOC level was not indicated on the can label

<u>COATING MATERIALS</u>

Table 1 below contains a listing of the coating materials included in the Technology Assessment, organized by service category, and the published VOC content (the manufacturers and products have been coded). The final column indicates how the product was grouped in the testing program. It should be noted that all coating materials were selected by the SCAQMD with the approval of the Technical Advisory Committee that was established to advise staff and make recommendations relative to Rule 1113. All paints and stains were supplied to KTA by the respective paint manufacturers or their distributors. All products are single component, except for one (1) two-component coating. Five (5) paints cross over into two service categories (non-flat interior/exterior, and primer interior/exterior).

Table 1 – Products Listing by Service Category

Manufacturer Code	Product Code	Category	Published VOC Content	Grouping (g/L)
A	1	Floor	145 g/L	>100
B	2	Floor	0 g/L	<100
C	3	Floor	71 g/L	<100
D	4	Floor	150 g/L	>100
D	5	Floor	282 g/L	<100
E	6	Floor	56 g/L	>100
F	7	NF-Interior	48-90 g/L	<150
G	8	NF-Interior	120 g/L	>150
A	9	NF-Interior	220 g/L	>150
H	11	NF-Interior	<250 g/L	>150
I	12	NF-Interior	148 g/L	<150
D	10	NF-Interior	194 g/L	>150
J	13	NF-Exterior	<380 g/L	>150
F	7	NF-Exterior	48-90 g/L	<150
A	9	NF-Exterior	220 g/L	>150
H	11	NF-Exterior	<250 g/L	>150
I	12	NF-Exterior	148 g/L	<150
D	14	NF-Exterior	118 g/L	<150
A	15	PSU-Interior	450 g/L	>200
K	16	PSU-Interior	250 g/L max	<200
L	17	PSU-Interior	118 g/L	<200
H	18	PSU-Interior	<200 g/L	<200
H	19	PSU-Interior	<350 g/L	>200
D	20	PSU-Interior	457 g/L	>200
A	15	PSU-Exterior	450 g/L	>200
H	21	PSU-Exterior	<200 g/L	<200
H	22	PSU-Exterior	<350 g/L	>200
D	23	PSU-Exterior	121 g/L	<200
D	24	PSU-Exterior	325 g/L	>200
M	25	PSU-Exterior	141 g/L	<200
N	26	Stain-Interior	350 g/L	>250
A	27	Stain-Interior	350 g/L	>250
O	28	Stain-Interior	15 g/L	<250
O	29	Stain-Interior	0 g/L	<250
P	30	Stain-Interior	No data sheet	>250
Q	31	Stain-Interior	No data sheet	<250

Based on the *published* VOC content, the number of products tested in each service category are listed in Table 2, below.

Table 2 – Number of Products Tested by Published VOC Range

Service Category	No. of Products (< "X" g/L)	No. of Products (> "X" g/L)
Floors	3 (<100 g/L)	3 (>100 g/L)
Non-Flat Interior	3 (<150 g/L)	3 (>150 g/L)
Non-Flat Exterior	3 (<150 g/L)	3 (>150 g/L)
PSU-Interior	3 (<200 g/L)	3 (>200 g/L)
PSU-Exterior	3 (<200 g/L)	3 (>200 g/L)
Stain-Interior	3 (<250 g/L)	3 (>250 g/L)

TASK 1 - ESTABLISHING THE TESTING PROTOCOL
TASK 2 - ESTABLISHING THE NUMBER AND IDENTITY OF TEST SAMPLES

Tasks 1 and 2 were performed concurrently and entailed finalization of the proposed test methods to be used for conducting the General Characteristics tests as well as the performance tests, and establishing the number and identity of the paints and stains to be included in the program. While all of the General Characteristics tests were based on standard ASTM testing procedures, several of the performance testing procedures were based on testing protocols developed by coating manufacturers or KTA, as there are no known industry accepted methods. Tables 3 and 4, respectively contain the General Characteristics tests that were performed on all products (as applicable) and the performance tests conducted based on the service category (floors [F]; non-flat interior [NF-I]; non-flat exterior [NF-E]; primer, sealer, under coater-interior [PSU-I]; primer, sealer, under coater-exterior [PSU-E]; and interior stains (IS). The source of the test method is also indicated. Finally, Table 5 describes the substrate material(s) employed for each of the service categories.

Table 3 – General Characteristics Testing

Test Description	Standard Reference	Paints/Stains
VOC Content	ASTM D3960	All paints and stains
Volume solids	ASTM D2697	All paints and stains
Infrared Spectroscopic Analysis	ASTM D2621	All paints and stains
Viscosity	ASTM D562	All paints and stains
Percent water	ASTM D3792	Waterborne products only
Freeze/Thaw Resistance	ASTM D2243	Waterborne products only
Hiding	ASTM D2805	All paints
Dry Time	ASTM D1640	All paints and stains
Sag Resistance	ASTM D4400	All paints and stains

Table 4 – Performance Testing

Test Description	Standard Reference	Service Category					
		F	NF-I	NF-E	PSU-I	PSU-E	IS
Open Time/Lapping	Ctg. Manufacturer		•	•			•
Grain Raising	Ctg. Manufacturer				•	•	•
Adhesion	ASTM D3359	•	•	•	•	•	•
Adhesion	ASTM D4541; A.4	•					
Stain Blocking	ASTM D6686					•	•
Scrub Resistance	ASTM D2486		•	•			•
Sandability	KTA generated				•		
Chemical Resistance	ASTM D1308	•			•		
Abrasion Resistance	ASTM D4060	•					
Impact Resistance	ASTM D2794	•					
Pencil Hardness	ASTM D3363	•					
Effluorescence	Ctg. Manufacturer	•					
Blocking Resistance[1]	ASTM D2793		•	•			
Blocking Resistance[2]	ASTM D2793		•	•			
Accelerated Weathering[3]	ASTM G154			•		•	

[1]Lab Ambient Temperature [2]Elevated Temperature [3]Includes color and gloss retention

Table 5 – Substrate Materials

Substrate	Service Category					
	F	NF-I	NF-E	PSU-I	PSU-E	IS
Wood-White Pine		•		•		•
Wood-Maple						•
Wood-Oak						•
Wood-Douglas Fir			•			
Wood-Western Red Cedar			•		•	
Wood-LP Siding					•	
Drywall				•		
Concrete	•					

Detailed test matrices for each of the service categories were generated and forwarded for acceptance. The matrices are attached as Appendix 1. Upon concurrence from the Rule 1113 Technical Group (October 18, 2001), KTA initiated application and performance testing of the paints and stains. Performance of the general characteristics tests, substrate fabrication and surface preparation procedures were initiated well before acceptance of the performance testing protocol, in anticipation of approval by the Technical Committee, in order to maintain (as best as possible) the abbreviated project schedule.

TASK 3 – PERFORMANCE OF THE TESTING

The Technology Assessment program included both General Characteristics testing and performance testing. The General Characteristics Tests (Task 3A) are described below. The results are contained in the Test Results section of this report. Task 3B (surface preparation and coating application procedures) and Task 3C (performance tests) are also described in this section. The results of the performance testing are contained in the Test Results section of this report.

Task 3A – General Characteristics Testing

Each of the General Characteristics tests performed on the coating materials is described below. The results are contained in the Test Results section of this report.

VOC Content

The VOC content of the coating materials and stains was determined using either of two analytical methods.

All coatings were initially tested in accordance with the requirements of ASTM D3960, “Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings,” using gas chromatography (GC). This data was used in conjunction with the results of the solids content, percent by weight (ASTM D2369, “Volatile Content of Coatings”) and density (ASTM D1475, “Density of Liquid Coatings, Inks, and Related Products”) to calculate the VOC content.

The results of the analyses were then compared to the manufacturer’s published VOC content. If the data generated by KTA using method D3960 differed from the manufacturer’s published values (for the waterborne products) the coatings were re-analyzed for percent water using the Karl Fisher Titration methodology (ASTM D4017, “Water in Paints and Paint Materials by Karl Fisher Method”). The VOC content was then re-calculated using the percent water data from the titration and the weight solids and density data. The results of the analyses are contained in Table 6. Density and weight solids data are reported in Table 6A. It should be noted that there is a large variance between the manufacturer's published VOC data and the experimental values reported herein. This is likely attributed to differences in testing procedures.

Volume Solids Content

The percent volume solids content of the coating materials and stains was determined in accordance with the requirements of ASTM D2697, "Volume Non-Volatile Matter in Clear or Pigmented Coatings." Triplicate stainless steel discs are weighed in air and submersed in water, both before and after coating. The volume solids content is calculated based on the weight solids and density of the coating material, in conjunction with the pre-and post weights. The results of the testing are contained in Table 7.

Infrared Spectroscopic Analysis

Infrared spectra of the various paint materials and stains received for this project were obtained and are attached to this test report (Appendix 1). They provide a "fingerprint" of the organic make-up of the resin system and limited information on the inorganic pigmentation/fillers used in the formulations. These spectra were obtained for historical purposes and can be used to verify future batch formulations, if necessary.

The analyses were performed using a Mattson Galaxy Model 3020 fourier transform infrared (FT-IR) spectrometer. Spectra were obtained by coating glass plates with each sample, then combining sample scrapings (after drying) with potassium bromide (KBr) powder and forming into pellets under high pressure and vacuum. The pellets were then placed individually in the optical path of the spectrometer and spectra obtained over the 4000 to 400 cm^{-1} region.

Viscosity

The viscosity of the coating materials was determined in accordance with ASTM D562, "Consistency of Paints Using the Stormer Viscometer." All testing was conducted at lab ambient conditions of 72 +/- 2^{o}F air temperature and 50+/- 5% relative humidity. The results of the analyses (in Krebs Units) are contained in Table 8.

Percent Water

Percent water analysis was conducted on the waterborne coatings in accordance with ASTM D3792, "Water Content of Coatings by Direct Injection into a Gas Chromatography," or ASTM D4017, "Water in Paints and Paint Materials by Karl Fisher Method." All "Karl Fisher" analyses were performed by DL Labs of New York. The results of the analyses are contained in Table 9.

Freeze/Thaw Resistance

Freeze/thaw resistance of the waterborne paints/stains was conducted in accordance with ASTM D2243, "Freeze-Thaw Resistance of Waterborne Coatings." When waterborne coatings are shipped during cold weather, they may experience cycles of freezing and thawing during transit. This cyclic exposure can cause more damage to a coating than when coatings are exposed to steady freezing. A one pint sample of each waterborne product was subjected to five (5) 24-hour cycles, each consisting of 17 hours freezing at 0^{o}F and 7 hours thaw at room temperature. Upon completion of five (5) test cycles, the freeze/thaw sample and a control sample were each evaluated for condition in the can (settling, gelation, coagulation), then evaluated for changes in viscosity according to ASTM D562 (Stormer Krebs, described earlier). Finally a sample of each cycled coating was applied to a test panel and visually evaluated for changes in hiding, color or gloss characteristics, and film defects such as pigment agglomerations or coagulation. The results of the analyses are contained in Table 10.

Hiding

Each of the coating materials was independently evaluated for its ability to hide in accordance with ASTM D2805, "Hiding Power of Paints by Reflectometry." This test examines a coatings ability to hide or cover the previous coat or substrate in a single application at the manufacturer's recommended thickness. All coatings were applied at the manufacturer's recommended thickness (if the data was available) over black/white hiding charts. Reflectance measurements were then obtained using a Hunter Miniscan. The CIE lab color scale was employed with the daylight illuminate and the 10^o standard observer. The contrast ratio was calculated based on the results of the reflectance measurements, using the "y" measurements of the "x y z" parameters. The results of the analyses are contained in Table 11.

Dry Time

Dry time (to touch) was evaluated in accordance with the requirements of ASTM D1640, "Drying, Curing, or Film Formation of Organic Coatings at Room Temperature." This test is used to determine the various stages and rates of drying, curing and film formation of organic coatings. By evaluating dry-to-touch, a comparison of "tack-free" times can be made. The coatings were applied at the manufacturer's recommended thickness, then evaluated for dry-to-touch time at lab ambient conditions of 70 +/- 2^oF and 50 +/- 5% relative humidity. The results of the analyses are contained in Table 12.

Sag Resistance

Sag resistance of the coating materials was evaluated according to the requirements of ASTM D4400, "Sag Resistance of Paints Using a Multinotch Applicator," using Procedure A (horizontal stripes). Coatings are often applied to vertical surfaces. Without adequate sag resistance, the applied coatings would exhibit runs and sags in the dry film, which can be aesthetically unpleasing. The maximum wet film thickness that did not exhibit sagging is reported for each product in Table 13.

Task 3B – Surface Preparation and Coating Application Procedures

The surface preparation and coating application procedures employed for this coatings study are described below.

The coatings study was performed on various substrate materials, including six types of wood, and drywall and concrete. The substrate type(s) was dependent on the service category of the coatings. In some cases, more than one substrate material was used for a service category (see Table 5). The wood substrates were obtained from Sutherland Lumber Company located in Burgettstown, PA. All wood panels were cut to size by the lumber company. The trowel finish concrete panels were poured by Avelli Corporation of Ambridge, PA and allowed to cure a minimum of 28 days prior to paint application (pour date 3-28-01). The effluorescence test was conducted on fresh concrete, painted 24 hours after pouring. The drywall was obtained from a local Home Depot store, and the LP siding was obtained from Future Building of America Co. of Farrell, PA.

With the exception of the LP siding, the wood substrates were prepared by sanding using a medium grade sand paper, followed by wiping with a dry cloth to remove any residual surface dust. The concrete substrate was prepared by acid-etching using muriatic acid solution, then thoroughly rinsed with fresh water. The drywall surfaces did not receive any special surface preparation prior to paint application. The LP siding was supplied to KTA pre-primed. Therefore, no special surface preparation was required for this substrate material. In some cases, the performance testing procedures required a specific type of surface preparation. In these cases, the specific surface preparation steps were followed in lieu of the general procedures described herein.

After surface preparation, all coating materials were mixed and applied in accordance with the respective coating manufacturer's recommendations printed on the product data sheets, as supplied with the coating materials or obtained by KTA personnel. Prevailing application conditions inside the KTA application facility (air temperature, relative humidity, dew point temperature) and surface temperature were measured and recorded for each application. Conditions were measured using a psychrometer and surface temperature thermometer. Psychrometric tables were used to determine the relative humidity and dew point temperature. The coating application records are attached to this report (Appendix 3); the range of each of the four conditions is summarized in the table below.

Prevailing Application Conditions – All Products

Condition	Range
Air Temperature	65°F - 77°F
Relative Humidity	24% - 60%
Dew Point Temperature	26°F - 55°F
Surface Temperature	65°F - 78°F

Coating materials were applied by brush, roller or spray, as instructed by each respective coating manufacturer. Coating thickness data (except for the interior stains) is attached to the coating records. Since the substrate material was non-ferrous, dry thickness data was generated by applying the coatings (using the same application technique) to smooth steel panels, then measuring the resulting dry film thickness on the steel panels non-destructively, according to ASTM D1186. It should be noted that the coating systems evaluated under the service category "Non-Flats Exterior" and "Non-Flats Interior" were applied over a common primer (Sherwin-Williams A-100, Y24W20), as directed by the Technical Advisory Committee.

The majority of the performance testing was initiated on the applied coatings after a minimum 14 day ambient curing period. However, some of the performance tests were conducted during application (e.g., lapping and grain raising), and the effluorescence testing was initiated two hours after paint application, as required by the procedure. The performance tests are described in the next section.

Task 3C – Performance Tests

The following performance tests were conducted on the applied coating systems. The results of the performance tests are contained in the Test Results section of this report (by Table Number, as indicated after each test description).

Open Time/Lapping

Open time/lapping was performed on twelve (12) paints representing two (2) service categories (Non-Flat Interior and Exterior) and six (6) interior stains. There is no known ASTM test method to evaluate this characteristic, therefore a procedure was supplied to KTA by the Technical Advisory Committee in the October 18, 2001 correspondence. However, this procedure, written for semi-transparent stains (not paints), employs the use of a single substrate (white pine) and describes the use of a "reference stain." Because of these limitations, KTA substantially revised the procedure for paints, as described below. Minor modifications were made for testing the interior stains.

Substrate representative of each matrix was prepared by sanding with 120 grit sandpaper, "tacked" with mineral spirits to remove any surface dust, then allowed to air dry for a minimum of two days at lab ambient temperature and humidity. All specimens were 6" wide x 12" long, and positioned horizontally during test, so that the 12" sides were at the top and bottom of the specimen. A 2-3" strip of paint was applied across the top of each specimen (for each paint and substrate material). Vertical strips of the same paint were then applied, overlapping into the horizontal strip at least 1" at six (6) time intervals after application of the horizontal strip (immediate, 1 minute, 2 minutes, 4 minutes, 8 minutes and 16 minutes). The overlap areas representing each time interval were examined for blending, and the "open time" reported for each. For example, if the vertical strips of paint blended into the horizontal strip after 1, 2 and 4 minutes, but not after 8 minutes, the open time is recorded as 4 minutes.

Conversely, lapping of the interior stains was essentially evaluated as described in the procedure supplied to KTA by the Technical Advisory Committee. White pine, maple and oak substrates were prepared (in triplicate) as described above. Since no reference stain was provided, KTA applied each of the six (6) test stains to half of each specimen. After approximately one minute, the excess stain was wiped with a clean, dry cloth. After approximately ten minutes, the same stain was applied to the opposite half of the specimen, overlapping into the first application by a minimum of 3 inches. After three minutes the excess stain was wiped with a clean, dry cloth. If the overlap area showed a darkened surface, further rubbing was employed in an attempt to blend the overlap. The two halves of each specimen were visually compared for color consistency. Visible color differences were quantified (if necessary) by measuring the color of the two halves and the color of overlap area, then reporting the delta E color difference. Results are contained in Table 14A-E.

Grain Raising

Grain raising was performed on twelve (12) paints representing two (2) service categories (Primer/Sealer/Undercoater- Interior and Exterior) and six (6) interior stains. Similar to open time/lapping, there is no known ASTM test method to evaluate this characteristic; therefore a procedure was supplied to KTA by the Technical Advisory Committee in the October 18, 2001 correspondence. This procedure (as described below) was employed by KTA, except that no reference material was supplied, and KTA established a rating scale, in order to quantify the smoothness of the grain after application.

Substrate representative of each matrix was prepared by sanding with 120 grit sandpaper, "tacked" with mineral spirits to remove any surface dust, then allowed to air dry for a minimum of two days at lab ambient temperature and humidity. All specimens were 6" wide x 12" long. The paints and stains were applied according to each respective manufacturer's instructions. The specimens were permitted a minimum 24 hour air dry, then were evaluated tactilely for relative smoothness on a scale of 1 to 5, described in the table below. Results are contained in Table 15A-E.

Rating	Surface Description
1	No graining raising – smooth to the touch

2	Slight grain raising
3	Moderate grain raising
4	Moderate-to-severe grain raising
5	Severe grain raising

Adhesion

Adhesion of the paints and stains to the underlying surfaces was evaluated on all products representing all six (6) service categories. Adhesion was performed in accordance with ASTM D3359, "Measuring Adhesion by Tape Test." Attempts were made to perform the testing as described in Method B (cross-cut), as most of the applied paints were less than 2 mils. However the knife blade had a tendency to follow the wood grain, resulting in non-parallel cuts. This yielded inconsistent test data. Therefore Method A (X-cut) was used for all paints and stains, independent of thickness (this procedure is normally employed for films in excess of 5 mils). Further, although this test was conducted on the interior stains, it is unlikely that this data will be meaningful, as the stains are not intended to "bond" to the underlying surface, but rather penetrate the wood grain. Briefly, an "X" was cut into the film, each leg of the "X" was approximately 1.5 inches long. The intersection of the "X" was a 15-30^{o} angle. The cut area was brushed to remove any debris, and the specified tape (Permacel 99) was applied to the cut areas and pressed firmly to the surface using a pencil eraser. The tape was subsequently removed rapidly from the surface, and the "X-cut" area evaluated for paint detachment according to the rating scale prescribed in the ASTM standard. A rating of 5A indicates no disbonding, while a rating of 0A indicates removal beyond the area of the "X" cut. The results are contained in Table 16A-H.

The original test matrix also called for adhesion testing per ASTM D2197, "Adhesion of Organic Coatings by Scrape Adhesion." This method states that the candidate paints should be applied to substrates of the composition and surface condition representative of the intended use. However, the method also states that the substrate must be hard enough so that it will not be damaged by the scraping loop (e.g., cold-rolled steel). Unfortunately, the wood and drywall surfaces included in this study are not of sufficient hardness to withstand the force of the scraping loop. However, applying paints to steel and evaluating the scrape adhesion to that substrate (which is non-representative of the intended service) will also not generate any useful data. Therefore, the test was not performed.

For the concrete coatings matrix, an alternative method of adhesion was employed (in addition to the tape adhesion), described below.

Tensile adhesion was performed on the concrete coatings according to ASTM D4541, "Pull-off Strength of Coatings using Portable Adhesion Testers;" Annex A.4 (pneumatic tester). Briefly, duplicate pull stubs were attached to each set of triplicate panels using a two component 100% solids epoxy adhesive. After a minimum 24 hour cure time, the pull stubs were detached using a pneumatically energized piston that applies perpendicular pulling force to the pull stub. The point of detachment is converted to pounds per square inch (psi) pulling force, and the location of break is reported as adhesion (a split or between the substrate and coating), cohesion (a split within the coating itself) or glue (pulling force exceeds glue strength). The results are contained in Table 27.

Stain Blocking

Stain blocking was performed on six (6) paints representing one (1) service category (Primer/Sealer/Undercoater- Exterior) and six (6) interior stains. Specimen preparation and testing were performed according to ASTM D6686-01, "Evaluation of Tannin Stain Resistance of Coatings." This procedure is summarized below.

Wood substrates (red cedar and LP siding for the paints and pine, oak and maple for the stains) were prepared by light sanding with 200 grit paper to break the surface glaze and remove any foreign materials. The 6" wide by 48" long specimens were subdivided into seven (7) - 6" segments (3" sections from both ends of each specimen were not used for testing). The middle 6" segment of each specimen was prepared by application of the "control paint" (supplied by Sherwin-Williams) that reportedly does not offer any tannin stain resistance (failure control). The six candidate paints were then applied (one per 6" segment) to the face of each wood substrate, leaving the backsides uncoated. Triplicate panels were prepared. After 24 hours drying time the panels were exposed to condensing humidity conditions (ASTM D4585) for 16 hours. Provided the control painted area exhibited staining, the panels were removed, allowed to air dry, then visually rated for tannin stain resistance on a scale of 0-10, with 10 being no evidence of tannin staining and 0 indicating severe staining (7: minor-moderate; 5: moderate; 3: moderate-severe). Color differences (ΔL^* and Δb^*) were then measured using the CIE L* a* b* spectrophotometer (ASTM D2244). The results are contained in Table 17A-E.

Scrub Resistance

Scrub resistance was performed on twelve (12) paints representing two (2) service categories (Non-flat Interior and Non-flat Exterior) and six (6) interior stains. Testing was performed according to ASTM D2486, "Test Method for Scrub Resistance of Wall Paints." Testing the interior stains was performed on prepared wood substrates, while testing of the paints was conducted on aluminum substrate, (aluminum could not be used for the stains, as it would not accept the stain). The number of scrub cycles performed (average of triplicate test specimens) until visible wear-through was observed for each product is contained in Table 18A-D.

Sandability

Sandability testing was performed on six (6) paints representing one (1) service category (Primer/Sealer/Undercoater-Interior) on both pine and drywall substrates. There is no known ASTM Standard for assessing sandability. Therefore the following testing procedure was proposed by KTA and approved for use by the Technical Advisory Committee.

Sandability testing was performed by adapting the scrub resistance tester (described in ASTM D2486) for this testing protocol. The scrub resistance apparatus was employed to standardize the pressure and stoke length on each paint material.

Three (3) grades of sandpaper were employed for the testing, including coarse (60 grit), medium (100 grit) and fine (150 grit) paper. Since triplicate 7" x 14" specimens were prepared for this test, each specimen was subdivided into thirds, each section being approximately 2.25" wide and 14" long. Each section was assigned a grade of sandpaper. The test apparatus was equipped with a fresh piece of coarse grade of sandpaper, and 64 cycles (one minute of continuous sanding) were conducted. The sandpaper was removed from the apparatus and the sandpaper and sanded surfaces were qualitatively examined as to whether the paint "powdered" during sanding, or whether the paint "gummed-up" the sandpaper. This procedure was repeated on the remaining two sections of each specimen using the medium and fine grades of sandpaper, respectively. Testing was performed on triplicate specimens, using fresh sandpaper for each trial. The results of the testing are contained in Table 19A-B.

Chemical Resistance

Chemical resistance (spot tests) was performed on twelve (12) paints representing two service categories (floors-concrete and primer/sealer/undercoater-interior). Testing was performed in accordance with ASTM D 1308, "Effect of Household Chemicals on Clear and Pigmented Organic Finishes." Briefly the testing involved application of chemical spots to the coated surfaces for 24 hours. The spots were covered with watch glasses to prevent evaporation/drying of the chemical solution. After 24 hours, the chemicals were rinsed from the surface using tap water and the area visually examined for loss of gloss, softening or other signs of chemical attack. The table below lists the chemicals for each of the two service categories. The results of the testing are provided in Table 20A-N.

Chemical	Primer/Sealer/Undercoater-Interior	Floors-Concrete
Ketchup	X	
Mustard	X	
Crayons	X	
Markers	X	
Lipstick	X	
Tap Water		X
Tap Water with Detergent		X
Gasoline (80% n-octane)		X
Oil		X
Anti-freeze		X
Skydrol[1]		X
Power Steering Fluid		X
Brake Line Fluid		X
Windshield Washer Fluid		X

[1]*Commercial aircraft hydraulic fluid acquired from US Airways*

Abrasion Resistance

Abrasion resistance testing was performed on six (6) paints representing one service category (floors-concrete). Testing was performed in accordance with ASTM D 4060, "Abrasion Resistance of Organic Coatings by the Taber Abraser." The coating thickness was measured and recorded on triplicate test panels. Subsequently the panels were subjected to abrasion testing using CS-17 abrasion wheels and a 1000 gram load. The number of cycles required to "wear-through" the coating was recorded, and the "wear cycles per mil" was computed using the following formula:

W = D/T, where: W = wear cycles per mil
D = number of cycles required to wear the coating to the substrate
T = thickness of the coating (in mils)

The number of cycles to "wear-through" (D) and the "wear cycles per mil" (W) are provided in Table 21. The higher the value, the better the abrasion resistance, as the value represents the number of cycles required to wear-through one (1) mil of coating.

Impact Resistance

Impact resistance testing was performed on six (6) paints representing one service category (floors-concrete). Testing was performed in accordance with ASTM D 2794, "Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)." A Gardner Variable Impactor was employed, and testing was performed in triplicate. The results of the testing (reported in inch/pounds) are contained in Table 22.

Pencil Hardness

Pencil hardness testing was performed on six (6) paints representing one service category (floors-concrete). Testing was performed in accordance with ASTM D 3363, "Test Method for Film Hardness by Pencil Test." Seventeen (17) pencils containing leads of various hardness (see scale below) are prepared by sharpening, then dulling the point flat using emery paper. A "mid-range" pencil is selected and held at a 45^o angle to the coated surface. An attempt is made to scratch the coating film using the edge of the dulled point. If the coating scratches, a softer lead is selected and the test is conducted in a new area. If the lead gives way, a harder lead is chosen, and a new area is tested. The hardest lead that will not scratch the coating is the coating's pencil hardness. Testing was performed in triplicate. The results of the testing are contained in Table 23.

Pencil Hardness Scale

6B	5B	4B	3B	2B	B	HB	F	H	2H	3H	4H	5H	6H	7H	8H	9H

Soft ***Medium*** ***Hard***

Effluorescence Resistance of Alkaline Substrates

Effluorescence resistance of alkaline substrates was performed on six (6) paints representing one service category (floors-concrete). This procedure was submitted for use in this testing program by Smiland Paint Company, Los Angeles, California. The purpose of the test is to evaluate a coating system's resistance to the migration of efflorescence from an alkaline substrate and the resistance to alkali "burn" or color change of tinted systems. This is achieved by tinting the coating with an organic red (Napthol Red) and an exterior organic yellow. The degree of change in color is an indication of alkali resistance and the degree of crystal growth and effect on adhesion and film appearance is an indication of efflorescence resistance.

Triplicate concrete panels (12" x 12" x 1") were freshly poured and cured for one day. The molds were removed and the coatings were applied and air dried for two hours. Prior to application, the coatings were thoroughly mixed, then tinted with 20 grams of Napthol Red and 20 grams of exterior yellow (to 13 fluid ounces of paint).

An 8' x 6'x 1.5" deep trough was constructed of 2" x 4" lumber and double visqueen. The coated concrete specimens were placed inside the trough, and the trough was filled with tap water to a level just below the top of the coated specimens. This water level was maintained for the test duration. Since the test method stated that efflorescence can typically be seen in three to four days, the test was conduced for a period of six (6) days, then stopped. The results of the testing are contained in Table 24.

Blocking Resistance

Blocking resistance was performed on twelve (12) paints representing two service categories (Non-flat Interior and Non-Flat Exterior) at two temperatures. Testing was performed in accordance with ASTM D 2793, “Block Resistance of Organic Coatings on Wood Substrates.” Briefly for each set of replicate samples and test temperature, six (6) test specimens are “stacked” and pressed into platens at 5 PSI pressure using a hydraulic press. The order of specimens (from bottom to top) is: one face-up; two face-down; one face-up; and two face-down, providing two face-to-face and two face-to-back contacts. Slip sheets between contact faces were not employed.

After compressing the samples, the specimens remained in the specified temperature atmosphere (72 +/- 2^{o}F or 120 +/- 5^{o}F) for 24 hours, then were disassembled and rated for the degree of blocking and surface damage according to the table below. The results of the testing are contained in Table 25A-F.

Degree of Blocking		**Surface Damage**	
A	Free fall separation	*0*	None
B	Slight tap to separate	*1*	<1%
C	Slight pressure to separate	*2*	1-5%
D	Moderate pressure to separate	*3*	5-20%
E	Extreme pressure to separate	*4*	20-50%
F	Tool required pressure to separate	*5*	>50%

<u>Accelerated Weathering</u>

Accelerated weathering resistance was performed on twelve (12) paints representing two service categories (Non-Flat Exterior and Primer/Sealer/Undercoater-Exterior). Testing was performed in accordance with ASTM G154, “Practice for Operating Fluorescent Light Apparatus.”

Baseline color and 60^o gloss data (ASTM D2244 and D523, respectively) was obtained on triplicate specimens representing each paint and service category. Subsequently, the test specimens were exposed to alternating condensation and heat /ultraviolet light using a QUV chamber manufactured by Q Panel Company of Cleveland, Ohio. Each cycle consisted of 4 hours UV (UVA 340 lamps) at 60^{o}C, followed by 4 hours condensation at 50^{o}C. After 500 hours (approximately three weeks), the specimens were removed from testing and post-exposure color and gloss data were collected. The results of the testing are contained in Table 26A-C.

TEST RESULTS

The results of the General Characteristics testing are contained in Part 1 of this section; the results of the Performance Testing are contained in Part 2.

Part 1 – Results of General Characteristics Testing

Tables 6-13 below contain the results of the General Characteristics testing performed under this contract. The data are segregated by service category. The VOC *"grouping"* for this study (based on the respective manufacturer's published data) is also indicated in Column 4 ([L] Lower VOC or [H] Higher VOC).

Table 6 – Measured VOC Content Data

Manufacturer Code	Product Code	Service Category	VOC Grouping		Measured VOC Content
A	1	Floor	>100 g/L	H	308 g/L
B	2	Floor	<100 g/L	L	0 g/L
C	3	Floor	<100 g/L	L	112 g/L
D	4	Floor	>100 g/L	H	308 g/L
D	5	Floor	>100 g/L	H	111 g/L
E	6	Floor	<100 g/L	L	136 g/L
F	7	NF-Int./Ext.	<150 g/L	L	102 g/L
G	8	NF-Interior	<150 g/L	L	290 g/L
A	9	NF-Int./Ext.	>150 g/L	H	247 g/L
D	10	NF-Interior	>150 g/L	H	281 g/L
J	13	NF-Exterior	>150 g/L	H	345 g/L
H	11	NF-Ext./Int.	>150 g/L	H	222 g/L
I	12	NF-Ext./Int.	<150 g/L	L	150 g/L
D	14	NF-Exterior	<150 g/L	L	7 g/L
A	15	PSU-Int./Ext.	>200 g/L	H	428 g/L
K	16	PSU-Interior	<200 g/L	L	106 g/L
L	17	PSU-Interior	<200 g/L	L	212 g/L
H	18	PSU-Interior	<200 g/L	L	91 g/L
H	19	PSU-Interior	>200 g/L	H	330 g/L
D	20	PSU-Interior	>200 g/L	H	445 g/L
H	21	PSU-Exterior	<200 g/L	L	207 g/L
H	22	PSU-Exterior	>200 g/L	H	319 g/L
D	23	PSU-Exterior	<200 g/L	L	111 g/L
D	24	PSU-Exterior	>200 g/L	H	323 g/L
M	25	PSU-Exterior	<200 g/L	L	227 g/L
N	26	Stain-Interior	>250 g/L	H	328 g/L
A	27	Stain-Interior	>250 g/L	H	364 g/L
O	28	Stain-Interior	<250 g/L	L	261 g/L
O	29	Stain-Interior	<250 g/L	L	315 g/L
P	30	Stain-Interior	>250 g/L	H	489 g/L
Q	31	Stain-Interior	<250 g/L	L	277 g/L

Table 6A – Density and Weight Solids Data (used to calculate VOC)

Manufacturer Code	Product Code	Service Category	VOC Category		Density (Lbs./gal)	Weight Solids
A	1	Floor	>100 g/L	H	10.37	46.38%
B	2	Floor	<100 g/L	L	9.68	45.6%
C	3	Floor	<100 g/L	L	9.51	89.45%
D	4	Floor	>100 g/L	H	10.43	50.72%
D	5	Floor	>100 g/L	H	11.10	79.72%
E	6	Floor	<100 g/L	L	12.58	68.27%
F	7	NF-Int./Ext.	<150 g/L	L	9.95	51.66%
G	8	NF-Interior	<150 g/L	L	9.64	53.52%
A	9	NF-Int./Ext.	>150 g/L	H	10.31	49.80%
D	10	NF-Interior	>150 g/L	H	10.21	56.39%
J	13	NF-Exterior	>150 g/L	H	10.02	43.60%
H	11	NF-Ext./Int.	>150 g/L	H	9.74	41.16%
I	12	NF-Ext./Int.	<150 g/L	L	10.35	50.2%
D	14	NF-Exterior	<150 g/L	L	10.86	52.45%
A	15	PSU-Int./Ext.	>200 g/L	H	10.70	66.64%
K	16	PSU-Interior	<200 g/L	L	10.89	57%
L	17	PSU-Interior	<200 g/L	L	9.97	53.83%
H	18	PSU-Interior	<200 g/L	L	10.94	53.92%
H	19	PSU-Interior	>200 g/L	H	11.68	75.85%
D	20	PSU-Interior	>200 g/L	H	9.81	62.06%
H	21	PSU-Exterior	<200 g/L	L	10.14	53.41%
H	22	PSU-Exterior	>200 g/L	H	12.16	78.11%
D	23	PSU-Exterior	<200 g/L	L	10.76	50.45%
D	24	PSU-Exterior	>200 g/L	H	11.49	76.55%
M	25	PSU-Exterior	<200 g/L	L	10.35	49.98%
N	26	Stain-Interior	>250 g/L	H	7.43	63.05%
A	27	Stain-Interior	>250 g/L	H	7.95	61.77%
O	28	Stain-Interior	<250 g/L	L	8.61	19.48%
O	29	Stain-Interior	<250 g/L	L	8.50	17.36%
P	30	Stain-Interior	>250 g/L	H	8.21	19.50%
Q	31	Stain-Interior	<250 g/L	L	8.48	20.6%

Table 7 – Percent Volume Solids Data

Manufacturer Code	Product Code	Service Category	VOC Category		Percent Volume Solids
A	1	Floor	>100 g/L	H	25.82%
B	2	Floor	<100 g/L	L	33.24%
C	3	Floor	<100 g/L	L	81.53%
D	4	Floor	>100 g/L	H	37.95%
D	5	Floor	>100 g/L	H	67.42%
E	6	Floor	<100 g/L	L	60.17%
F	7	NF-Int./Ext.	<150 g/L	L	41.67%
G	8	NF-Interior	<150 g/L	L	40.07%
A	9	NF-Int./Ext.	>150 g/L	H	35.58%
D	10	NF-Interior	>150 g/L	H	41.48%
J	13	NF-Exterior	>150 g/L	H	32.36%
H	11	NF-Ext./Int.	>150 g/L	H	29.19%
I	12	NF-Ext./Int.	<150 g/L	L	35.25%
D	14	NF-Exterior	<150 g/L	L	40.95%
A	15	PSU-Int./Ext.	>200 g/L	H	43.06%
K	16	PSU-Interior	<200 g/L	L	44.20%
L	17	PSU-Interior	<200 g/L	L	38.07%
H	18	PSU-Interior	<200 g/L	L	34.50%
H	19	PSU-Interior	>200 g/L	H	52.57%
D	20	PSU-Interior	>200 g/L	H	41.89%
H	21	PSU-Exterior	<200 g/L	L	41.68%
H	22	PSU-Exterior	>200 g/L	H	58.30%
D	23	PSU-Exterior	<200 g/L	L	34.98%
D	24	PSU-Exterior	>200 g/L	H	56.9%
M	25	PSU-Exterior	<200 g/L	L	36.55%
N	26	Stain-Interior	>250 g/L	H	51.13%
A	27	Stain-Interior	>250 g/L	H	45.47%
O	28	Stain-Interior	<250 g/L	L	3.58%
O	29	Stain-Interior	<250 g/L	L	2.61%
P	30	Stain-Interior	>250 g/L	H	15.10%
Q	31	Stain-Interior	<250 g/L	L	16.12%

Table 8 – Viscosity Data

Manufacturer Code	Product Code	Service Category	VOC Category		Viscosity (Krebs Units)
A	1	Floor	>100 g/L	H	79 KU
B	2	Floor	<100 g/L	L	59 KU
C	3	Floor	<100 g/L	L	72 KU
D	4	Floor	>100 g/L	H	88 KU
D	5	Floor	>100 g/L	H	87 KU
E	6	Floor	<100 g/L	L	118 KU
F	7	NF-Int./Ext.	<150 g/L	L	87 KU
G	8	NF-Interior	<150 g/L	L	87 KU
A	9	NF-Int./Ext.	>150 g/L	H	100 KU
D	10	NF-Interior	>150 g/L	H	99 KU
J	13	NF-Exterior	>150 g/L	H	89 KU
H	11	NF-Ext./Int.	>150 g/L	H	100 KU
I	12	NF-Ext./Int.	<150 g/L	L	113 KU
D	14	NF-Exterior	<150 g/L	L	115 KU
A	15	PSU-Int./Ext.	>200 g/L	H	97 KU
K	16	PSU-Interior	<200 g/L	L	100 KU
L	17	PSU-Interior	<200 g/L	L	84 KU
H	18	PSU-Interior	<200 g/L	L	104 KU
H	19	PSU-Interior	>200 g/L	H	94 KU
D	20	PSU-Interior	>200 g/L	H	96 KU
H	21	PSU-Exterior	<200 g/L	L	93 KU
H	22	PSU-Exterior	>200 g/L	H	90 KU
D	23	PSU-Exterior	<200 g/L	L	101 KU
D	24	PSU-Exterior	>200 g/L	H	123 KU
M	25	PSU-Exterior	<200 g/L	L	89 KU
N	26	Stain-Interior	>250 g/L	H	45 KU
A	27	Stain-Interior	>250 g/L	H	47 KU
O	28	Stain-Interior	<250 g/L	L	<51 KU
O	29	Stain-Interior	<250 g/L	L	<42 KU
P	30	Stain-Interior	>250 g/L	H	55 KU
Q	31	Stain-Interior	<250 g/L	L	47 KU

Table 9 – Percent Water Data

Manufacturer Code	Product Code	Service Category	VOC Category		Method	Percent Water
A	1	Floor	>100 g/L	H	B	41.73%
B	2	Floor	<100 g/L	L	B	56.1%
C	3	Floor	<100 g/L	L		Solvent borne
D	4	Floor	>100 g/L	H	B	35.63%
D	5	Floor	>100 g/L	H		Solvent borne
E	6	Floor	<100 g/L	L	A	27.17%
F	7	NF-Int./Ext.	<150 g/L	L	B	44.31%
G	8	NF-Interior	<150 g/L	L	B	35.04%
A	9	NF-Int./Ext.	>150 g/L	H	A	40.17%
D	10	NF-Interior	>150 g/L	H	A	30.65%
J	13	NF-Exterior	>150 g/L	H	B	42.34%
H	11	NF-Ext./Int.	>150 g/L	H	B	48.13%
I	12	NF-Ext./Int.	<150 g/L	L	B	44.4%
D	14	NF-Exterior	<150 g/L	L	A	47.36%
A	15	PSU-Int./Ext.	>200 g/L	H		Solvent borne
K	16	PSU-Interior	<200 g/L	L	B	39.0%
L	17	PSU-Interior	<200 g/L	L	B	36.13%
H	18	PSU-Interior	<200 g/L	L	A	43.08%
H	19	PSU-Interior	>200 g/L	H		Solvent borne
D	20	PSU-Interior	>200 g/L	H		Solvent borne
H	21	PSU-Exterior	<200 g/L	L	B	37.29%
H	22	PSU-Exterior	>200 g/L	H		Solvent borne
D	23	PSU-Exterior	<200 g/L	L	B	46.05%
D	24	PSU-Exterior	>200 g/L	H		Solvent borne
M	25	PSU-Exterior	<200 g/L	L	B	41.02%
N	26	Stain-Interior	>250 g/L	H		Solvent borne
A	27	Stain-Interior	>250 g/L	H		Solvent borne
O	28	Stain-Interior	<250 g/L	L	B	74.8%
O	29	Stain-Interior	<250 g/L	L	B	75.6%
P	30	Stain-Interior	>250 g/L	H	A	60.43%
Q	31	Stain-Interior	<250 g/L	L	B	72.2%

Method A: Gas Chromatography (ASTM D3792)
Method B: Karl Fisher Titration (ASTM D4017)
Determination of "solvent borne versus water borne" is based on solubility in solvent or water in aluminum lab dishes prior to analysis.

Table 10 – Freeze/Thaw Resistance Data

Manufacturer Code	Product Code	Service Category	VOC Category		Control Viscosity	Post Freeze/Thaw Viscosity & Observations
A	1	Floor	>100 g/L	H	79 KU	134 KU (Note 1)
B	2	Floor	<100 g/L	L	59 KU	70 KU
C	3	Floor	<100 g/L	L	72 KU	Solvent borne
D	4	Floor	>100 g/L	H	88 KU	90 KU
D	5	Floor	>100 g/L	H	87 KU	Solvent borne
E	6	Floor	<100 g/L	L	118 KU	129 KU
F	7	NF-Int./Ext.	<150 g/L	L	87 KU	Gelled in can
G	8	NF-Interior	>150 g/L	H	87 KU	Gelled in can
A	9	NF-Int./Ext.	>150 g/L	H	100 KU	Gelled in can
D	10	NF-Interior	>150 g/L	H	99 KU	105 KU
J	13	NF-Exterior	>150 g/L	H	89 KU	93 KU
H	11	NF-Ext./Int.	>150 g/L	H	100 KU	101 KU
I	12	NF-Ext./Int.	<150 g/L	L	113 KU	138 KU
D	14	NF-Exterior	<150 g/L	L	115 KU	121 KU
A	15	PSU-Int./Ext.	>200 g/L	H	97 KU	Solvent borne
K	16	PSU-Interior	<200 g/L	L	100 KU	Gelled in can
L	17	PSU-Interior	<200 g/L	L	84 KU	Gelled in can
H	18	PSU-Interior	<200 g/L	L	104 KU	124 KU (Note 1)
H	19	PSU-Interior	>200 g/L	H	94 KU	Solvent borne
D	20	PSU-Interior	>200 g/L	H	96 KU	Solvent borne
H	21	PSU-Exterior	<200 g/L	L	93 KU	98 KU
H	22	PSU-Exterior	>200 g/L	H	90 KU	90-92 KU
D	23	PSU-Exterior	<200 g/L	L	101 KU	110 KU
D	24	PSU-Exterior	>200 g/L	H	123 KU	Solvent borne
M	25	PSU-Exterior	<200 g/L	L	89 KU	114 KU
N	26	Stain-Interior	>250 g/L	H	45 KU	Solvent borne
A	27	Stain-Interior	>250 g/L	H	47 KU	Solvent borne
O	28	Stain-Interior	<250 g/L	L	<51 KU	<47 KU
O	29	Stain-Interior	<250 g/L	L	<42 KU	<56 KU
P	30	Stain-Interior	>250 g/L	H	55 KU	55 KU
Q	31	Stain-Interior	<250 g/L	L	47 KU	< 51 KU

Note 1: Solids/agglomerations in can

With the exception of the five (5) products that gelled in the can and the two (2) products that exhibited agglomerations in the can (per Note 1), all other products tested appeared in good condition after five (5) freeze/thaw cycles, and did not exhibit changes in hiding, gloss or color. The solvent borne coatings were not evaluated for freeze/thaw resistance.

Table 11 – Hiding Data

Manufacturer Code	Product Code	Service Category	VOC Category		Contrast Ratio
A	1	Floor	>100 g/L	H	0.98
B	2	Floor	<100 g/L	L	0.94
C	3	Floor	<100 g/L	L	0.99
D	4	Floor	>100 g/L	H	1.00
D	5	Floor	>100 g/L	H	1.00
E	6	Floor	<100 g/L	L	0.99
F	7	NF-Int./Ext.	<150 g/L	L	0.96
G	8	NF-Interior	<150 g/L	L	0.91
A	9	NF-Int./Ext.	>150 g/L	H	0.96
D	10	NF-Interior	>150 g/L	H	0.99
J	13	NF-Exterior	>150 g/L	H	0.93
H	11	NF-Ext./Int.	>150 g/L	H	0.88
I	12	NF-Ext./Int.	<150 g/L	L	0.96
D	14	NF-Exterior	<150 g/L	L	0.94
A	15	PSU-Int./Ext.	>200 g/L	H	0.91
K	16	PSU-Interior	<200 g/L	L	0.90
L	17	PSU-Interior	<200 g/L	L	0.88
H	18	PSU-Interior	<200 g/L	L	0.86
H	19	PSU-Interior	>200 g/L	H	0.95
D	20	PSU-Interior	>200 g/L	H	0.82
H	21	PSU-Exterior	<200 g/L	L	0.89
H	22	PSU-Exterior	>200 g/L	H	0.89
D	23	PSU-Exterior	<200 g/L	L	0.91
D	24	PSU-Exterior	>200 g/L	H	0.91
M	25	PSU-Exterior	<200 g/L	L	0.85
N	26	Stain-Interior	>250 g/L	H	0.21
A	27	Stain-Interior	>250 g/L	H	0.18
O	28	Stain-Interior	<250 g/L	L	0.06
O	29	Stain-Interior	<250 g/L	L	0.02
P	30	Stain-Interior	>250 g/L	H	0.39
Q	31	Stain-Interior	<250 g/L	L	0.01

Table 12 – Drying Time Data (Dry-to-Touch)

Manufacturer Code	Product Code	Category	VOC Category		Drying Time (to touch)
A	1	Floor	>100 g/L	H	25 minutes
B	2	Floor	<100 g/L	L	33 minutes
C	3	Floor	<100 g/L	L	27 hours
D	4	Floor	>100 g/L	H	20 minutes
D	5	Floor	>100 g/L	H	205 minutes
E	6	Floor	<100 g/L	L	200 minutes
F	7	NF-Int./Ext.	<150 g/L	L	30 minutes
G	8	NF-Interior	>150 g/L	H	20 minutes
A	9	NF-Int./Ext.	>150 g/L	H	20 minutes
D	10	NF-Interior	>150 g/L	H	30 minutes
J	13	NF-Exterior	>150 g/L	H	30 minutes
H	11	NF-Ext./Int.	>150 g/L	H	40 minutes
I	12	NF-Ext./Int.	<150 g/L	L	17 minutes
D	14	NF-Exterior	<150 g/L	L	30 minutes
A	15	PSU-Int./Ext.	>200 g/L	H	10 minutes
K	16	PSU-Interior	<200 g/L	L	26 minutes
L	17	PSU-Interior	<200 g/L	L	15 minutes
H	18	PSU-Interior	<200 g/L	L	20 minutes
H	19	PSU-Interior	>200 g/L	H	124 minutes
D	20	PSU-Interior	>200 g/L	H	45 minutes
H	21	PSU-Exterior	<200 g/L	L	30 minutes
H	22	PSU-Exterior	>200 g/L	H	35 minutes
D	23	PSU-Exterior	<200 g/L	L	30 minutes
D	24	PSU-Exterior	>200 g/L	H	90 minutes
M	25	PSU-Exterior	<200 g/L	L	30 minutes
N	26	Stain-Interior	>250 g/L	H	300 minutes
A	27	Stain-Interior	>250 g/L	H	180 minutes
O	28	Stain-Interior	<250 g/L	L	7.5 minutes
O	29	Stain-Interior	<250 g/L	L	8.5 minutes
P	30	Stain-Interior	>250 g/L	H	60 minutes
Q	31	Stain-Interior	<250 g/L	L	39 minutes

Table 13 – Sag Resistance Data

Manufacturer Code	Product Code	Service Category	VOC Category		Sag Resistance (WFT)
A	1	Floor	>100 g/L	H	No sag @ 12 mils
B	2	Floor	<100 g/L	L	5 mils
C	3	Floor	<100 g/L	L	Cannot measure
D	4	Floor	>100 g/L	H	No sag @ 12 mils
D	5	Floor	>100 g/L	H	1 mil
E	6	Floor	<100 g/L	L	Cannot measure
F	7	NF-Int./Ext.	<150 g/L	L	7 mils
G	8	NF-Interior	>150 g/L	H	No sag @ 12 mils
A	9	NF-Int./Ext.	>150 g/L	H	8 mils
D	10	NF-Interior	>150 g/L	H	11 mils
J	13	NF-Exterior	>150 g/L	H	9 mils
H	11	NF-Ext./Int.	>150 g/L	H	8 mils
I	12	NF-Ext./Int.	<150 g/L	L	5 mils
D	14	NF-Exterior	<150 g/L	L	6 mils
A	15	PSU-Int./Ext.	>200 g/L	H	5.5 mils
K	16	PSU-Interior	<200 g/L	L	No sag @ 12 mils
L	17	PSU-Interior	<200 g/L	L	No sag @ 12 mils
H	18	PSU-Interior	<200 g/L	L	No sag @ 12 mils
H	19	PSU-Interior	>200 g/L	H	6 mils
D	20	PSU-Interior	>200 g/L	H	5 mils
H	21	PSU-Exterior	<200 g/L	L	9 mils
H	22	PSU-Exterior	>200 g/L	H	7 mils
D	23	PSU-Exterior	<200 g/L	L	10 mils
D	24	PSU-Exterior	>200 g/L	H	5.5 mils
M	25	PSU-Exterior	<200 g/L	L	5 mils
N	26	Stain-Interior	>250 g/L	H	1 mil
A	27	Stain-Interior	>250 g/L	H	1 mil
O	28	Stain-Interior	<250 g/L	L	1 mil
O	29	Stain-Interior	<250 g/L	L	1 mil
P	30	Stain-Interior	>250 g/L	H	4.5 mils
Q	31	Stain-Interior	<250 g/L	L	1 mil

Part 2 – Results of Performance Testing

Tables 14A-27 below contain the results of the performance testing performed under this contract. The data are segregated by service category. The VOC *categorization* for this project (in g/L and Low [L]/High [H]) is also indicated. The test results reported herein represent the average of triplicate data points.

Data Tables 14A-14E - Open Time/Lapping Characteristics

Table 14A – Results of Open Time/Lapping Testing – White Pine Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Open Time/ Lapping
F	7	NF-Int./Ext.	<150 g/L	L	>16 minutes
G	8	NF-Interior	<150 g/L	L	>16 minutes
A	9	NF-Int./Ext.	>150 g/L	H	>16 minutes
H	11	NF-Ext./Int.	>150 g/L	H	>16 minutes
I	12	NF-Ext./Int.	<150 g/L	L	>16 minutes
D	10	NF-Interior	>150 g/L	H	>16 minutes
N	26	Stain-Interior	>250 g/L	H	No visible overlap
A	27	Stain-Interior	>250 g/L	H	No visible overlap
O	28	Stain-Interior	<250 g/L	L	No visible overlap
O	29	Stain-Interior	<250 g/L	L	No visible overlap
P	30	Stain-Interior	>250 g/L	H	No visible overlap
Q	31	Stain-Interior	<250 g/L	L	No visible overlap

Table 14B – Results of Open Time/Lapping Testing – Douglas Fir Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Open Time/ Lapping
J	13	NF-Exterior	>150 g/L	H	>16 minutes
F	7	NF-Int./Ext.	<150 g/L	L	>16 minutes
A	9	NF-Int./Ext.	>150 g/L	H	>16 minutes
H	11	NF-Ext./Int.	>150 g/L	H	>16 minutes
I	12	NF-Ext./Int.	<150 g/L	L	>16 minutes
D	14	NF-Exterior	<150 g/L	L	>16 minutes

Table 14C – Results of Open Time/Lapping Testing – Red Cedar Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Open Time/ Lapping
J	13	NF-Exterior	>150 g/L	H	>16 minutes
F	7	NF-Int./Ext.	<150 g/L	L	>16 minutes
A	9	NF-Int./Ext.	>150 g/L	H	>16 minutes
H	11	NF-Ext./Int.	>150 g/L	H	>16 minutes
I	12	NF-Ext./Int.	<150 g/L	L	>16 minutes
D	14	NF-Exterior	<150 g/L	L	>16 minutes

Table 14D – Results of Open Time/Lapping Testing – Oak Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Open Time/ Lapping
N	26	Stain-Interior	>250 g/L	H	No visible overlap
A	27	Stain-Interior	>250 g/L	H	No visible overlap
O	28	Stain-Interior	<250 g/L	L	No visible overlap
O	29	Stain-Interior	<250 g/L	L	No visible overlap
P	30	Stain-Interior	>250 g/L	H	No visible overlap
Q	31	Stain-Interior	<250 g/L	L	No visible overlap

Table 14E – Results of Open Time/Lapping Testing – Maple Wood

Manufacturer Code	Product Code	Category	VOC Category		Open Time/ Lapping
N	26	Stain-Interior	>250 g/L	H	No visible overlap
A	27	Stain-Interior	>250 g/L	H	No visible overlap
O	28	Stain-Interior	<250 g/L	L	No visible overlap
O	29	Stain-Interior	<250 g/L	L	No visible overlap
P	30	Stain-Interior	>250 g/L	H	No visible overlap
Q	31	Stain-Interior	<250 g/L	L	No visible overlap

Data Tables 15A-15E – Grain Raising Characteristics

Table 15A – Results of Grain Raising Testing – White Pine Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	3
K	16	PSU-Interior	<200 g/L	L	2
L	17	PSU-Interior	<200 g/L	L	2-3
H	18	PSU-Interior	<200 g/L	L	2
H	19	PSU-Interior	>200 g/L	H	2
D	20	PSU-Interior	>200 g/L	H	3
N	26	Stain-Interior	>250 g/L	H	1
A	27	Stain-Interior	>250 g/L	H	1
O	28	Stain-Interior	<250 g/L	L	1
O	29	Stain-Interior	<250 g/L	L	2
P	30	Stain-Interior	>250 g/L	H	1
Q	31	Stain-Interior	<250 g/L	L	1

Table 15B – Results of Grain Raising Testing – LP Siding Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	1
H	21	PSU-Exterior	<200 g/L	L	1
H	22	PSU-Exterior	>200 g/L	H	1
D	23	PSU-Exterior	<200 g/L	L	1
D	24	PSU-Exterior	>200 g/L	H	1
M	25	PSU-Exterior	<200 g/L	L	1

Table 15C – Results of Grain Raising Testing – Red Cedar Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	3
H	21	PSU-Exterior	<200 g/L	L	2
H	22	PSU-Exterior	>200 g/L	H	2
D	23	PSU-Exterior	<200 g/L	L	2
D	24	PSU-Exterior	>200 g/L	H	2
M	25	PSU-Exterior	<200 g/L	L	2

Table 15D – Results of Grain Raising Testing – Oak Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
N	26	Stain-Interior	>250 g/L	H	1
A	27	Stain-Interior	>250 g/L	H	1
O	28	Stain-Interior	<250 g/L	L	1
O	29	Stain-Interior	<250 g/L	L	2
P	30	Stain-Interior	>250 g/L	H	2
Q	31	Stain-Interior	<250 g/L	L	1

Table 15E – Results of Grain Raising Testing – Maple Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
N	26	Stain-Interior	>250 g/L	H	1
A	27	Stain-Interior	>250 g/L	H	1
O	28	Stain-Interior	<250 g/L	L	1-2
O	29	Stain-Interior	<250 g/L	L	1
P	30	Stain-Interior	>250 g/L	H	1
Q	31	Stain-Interior	<250 g/L	L	1

Data Tables 16A-16H – Tape Adhesion Characteristics

Table 16A – Results of Tape Adhesion Testing – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	1	Floor	>100g/L	H	3A
B	2	Floor	<100g/L	L	5A (1); 1A (2)
C	3	Floor	<100g/L	L	5A
D	4	Floor	>100g/L	H	2A-4A
D	5	Floor	>100g/L	H	3A
E	6	Floor	<100g/L	L	4A-5A

Table 16B – Results of Tape Adhesion Testing – Drywall

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	4A
K	16	PSU-Interior	<200 g/L	L	5A
L	17	PSU-Interior	<200 g/L	L	5A
H	18	PSU-Interior	<200 g/L	L	4-5A
H	19	PSU-Interior	>200 g/L	H	4A
D	20	PSU-Interior	>200 g/L	H	4A

Table 16C – Results of Tape Adhesion Testing – LP Siding Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	4-5A
H	21	PSU-Exterior	<200 g/L	L	4A
H	22	PSU-Exterior	>200 g/L	H	4A
D	23	PSU-Exterior	<200 g/L	L	4A
D	24	PSU-Exterior	>200 g/L	H	4A
M	25	PSU-Exterior	<200 g/L	L	4A

Table 16D – Results of Tape Adhesion Testing – Red Cedar Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	4A
H	21	PSU-Exterior	<200 g/L	L	4-5A
H	22	PSU-Exterior	>200 g/L	H	4A
D	23	PSU-Exterior	<200 g/L	L	5A
D	24	PSU-Exterior	>200 g/L	H	4A
M	25	PSU-Exterior	<200 g/L	L	5A
J	13	NF-Exterior	>150 g/L	H	5A
F	7	NF-Int./Ext.	<150 g/L	L	5A
A	9	NF-Int./Ext.	>150 g/L	H	4-5
H	11	NF-Ext./Int.	>150 g/L	H	5A
I	12	NF-Ext./Int.	<150 g/L	L	4-5A
D	14	NF-Exterior	<150 g/L	L	5A

Table 16E – Results of Tape Adhesion Testing – Douglas Fir Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
J	13	NF-Exterior	>150 g/L	H	5A
F	7	NF-Int./Ext.	<150 g/L	L	4-5A
A	9	NF-Int./Ext.	>150 g/L	H	5A
H	11	NF-Ext./Int.	>150 g/L	H	5A
I	12	NF-Ext./Int.	<150 g/L	L	4-5A
D	14	NF-Exterior	<150 g/L	L	5A

Table 16F – Results of Tape Adhesion Testing – Oak Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
N	26	Stain-Interior	>250 g/L	H	5A
A	27	Stain-Interior	>250 g/L	H	5A
O	28	Stain-Interior	<250 g/L	L	5A
O	29	Stain-Interior	<250 g/L	L	5A
P	30	Stain-Interior	>250 g/L	H	5A
Q	31	Stain-Interior	<250 g/L	L	5A

Table 16G – Results of Tape Adhesion Testing – Maple Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
N	26	Stain-Interior	>250 g/L	H	5A
A	27	Stain-Interior	>250 g/L	H	5A
O	28	Stain-Interior	<250 g/L	L	5A
O	29	Stain-Interior	<250 g/L	L	5A
P	30	Stain-Interior	>250 g/L	H	5A
Q	31	Stain-Interior	<250 g/L	L	5A

Table 16H – Results of Tape Adhesion Testing – White Pine Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	5A
K	16	PSU-Interior	<200 g/L	L	5A
L	17	PSU-Interior	<200 g/L	L	5A
H	18	PSU-Interior	<200 g/L	L	5A
H	19	PSU-Interior	>200 g/L	H	4-5A
D	20	PSU-Interior	>200 g/L	H	5A
F	7	NF-Int./Ext.	<150 g/L	L	5A
G	8	NF-Interior	<150 g/L	L	5A
A	9	NF-Int./Ext.	>150 g/L	H	5A
H	11	NF-Ext./Int.	>150 g/L	H	5A
I	12	NF-Ext./Int.	<150 g/L	L	5A
D	10	NF-Interior	>150 g/L	H	5A
N	26	Stain-Interior	>250 g/L	H	5A
A	27	Stain-Interior	>250 g/L	H	5A
O	28	Stain-Interior	<250 g/L	L	5A
O	29	Stain-Interior	<250 g/L	L	5A
P	30	Stain-Interior	>250 g/L	H	5A
Q	31	Stain-Interior	<250 g/L	L	5A

Data Tables 17A-17E – Tannin Stain Blocking Characteristics

Table 17A – Results of Stain Blocking Testing – White Pine Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating	ΔL*	Δb*
N	26	Stain-Interior	>250 g/L	H	7	-0.80	-1.44
A	27	Stain-Interior	>250 g/L	H	8	+0.75	-0.41
O	28	Stain-Interior	<250 g/L	L	7	-1.10	-1.72
O	29	Stain-Interior	<250 g/L	L	7	-1.21	-1.79
P	30	Stain-Interior	>250 g/L	H	10	+0.09	+0.04
Q	31	Stain-Interior	<250 g/L	L	9	-1.67	-0.37

Table 17B – Results of Stain Blocking Testing – Oak Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating	ΔL*	Δb*
N	26	Stain-Interior	>250 g/L	H	10	+0.25	-0.63
A	27	Stain-Interior	>250 g/L	H	8	+0.80	-1.24
O	28	Stain-Interior	<250 g/L	L	9	+0.76	-0.33
O	29	Stain-Interior	<250 g/L	L	9	+0.44	-0.62
P	30	Stain-Interior	>250 g/L	H	9	+1.23	-0.37
Q	31	Stain-Interior	<250 g/L	L	8	-0.18	-1.05

Table 17C – Results of Stain Blocking Testing – Maple Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating	ΔL*	Δb*
N	26	Stain-Interior	>250 g/L	H	9	+0.47	-0.28
A	27	Stain-Interior	>250 g/L	H	8	+1.16	-1.11
O	28	Stain-Interior	<250 g/L	L	8	+0.83	-1.13
O	29	Stain-Interior	<250 g/L	L	9	-0.32	-0.88
P	30	Stain-Interior	>250 g/L	H	8	+1.92	-0.62
Q	31	Stain-Interior	<250 g/L	L	9	-0.82	+0.39

Table 17D – Results of Stain Blocking Testing – LP Siding Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating	ΔL*	Δb*
A	15	PSU-Int./Ext.	>200 g/L	H	10	+0.46	+0.05
H	21	PSU-Exterior	<200 g/L	L	10	+0.71	+0.21
H	22	PSU-Exterior	>200 g/L	H	10	-0.25	+0.31
D	23	PSU-Exterior	<200 g/L	L	10	-0.3	-0.08
D	24	PSU-Exterior	>200 g/L	H	10	-0.51	+0.11
M	25	PSU-Exterior	<200 g/L	L	9	+1.16	+0.14

Table 17E – Results of Stain Blocking Testing – Red Cedar Wood

Manufacturer Code	Product Code	Category	VOC Category		Rating	ΔL*	Δb*
A	15	PSU-Int./Ext.	>200 g/L	H	8	-1.68	+0.86
H	21	PSU-Exterior	<200 g/L	L	5	-3.65	+2.53
H	22	PSU-Exterior	>200 g/L	H	1	-8.86	-2.38
D	23	PSU-Exterior	<200 g/L	L	7	-2.6	+1.16
D	24	PSU-Exterior	>200 g/L	H	7	-1.45	+1.57
M	25	PSU-Exterior	<200 g/L	L	7	-2.61	+2.75

Data Tables 18A-18D – Scrub Resistance Characteristics

Table 18A – Results of Scrub Resistance Testing
Non-Flat Interior & Non-Flat Exterior (tested on aluminum substrate)

Manufacturer Code	Product Code	Service Category	VOC Category		No. of Cycles
F	7	NF-Int. & Ext.	<150 g/L	L	647
G	8	NF-Interior	<150 g/L	L	689
A	9	NF-Int. & Ext.	>150 g/L	H	957
H	11	NF-Ext. & Int.	>150 g/L	H	542
I	12	NF-Ext. & Int.	<150 g/L	L	1057
D	10	NF-Interior	>150 g/L	H	769
J	13	NF-Exterior	>150 g/L	H	449
D	14	NF-Exterior	<150 g/L	L	1299

Table 18B – Results of Scrub Resistance Testing – Pine Wood

Manufacturer Code	Product Code	Service Category	VOC Category		No. of Cycles
N	26	Stain-Interior	>250 g/L	H	258
A	27	Stain-Interior	>250 g/L	H	59
O	28	Stain-Interior	<250 g/L	L	123
O	29	Stain-Interior	<250 g/L	L	219
P	30	Stain-Interior	>250 g/L	H	175
Q	31	Stain-Interior	<250 g/L	L	Clear*

Table 18C – Results of Scrub Resistance Testing – Oak Wood

Manufacturer Code	Product Code	Service Category	VOC Category		No. of Cycles
N	26	Stain-Interior	>250 g/L	H	440
A	27	Stain-Interior	>250 g/L	H	187
O	28	Stain-Interior	<250 g/L	L	135
O	29	Stain-Interior	<250 g/L	L	229
P	30	Stain-Interior	>250 g/L	H	123
Q	31	Stain-Interior	<250 g/L	L	Clear*

Table 18D – Results of Scrub Resistance Testing – Maple Wood

Manufacturer Code	Product Code	Service Category	VOC Category		No. of Cycles
N	26	Stain-Interior	>250 g/L	H	>2200
A	27	Stain-Interior	>250 g/L	H	91
O	28	Stain-Interior	<250 g/L	L	127
O	29	Stain-Interior	<250 g/L	L	562
P	30	Stain-Interior	>250 g/L	H	161
Q	31	Stain-Interior	<250 g/L	L	Clear*

*Since scrub resistance is rated visually, it could not be performed on a clear product.

Data Tables 19A-19B – Sandability Characteristics

Table 19A – Results of Sandability Testing – White Pine Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	Good
K	16	PSU-Interior	<200 g/L	L	Poor
L	17	PSU-Interior	<200 g/L	L	Good
H	18	PSU-Interior	<200 g/L	L	Good
H	19	PSU-Interior	>200 g/L	H	Good
D	20	PSU-Interior	>200 g/L	H	Good

Table 19B – Results of Sandability Testing – Drywall

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
A	15	PSU-Int./Ext.	>200 g/L	H	Good
K	16	PSU-Interior	<200 g/L	L	Poor
L	17	PSU-Interior	<200 g/L	L	Good
H	18	PSU-Interior	<200 g/L	L	Good
H	19	PSU-Interior	>200 g/L	H	Good
D	20	PSU-Interior	>200 g/L	H	Good

Data Tables 20A-20N – Chemical Resistance Characteristics

Table 20A – Results of Chemical Resistance Testing (ketchup)
White Pine Wood & Drywall

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	15	PSU-Int./Ext.	>200 g/L	H	No effect
K	16	PSU-Interior	<200 g/L	L	No effect
L	17	PSU-Interior	<200 g/L	L	No effect
H	18	PSU-Interior	<200 g/L	L	No effect
H	19	PSU-Interior	>200 g/L	H	No effect
D	20	PSU-Interior	>200 g/L	H	No effect

Table 20B – Results of Chemical Resistance Testing (mustard)
White Pine Wood & Drywall

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	15	PSU-Int./Ext.	>200 g/L	H	Severe staining
K	16	PSU-Interior	<200 g/L	L	Severe staining
L	17	PSU-Interior	<200 g/L	L	Severe staining
H	18	PSU-Interior	<200 g/L	L	Severe staining
H	19	PSU-Interior	>200 g/L	H	Severe staining
D	20	PSU-Interior	>200 g/L	H	Severe staining

Table 20C – Results of Chemical Resistance Testing (crayons)
White Pine Wood & Drywall

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	15	PSU-Int./Ext.	>200 g/L	H	Moderate staining
K	16	PSU-Interior	<200 g/L	L	Moderate staining
L	17	PSU-Interior	<200 g/L	L	Moderate staining
H	18	PSU-Interior	<200 g/L	L	Moderate staining
H	19	PSU-Interior	>200 g/L	H	Moderate staining
D	20	PSU-Interior	>200 g/L	H	Moderate staining

Table 20D – Results of Chemical Resistance Testing (blue magic marker)
White Pine Wood & Drywall

Manufacturer Code	Product Code	Category	VOC Category		Observations
A	15	PSU-Int./Ext.	>200 g/L	H	Severe staining
K	16	PSU-Interior	<200 g/L	L	Severe staining
L	17	PSU-Interior	<200 g/L	L	Severe staining
H	18	PSU-Interior	<200 g/L	L	Severe staining
H	19	PSU-Interior	>200 g/L	H	Severe staining
D	20	PSU-Interior	>200 g/L	H	Severe staining

Table 20E – Results of Chemical Resistance Testing (lipstick)
White Pine Wood & Drywall

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	15	PSU-Int./Ext.	>200 g/L	H	Minor staining
K	16	PSU-Interior	<200 g/L	L	Minor staining
L	17	PSU-Interior	<200 g/L	L	Minor staining
H	18	PSU-Interior	<200 g/L	L	Minor staining
H	19	PSU-Interior	>200 g/L	H	Minor staining
D	20	PSU-Interior	>200 g/L	H	Minor staining

Table 20F – Results of Chemical Resistance Testing (tap water) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	No effect
B	2	Floor	<100 g/L	L	No effect
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	No effect
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	No effect

Table 20G – Results of Chemical Resistance Testing (water w/ detergent) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	No effect
B	2	Floor	<100 g/L	L	No effect
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	No effect
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	No effect

Table 20H – Results of Chemical Resistance Testing (gasoline) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	No effect
B	2	Floor	<100 g/L	L	No effect
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	No effect
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	No effect

Table 20I – Results of Chemical Resistance Testing (oil) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	No effect
B	2	Floor	<100 g/L	L	No effect
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	No effect
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	No effect

Table 20J – Results of Chemical Resistance Testing (anti-freeze) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	No effect
B	2	Floor	<100 g/L	L	Softened coating
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	No effect
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	Softened coating

Table 20K – Results of Chemical Resistance Testing (Skydrol) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	Wrinkled coating
B	2	Floor	<100 g/L	L	Softened coating
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	Softened coating
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	Softened coating

Table 20L – Results of Chemical Resistance Testing (power steering fluid) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	No effect
B	2	Floor	<100 g/L	L	No effect
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	No effect
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	No effect

Table 20M– Results of Chemical Resistance Testing (brake line fluid) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	Softened coating
B	2	Floor	<100 g/L	L	Softened coating
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	Softened coating
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	Softened coating

Table 20N– Results of Chemical Resistance Testing (windshield washer fluid) – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	No effect
B	2	Floor	<100 g/L	L	No effect
C	3	Floor	<100 g/L	L	No effect
D	4	Floor	>100 g/L	H	No effect
D	5	Floor	>100 g/L	H	No effect
E	6	Floor	<100 g/L	L	No effect

Data Tables 21-24 – Characteristics of Coatings on Concrete

Table 21 – Results of Abrasion Resistance Testing – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Cycles	Wear / Mil
A	1	Floor	>100 g/L	H	316	210
B	2	Floor	<100 g/L	L	520	173
C	3	Floor	<100 g/L	L	9361	442
D	4	Floor	>100 g/L	H	163	116
D	5	Floor	>100 g/L	H	1367	380
E	6	Floor	<100 g/L	L	*	*

**Cannot perform test. Anti-skid additive prevents abrasion wheels from resting on coated surface*

Table 22 – Results of Impact Resistance Testing – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Impact Resistance
A	1	Floor	>100 g/L	H	28 in-lbs.
B	2	Floor	<100 g/L	L	>42 in-lbs. (concrete cracked)
C	3	Floor	<100 g/L	L	34 in-lbs.
D	4	Floor	>100 g/L	H	33 in-lbs.
D	5	Floor	>100 g/L	H	30 in-lbs.
E	6	Floor	<100 g/L	L	>54 in-lbs. (concrete cracked)

Table 23 – Results of Pencil Hardness Testing – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Pencil Hardness
A	1	Floor	>100 g/L	H	4H
B	2	Floor	<100 g/L	L	H-3H
C	3	Floor	<100 g/L	L	3H
D	4	Floor	>100 g/L	H	4H
D	5	Floor	>100 g/L	H	4H
E	6	Floor	<100 g/L	L	9H

Table 24 – Results of Effluorescence Resistance Testing – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		Observations
A	1	Floor	>100 g/L	H	Note 1
B	2	Floor	<100 g/L	L	Note 2
C	3	Floor	<100 g/L	L	Note 3
D	4	Floor	>100 g/L	H	Note 4
D	5	Floor	>100 g/L	H	No change
E	6	Floor	<100 g/L	L	Note 5

Note 1: Color change (1/2-1" band at perimeter of top surface) after 24 hours. Blotchy white appearance after 3 days. No evidence of effluorescence after 6 days.

Note 2: No color change or effluorescence after 6 days. Blotchy white appearance after 3 days.

Note 3: Color change (entire surface) after 24 hours. No blotchy white appearance or evidence of effluorescence after 6 days.

Note 4: Color change (1-2" band at perimeter of top surface) after 24 hours. Blotchy white appearance after 3 days. No evidence of effluorescence after 6 days.

Note 5: Color change (1/2-1" band at perimeter of top surface) after 24 hours. Effluorescence (powdery white) on majority of top surface.

Data Tables 25A-25F –Blocking Resistance Characteristics

Table 25A – Results of Blocking Resistance Testing (lab ambient) – White Pine Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
F	7	NF-Int./Ext.	<150 g/L	L	F-2
G	8	NF-Interior	<150 g/L	L	B-0
A	9	NF-Int./Ext.	>150 g/L	H	A-0
H	11	NF-Ext./Int.	>150 g/L	H	B-1
I	12	NF-Ext./Int.	<150 g/L	L	A-0
D	10	NF-Interior	>150 g/L	H	B-0

Table 25B – Results of Blocking Resistance Testing (120^{o}F) – White Pine Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
F	7	NF-Int./Ext.	<150 g/L	L	F-4
G	8	NF-Interior	<150 g/L	L	F-3
A	9	NF-Int./Ext.	>150 g/L	H	C-0
H	11	NF-Ext./Int.	>150 g/L	H	F-3
I	12	NF-Ext./Int.	<150 g/L	L	F-3
D	10	NF-Interior	>150 g/L	H	F-1

Table 25C – Results of Blocking Resistance Testing (lab ambient) – Douglas Fir Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
J	13	NF-Exterior	>150 g/L	H	A-0
F	7	NF-Int./Ext.	<150 g/L	L	A-1
A	9	NF-Int./Ext.	>150 g/L	H	A-0
H	11	NF-Ext./Int.	>150 g/L	H	B-0
I	12	NF-Ext./Int.	<150 g/L	L	A-2
D	14	NF-Exterior	<150 g/L	L	E-1

Table 25D – Results of Blocking Resistance Testing (120^{o}F) – Douglas Fir Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
J	13	NF-Exterior	>150 g/L	H	F-4
F	7	NF-Int./Ext.	<150 g/L	L	F-4
A	9	NF-Int./Ext.	>150 g/L	H	C-0
H	11	NF-Ext./Int.	>150 g/L	H	E-3
I	12	NF-Ext./Int.	<150 g/L	L	D-2
D	14	NF-Exterior	<150 g/L	L	F-2

Table 25E – Results of Blocking Resistance Testing (lab ambient) – Red Cedar Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Rating
J	13	NF-Exterior	>150 g/L	H	A-0
F	7	NF-Int./Ext.	<150 g/L	L	A-1
A	9	NF-Int./Ext.	>150 g/L	H	A-0
H	11	NF-Ext./Int.	>150 g/L	H	B-0
I	12	NF-Ext./Int.	<150 g/L	L	B-3
D	14	NF-Exterior	<150 g/L	L	C-1

Table 25F – Results of Blocking Resistance Testing (120^{o}F) – Red Cedar Wood

Manufacturer Code	Product Code	Category	VOC Category		Rating
J	13	NF-Exterior	>150 g/L	H	F-4
F	7	NF-Int./Ext.	<150 g/L	L	F-5
A	9	NF-Int./Ext.	>150 g/L	H	C-0
H	11	NF-Ext./Int.	>150 g/L	H	F-3
I	12	NF-Ext./Int.	<150 g/L	L	E-3
D	14	NF-Exterior	<150 g/L	L	F-3

Data Tables 26A-26C – Accelerated Weathering Characteristics

Table 26A – Results of Accelerated Weathering Testing – Douglas Fir Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Color Shift ΔE	Initial Gloss	Gloss Reduction
J	13	NF-Exterior	>150 g/L	H	1.55	20.4	1.4
F	7	NF-Int./Ext.	<150 g/L	L	3.9	34.6	5.6
A	9	NF-Int./Ext.	>150 g/L	H	1.48	39.4	4.4
H	11	NF-Ext./Int.	>150 g/L	H	2.14	38.7	20.6
I	12	NF-Ext./Int.	<150 g/L	L	1.51	40.4	8.0
D	14	NF-Exterior	<150 g/L	L	1.62	52.2	6.7 (1/3)

Table 26B – Results of Accelerated Weathering Testing – Red Cedar Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Color Shift ΔE	Initial Gloss	Gloss Reduction
A	15	PSU-Int./Ext.	>200 g/L	H	4.16	4.1	None
H	21	PSU-Exterior	<200 g/L	L	3.27	6.4	None
H	22	PSU-Exterior	>200 g/L	H	2.43	2.8	None
D	23	PSU-Exterior	<200 g/L	L	2.36	3.4	None
D	24	PSU-Exterior	>200 g/L	H	2.53	2.8	None
M	25	PSU-Exterior	<200 g/L	L	3.82	9.1	2.1
J	13	NF-Exterior	>150 g/L	H	1.49	20.1	1.9
F	7	NF-Int./Ext.	<150 g/L	L	1.56	34.2	None
A	9	NF-Int./Ext.	>150 g/L	H	1.33	28.3	3.3
H	11	NF-Ext./Int.	>150 g/L	H	2.5	35.7	19.1
I	12	NF-Ext./Int.	<150 g/L	L	1.47	49.3	11.7
D	14	NF-Exterior	<150 g/L	L	1.36	40.0	3.3 (1/3)

Table 26C – Results of Accelerated Weathering Testing – LP Siding Wood

Manufacturer Code	Product Code	Service Category	VOC Category		Color Shift ΔE	Initial Gloss	Gloss Reduction
A	15	PSU-Int./Ext.	>200 g/L	H	3.81	3.2	None
H	21	PSU-Exterior	<200 g/L	L	2.42	4.3	None
H	22	PSU-Exterior	>200 g/L	H	3.1	2.9	None
D	23	PSU-Exterior	<200 g/L	L	2.68	2.7	None
D	24	PSU-Exterior	>200 g/L	H	2.83	3.4	None
M	25	PSU-Exterior	<200 g/L	L	2.81	4.9	None

Data Table 27 – Tensile (pull-off) Adhesion Characteristics

Table 27 – Results of Tensile Adhesion Testing – Concrete

Manufacturer Code	Product Code	Service Category	VOC Category		PSI[1]	Primary Break[1]
A	1	Floor	>100 g/L	H	441	80% C-C; 20% A[3]
B	2	Floor	<100 g/L	L	285	15% C-C; 85% A[3]
C	3	Floor	<100 g/L	L	1,332	100% C-C[2]
D	4	Floor	>100 g/L	H	461	25% C-C; 75% A[3]
D	5	Floor	>100 g/L	H	1,103	100% C-C[2]
E	6	Floor	<100 g/L	L	366	50% C-C; 50% A[3]

[1] Average of six values
[2] C-C: Cohesion break within concrete substrate
[3] A: Adhesion break at concrete/coating interface

APPENDIX C

Response to Questions

Question	Response
Can a manufacturer continue to sell quick-dry primers, sealers and undercoaters with a VOC of greater than 350 g/l?	Yes. Section (g)(2) states "Until July 1, 2002, architectural coatings recommended by the manufacturer for use solely as quick-dry primers, sealers and undercoaters, need not comply with the provisions of subdivision (c), so long as the manufacturer submits an annual report to the Executive Officer within three months of the end of each calendar year reporting the number of gallons of coatings sold in California under this exemption." There is an allowable time limit to sell products manufactured prior to a VOC limit change in the rule (see next question).
Is there a sell-through or "grandfather" provision in the rule?	Yes. Section (c)(4) of Rule 1113, Architectural Coatings states that "Except where already required to be in compliance with the previous version of this rule, sale or application of a coating manufactured prior to the effective date of the corresponding standard in the Table of Standards, and not complying with that standard, shall not constitute a violation of paragraph (c)(2) until three years after the effective date of the standard." What this means is, for example, if a Quick-Dry Primer (now subsumed in the PSU Category) product has a manufacture date prior to July 1, 2002, then that product may be sold or applied up to three years after 7/1/02 without being in violation of the rule. This sell-through provision applies to all coatings listed in the Table of Standards and any effective dates applicable to the specific coating.

The stated definition for nonflat coatings is confusing. Does the product have to register a gloss of 5 or greater on a 60-degree meter **and** a gloss of 15 or greater on an 85-degree meter?	No. In the 1999 Staff Report, it states that the definition for "Nonflat Coatings" is to be as defined in the National AIM Rule. The National AIM Rule defines Nonflat Coatings as "...a coating that is not defined under any other definition in this section and that registers a gloss of 15 or greater on an 85-degree meter or 5 or greater on a 60-degree meter according to ASTM Method D 523-89, Standard Test Method for Specular Gloss (incorporated by reference--see Sec. 59.412 of this subpart)." The intent of the definition was to stipulate the conjunctive or rather than and, as reflected in the National AIM Rule, thereby eliminating any confusion. This was an oversight, and the next time the rule is opened up for amendment this will be corrected.
How is a rust preventive coating defined under Rule 1113 and are there specific requirements associated with this category?	Rule 1113 defines rust preventive coatings as those coatings formulated for use in preventing the corrosion of metal surfaces in Residential and commercial situations. If the recommended use indicated on a typical product data sheet includes various types of metal substrates such as ornamental iron, lawn furniture, structural steel, railings, machinery, or other equipment, then a product would fall under the category of rust preventative coatings currently set at 400 g/l VOC, as seen in the Table of Standards in Rule 1113. The labeling of this particular coating category must reflect the language in Rule 1113, subpart (d) (5) that states indicates the labels of all rust preventative coatings shall include the statement "For Metal Substrates Only" prominently Displayed beginning on July 1, 2002. Additionally, any manufacturer opting for this higher VOC category shall submit an annual report to the District as stipulated in section(g)(6) of the rule.
In the Table of Standards VOC Limits for Rule 1113, it is not clear if the 250g/l limit applies to Waterproofing Sealers for both Wood and Concrete/Masonry applications.	It applies to waterproofing and sealers only. During the May 14, 1999 Rule 1113 revisions, industry provided comments pertaining to a lack of performance on concrete/masonry surfaces, especially concrete tilt-up buildings. Therefore, staff limited the reduction to waterproofing wood sealers and created a new category for waterproofing concrete/masonry sealers. The current limit for wood sealers is 400 g/l VOC with further reductions to 250 g/l VOC on July 1, 2002 as seen in the Table of Standards.

Rule 1113 exempts the VOC content of colorants when calculating VOC for the product, however, does it only exempt colorants added at the retail store?	Yes. As defined in Rule 1113 (b)(50), a tint base is an architectural coating to which colorants are added. The AQMD recognizes any paint that leaves the factory with colorant added to be considered a tint base. Therefore, for VOC calculation of coatings, colorants are excluded only at the point of sale (e.g. wholesale or retail). At the point of manufacture any colorant added is considered part of the overall VOC content of the coating. As an example, a basic white colorant that is tinted at the factory would require the manufacturer to list the VOC content as produced, including the colorant added. Once the product reaches the retail or wholesale market, any colorant added at that point would not be considered as part of the total VOC of the product.
What is the VOC limitation for a product that does not meet any of the definitions in the Table of Standards?	The VOC limitation is 250 g/l. Specifically, if a coating product does not meet the definitions of any coating category listed in the Table of Standards, refer to subsection (c)(1) of the rule that states, "Except as provided in paragraphs (c)(2), (c)(3), (c)(4), and specified coatings averaged under (c)(6), no person shall supply, sell, offer for sale, manufacture, blend, or repackage any architectural coating for use in the District which, at the time of sale or manufacture, contains more than 250 grams of VOC per liter of coating (2.08 pounds per gallon), less water, less exempt compounds, and less any colorant added to tint bases, and no person shall apply or solicit the application of any architectural coating within the District that exceeds 250 grams of VOC per liter of coating as calculated in this paragraph."