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EVALUATION OF ARCHITECTURAL COATINGS II

PART B

EXEMPT ARCHITECTURAL COATINGS

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ABSTRACT

An important source of air pollution is the evaporation of solvent during the application of most paints and coatings. Consequently, the California Air Resources Board (CARB) has established specific limitations on the amount of volatile organic compounds (VOC), or solvents, employed in certain types of architectural coatings. However, because the low solvent technology had not fully developed, fourteen classes of architectural paints were exempted. These included the following:

1. Clear finishes, e.g., varnish
2. Semi-transparent wood stains
3. Opaque wood stains
4. Primers, sealers and undercoaters
5. Wood preservatives
6. Fire retardant paints
7. Tile-like glaze coatings
8. Waterproofing coatings
9. Maintenance paints
10. Metallic, e.g., aluminum paints
11. Swimming pool paints
12. Graphic art, e.g., sign paints
13. Mastic (thick) coatings
14. Multicolor (speckled) paints.

The ARB wished to determine whether products, among these exempt classes, were available on the market which would meet the VOC limitations and be competitive in performance to conventional, solvent-thinned, paints. Therefore, the ARB sponsored a study in 1979, performed by D/L Laboratories, to test architectural coatings among the exempt categories. The results were published in August 1980. A total of 89 low solvent and 57 conventional architectural coatings representing eleven of the fourteen exempt categories were tested at that time. Samples were submitted by coating manufacturers throughout the country in response to direct mail solicitation and notices in major trade publications. Samples received too late for inclusion in the initial evaluation were tested in this current follow-up study to determine the effect of additional testing on the original conclusions. An additional 20 low solvent and six conventional coatings were tested and expands the number of exempt categories for which coatings have been tested to twelve.

Samples could not be obtained for wood preservatives and sign paints. Upon closer examination, it was found that the fourteen classes were so broad in scope that they had to be expanded to a total of total of 26 classes and sub-classes, of which 24 were tested. The result of both the original and the current testing programs are compiled in this report and the original conclusions have been updated to reflect the additional data.

Results of laboratory tests and accelerated laboratory exposures demonstrate that a total of 42 low VOC coatings representing 8 of 12 classes tested and 13 of 24 sub-classes tested have the potential of competing with their equivalent conventional coatings. 9 of these sub-classes appear to be capable of being produced with VOC levels below 250 g/l. However, most are still not directly competitive with conventional coatings below that VOC level.

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DISCLAIMER

The statements and conclusions in this report are those of the contractor and not necessarily those of the California Air Resources Board. The mention of commercial products, their source or use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

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I SUMMARY AND CONCLUSIONS

This investigation is a continuation of a study, which was initiated in 1979, to evaluate low solvent architectural paints and coatings among the fourteen classes of products presently exempt from the California ARB Model Rule for Architectural Coatings. These products were to be compared with equivalent conventional (solvent-thinned) paints and coatings, preferably from the same suppliers, in order to determine whether each CARB conforming class, as a whole, was competitive with the equivalent conventional products and therefore can be removed from the exempt list.

Publicity releases were sent to 23 industry publications and industry associations during the inception of the program in order to reach as broad a source as possible. Ultimately, over 500 letters and questionnaire forms were sent to paint manufacturers and raw material suppliers throughout the United States. A total of 89 CARB conforming paints and coatings and 57 equivalent conventional coatings representing ten of the fourteen exempt classes were received before the cutoff date and tested in the first evaluation. The results were published in August 1980. Samples received too late for inclusion in the initial evaluation were tested in this current follow-up evaluation to determine the effect of additional testing on the original conclusions. The results of both evaluations are compiled in this report and the original conclusions have been revised to reflect the additional data.

Upon review of the samples and data received, it was evident that some of the exempt classes were too broad in scope and therefore had to be subdivided into sub-classes. The entire list of classes and sub-classes is shown in Table 1 below.

The evaluation was carried out using laboratory test methods and accelerated exposures commonly used in the industry. The properties evaluated were limited to those of major importance for each class in consideration of the time required for completion. The results of the tests were then summarized using a simple rating scheme of 10 to 0 in order to enable analysis of the data without the necessity of having a coating technology background.

The test coatings (both low-solvent and conventional) are compared to a standard representing a minimum acceptable level of performance. Low VOC coatings among the following exempt classes and sub-classes can be considered to be Acceptable and capable of competing with their conventional counterparts though some improvements can still be made. The average VOC levels are based on the data obtained and do not apply to all samples.

The conclusions apply to low VOC coatings tested as compared with the equivalent conventional coatings.

Class 1A Clear Interior Gloss Finishes

4 of the 5 coatings tested are equal to conventional clear interior gloss finishes in all properties tested. However the average VOC is 329 g/l.

Class 1B Clear Interior Semigloss Finishes

All 4 coatings tested are equal to conventional clear interior semigloss finishes in all properties. The average VOC is 292 g/l.

Class 1C Clear Exterior Gloss Finishes

2 of the 3 coatings tested are equal to conventional clear exterior gloss finishes in performance but viscosity stability could be improved. The average VOC is 275 g/l.

Class 2 Transparent Stains

The 2 stains tested dry very well but they are not as transparent as desired and water repellancy could be improved. The average VOC is 121 g/l.

Class 3 Opaque Stains

2 of the 8 stains tested are almost equal to conventional opaque stains but 5 others could be improved in opacity and water repellancy. Average VOC is 119 g/l.

Class 4A-1 Metal Primers - One Package

2 of 13 primers tested exhibit superior stability and corrosion resistance but dry and opacity could be improved. Average VOC is only 44 g/l.

Class 4A-Z Metal Primers - Zinc Rich

2 of 3 primers tested are superior to conventional Zinc Rich primers, especially in durability. Average VOC is only 61 g/l.

Class 4B Exterior Wood Primers

3 of 5 primers tested are superior to conventional exterior wood primers except for less bleeding resistance, since most wood compounds which cause bleeding are water soluble. VOC averages 126 g/l.

Class 4C Interior Wall Primers

All 5 primers tested are competitive but will not seal water soluble stains as well. Average VOC is 100 g/l.

Class 7 Tile-Like Glaze Coatings

2 of the 6 coatings tested exhibit superior gloss and color retention,as well as water resistance,as compared with the conventional coatings. However their pot life and dry could be improved. Average VOC is 220 g/l.

Class 9A Maintenance Topcoats - Light Duty

4 of the 7 coatings tested exhibit faster dry and better weathering than the conventional topcoats but at a sacrifice in opacity. VOC averages 235 g/l.

Class 10 Metallic Paints

The two paints tested have possibilities but need improved storage stability and weathering. They would be satisfactory for interior use. No data on VOC was available.

Class 13B Mastic Coatings - Texture Paints

All 4 coatings tested are competitive to the conventional paints exhibiting better storage stability, faster dry and easier application. VOC averages only 26 g/l.

All other products tested are either not acceptable or insufficient in number to arrive at any conclusion.

II RECOMMENDATIONS

It is apparent from the results of this evaluation that products in the exempt list which readily meet the CARB VOC limit of 250 grams per liter of paint, less water, are limited.

However, it is evident that the requirement for low VOC concentration, is a technology that is becoming more attainable by the paint and coatings industry. Furthermore, Government agencies which use paints and coatings, such as the Army, Navy and Federal Highway Administration, are considering the specification of low VOC coatings. Therefore, there is an accelerating development of this technology.

Consequently, it is probable that, if a program such as the one covered in this report were repeated, the number of conforming products would be much greater. Paint manufacturers will have had more technological experience so that there should be more low VOC products readily available in the market place.

It also has been noted that many water based coatings tend to exhibit shorter periods of storage stability than conventional coatings. Therefore, it is possible that repeat tests, conducted on fresh samples, will yield improved results. It also is possible that low VOC coatings may exhibit improved performance if the applied coatings are allowable to cure for a longer period of time, approaching actual use conditions, e.g., one month rather than one week. Therefore, it may be advisable to repeat some tests after longer periods of drying. Of course, this will have to be done in comparison with equivalent aged conventional coatings to avoid drawing conclusions based on one sided test data.

An additional test of major importance is the field exposure testing of exterior paints. Although laboratory accelerated exposures are conducted for the sake of expediency when testing new products, exterior paints should also be subjected to actual exposure outdoors. There are a number of exposure stations, located primarily in Florida, as well as in other locations, such as Arizona, with a high level of sunlight, and Puerto Rico with a climate having both a high level of sunlight plus high humidity which accelerates the growth of mildew. Results of tests conducted at these stations are accepted by the trade. However at least a year of exposure, and preferably two years of exposure, are required for meaningful results.

Application and exposure under actual field conditions are of prime importance for water based exterior primers and stains which are applied on raw (porous) wood since both rapid evaporation, e.g., in hot weather, and absorption can result in application problems. This would also apply to water base coatings, e.g., waterproofing, applied on exterior porous masonry in hot weather.

III INTRODUCTION

Architectural coatings are a significant source of air pollution, inasmuch as approximately one half of each gallon of paint, varnish, lacquer or related coating consists of volatile solvents which evaporate when the coating is applied. This is a relatively minor problem with water-base coatings, in which most of the solvent is water, but is serious with solvent-thinned coatings. The solvents emitted during application of the latter pollute the air in the immediate vicinity and eventually spread elsewhere.

California was foremost in the initiation of efforts and regulations to reduce the adverse effects of these solvents in their environment because of the serious problem in the Los Angeles area. The first result was Rule 66 which was quickly adopted in other areas of the State. It has since spread to other states and was finally adopted in a modified form by the Environmental Protection Agency.

Rule 66, however, did not reduce solvent emission in architectural coatings. It only required the substitution of less photochemically reactive solvents.

During the recent past, the California Air Resources Board has taken steps, by developing the ARB Model Rule for Architectural Coatings, to actually reduce emissions of all volatile organic material to about half of the former amount, i.e., to a maximum of 250 grams per liter of applied coating.

Conformance to this ruling presented minimum difficulty for manufacturers of interior wall paints and exterior house paints, which account for approximately 50% of the total architectural coatings used, since most of these coatings are based on latex emulsions and thus contain less than 250 grams per liter of volatile organic material. However, exemptions has to be made for the 14 categories of these coatings, which are listed under the Objective below, and which account for the other 50% of these coatings.

Therefore, CARB wished to determine whether exempt commercial architectural coatings are now available, even from a limited number of suppliers, which can compete in performance with their conventional counterparts and thus enable CARB to remove these categories from the exempt list.

IV. OBJECTIVE

The purpose of this study was to obtain and evaluate the performance properties of commercially available high solids or water-based coatings, among the 14 classes now exempt from CARB's model rule for maximum content of organic material, in order to determine if these products are equivalent to the conventional (high solvent) coatings of the same type.

The exempt classes of coatings are as follows:

1. Unpigmented finishes, e.g., varnish, lacquer shellac
2. Semi-transparent stains
3. Opaque stains for use on redwood, cedar mahogany and fir
4. Primers, sealers and undercoaters
5. Wood preservatives (penetrating type)
6. Fire retardant coatings
7. Tile-like, high build glaze coatings
8. Waterproofing coatings except bituminous pavement sealers
9. Industrial maintenance topcoats
10. Metallic coatings
11. Swimming pool paints
12. Sign paints
13. Mastic coatings (15 mils minimum)
14. Multicolor paints

V PROCEDURE

A. The plan followed during this investigation was to obtain CARB conforming paints and coatings and evaluate their properties vs equivalent conventional (solvent-thinned) coatings, preferably from the same suppliers.

However it was realized that the development of CARB conforming products was still in its infancy and that two problems would be encountered in doing so:

1. The technical difficulty (and cost) involved in developing equivalent low VOC coatings, especially with VOC levels below 250 g/l, of paint, less water.

2. The reticence among some manufacturers to participate in the program because they were concerned that CARB would circulate reports containing comparative data on their products.

Therefore, it was planned to cover as wide a territory as possible by:

1. Publicizing the program

2. Writing to a broad spectrum of paint manufacturers in order to make contact with any who might have products to offer.

B. Consequently, the following steps were taken:

1. A publicity release was sent to 23 industry publications and industry associations. See Appendix 1A & 1B.

2. Letters and questionnaires were sent to about 200 major paint manufacturers plus 164 companies in California requesting products which were commercial and could be purchased. See Appendix IIC & IID.

The results were limited, which was not too surprising considering the statements made in A above.

C. In order to encourage a better and broader response, letters and simplified test data forms were sent to about 70 raw material suppliers, to about 50 specialty paint manufacturers (wood preservatives, fire retardant paints, etc.) and to about 35 manufacturers who responded to the Publicity Release. Samples of test paints were requested directly from the supplier in order to encourage submission of products not yet commercial. See Appendix IIE thru IIG. Also, VOC levels of up to about 350 g/l were accepted. Manufacturers were also advised that the sources would be kept confidential.

Thus, over 500 letters and questionnaires or test data forms were issued.

D. As a result of the publicity and survey, a total of 89 low VOC products and 57 equivalent conventional products representing 10 classes were received and tested.

E. Subsequently an additional 20 low VOC and six conventional coatings representing additions to the above, as well as two additional exempt classes, were received and tested.

Consequently a total of 109 low VOC and 63 equivalent conventional coatings, representing 12 exempt classes, were tested.

F. The following tests were conducted, the choice of which depend on the class of coatings being tested:

1. Viscosity
2. Viscosity stability
3. Storage stability
4. Pot life
5. Drying Time
6. Ease of application
7. Gloss
8. Opacity
9. Enamel holdout
10. Resistance to bleeding
11. Sealing of stains
12. Sanding qualities
13. Appearance
14. Adhesion
15. Flexibility
16. Abrasion resistance
17. Water repellency
18. Resistance to cold water

19. Resistance to sodium hypochlorite (bleach)
20. Resistance to xylol (xylene)
21. Resistance to mineral spirits
22. Resistance to alcohol - 50% (liquor) and 95% (pure)
23. Resistance to hot water
24. Resistance to butyl acetate (nail polish)
25. Resistance to hydrochloric acid
26. Mud cracking
27. Gloss retention
28. Color retention
29. Metallic leafing
30. Fire retardancy
31. Resistance to salt fog (corrosion)
32. Accelerated weathering

These tests were decided upon to attempt to differentiate between low VOC and equivalent conventional paints.

VI PRODUCTS TESTED

Upon examination of the samples and data submitted, it was realized that some of the exempt classes were broader than listed. Therefore, where necessary, they were broken down into sub-classes as shown below. Note also that the titles have been modified where necessary to coincide with actual practice. The number of samples tested are shown in Table 1.

Table 1 PRODUCTS TESTED

Class	Product	Low VOC	Conventional
1	Clear Finishes	13	8
1A	Interior Gloss	5	2
1B	Interior Semigloss	4	3
1C	Exterior Gloss	3	2
1D	Exterior Semigloss	1	1
2	Semi-transparent Stains	2	1
3	Opaque Stains	8	5
4	Primers, Sealers, Undercoaters	30	20
4A	Metal Primers		
4A-1	One Package	13	9
4A-2	Two Component	3	2
4A-Z	Zinc Rich	3	2
4B	Exterior Wood Primers	5	4
4C	Interior Wall Primers	5	2
4D	Enamel Undercoaters	1	1
5	Wood Preservatives	None	None
6	Fire Retardant Paints	5	1
7	Tile-like Glaze Coatings	6	4
8	Waterproofing Coatings	9	3
8A	Clears	3	2
8B	Colors	6	1
9	Maintenance Topcoats	17	13
9A	Light Duty	7	7
9B	One Package	6	4
9C	Two Component	4	2
10	Metallic Coatings	2	3
11	Swimming Pool Paints	6	1
12	Graphic (Sign) Paints	None	None
13	Mastic Coatings	10	3
13A	Waterproofing	6	2
13B	Texture Paints	4	1
14	Multi-color Paints	1	1
14/26		109	63

VII TEST RESULTS

The test data are presented in the Appendix section of this report. See Section IX "Glossary" for a description of the properties tested, Section X "Code and Abbreviation" for an explanation of the terms used and the Test Procedures (Appendix III) for the test methods used.

Inasmuch as some tests are subjective, the observations made have been scored using the following ASTM Scoring Scheme:

Score	Performance	or	Effort
10	Perfect		None
9	Excellent		Trace
8	Very good		Very slight
6	Good		Slight
4	Fair		Moderate
2	Poor		Considerable
1	Very poor		Severe
0	No value		Failed

The use of this numerical scheme avoids the necessity of inserting verbal descriptions in the Test Data tables.

The test results can be compared and analyzed most effectively by rating the data obtained using a scale of 10 to 0. This has been done using the Rating Scheme described in Appendix IV.

The ratings for all coatings are shown in Table 2 thru 28 which correspond with the data shown in Appendix II.

In order to compare the low VOC vs the equivalent conventional coatings, it is appropriate to compare only those which are considered to be Acceptable in both categories and disregard those which are deficient in one or more important properties.

Comparisons are made only within classes or subclasses, in which there are at least two Acceptable low VOC coatings and one Acceptable conventional coating. The table below summarizes these concepts by listing the following data for each group:

1. Total number of coatings tested.

2. Total number of Acceptable coatings.

3. Average ratings for the Acceptable coatings where at least two low VOC coatings and at least one conventional coating were acceptable.

4. Average VOC for the Acceptable low VOC coatings

VIII DISCUSSION OF RESULTS

The test results can be compared and analyzed most effectively by rating all data obtained using a scale of 10 to 0. This has been done by using the Rating Scheme described in Appendix IV.

The ratings for all coatings tested are shown in Tables 2 thru 28 below which correspond with the data shown in Appendix II.

Note the following modifications which have been made in laying out these tables:

1. The following properties have been described rather than rated since they normally have a relatively minor effect on performance:

   Viscosity
   Gloss

2. The following test results are considered to be critical, and have been so designated by an X to the left of the property:

   1. Pot Life - Two component coatings
   2. Opacity - Pigmented coatings
   3. Enamel holdout - Primers
   4. Bleeding resistance - Wood primers
   5. Sealing water and grease stains - Wall primers
   6. Sanding qualities - Enamel undercoaters
   7. Appearance - Multicolor paints
   8. Adhesion
   9. Flexibility
   10. Abrasion resistance
   11. Water repellancy - Exterior stains and waterproofing
   12. Water resistance
   13. Resistance to sodium hypochlorite - Swimming pool paints
   14. Resistance to 50% alcohol - Interior clear finishes vs liquor spills
   15. Resistance to mineral spirits
   16. Resistance to hot water - Interior clear finishes vs spills of hot tea or coffee
   17. Mud cracking - Texture paints

18. Metallic leafing - Metallic paints (except non-leafing type)

19. Fire retardancy - Fire retardant paints

20. Corrosion (salt fog) resistance - Zinc rich primers

21. Durability (accelerated weathering) - Exterior paints

The exceptions to the above are for specific applications:

Class 4A-Z Zinc Rich Primers

Enamel holdout is not included since zinc rich primers tend to form a relatively porous surface which will not give good enamel holdout.

Class 6 Fire Retardant Coatings

Flexibility is not included since these paints are especially highly pigmented to retard the spread of fire. Hence they tend to have poor flexibility.

The following properties have also been omitted since they are of minor importance in the overall performance of the coatings tested:

Set to touch

Butyl acetate (nail lacquer) resistance

Acid resistance

Xylol resistance

Alcohol (95%) resistance

In order to compare the low VOC vs the equivalent conventional coatings, it is best to compare only those which are considered to be Acceptable and disregard those which are deficient in one or more important properties.

This can be done by assigning minimum criteria for Acceptability, as follows:

1. A minimum rating of 6 (Good) for all critical properties.

2. A minimum rating of 4 (Fair) for all other properties.

These Acceptable products are so designated by "Yes under the ratings for each in Tables 2 thru 28. The total tested are considered to be Acceptable are so noted in Table 29.

In order to compare each low VOC group vs its conventional counterpart group, it is logical that at least two low VOC coatings within the group be considered to be acceptable. Their ratings have been averaged for each property and compared with the average ratings for the conventional coatings for each class in Table 29.

Table 2

Class 1A — CLEAR INTERIOR GLOSS FINISHES

		Low VOC					Conv.	
	From -----	1[a] (15)	5 (33)	15 (8)	19 (15)	20 (15)	6 (15)	10 (33)
	VOC (g/l)---	382	369	237	ND	ND	-	-
	Viscosity	LM	LM	VL	LM	LM	L	LM
	Viscosity Stability	10	9	10	9	10	10	9
	Storage Stability	10	10	10	10	10	10	10
	Drying Time	10	8	10	10	10	10	9
	Application Ease	10	10	10	10	10	10	10
	Gloss	VH	VH	VH	VH	VH	VH	VH
X	Adhesion	10	10	10	10	10	10	10
X	Flexibility	10	10	10	10	0	10	10
	Resistance To -							
X	Abrasion	10	9	10	10	6	10	10
X	Alcohol (50%)[b]	8	10	10	10	4	10	10
X	Mineral Spirits[c]	10	10	10	10	8	10	10
X	Hot Water	10	10	10	10	10	10	10
X	Cold Water	10	10	10	10	10	10	10
	ACCEPTABLE	Yes	Yes	Yes	Yes	No	Yes	Yes

X - Critical property
a - Requires a special sealer
b - Simulates liquor
c - Simulates household cleaner
ND - No data

Note: All low VOC coatings are water based

Table 3

Class 1B CLEAR INTERIOR SEMIGLOSS FINISHES

		Low VOC				Conv.		
	From ------	2[a] (15)	11 (19)	14 (8)	17 (9)	7 (15)	16 (8)	18 (9)
	VOC (g/l) --	362	ND	222	ND	-	-	-
	Viscosity	L	H	VL	L	L	L	VL
	Viscosity Stability	10	4	10	10	9	10	10
	Storage Stability	10	10	10	10	10	10	10
	Drying Time	10	10	10	10	10	10	9
	Application Ease	10	10	10	10	10	10	10
	Gloss	L	M	ML	VL	ML	ML	ML
X	Adhesion	10	10	10	10	10	10	10
X	Flexibility	10	8	10	10	10	10	10
	Resistance To -							
X	Abrasion	8	9	10	6	10	4	8
X	Alcohol (50%)	10	10	8	10	10	10	10
X	Mineral Spirits	10	10	10	10	10	10	10
X	Hot Water	10	10	10	10	10	10	10
X	Cold Water	8	10	10	10	10	10	9
	ACCEPTABLE	Yes	Yes	Yes	Yes	Yes	No	Yes

a - Requires a special sealer

Note: All low VOC coatings are water based

Table 4

Class 1C — CLEAR EXTERIOR GLOSS FINISHES

		Low VOC			Conv.	
	From ------	3[a] (15)	12 (20)	21 (15)	8 (15)	13 (20)
	VOC (g/l) -	275	321	ND	-	-
	Viscosity	LM	L	LM	L	LM
	Viscosity Stability	8	10	6	10	10
	Storage Stability	10	10	10	10	10
	Drying Time	8	10	10	9	10
	Application Ease	10	10	10	10	10
	Gloss	VH	VH	VH	VH	VH
X	Adhesion	10	10	10	10	10
X	Flexibility	10	0	10	10	10
X	Abrasion Resistance	10	9	9	10	8
X	Accelerated Weathering	10	10	9	10	4
	ACCEPTABLE	Yes	No	Yes	Yes	No

a Requires a special sealer

Note: All low VOC coatings are water based

Table 5

Class 1D CLEAR EXTERIOR SEMIGLOSS FINISHES

	From ----------	Low VOC 4[a] (15)	Conv. 9 (15)
	VOC (g/l)	274	-
	Viscosity	LM	L
	Viscosity Stability	4	10
	Storage Stability	9	10
	Drying Time	9	9
	Application Ease	10	10
	Gloss	L	ML
X	Adhesion	10	10
X	Flexibility	10	10
X	Abrasion Resistance	10	10
X	Accelerated Weathering	10	8
	ACCEPTABLE	Yes	Yes

a - Requires a special sealer

Note: Low VOC coating is water based

Table 6

Class 2 SEMI-TRANSPARENT STAINS

		Low VOC		Conv.
	From -------	1 (21)	3 (9)	2 (21)
	VOC (g/l) --	155	86	-
	Viscosity	LM	M	VL
	Viscosity Stability	10	9	10
	Storage Stability	10	9	10
	Drying Time	9	10	6
	Application Ease	10	10	10
	Transparency	4	4	10
X	Water Repellancy	6	8	9
X	Accelerated Weathering	10	10	10
	ACCEPTABLE	Yes	Yes	Yes

Note: Low VOC coatings are water based

Table 7

Class 3 — OPAQUE STAINS — Low VOC

		1	3	5	6	7	10	12	14
	Color ------	Bwn	Wht	Red	Wht	Bwn	Grn	Bwn	Bwn
	From -------	(13)	(21)	(35)	(25)	(25)	(29)	(32)	(9)
	VOC (g/l) --	ND	186	235	81	72	124	214	38
	Viscosity	LM	M	L	M	LM	M	MH	M
	Viscosity Stability	10	9	10	10	10	9	10	10
	Storage Stability	6	8	4	6	8	10	10	10
	Drying Time	10	10	10	10	10	10	10	10
	Application Ease	10	10	10	10	10	10	10	10
X	Opacity	10	6	10	8	6	8	10	10
X	Water Repellancy	8	9	2	6	9	6	9	8
X	Acc. Weathering	10	10	10	10	10	10	10	10
	ACCEPTABLE	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes

Bwn - Brown
Wht - White
Grn - Green
Acc. - Accelerated

Note: Low VOC coatings are water based

Table 8

Class 3 — OPAQUE STAINS — Conventional

	Color ---------- From ----------	4 Brown (15)	8 White (25)	9 Brown (25)	11 Green (29)	13 Brown (32)
	Viscosity	MH	L	L	L	L
	Viscosity Stability	0	10	8	10	10
	Storage Stability	0	4	4	4	8
	Drying Time	9	6	8	6	9
	Application Ease	10	10	10	10	10
X	Opacity	10	8	10	10	10
X	Water Repellancy	8	10	9	9	10
X	Accelerated Weathering	9	8	8	10	10
	ACCEPTABLE	No	Yes	Yes	Yes	Yes

Table 9

Class 4A-1 — METAL PRIMERS - One Package — Low VOC

		1	2	4	10	13	20	23	24	32	36	42	49	51
	Color	Gry	Bwn	Bwn	Gry	Bwn	Bwn	Org	Bwn	Wht	Bwn	Wht	Grn	Wht
	From	(23)	(23)	(31)	(13)	(33)	(11)	(22)	(22)	(22)	(20)	(26)	(34)	(14)
	Type	WB	WB	WB	WB	WB	HS	HS	HS	WB	WB	WB	HS	WB
	VOC (g/l)	276	283	71	ND	312	238	243	180	ND	248	44	0	77
	Viscosity	M	M	H	MH	M	MH	VH	MH	H	VH	MH	MH	MH
	Viscosity Stability	4	9	8	9	1	2	4	6	0	0	9	10	9
	Storage Stability	6	2	9	9	1	9	9	8	0	0	10	9	10
	Drying Time	10	10	10	10	10	6	2	2	10	9	8	4	10
	Application Ease	10	10	10	10	10	10	9	10	10	10	10	10	10
X	Opacity	10	10	10	9	10	10	8	10	8	10	6	10	6
X	Adhesion	10	10	10	10	10	6	9	8	10	10	10	10	10
X	Enamel Holdout	10	9	8	10	10	9	9	10	6	9	9	8	6
	Corrosion Resistance	0	0	0	0	10	4	10	4	2	9	6	10	2
X	Acc. Weathering	9	9	9	9	9	9	4	9	10	10	8	9	10
	ACCEPTABLE	No	No	No	No	No	No	No	No	No	No	Yes	Yes	No

Gry - Gray
Org - Orange

Table 10

Class 4A-1 — METAL PRIMERS - One Package — Conventional

	Color -------- / From ---------	6 Gry (23)	7 Bwn (23)	8 Bwn (31)	14 Bwn (33)	17 Wht (13)	21 Bwn (11)	26 Org (22)	27 Bwn (22)	37 Bwn (20)
	Viscosity	M	M	M	M	M	MH	MH	M	M
	Viscosity Stability	8	8	9	8	9	9	1	8	8
	Storage Stability	6	6	6	8	6	6	4	4	8
	Drying Time	8	9	6	9	10	10	6	4	8
	Application Ease	10	10	10	10	10	10	10	10	10
X	Opacity	10	10	10	10	8	10	8	10	10
X	Adhesion	10	10	10	10	10	10	10	10	10
X	Enamel Holdout	9	10	9	9	10	8	9	9	10
	Corrosion Resistance	4	4	6	10	0	4	4	0	6
X	Accelerated Weathering	6	6	9	9	6	9	4	10	9
	ACCEPTABLE	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes

Table 11

Class 4A-2 METAL PRIMERS - 2 Component

		Low VOC			Conventional	
		29	39	43	28	40
	Color	Wht	Red	Wht	Bwn	Red
	From	(22)	(28)	(10)	(22)	(28)
	Type	WB	HS	Pow		
	VOC (g/l)	116	213	0	-	-
	Viscosity - Mixed	VH	VH	(b)	H	LM
	Viscosity Stability[a]	0	1	10	2	4
	Storage Stability[a]	0	1	10	6	8
X	Pot Life	10	10	2	10	10
	Drying Time	10	9	(c)	10	10
	Application Ease	10	10	4[d]	10	10
X	Opacity	4	10	10	10	10
X	Adhesion	10	10	4	10	10
X	Enamel Holdout	6	8	0	9	9
	Corrosion Resistance	4	10	9	10	10
X	Accelerated Weathering	0	6	4	10	6
	ACCEPTABLE	No	No	No	No	Yes

Pow - Powder
a - Based on least stable component
b - Powder mixed with water before use
c - Not determined due to powdery surface
d - Must be sprayed

Table 12

Class 4A-Z METAL PRIMERS - Zinc Rich

		Low VOC			Conventional	
		30	33	35	31	34
	Color --------	Gry	Gry	Gry	Grn	Gry
	From ----------	(22)	(22)	(22)	(22)	(22)
	Type ----------	WB	WB	HS	-	-
	VOC (g/l)-----	61	0	135	-	-
	Viscosity	VH	M	MH	M	M
	Viscosity Stability	10	10	9	10	0
	Storage Stability	10	10	9	9	0
	Pot Life	10	10	10	10	2
	Drying Time	8	10	4	8	10
	Application Ease	10	10	10	10	10
X	Opacity	10	10	10	10	10
X	Adhesion	10	10	9	10	10
X	Corrosion Resistance	10	10	4	10	10
X	Accelerated Weathering	10	10	8	8	9
	ACCEPTABLE	Yes	Yes	No	Yes	No

WB - Water base
HS - High Solids

Table 13

Class 4B

EXTERIOR WOOD PRIMERS

		Low VOC					Conventional			
	From ----------	3 (21)	5 (36)	11 (13)	41 (22)	44 (9)	9 (36)	15 (13)	18 (21)	47 (9)
	VOC (g/l) -------	111	114	ND	141	38	-	-	-	-
	Viscosity	M	MH	M	MH	MH	M	M	H	M
	Viscosity Stability	9	9	10	8	9	8	9	6	10
	Storage Stability	8	9	6	8	9	8	8	4	9
	Drying Time	10	10	10	9	10	6	4	4	4
	Application Ease	10	10	10	10	10	10	10	10	10
	Opacity	8	8	6	8	4	8	6	6	4
X	Adhesion	10	10	10	10	10	10	9	10	10
X	Bleeding Resistance	6	6	8	6	4	9	8	8	8
X	Enamel Holdout	10	9	8	10	4	10	10	9	4
X	Accelerated Weathering	10	2	10	8	8	2	8	2	2
	ACCEPTABLE	Yes	No	Yes	Yes	No	No	Yes	No	No

Notes: All are white

All low VOC coatings are water based.

Table 14

Class 4C — INTERIOR WALL PRIMERS

	Low VOC					Conventional	
	12	19	22	25	45	16	46
From ----------	(13)	(7)	(4)	(22)	(9)	(13)	(9)
VOC (g/l) --------	ND	78	143	141	36	-	-
Viscosity	MH	M	MH	M	MH	MH	MH
Viscosity Stability	9	9	9	10	9	10	10
Storage Stability	4	10	10	10	8	4	9
Drying Time	10	10	10	10	10	10	10
Application Ease	10	10	10	10	10	10	10
X Opacity	6	6	6	6	6	6	6
X Adhesion	10	10	10	10	10	10	10
X Enamel Holdout	10	9	10	8	9	9	8
Stain Sealing-							
X Rusty Water	9	10	10	10	10	10	10
Coffee	6	6	4	6	6	10	10
Tea	4	4	4	8	6	10	10
X Grease stains	10	8	10	9	6	6	6
ACCEPTABLE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All coatings are white

All low VOC coatings are water based.

Table 15

Class 4D ENAMEL UNDERCOATERS

		Low VOC 1	Conv 2
	From ----------	(15)	(38)
	VOC (g/l) ------	ND	-
	Viscosity	M	VH
	Viscosity Stability	9	8
	Storage Stability	10	4
	Drying Time	10	9
	Application Ease	10	10
X	Sanding Qualities	10	10
X	Enamel Holdout	6	9
X	Opacity	8	8
X	Adhesion	10	10
X	Flexibility	10	10
	ACCEPTABLE	Yes	Yes

Notes: Both coatings are white

The low VOC coating is water based.

Table 16

Class 6 FIRE RETARDANT COATINGS

	Low VOC					Conv
	1	2	4	5	6	3
Color ----------	Wht	Grn	Wht	Wht	Bge	Wht
From ----------	(38)	(38)	(5)	(20)	(40)	(38)
VOC(g/l) -------	ND	ND	ND	ND	ND	-
Viscosity	XH	LM	M	L	XH	MH
Viscosity Stability	0	0	0	9	0	8
Storage Stability	0	0	0	8	0	8
Drying Time	10	10	10	10	10	10
Application Ease	8	10	10	4*	8	10
X Opacity	6	10	4	6	6	4
X Adhesion	10	10	8	10	10	6
X Fire Retardancy	8	2	8	2	8	6
ACCEPTABLE	No	No	No	No	No	No

* - Must be sprayed

Bge - Beige

Note: All low VOC coatings are water based.

Table 17

Class 7

TILE - LIKE GLAZE COATINGS

	Low VOC						Conventional			
	1	2	5	6	12	16	9	10	11	15
Color	Wht	TR	Wht	Wht	Wht	TR	Wht	Wht	Wht	Wht
From	(1)	(1)	(16)	(21)	(16)	(5)	(16)	(16)	(21)	(1)
Type	SF	SF	HS	HS	WB	HS				
VOC(g/l)	0	0	353	87	235	0	-	-	-	-
Viscosity - Mixed	H	VH	M	VH	VH	VH	M	MH	VH	MH
Viscosity Stability *	6	9	8	4	1	10	4	0	9	8
Storage Stability *	2	10	9	10	10	10	10	0	10	8
X Pot Life	0	2	6	10	10	2	10	10	8	10
Drying Time	6	6	6	8	6	6	10	9	8	10
Application Ease	9	9	9	8	9	10	9	10	9	10
Gloss	ML	VH	HM	VH	ML	VH	HM	HM	VH	HM
Gloss Retention	8	8	10	10	10	8	8	10	8	10
X Adhesion	10	10	10	10	10	10	10	6	10	10
X Flexibility	0	0	10	10	10	0	10	10	10	10
X Abrasion Resistance	6	8	9	10	8	8	9	8	10	8
X Water Resistance	10	10	10	10	4	10	4	10	10	10
Color Retention	4	8	8	4	4	9	4	9	4	4
ACCEPTABLE	No	No	Yes	Yes	No	No	No	No	Yes	Yes

SF - Solvent free

* - Least stable component

Note: All coatings are two component.

TR - Tile Red

Table 18

Class 8A WATERPROOFING COATINGS - CLEAR

	Low VOC			Conventional	
	3	4	8	11	12*
From ----------	(24)	(24)	(12)	(1)	(1)
VOC (g/l) -----	0	0	0	-	-
Viscosity	XL	XL	H	XL	XL
Viscosity Stability	0	0	0	10	4
Storage Stability	0	0	0	10	10
Drying Time	10	10	10	2	10
Application Ease	10	10	10	10	10
X Adhesion	10	10	10	10	10
X Water Repellancy	2	2	4	2	8
X Water Resistance	10	10	8	10	10
X Acc. Weathering	10	4	10	9	10
ACCEPTANCE	No	No	No	No	Yes

* Two component

Table 19

Class 8B WATERPROOFING COATINGS - COLORS

	Low VOC						Conv
	6	13	14	15	16	17	7
Color ---------	Wht	Gry	Blk	Blk	Blk	Blk	Wht
From ---------	(17)	(3)	(3)	(20)	(20)	(20)	(17)
VOC(g/l) ------	ND	0	0	0	ND	ND	-
Viscosity	M	VH	MH	VH	VH	VH	VH
Viscosity Stability	1	0	4	6	10	10	4
Storage Stability	4	0	9	10	10	10	9
Drying Time	10	6	0	0	0	0	10
Application Ease	10	6	10	10	6	8	10
X Adhesion	10	10	10	10	10	10	10
X Opacity	2	10	10	10	10	10	4
X Water Repellancy	4	4	6	6	10	8	8
X Water Resistance	10	9	0	9	9	9	9
X Acc. Weathering	9	10	6	10	6	9	10
ACCEPTABLE	No		No	No	No	No	No

Table 20

Low VOC

Class 9A MAINTENANCE TOPCOATS - Light Duty

	1	2	3	4	15	27	28
Color --------	Red	Blue	Wht	Wht	Wht	Wht	Red
From --------	(23)	(23)	(23)	(31)	(36)	(21)	(21)
VOC(g/l) -----	178	168	225	242	253	278	217
Viscosity	M	M	MH	MH	LM	MH	LM
Viscosity Stability	1	8	0	9	10	9	0
Storage Stability	10	10	0	10	6	10	0
Drying Time	6	10	10	10	9	10	10
Application Ease	10	10	8	10	9	10	10
X Opacity	6	4	8	10	6	8	4*
Gloss	ML	M	ML	ML	HM	HM	M
X Adhesion	6	10	10	10	10	10	6
X Flexibility	10	10	10	10	10	10	10
X Acc. Weathering	10	9	10	10	10	10	9
ACCEPTABLE	No	No	No	Yes	Yes	Yes	No

* Bright reds tend to have lower opacity.

Note: All coatings are water based.

Table 21 — Conventional

Class 9A — MAINTENANCE TOPCOATS - Light Duty

	Color ------- From -------	6 Red (23)	7 Blue (23)	8 Wht (23)	9 Wht (31)	16 Wht (15)	29 Wht (21)	30 Red (21)
	Viscosity	M	M	M	M	M	M	M
	Viscosity Stability	8	8	10	10	0	4	6
	Storage Stability	8	9	8	8	0	2	2
	Drying Time	6	6	6	9	10	6	6
	Application Ease	10	10	10	10	10	10	10
X	Opacity	10	10	8	10	10	8	4*
	Gloss	H	HM	H	HM	HM	HM	M
X	Adhesion	10	10	10	10	10	10	10
X	Flexibility	10	10	10	10	10	10	10
X	Acc. Weathering	8	8	8	8	8	9	4
	ACCEPTABLE	Yes	Yes	Yes	Yes	No	No	No

* Bright reds tend to have low opacity.

Table 22

Class 9B — MAINTENANCE TOPCOATS - One Package

	Low VOC						Conventional			
	5	11	13	17	25	26	10	12	14	18
Color	Wht	Wht	Gry	Wht	Gry	Wht	Wht	Wht	Gry	Wht
From	(36)	(33)	(33)	(11)	(34)	(30)	(36)	(33)	(33)	(11)
Type	WB	WB	WB	HS	HS	WB				
VOC(g/l)	186	334	346	229	ND	243	-	-	-	-
Viscosity	M	M	M	M	MH	M	M	M	M	H
Viscosity Stability	9	10	9	1	10	9	4	10	9	8
Storage Stability	8	8	4	9	8	10	6	9	10	10
Drying Time	10	6	10	6	1	10	8	9	10	8
Application Ease	10	10	10	10	10	10	10	10	10	10
X Opacity	10	8	10	8	10	8	4	9	10	9
Gloss	M	H	H	HM	VL	ML	H	VH	H	H
X Adhesion	10	10	10	10	6	10	8	10	10	6
X Flexibility	10	10	10	10	10	10	10	10	10	10
X Resistance - Abrasion	10	6	6	4	8	9	8	8	6	6
- Water	4	2	6	4	0	10	4	4	6	0
X - M.S.	9	8	8	9	2	10	8	8	9	9
- Corrosion	2	4	9	8	10	8	2	4	*	9
X Acc. Weathering	10	8	6	9	8	10	8	8	*	8
ACCEPTABLE	No	No	Yes	No	No	Yes	No	No	No	No

* Unable to determine

Table 23

Class 9C MAINTENANCE TOPCOATS - 2 Component

	Low VOC				Conventional	
	19	20	22	24	21	23
Color	Wht	Bge	Wht	Wht	Bge	Wht
From	(22)	(22)	(28)	(18)	(22)	(28)
Type	HS	WB	HS	WB		
VOC(g/l)	120	106	213	117	-	-
Viscosity - Mixed	MH	VH	MH	MH	MH	M
Viscosity Stability	6	6	8	6	6	4
Storage Stability	9	9	8	8	8	6
X Pot Life	10	4	10	10	10	10
Drying Time	6	9	8	6	10	10
Application Ease	10	10	10	10	10	10
X Opacity	8	10	6	4	8	4
Gloss	M	VL	ML	M	VL	VL
X Adhesion	10	10	10	10	10	10
X Flexibility	10	10	10	10	10	10
Resistance To -						
X - Abrasion	2	2	8	6	2	4
X - Water	10	2	10	0	10	6
X - Mineral Spirits	10	10	10	10	10	10
- Corrosion	10	0	10	0	10	10
X Acc. Weathering	4	6	6	4	6	6
ACCEPTABLE	No	No	Yes	No	No	No

Table 24

Class 10 METALLIC FINISHES

	Low VOC		Conventional		
	1	2	3	4	5
From ---------	(20)	(20)	(9)	(39)	(41)
VOC(g/l) -----	ND	ND	-	-	-
Viscosity - Mixed	L	L	VL	VL	L
Viscosity Stability	10 (a)	10 (a)	9	9	10
Storage Stability	8 (a)	8 (a)	8	10	8
Drying Time	10	10	8	8	4
Application Ease	10	10	10	10	10
X Opacity	10	10	10	10	6
X Metallic Leafing	10	(b)	0	10	0
X Adhesion	10	10	10	10	10
X Flexibility	10	10	10	10	10
X Accelerated Weathering	4	4	9	9	6
ACCEPTABLE	Yes*	Yes*	No	Yes	No

a - Vehicle only. Aluminum is packaged separately.

b - Not applicable - Non leafing aluminum.

Notes: All coatings are aluminum paints.

Low VOC coatings are water based.

* Satisfactory for interior use

Table 25

Class 11 SWIMMING POOL PAINTS

		Low VOC						Conv
		1	3	4	5	6	7	2
	From ---------	(20)	(27)	(10)	(10)	(10)	(10)	(20)
	Type ---------	WB	WB	Pow	Pow	Pow	Pow	
	VOC(g/l) -----	320	ND	0	0	0	0	-
	Viscosity	MH	M	LM[a]	LM[a]	LM[a]	LM[a]	M
	Viscosity Stability	2	9	(b)	(b)	(b)	(b)	10
	Storage Stability	8	8	(b)	(b)	(b)	(b)	8
	Drying Time	10	10	(c)	(c)	(c)	(c)	10
	Application Ease	10	10	2	2	2	2	10
X	Opacity	8	6	8	8	6	6	6
X	Adhesion	10	10	0	0	10	10	8
	Resistance To -							
X	- Sod. Hypochlorite	10	10	10	10	10	10	10
X	- Water	10	10	10	10	10	10	10
X	Acc. Weathering	10	8	4	6	6	10	10
	ACCEPTABLE	No	Yes	No	No	No	No	Yes

a - Mixed with water

b - Not applicable

c - Powdery surface

Sod - Sodium

Notes: All paints are white

Table 26

Class 13A

MASTIC COATINGS - WATERPROOFING

		Low VOC						Conventional	
		3	4	6	10	12	13	8	9
	Color -------	Wht	Wht	Wht	Wht	Blk	Blk	Blk	Wht
	From --------	(6)	(6)	(22)	(12)	(12)	(12)	(20)	(12)
	Type --------	WB	WB	HS-2	WB	WB	WB		
	VOC (g/l) ---	27	31	ND	0	0	0	-	-
	Viscosity	VH	H	VH	H	H	VH	VH	VH
	Viscosity Stability	10	9	10*	0	6	8	10	0
	Storage Stability	10	9	9*	0	9	10	10	0
	Drying Time	0	0	6	10	6	6	0	10
	Application Ease	8	8	4	10	10	10	6	10
X	Adhesion	10	10	10	10	10	10	10	10
X	Opacity	10	10	10	10	10	10	10	10
X	Water Repellancy	6	9	10	6	4	4	10	9
X	Water Resistance	0	0	10	10	10	10	10	10
X	Accelerated Weathering	10	10	4	10	10	10	6	10
	ACCEPTABLE	No	No	No	No	No	No	No	No

* - Least stable component
HS-2 - High solids - two component

Table 27

Class 13B MASTIC COATINGS - TEXTURE PAINTS

		Low VOC				Conv.
		14	15	17	18	16
	Color	Wht	Grn	Wht	Wht	Wht
	From	(21)	(9)	(42)	(42)	(42)
	VOC (g/l)	ND	ND	ND	ND	-
	Viscosity	VH	VH	VH	MH	VH
	Viscosity Stability	10	10	10	9	10
	Storage Stability	9	10	6	8	6
	Drying Time	10	10	10	4	6
	Application Ease	10	10	4	10	4
X	Opacity	10	10	10	10	10
X	Adhesion	6	10	10	10	10
X	Mud Cracking	10	10	10	10	10
	ACCEPTABLE	Yes	Yes	Yes	Yes	Yes

Note: Low VOC coatings are water based

Table 28

Class 14 MULTICOLOR PAINTS

		Low VOC 1. (2)	Conv. 2 (37)
	From ------- VOC (g/l) --	ND	-
	Viscosity	M	M
	Viscosity Stability	9	0
	Storage Stability	10	0
	Drying Time	10	10
	Application Ease	10	10
X	Appearance	2	8
X	Opacity	2	10
	Gloss	VL	VL
X	Adhesion	10	8
X	Flexibility	10	10
	ACCEPTABLE	No	No

Table 29

Average Ratings - Acceptable Coatings

	1A		1B		1C		1D		2		3	
	V	C	V	C	V	C	V	C	V	C	V	C
Total Tested --------	5	2	4	3	3	2	1	1	2	1	8	5
Acceptable --------	4	2	4	2	2	1	1	1	2	1	7	4
Viscosity Stability	9.5	9.5	8.5	9.5	7	10	Too Few		9.5	10	9.7	9.5
Storage Stability	10	10	10	10	10	10			9.5	10	8.3	5
Drying Time	9.5	9.5	10	9.7	9	9			9.5	6	10	7.3
Application Ease	10	10	10	10	10	10			10	10	10	10
Opacity	-	-	-	-	-	-			-	-	8.3	9.5
Transparency	-	-	-	-	-	-			4	10	-	-
Adhesion	10	10	10	10	10	10			-	-	-	-
Flexibility	10	10	9.5	10	10	10			-	-	-	-
Water Repellancy	-	-	-	-	-	-			7	9	7.9	9.5
Resistance To -												
- Abrasion	9.7	10	8.3	7.3	9.5	10			-	-	-	-
- Alcohol	9.5	10	9.5	10	-	-			-	-	-	-
- Mineral Spirits	10	10	10	10	-	-			-	-	-	-
- Hot Water	10	10	10	10	-	-			-	-	-	-
- Cold Water	10	10	9.5	9.7	-	-			-	-	-	-
Weathering	-	-	-	-	9.5	10			10	10	10	9
Average VOC (g/l)*	329		292		275				121		119	

V - Low VOC

C - Conventional

- - Not applicable

* Based on acceptable samples for which data was received.

Table 29 (Cont)

Average Ratings - Acceptable Coatings

	4A-1		4A-2		4A-Z		4B		4C		4D	
	V	C	V	C	V	C	V	C	V	C	V	C
Total Tested --------	13	9	3	2	3	2	5	4	5	2	1	1
Acceptable --------	2	6	0	1	2	1	3	1	5	2	1	1
Viscosity Stability	9.5	8.3	Too Few		10	10	9	9	9.2	10	Too Few	
Storage Stability	9.5	6.7			10	9	7.3	8	8.4	6.5		
Pot Life	-	-			10	10	-	-	-	-		
Drying Time	6	8.5			9	8	10	4	10	10		
Application Ease	10	10			10	10	10	10	10	10		
Opacity	8	10			10	10	7.3	6	6	6		
Adhesion	10	10			10	10	10	9	10	10		
Bleeding Resistance	-	-			-	-	6.7	8	-	-		
Sanding Qualities	-	-			-	-	-	-	-	-		
Enamel Holdout	8.5	9.2			-	-	9.3	10	9.2	8.5		
Stain Sealing -	-	-			-	-	-	-				
Rusty water									9.8	10		
Coffee									5.6	10		
Tea									5.2	10		
Grease									8.6	6		
Flexibility	-	-			-	-	-	-	-	-		
Corrosion Resist.	8	5.7			10	10	-	-	-	-		
Weathering	8.5	8			10	8	9.3	8	-	-		
Average VOC(g/l)	44				61		126		100			

Table 29 (Cont)

Average Ratings - Acceptable Coatings

	6		7		8A		8B		9A		9B	
	V	C	V	C	V	C	V	C	V	C	V	C
Total Tested --------	5	1	6	4	3	2	6	1	7	7	6	4
Acceptable --------	0	0	2	2	0	0	0	1	3	4	2	0
Viscosity Stability	None		6	8.5	None		Too Few		9.3	9	Too Few	
Storage Stability			9.5	9					8.7	8.3	Conv.	
Pot Life			6	9					-	-		
Drying Time			7	9					10	6.7		
Application Ease			8.5	9.5					9.7	10		
Opacity			-	-					8	9.5		
Adhesion			10	10					10	10		
Gloss Retention			10	9					-	-		
Color Retention			6	4					-	-		
Flexibility			10	10					10	10		
Resistance To -									-	-		
- Abrasion			9.5	9								
- Water			10	10								
- M.S.			-	-								
- Corrosion			-	-								
Weathering			-	-					10	8		
Average VOC(g/l)			220						258			

Clr - Clears

Table 29 (Cont)

Average Ratings - Acceptable Coatings

	9C		10		11		13A		13B		14	
	V	C	V	C	V	C	V	C	V	C	V	C
Total Tested --------	4	2	2	3	6	1	6	2	4	1	1	1
Acceptable --------	1	0	2	1	1	1	0	0	4	1	0	0
Viscosity Stability	Too Few		10	9	Too Few		None		9.7	10	None	
Storage Stability			8	10					8.3	6		
Drying Time			10	8					8.5	6		
Application Ease			10	10					8.5	4		
Opacity			10	10					10	10		
Adhesion			10	10					9	10		
Flexibility			10	10					-	-		
Mud Cracking			-	-					10	10		
Metallic Leafing			10*	10					-	-		
Weathering			4	9					-	-		
Average VOC(g/l)			ND						26			

* Where applicable

ND - No data

The Acceptable low VOC coatings exhibited the following significant differences (more than one unit) vs the equivalent conventional coatings:

Class		Superior	Inferior
1A	Interior Clear Gloss	Equal in all properties	
1B	Interior Clear Semigloss	Equal in all properties	
1C	Exterior Clear Gloss	None	Viscosity stability
2	Transparent Stains	Faster dry	Transparency Water repellancy
3	Opaque Stains	Storage stability Faster dry	Opacity Water repellancy
4A1	Metal Primers (one package)	Viscosity stability Storage stability Corrosion resistance	Slower dry Opacity
4AZ	Zinc Rich Primers	Weathering	None
4B	Exterior Wood Primers	Faster dry Opacity Weathering	Bleeding resistance
4C	Interior Wall Primers	Storage stability Seal grease stains	Seal water soluble stains
7	Tile-like Glaze Coatings	Color retention	Viscosity stability Short pot life Slower dry
9A	Maintenance Paints - Light Duty	Faster dry Weathering	Opacity
10	Metallic Finishes	Faster dry	Storage stability Weathering
13B	Mastic Coatings - Texture Paints	Storage stability Faster dry Ease of application	None

The following classes have not been averaged either because less than two low VOC coatings or no conventional coating was considered to be Acceptable:

1D	Exterior Clear Semigloss
4A-2	Metal Primers - Two Component
4D	Enamel Undercoaters
6	Fire Retardent Coatings
8A	Waterproofing Coatings - Clear
8B	Waterproofing Coatings - Colors
9B	Maintenance Topcoats - One Package
9C	Maintenance Topcoats - Two Component
11	Swimming Pool Paints
13A	Mastic Coatings - Waterproofing
14	Multicolor Paints

The following low VOC products are probably capable of being produced at VOC levels below 250 g/l:

Semi-transparent stains
Opaque stains
Metal primers - One package
Metal primers - Zinc rich
Exterior wood primers
Interior wall primers
Tile-like glaze coatings
Maintenance topcoats - Light duty
Mastic coatings - Texture paints

IX GLOSSARY

A simple description of the properties tested will aid in understanding the test data:

Viscosity - Fluidity

Viscosity Stability - Retention of viscosity during storage. Four weeks of accelerated storage is considered to be as severe as 6 months of normal storage.

Storage Stability - Absence of separation, skinning and pigment settling during storage, and the relative ease of remixing the paint after storage.

Pot Life - Multicomponent paints tend to react as soon as mixed. However, this reaction should be controlled so that the mixed paint is useable for at least a working day, i.e., 6 to 8 hours.

Drying Time -

Set to touch - A measure of the "open" or working time during which the paint can be easily brushed.

Tack Free - Free of any tackiness. Coating can be handled carefully.

Dry hard - Coating is resistant to normal handling.

Dry thru - Coating is hard and can be handled readily. It can be placed in service except for extreme conditions which require a 7 day dry.

Application Ease - The ability to apply the coating without excessive drag.

Gloss - Shininess or lustre.

Opacity - Ability of the coating to hide or obscure the surface onto which it is applied.

Enamel Holdout - A measure of the porosity of the primer. A nonporous primer will not adversely affect the gloss of the topcoat applied over it.

Bleeding - Cedar, redwood and fir contain water soluble compounds which tend to bleed through and discolor the applied paint. One purpose of a wood primer is to prevent bleeding so that the house paint applied over it will not be discolored.

Sealing Stains - Interior walls may be stained during use, e.g., in kitchens or laundry areas, or because of water leaks from behind the walls.

Sanding Qualities - The ability to be sanded to produce a smooth surface without sticking or gumming up the sandpaper.

Appearance - Multicolor paints are applied to produce a specific and recognizable pattern with a distinct definition.

Adhesion - Ability to adhere to the substrate. The performance of a coating will deteriorate rapidly if its adhesion is poor.

Flexibility - Since exposed steel expands and contracts with changes in temperature, it is important that coatings applied on steel be flexible to prevent rapid failure.

Taber Abrasion - Coatings used on horizontal surfaces, such as floors, furniture, etc., which are subject to wear from traffic or handling should be resistant to abrasion.

Water Repellency - Coatings such as exterior stains, waterproofing coatings and mastic coatings should prevent the absorption of water, i.e., from rain, so as to protect the substrate.

Reagent Resistance -

Cold Water - All coatings should be water resistant to prevent damage, if wet.

Sodium Hypochlorite - Bleach solution similar to chemicals added to water in swimming pools.

Xylol (Xylene) - Xylol simulates strong solvents which may be present in industrial operations.

Mineral spirits - Many household cleaners contain solvents which are, or are similar to, mineral spirits.

Alcohol (95%) - Alcohol may be present in industrial operations.

Alcohol (50%) - This simulates a liquor spill.

Hot water - This simulates a spill of hot tea or coffee.

Butyl acetate - This simulates nail polish.

Hydrochloric acid - This acid may be present in industrial operations.

Recovery - Return to original hardness.

Mud Cracking - Thick coatings such as texture paints may tend to form fine cracks during the drying process.

Color and Gloss Retention - Coatings exposed indoors are still subject to changes in color and/or gloss over long periods of time. Ultraviolet light accelerates the change.

Metallic Leafing - The ability to produce a brigh metallic finish

Fire Retardancy -

Flammability - The spread of flame when ignited.

After flame - Continue burning after removal of source of inition

Substrate consumed - Amount burned (weight loss) as a result of fire.

Salt Fog Exposure - A major determination of corrosion resistance is exposure to a fog of a 5% salt solution. This simulates a seashore environment. In order to accelerate corrosion, an "X" is scored through the coating to expose the steel and simulate damage to the coating.

Accelerated Weathering - The apparatus combines artificial sunlight lamps and moisture condensation to simulate exposure conditions.

X CODE AND ABBREVIATIONS

The following ASTM Scoring Scheme has been used in the Test Data (Appendix II) to score subjective observations in order to avoid lengthy descriptions:

Score	Performance	or	Effect
10	Perfect		None
9	Excellent		Trace
8	Very good		Very slight
6	Good		Slight
4	Fair		Moderate
2	Poor		Considerable
1	Very poor		Severe

The following units have been used in the Test Data (Appendix II). See the Test Procedure (Appendix III) for a complete description.

KU - Krebs units
Hrs - Hours
mgm - milligrams
mm - millimeters
ASTM - See appropriate test method
Index- See Flamability test method

The following abbreviations have been used to avoid lengthy descriptions:

Tests: -
- Sod. - Sodium
- HCl - Hydrochloric acid
- X - "X" scribed through coating to expose steel
- Creep - Distance of corrosion from the "X"
- Acc. - Accelerated
- Check. - Checking
- Crack. - Cracking

Products:
- Conv. - Conventional
- WB - Water base
- HS - High solids
- SF - Solvent free
- Pow - Powder
- -2 - Two component

Colors: -
- Bge - Beige
- Blk - Black
- Bwn - Brown
- Clr - Clear
- Grn - Green
- Gry - Grey
- Org - Orange
- TR - Tile Red
- Wht - White

Viscosity and Gloss: -
- L - Low
- H - High
- V - Very
- X - Extra

APPENDIX

Appendix IA

D/L LABORATORIES

(FORMERLY DAVID LITTER LABORATORIES)

116 East 16th Street, New York, N.Y. 10003
Telephone: 212-777-4410

Publicity Covering Letter

Dear Editor:

As you probably know, air pollution regulations have been issued which restrict the type and amount of solvents, other than water, that can be used in paint and coatings.

The California Air Resources Board (CARB), which has been in the forefront in developing regulations of this type, has taken the practical step of trying to determine whether it is possible for all major types of architectural coatings on the market to meet these strict requirements and yet demonstrate competitive performance vs equivalent conventional paints and coatings. They have contracted with the D/L Laboratories to assist them in this program.

Our first approach is to publicize their interest as widely as possible in order to alert manufacturers of these products as to CARB's interest. Commercial or prototype samples of these products will then be compared with equivalent conventional products by us.

We would therefore appreciate your inserting the enclosed Publicity Release in an early issue of your publication. If and when you do, please send us two copies of the item.

Thank you for your cooperation.

Sincerely,

Sidney B. Levinson
President

SBL/df
cc: S. Spindel

enc.

Appendix IB

D/L LABORATORIES

(FORMERLY DAVID LITTER LABORATORIES)

116 East 16th Street, New York, N.Y. 10003
Telephone: 212-777-4410

Publicity Release

CARB SEEKS ACCEPTABLE COATINGS

The California Air Resources Board (CARB), as part of their research program to investigate the current status of coating technology, is seeking commercial paints and coatings which meet CARB solvent limitation requirements. Consequently, CARB has contracted with the D/L Laboratories to locate and investigate the relative performance of commercial field applied products which contain less than 250 gm of volatile organic material (e.g., solvent) per liter of paint (excluding water) and which exhibit competitive performance to conventional products.

These paints and coatings are as follows:

1. Clear Finishes, e.g., varnish, lacquer (brushing), shellac
2. Wood Stains - semi-transparent type, either interior or exterior
3. Wood Stains - opaque type (heavy bodied)
4. Primers, Sealers or Undercoaters
5. Penetrating Wood Preservatives
6. Fire Retardant Coatings - Flame spread of 25 or less
7. Tile-like (high build) Glaze Coatings
8. Waterproofing Coatings, e.g., roof coatings, concreate waterproofing
9. Industrial Maintenance Topcoats
10. Metallic (e.g., aluminum) Coatings
11. Swimming Pool Paints
12. Graphic Arts Coatings, e.g., sign paints, bulletin boards

D/L LABORATORIES
116 East 16th Street, New York, N.Y. 10003

13. High Build Mastic Coatings, e.g., texture paint, at least 15 mils thick

14. Multicolor Paints

15. Aerosol Spray Paints

These paints and coatings may be either water-base or high solids provided that they are similar to the equivalent competitive products in package qualities, application properties, appearance and performance. The water-base coatings may contain any organic solvents, provided that the total volatile organic material is less than 250 gms per liter of paint (excluding water). It is not necessary that the solvents meet the requirements of Rule 66 or its variation.

Your cooperation in obtaining this information is solicited. If you have any of the above products, either on the market or in preparation for marketing, please call or write to:

Sidney B. Levinson
President
D/L Laboratories
116 East 16th Street
New York, N.Y. 10003

Phone: (212) 777-4410

Appendix IC

D/L LABORATORIES

(FORMERLY DAVID LITTER LABORATORIES)

116 East 16th Street, New York, N.Y. 10003
Telephone: 212-777-4410

Questionnaire Covering Letter

Dear Sir:

The California Air Resources Board (CARB), as part of their research program to investigate the current status of the technology, is seeking commercial paints and coatings which meet CARB solvent limitation requirements. Consequently, CARB has contracted with the D/L Laboratories to locate and investigate the relative performance of commercial field applied products which contain less than 250 gm of volatile organic material (e.g. solvent) per liter of paint (excluding water) and which exhibit competitive performance to conventional products.

These paints and coatings are as follows:

1. Clear Finishes, e.g., varnish, lacquer (brushing), shellac
2. Wood Stains - semi-transparent type, either interior or exterior
3. Wood Stains - opaque type (heavy bodied)
4. Primers, Sealers or Undercoaters
5. Penetrating Wood Preservatives
6. Fire Retardant Coatings - Flame spread of 25 or less
7. Tile-like (high build) Glaze Coatings
8. Waterproofing Coatings, e.g., roof coatings, concrete waterproofing
9. Industrial Maintenance Topcoats
10. Metallic (e.g., aluminum) Coatings
11. Swimming Pool Paints

LABORATORIES
116 East 16th Street, New York, N.Y. 10003

12. Graphic Art Coatings, e.g., sign paints, bulletin colors

13. High Build Mastic Coatings, e.g., texture paints, at least 15 mils thick

14. Multicolor Paints

15. Aerosol Spray Paints

These paints and coatings may be either water-base or high solids provided that they are similar to the equivalent competitive products in package qualities, application properties, appearance and performance. The water-base coatings may contain any organic solvents provided that the total volatile organic material is less than 250 gms per liter or paint (excluding water). It is not necessary that the solvents meet the requirements of Rule 66 or its variations.

If you have any of the above products, either on the market or in preparation for marketing, will you please submit as much as you can of the information requested on the enclosed form. Use a separate form for each product you have to offer. More forms are available on request or you can duplicate them, if you prefer to do so.

We solicit your cooperation in obtaining this information and look forward to your reply.

Sincerely,

Sidney B. Levinson
President

SBL/df
cc: S. Spindel

enc.

LOW SOLVENT VS CONVENTIONAL PAINTS AND COATINGS

Please supply whatever data you have, where applicable,on both the new product and the equivalent conventional coating. The latter may be either your own or one of your competitors. Use one form for each product.

Type of Product: _____

	LOW SOLVENT	CONVENTIONAL
1. Trade Name:		
2. Code No:		
3. Water: (by vol)	_____%	_____%
4. Volatile Organic Material: (by vol)	_____%	_____%
5. Total Solids:		
Weight:	_____%	_____%
Volume:	_____%	_____%
6. Application Properties:		
a) Any Special problems or requirements?		
b) Speed of Dry:		
Tack free:	_____hours	_____hours
Dry hard:	_____hours	_____hours
7. Appearance Properties:		
a) Opacity:		
Thickness (dry):	_____Mils	_____Mils
Contrast Ratio:	_____%	_____%
b) Gloss - 60°:		
c) Reflectance (White):		

	LOW SOLVENT	CONVENTIONAL
8. Performance Properties (as applicable):		
a) Adhesion (# hatch):	_____ %	_____ %
b) Flexibility :	_____ in	_____ in
c) Resistance to:		
(1) Water:	_____ days	_____ days
(2) _____:	_____ days	_____ days
(3) _____:	_____ days	_____ days
d) Durability:		
Accelerated:	_____ hours	_____ hours
Exterior:	_____ months	_____ months
e) Salt Fog Resistance:	_____ hrs	_____ hrs
f) Flame Spread:	_____	_____
9. Other Properties of Interest:		
_____	_____ Unit	_____ Unit
_____	_____ Unit	_____ Unit
10. Approximate Retail Price:		
1 gal:	$_____ per Gal	$_____ per Gal
5 gals:	$_____ per Gal	$_____ per Gal

11. Samples for Test:

a) Qts Can Be Purchased From: _____

b) If not, will you please send us 1 Quart for test purposes.

12. Company _____

By _____

Date _____

Please mail to:

Sidney B. Levinson
President
D/L Laboratories
116 East 16th Street
New York, N.Y. 10003

Appendix IE

DL LABORATORIES

(FORMERLY DAVID LITTER LABORATORIES)

116 East 16th Street, New York, N.Y. 10003
Telephone: 212-777-4410

Letter to Raw Material Suppliers

Re: California Air Resources Board (CARB)

The enclosed letter has been sent to major paint and coating manufacturers throughout the continental U.S.A. and to all paint manufacturers of any significant size in California.

Have you developed any coatings on the enclosed list which meet CARB requirememts? If so, is any paint manufacturer presently either marketing or getting ready to market a similar product? In that event, will you either forward the enclosed information to him or advise us and we will do so.

We also would appreciate your sending us whatever literature is available on the products you have developed that are on the list and conform to the CARB requirements.

Sincerely,

Sidney B. Levinson
President

SBL/nv
cc: S.Spindel

enc.

Appendix IF

D/L LABORATORIES

(FORMERLY DAVID LITTER LABORATORIES)

116 East 16th Street, New York, N.Y. 10003
Telephone: 212-777-4410

Revised Covering Letter

The California Air Resources Board (CARB), as part of their research program to investigate the current status of coating technology, is seeking commercial paints which meet CARB solvent limitation requirements. Consequently, CARB has contracted with the D/L Laboratories to obtain and test the following products which contain less than 250 gm of volatile organic material (e.g., solvent) per liter of paint (excluding water) and which are competitive to conventional paints.

1. Clear Finishes
2. Wood Stains - semi-transparent and /or opaque
3. Primers and/or Undercoaters
4. Penetrating Wood Preservatives
5. Fire Retardant Coatings
6. Tile-like (high build) Glaze Coatings
7. Waterproofing Coatings, e.g., for roofs or concrete
8. Industrial Maintenance Topcoats
9. Aluminum Paints
10. Swimming Pool Paints
11. Sign Paints or Bulletin Colors
12. High Build Mastic Coatings, e.g., texture paints
13. Multicolor Paints

LABORATORIES
116 East 16th Street, New York, N.Y. 10003

These paints and coatings may be either water-base or high solids, provided that they are competitive to the equivalent conventional products. The water-base coatings may contain any organic solvents provided that the total volatile organic material is less than 250 gms per liter of paint (excluding water).

If you have developed any of these products, will you please send us a quart sample and any data that you have on the product(s).

We solicit your cooperation in obtaining this information and look forward to your reply.

Sincerely,

Sidney B. Levinson
President

SBL/nv
cc: S.Spindel

Appendix IG

D/L LABORATORIES
116 East 16th St.
New York, NY 10003

Data Sheet (Revised Questionnaire)

LOW SOLVENT VS CONVENTIONAL PAINTS AND COATINGS

Please supply any data you have, where applicable, on the new product. If you can, include data on any equivalent conventional product which can either be your product or a competitive one.

Type of Product: _____

	LOW SOLVENT	CONVENTIONAL
Trade Name:		
Code No.:		
Water: (by volume)	_____ %	_____ %
Volatile Organic Material: (by vol.)	_____ %	_____ %
Total Solids:		
Weight:	_____ %	_____ %
Volume:	_____ %	_____ %
Application Properties:		
a) Any special requirements?		
b) Speed of Dry:		
Tack free:	_____ hours	_____ hours
Dry hard:	_____ hours	_____ hours
Appearance Properties:		
a) Opacity:		
Thickness (dry):	_____ Mils	_____ Mils
Contrast Ratio:	_____ %	_____ %
b) Gloss - 60°		
c) Reflectance (White):		

	LOW SOLVENT	CONVENTIONAL
Performance Properties (as applicable and available)		
a) Water resistance:	_____ days	_____ days
b) Durability:	_____ years	_____ years
c) Salt Fog Resistance:	_____ hrs	_____ hrs
d) Flame Spread:	_____	_____
Other Properties of Interest:		
_____	_____ Unit	_____ Unit
_____	_____ Unit	_____ Unit
Approximate Retail Price:		
1 gal:	$_____ per Gal	$_____ per Gal
5 gals:	$_____ per Gal	$_____ per Gal

Samples for Test:

Please submit quart (or gallon) samples for test. White is the preferred color, if possible. If the conventional product is not yours, please advise where it may be obtained.

Company _____

By _____

Date _____

Please sent to:

Sidney B. Levinson
President
D/L Laboratories
116 East 16th Street
New York, N.Y. 10003

Appendix IIA

TEST DATA

Class 1A — CLEAR INTERIOR GLOSS FINISHES

		Low VOC					Conv.	
From ----------→		1 (15) (a)	5 (33)	15 (8)	19 (15)	20 (15)	6 (15)	10 (33)
Viscosity	KU							
Initial		61	66	51	61	64	57	63
4 wks/120°F		64	61	51	70	64	57	68
Storage - 4 wks/120°F			(b)					
Skinning	Score	10	10	10	10	10	10	10
Drying Time	Hrs							
Set to touch		0.3	0.3	0.3	0.4	0.2	0.3	0.9
Tack free		0.3	1.4	0.3	2.0	0.4	0.6	4.5
Dry hard		0.4	16.5	1.0	3.0	1.0	1.4	7.0
Dry thru		0.4	16.5	1.0	3.0	1.0	1.4	7.0
Application Ease	Score	10	10	10	10	10	10	10
Gloss - 60°		95	95	100	100	100	100	100
Adhesion	%	100	100	100	100	100	100	100
Flexibility - Pass	Inch	1/8	1/8	1/8	1/8	1+	1/8	1/8
Taber Abrasion	mgm	12	24	15	18	50	11	15
Alcohol (50%) - 1 hr								
Blistering	ASTM	8M	10	10	10	0 (c)	10	10
Color change	Score	9	10	9	10	9	10	9
Gloss change	"	8	10	10	10	0	10	10
Hardness	"	6	6	6	10	0	9	8
Recovery	"	10	9	9	10	10	10	9
Butyl Acetate (d) - 3 hrs								
Solution	Score	2	8	10	2	0 (c)	10	10
Hardness	"	0	0	0	0	0	4	8
Recovery		10	10	10	10	8	10	10

Appendix IIA

TEST DATA

Class 1A CLEAR INTERIOR GLOSS FINISHES (cont)

		Low VOC					Conv.	
From ----------→		1 (15) (a)	5 (33)	15 (8)	19 (15)	20 (15)	6 (15)	10 (33)
Mineral Spirits - 1 hr								
Blistering	ASTM	10	10	10	10	10	10	10
Color change	Score	10	10	9	10	10	10	10
Gloss change	"	10	10	10	10	10	10	10
Hardness	"	10	10	8	10	4	10	8
Recovery	"	10	10	9	10	6	10	9
Hot Water - 1 hr								
Blistering	ASTM	10	10	10	10	10	10	10
Color change	Score	10	10	10	10	10	10	10
Gloss change	"	10	10	10	10	10	10	10
Hardness	"	10	9	9	10	10	9	8
Recovery	"	10	9	10	10	10	10	9
Cold Water	Hrs	500	500	500	500	3	500	500
Visual changes	Score	10	9	9	10		10	10
Hardness	"	10	9	10	9		10	9
Recovery	"	10	10	10	10		10	9

a - Special sealer. All other samples - two coats, first coat reduced 10%

b - Slight separation

c - Lifted

d - Simulates nail polish remover

Conv. - Conventional

Appendix IIB

TEST DATA

Class 1B CLEAR INTERIOR SEMIGLOSS FINISHES

		Low VOC				Conv.		
From --------→		2 (15) (a)	11 (19)	14 (8)	17 (9)	7 (15)	16 (8)	18 (9)
Viscosity	KU							
Initial		57	108	51	54	56	56	47
4 wks/120°F		58	150	51	51	62	53	47
Storage - 4 wks/120°F,	Score							
Separation		9	10	10	8	9	9	10
Skinning		10	8	10	10	10	10	10
Settling		9	10	10	10	10	10	10
Redispersion		9	10	10	10	9	10	10
Drying Time	Hrs							
Set to touch		0.3	0.1	0.3	0.4	0.3	0.6	1.6
Tack free		0.3	0.1	0.3	0.4	0.6	1.0	5.0
Dry hard		0.4	0.2	1.0	2.0	1.4	1.0	6.5
Dry thru		0.4	0.2	1.0	2.0	1.4	1.0	6.5
Application Ease	Score	10	10	10	10	10	10	10
Gloss - 60°		15	64	38	7	24	29	31
Adhesion	%	100	100	100	100	100	100	100
Flexibility - Pass	Inch	1/8	1/4	1/8	1/8	1/8	1/8	1/8
Taber Abrasion	mgm	36	26	18	52	18	85	44
Alcohol (50%) - 1 hr								
Blistering	ASTM	10	10	10	10	10	10	10
Color change	Score	9	8	8	10	9	9	10
Gloss change	"	10	8	6	10	10	10	10
Hardness	"	6	8	6	10	10	10	10
Recovery	"	10	10	10	10	10	10	10
Butyl Acetate[b] - 3 hrs								
Performance	Score	6	2	0	0	10	0	10
Hardness	"	4	4	0	0	6	0	6
Recovery	"	10	10	8	10	10	0	10

Appendix IIB

TEST DATA

Class IB CLEAR INTERIOR SEMIGLOSS FINISHES (cont)

		Low VOC				Conv.		
From --------→		2 (15) (a)	11 (19)	14 (8)	17 (9)	7 (15)	16 (8)	18 (9)
Mineral Spirits - 1 hr		10	10	10	10	10	10	10
Hot Water - 1 hr								
Blistering	ASTM	10	10	10	10	10	10	10
Color change	Score	10	10	9	10	10	10	10
Gloss change	"	10	10	10	10	10	10	10
Hardness	"	10	10	8	10	9	9	10
Recovery	"	10	10	10	10	10	10	10
Cold Water - 500 hrs								
Performance	Score	2 (c)	10	9	9	9	10	4 (c)
Hardness	"	0	10	10	9	10	10	8
Recovery	"	0	10	10	10	10	10	9

a - Special sealer, all other samples - 2 coats, first coat reduced 10%

b - Butyl Acetate simulates nail polish remover

c - Discolored and lost adhesion

Appendix IIC

TEST DATA

Class 1C — CLEAR EXTERIOR GLOSS FINISHES

		Low VOC			Conv.	
From ----------→		3 (15) (a)	12 (20)	21 (15)	8 (15)	13 (20)
Viscosity	KU					
Initial		61	54	63	58	61
2 wks/120°F		79	51	86	57	63
Storage - 4 wks/120°F						
Skinning	Score	10	10	10	10	10
Drying Time	Hrs					
Set to touch		0.3	0.3	0.4	1.1	0.2
Tack free		1.8	0.6	0.6	3.5	0.3
Dry hard		16.5	0.6	4.0	7.0	0.5
Dry thru		16.5	0.6	4.0	7.0	0.5
Application Ease	Score	10	10	10	10	10
Gloss - 60°		91	100	100	96	70
Adhesion	%	100	100	100	100	100
Flexibility - Pass	Inch	1/8	1+	1/8	1/8	1/8
Taber Abrasion	mgm	18	21	20	7	32
Accelerated Weathering - 500 hrs						
Color change	Score	10	10	4	10	10
Gloss change	"	10	9	8	10	2
Chalking	ASTM	10	10	10	10	10
Checking	"	10	10	10	10	10
Cracking	"	10	9	10	10	10
Wrinkling	Score	10	10	10	10	6

a - Special sealer required

Appendix IID

TEST DATA

Class ID — CLEAR EXTERIOR SEMIGLOSS FINISHES

		Low VOC 4 (15) (a)	Conv. 9 (15)
Viscosity	KU		
Initial		61	56
2 wks/120°F		92	53
Storage - 2 wks/120°F	Score	9	10
Separation		10	10
Skinning		9	10
Settling		9	10
Resispersion			
Drying Time	Hrs		
Set to touch		0.3	0.9
Tack free		0.3	3.5
Dry hard		2.5	7.0
Dry thru		16.5	7.0
Application Ease	Score	10	10
Gloss - 60°		10	29
Adhesion	%	100	100
Flexibility - Pass	Inch	1/8	1/8
Taber Abrasion	mgms	17	15
Accelerated Weathering -	500 hrs		
Color change	Score	10	10
Gloss change	"	10	10
Chalking	ASTM	10	6
Checking	"	10	10
Cracking	"	10	10

a - Special sealer required

Appendix IIE

TEST DATA

Class 2 SEMI-TRANSPARENT STAINS

		Low VOC		Conv.
		1	3	2
Color ------→		Brown	Brown	Brown
From ------→		(21)	(9)	(21)
Viscosity	KU			
Initial		60	71	51
4 wks /120°F		60	64	47
Storage - 4 wks/120°F	Score			
Separation		9	8	9
Skinning		10	10	10
Settling		10	10	10
Redispersion		9	9	9
Drying Time	Hrs			
Set to touch		0.6	0.5	3.0
Tack free		1.0	0.5	24
Dry hard		2.5	0.7	24
Dry thru		3.5	0.7	24
Application Ease	Score	10	10	10
Opacity	%	90	94	50
Water Absorption	%	2.6	1.4	1.0
Accelerated Weathering - 500 hrs				
Color change	Score	9	10	9
Gloss change	"	10	10	10
Chalking	ASTM	9	10	9
Checking	"	10	10	10
Cracking	"	10	10	10

Appendix IIF

TEST DATA

Class 3 — OPAQUE STAINS — Low VOC

		1	3	5	6	7	10	12	14
Color ----→		Bwn	Wht	Red	Wht	Bwn	Grn	Bwn	Bwn
From ----→		(13)	(21)	(35)	(25)	(25)	(29)	(32)	(9)
Viscosity	KU								
Initial		62	69	58	71	62	81	90	83
4 wks/120°F		62	75	58	71	60	89	90	83
Storage - 4 wk/120°F,	Score								
Separation		4	6	2	4	4	10	10	10
Skinning		10	10	10	10	10	10	10	10
Settling		8	8	9	9	9	10	10	10
Redispersion		6	8	8	6	8	10	10	10
Drying Time	Hrs								
Set to touch		0.4	0.2	0.5	0.3	0.5	0.3	0.3	0.5
Tack free		0.5	0.3	1.5	0.3	0.5	0.3	0.3	0.5
Dry hard		0.6	1.5	2.2	1.5	1.5	0.5	2.5	0.7
Dry thru		1.5	1.5	2.2	1.5	2.2	2.2	2.5	0.7
Application Ease	Score	10	10	10	10	10	10	10	10
Opacity	%	100	89	100	96	93	95	100	100
Water Absorption	%	1.4	0.6	5.8	2.2	0.8	2.1	0.5	1.2
Accelerated Weathering - 500 hrs									
Color change	Score	10	10	10	10	10	10	10	10
Gloss change	"	10	10	10	10	10	10	10	10
Chalking	ASTM	8	8	8	9	8	8	8	10
Checking	"	10	10	10	10	10	10	10	10
Cracking	"	10	10	10	10	10	10	10	10

Grn - Green

Appendix IIG

TEST DATA

Class 3 — OPAQUE STAINS — Conventional

		4	8	9	11	13
Color ------>		Brown	White	Brown	Green	Brown
From ------>		(15)	(25)	(25)	(29)	(32)
Viscosity	KU					
Initial		89	58	55	53	57
4 wks/120 F		Gel	55	42	51	57
Storage - 4 wk/120°F ,	Score					
Separation		-	2	2	2	9
Skinning		-	10	10	10	6
Settling		-	6	4	6	10
Separation		-	6	4	8	9
Drying Time	Hrs					
Set to Touch		0.3	17	5.0	5.5	2.0
Tack free		2.2	19	6.5	6.5	4.0
Dry hard		6.5	31	18	16	5.5
Dry thru		6.5	31	19	48	5.5
Application Ease	Score	10	10	10	10	10
Opacity	%	100	97	100	99	100
Water Absorption	%	1.8	0.1	0.7	0.9	0.3
Accelerated Weathering - 500 hrs						
Color change	Score	10	9	10	10	10
Gloss change	"	8	10	10	10	10
Chalking	ASTM	8	6	6	8	8
Checking & Cracking	"	10	10	10	10	10

Appendix IIH

TEST DATA — One Package

Class 4A-1 — METAL PRIMERS — Low VOC

		1	2	4	10	13	20	23	24	32	36	42	49	51
Color ---->		Gry	Bwn	Bwn	Gry	Bwn	Bwn	Org	Bwn	Wht	Bwn	Wht	Grn	Wht
From ---->		(23)	(23)	(31)	(13)	(33)	(11)	(22)	(22)	(22)	(20)	(26)	(34)	(14)
Viscosity	KU													
Initial		75	70	110	94	74	88	118	98	113	124	89	95	90
4 wks/120°F		107	77	125	100	b	138	150	121	Gel	Gel	98	95	97
Storage - 4 wks/120°F	Score		a											
Separation		4	4	8	9	6	8	8	6	-	-	9	9	9
Skinning		10	10	10	10	10	10	10	10	-	-	10	10	10
Settling		4	4	9	9	0	8	9	6	-	-	10	8	10
Redispersion		4	2	8	9	0	8	9	6	-	-	10	9	9
Drying Time	Hrs													
Set to touch		0.2	0.3	0.2	0.2	0.5	16	0.4	5.0	0.2	0.1	0.2	20	0.2
Tack free		0.4	0.5	0.3	0.4	0.7	16	3.0	48	0.3	3.0	5.0	24	0.2
Dry hard		1.0	1.0	0.4	0.4	1.2	16	168	168	0.8	6.0	16	72	1.0
Dry thru		1.0	1.0	0.6	0.4	1.2	16	168	168	0.8	7.0	16	72	1.0
Application Ease	Score	10	10	10	10	10	10	9	10	10	10	10	10	10
Opacity	%	100	100	100	99	100	100	97	100	95	100	93	100	91
Adhesion	%	100	100	100	100	100	80	97	95	100	100	100	100	100
Enamel Holdout	%	100	91	79	100	100	87	86	94	67	84	90	70	64
Salt Fog	Hrs	36	36	24	15	500	132	500	132	53	285	240	500	45
Blisters - body	ASTM					6F		10					4F	
" at X	"					8D		6F					6D	
Corrosion	Score					6		9					8	
Creep at X	mm					9		0					4	
Acc. Weathering - 500 hrs														
Chalking	ASTM	8	8	8	8	8	8	2	8	9	10	6	8	10
Check. & Crack.	"	10	10	10	10	10	10	10	10	10	10	10	10	10

a - Gel particles
b - Cannot determine due to hard settling

Gry - Grey
Bwn - Brown

Org - Orange
Wht - White

Appendix II-I

TEST DATA — One Package

Class 4A-1 — METAL PRIMERS — Conventional

		6	7	8	14	17	21	26	27	37
Color ---->		Gry	Bwn	Bwn	Bwn	Wht	Bwn	Org	Bwn	Bwn
From ---->		(23)	(23)	(31)	(33)	(13)	(11)	(22)	(22)	(20)
Viscosity	KU									
Initial		74	73	72	75	78	86	87	74	72
4 wks/120°F		89	86	77	92	86	96	150	89	86
Storage - 4 wks/120°F	Score									
Separation		4	4	4	6	4	4	6	8	6
Skinning		10	10	10	10	10	10	2	2	10
Settling		9	6	4	8	4	4	6	8	6
Redispersion		6	6	4	8	4	4	6	8	6
Drying Time	Hrs									
Set to touch		0.5	0.5	0.6	0.5	0.3	0.3	0.4	2.5	0.5
Tack free		1.7	1.7	1.7	1.5	0.5	0.7	3.0	24	4.0
Dry hard		6.2	4.3	24	5.5	0.5	1.0	24	48	16
Dry thru		16	6.2	24	7.0	0.5	1.3	24	48	16
Application Ease	Score	10	10	10	10	10	10	10	10	10
Opacity	%	100	100	100	100	96	100	95	100	100
Adhesion	%	100	100	100	100	100	100	100	100	100
Enamel Holdout	%	91	95	84	90	98	76	83	90	96
Salt Fog	Hrs	100	80	220	500	15	130	130	20	285
Blisters - body	ASTM				10					
" at X	"				4MD					
Corrosion	Score				10					
Creep at X	mm				0					
Acc. Weathering - 500 hrs										
Chalking	ASTM	6	6	8	8	4	8	2	9	8
Check. & Crack.	"	10	10	10	10	10	10	10	10	10

Appendix IIJ

TEST DATA

Class 4A-2 METAL PRIMERS		Low VOC			2 Component Conventional	
		29	39	43	28	40
Color ------→		Wht	Red	Wht	Bwn	Red
From ------→		(22)	(28)	(10)	(22)	(28)
Viscosity	KU					
Parts A/B			(a)	(d)		
Initial		150/106	139/N		102/91	72/52
4 wks/120°F		(b)/125	(c)/N		150/150	104/52
Mixed Paint		119	116		106	61
Storage - 4 wks/120°F,	Score					
Separation		-/ 4	4/10	10	10/8	6/10
Skinning		-/10	10/10	10	2/10	10/10
Settling		-/ 6	0/10	10	9/8	8/8
Redispersion		-/ 4	0/10	10	10/8	8/8
Pot Life	Hrs	30+	24	2	24	30+
Drying Time	Hrs					
Set to touch		0.2	0.4	0.1	0.2	0.3
Tack free		1.0	3.0	0.1	0.2	0.7
Dry hard		3.0	6.0	(e)	3.0	1.5
Dry thru		3.0	6.0	(e)	3.0	1.5
Application Ease	Score	10	10	(f)	10	10
Opacity	%	89	100	100	100	100
Adhesion	%	100	100	50	100	100
Enamel Holdout	%	67	78	0	88	81
Salt Fog	Hrs	53	500	400	300	500
Blisters - body	ASTM		2F			10
" at X	"		2F			2F
Corrosion	Score		10			9
Creep at X	mm		0			0
Acc. Weathering	Hrs	120	500	500	500	500
Chalking	ASTM		4	2	9	4
Check. & Crack.	"		10	10	10	10
Erosion & Rusting	Score		10	8	10	10

a - Gardner Holdt
b - Solidified or gelled
c - Cannot determine due to extremely hard settling
d - Powder mixed with water
e - Cannot determine - powdery surface
f - Must be sprayed

Appendix IIK

TEST DATA

Class 4A-Z		METAL PRIMERS			Zinc - Rich	
		Low VOC			Conventional	
	Color ---→	30 Gry	33 Gry	35 Gry	31 Grn	34 Gry
	From ---→	(22)	(22)	(22)	(22)	(22)
Viscosity	KU					
Parts A/B		(a)	(b)	(b)	(a)	(b)
Initial		65/Z5	53	83	53/G	53
4 wks/120°F		65/Z6	51	74	53/H	Gel
Mixed Paint		126	74	98	72	72
Storage - 4 wks/120°F,	Score					
Separation		9/10	8	6	9/10	-
Skinning		10/10	10	10	9/10	-
Settling		10/10	8	8	9/10	-
Redispersion		10/10	8	8	9/10	-
Pot Life	Hrs	24	30+	30+	30+	1.5
Drying Time	Hrs					
Set to touch		0.3	0.1	16	0.4	0.2
Tack free		0.3	0.1	16	0.4	0.2
Dry hard		16	0.3	48	16	0.2
Dry thru		16	0.3	48	16	0.2
Application Ease	Score	10	10	10	10	10
Opacity	%	100	10	10	10	10
Adhesion	%	100	100	98	100	100
Enamel Holdout	%	67	30	81	42	42
Salt Fog	Hrs	53	1000	95	1000	1000
Blisters - body	ASTM		10		10	10
" at X	"		10		10	10
Corrosion	Score		10		10	10
Creep at X	mm		0		0	0
Acc. Weathering - 500 hrs						
Chalking	ASTM	9	9	6	6	8
Checking & cracking	"	10	10	10	10	10

a Gardner Holdt
b Liquid portion to which powder portion is added

Appendix IIL

TEST DATA

Class 4B

EXTERIOR WOOD PRIMERS

		Low VOC					Conventional			
		3	5	11	41	44	9	15	18	47
	Color ----→	White	----------→				White	----------→		
	From ----→	(21)	(36)	(13)	(22)	(9)	(36)	(13)	(21)	(9)
Viscosity	KU									
Initial		79	86	72	95	85	80	73	106	69
4 wks/120°F		86	95	72	108	95	95	82	128	69
Storage - 4 wk/120°F	Score									
Separation		6	9	4	9	9	6	6	8	9
Skinning		10	10	10	6	8	10	10	2	10
Settling		8	8	8	10	10	9	9	8	8
Redispersion		9	9	4	9	10	8	8	8	9
Drying Time	Hrs									
Set to touch		0.2	0.4	0.4	0.4	0.1	1.0	0.4	1.5	2.0
Tack free		0.5	0.5	0.4	1.4	0.4	16	7.0	7.0	24
Dry hard		0.7	0.6	1.4	5.5	0.6	16	55	48	72
Dry thru		1.0	6.7	1.4	5.5	0.6	16	55	48	72
Application Ease	Score	10	10	10	10	10	10	10	10	10
Opacity	%	95	96	94	96	82	95	91	92	86
Adhesion	%	100	100	100	100	100	100	98	100	100
Bleeding	Score	6	6	8	6	4	9	8	8	8
Enamel Holdout	%	96	86	74	96	54	95	97	91	55
Accelerated Weathering	Hrs	500	310	500	500	500	310	500	240	310
Color change	Score	10		10	8	6		8		
Gloss change	"	10		10	9	6		6		
Chalking	ASTM	8		9	9	9		8		
Checking	"	10		10	10	10		10		
Cracking	"	10		10	6	10		10		

Appendix IIM

TEST DATA

Class 4C

INTERIOR WALL PRIMERS

		Low VOC					Conv.	
		12	19	22	25	45	16	46
	Color ----→	White	----------→				White	--→
	From ----→	(13)	(7)	(4)	(22)	(9)	(13)	(9)
Viscosity	KU							
Initial		90	83	91	76	94	98	85
4 wks/120°F		95	90	100	79	104	100	84
Storage - 4 wk/120°F,	Score							
Separation		4	9	9	9	9	6	8
Skinning		10	10	10	10	6	2	10
Settling		2	10	10	10	10	8	9
Redispersion		4	9	9	10	10	6	9
Drying Time	Hrs							
Set to touch		0.4	0.3	0.2	0.2	0.4	0.7	0.4
Tack free		0.4	0.3	0.6	0.2	0.4	1.0	1.0
Dry hard		1.0	0.7	1.5	1.5	0.5	1.5	1.0
Dry thru		1.0	0.7	1.5	1.5	0.5	3.0	1.4
Application Ease	Score	10	10	10	10	10	10	10
Opacity	%	90	91	90	90	94	94	89
Adhesion	%	100	100	100	100	100	100	100
Enamel Holdout	%	96	90	94	78	86	90	75
Seal Stains	Score							
Rusty Water		9	10	10	10	10	10	10
Coffee		6	6	4	6	6	10	10
Tea		4	4	4	8	6	10	10
Grease		10	8	10	9	6	6	6

Appendix IIN

TEST DATA

Class 4D ENAMEL UNDERCOATERS

		Low VOC 1	Conventional 2
Color ----------→		White	White
From ----------→		(15)	(38)
Viscosity	KU		
Initial		68	120
4 wks at 120°F		78	106
Storage - 4 wks at 120°F			
Liquid separation	Score	10	9
Skinning		10	2
Settling		10	9
Redispersion		10	9
Drying Time	Hrs		
Set to touch		0.3	1.2
Tack free		3.0	3.0
Dry hard		3.0	4.0
Dry thru		3.0	4.0
Application Ease	Score	10	10
Sanding Qualities	Score	10	10
Enamel Holdout	%	60	81
Opacity	%	98	95
Adhesion	%	100	100
Flexibility - Pass	Inch	1/8	1/8

Appendix IIO

TEST DATA

Class 6 FIRE RETARDANT COATINGS

		Low VOC					Conv.
		1	2	4	5	6	3
Color --------→		White	Green	White	White	Beige	White
From --------→		(38)	(38)	(5)	(20)	(40)	(38)
Viscosity	KU						
Initial		150	61	74	54	134	92
4 wks at 120°F					47		108
Storage - 4 wks at 120°F							
Liquid separation	Score	(a)	(a)	(a)	6	(a)	6
Skinning	"				10		10
Settling					10		9
Redispersion					8		8
Drying Time	Hrs						
Set to touch		0.2	0.2	0.2	1.0	0.2	1.0
Tack free		0.3	0.5	0.3	1.1	0.3	1.5
Dry hard		0.3	1.3	0.3	1.1	0.3	2.0
Dry thru		0.4	1.3	0.5	1.1	0.5	2.0
Ease of Application	Score	8	10	10	(b)	8	10
Opacity	%	91	100	88	89	94	87
Adhesion	%	100	100	95	100	100	85
Flexibility - Pass	Inch	1	1/8	1+	1/8	1+	1+
Fire Retardancy							
Flamability	Index	29	100	36	100	26	50
After Flame	Secs.	14	23	15	22	11	22
Substrate consumed vs unpainted	%	51	131	42	136	47	62

a - Solidified

b - Must be sprayed

Appendix IIP

TEST DATA

Class 7

TILE - LIKE GLAZE COATINGS

		Low VOC						Conventional			
	Color --->	1 Wht	2 TR	5 Wht	6 Wht	12 Wht	16 TR	9 Wht	10 Wht	11 Wht	15 Wht
	From --->	(1)	(1)	(16)	(21)	(16)	(5)	(16)	(16)	(21)	(1)
Viscosity	KU										
Initial											
Part A/B		106/137	144/83	98/56	150/56	69/X[a]	150/M[a]	118/55	106/96	140/79	112/62
Paint		109	120	74	150	140	136	77	99	120	96
4 wks/120°F (Part A/B)		131/150	150/92	108/74	150/95	150/X	150/N	150/55	150/Gel	150/82	125/62
Storage - 4 wk/120°F	Score										
Separation		4/8	9/10	8/10	10/10	10/10	10/10	9/10	9/-	9/10	6/10
Skinning		10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/-	10/10	10/10
Settling		2/8	10/10	10/10	10/10	9/10	10/10	10/10	10/-	10/10	10/9
Redispersion		1/8	10/10	9/10	10/10	9/10	10/10	9/10	9/-	9/10	9/10
Pot Life	Hrs	0.4	2	4	O/N	48	2	O/N	O/N	6	16
Drying Time	Hrs										
Set to touch		3.5	4.5	2.0	2.0	0.3	3.0	0.3	1.3	1.8	0.5
Tack free		16	16	16	5.5	3.0	16	1.3	6.0	4.8	1.3
Dry hard		16	16	16	16	24	16	2.5	6.0	16	2.5
Dry thru		16	16	16	16	24	16	2.5	6.0	16	2.5
Application Ease	Score	9	9	9	8	9	10	9	10	9	10
Gloss - 60°		42	98	75	92	28	95	74	79	94	80
Retention (UV)	Score	8	8	10	10	10	8	8	10	8	10

a - Gardner Holdt

TR - Tile Red

O/N - Overnight

Appendix IIP

TEST DATA

Class 7

TILE - LIKE GLAZE COATINGS (cont)

		Low VOC						Conventional			
		1	2	5	6	12	16	9	10	11	15
	Color --->	Wht	TR	Wht	Wht	Wht	TR	White	----------	----------	--->
	From --->	(1)	(1)	(16)	(21)	(16)	(5)	(16)	(16)	(21)	(1)
Adhesion	%	100	100	100	100	100	100	100	80	100	100
Flexibility - Pass	Inch	1+	1+	1/8	1/8	1/8	1+	1/8	1/8	1/8	1/8
Taber Abrasion	mgm	58	34	23	17	35	40	30	41	13	35
Water Resistance	Hrs	672	672	672	672	192	672	168	672	672	672
Blistering	ASTM	10	10	10	10		10		10	10	10
Color change	Score	10	10	9	10		10		10	10	10
Gloss change	"	10	10	10	10		10		10	10	10
Hardness	"	10	10	10	10		10		10	10	10
Color Retention	Score	2	4	8	2	2	8	2	9	2	2

TEST DATA

Class 8

WATERPROOFING COATINGS

		Low VOC									Conventional		
		3	4	6	8	13	14	15	16	17	7	11	12
Color ------>		Clr	Clr	Wht	Clr	Gry	Blk	Blk	Blk	Blk	Wht	Clr	Clr
From ------>		(24)	(24)	(17)	(12)	(3)	(3)	(20)	(20)	(20)	(17)	(1)	(1)
Viscosity	KU	(a)	(a)									(a)(d)	(a)(d)
Initial		A-	A-	82	108	140	92	120	141+	141+	118	A-/A-	B/A-
4 wks/120°F		(b)	(b)	150	(c)	Gel	128	150	141+	141+	150	A-/A-	K/A-
Storage - 4 wks/120°F	Score												
Separation		-	-	9	-	-	9	10	10	10	10	10/10	10/10
Skinning		-	-	10	-	-	9	9	10	10	8	10/10	10/10
Settling		-	-	2	-	-	10	10	10	9	10	10/10	10/10
Redispersion		-	-	2	-	-	9	9	10	9	10	10/10	10/10
Drying Time	Hrs												
Set to touch		1.1	1.2	0.2	0.2	3.8	1.0	1.0	1.5	1.5	0.2	1.5	0.5
Tack free		1.1	2.0	0.2	0.6	7.0	500	500	500	500	0.2	72	1.3
Dry hard		1.1	2.0	0.2	0.6	24	500	500	500	500	2.0	72	2.5
Dry thru		1.1	2.0	0.2	0.6	24	500	500	500	500	2.0	120	2.5
Application Ease	Score	10	10	10	10	6	10	10	6	8	10	10	10

TEST DATA

Class 8

WATERPROOFING COATINGS (Cont)

		Low VOC									Conventional		
Color ----------→		3 Clr	4 Clr	6 Wht	8 Clr	13 Gry	14 Blk	15 Blk	16 Blk	17 Blk	7 Wht	11 Clr	12 Clr
From ----------→		(24)	(24)	(17)	(12)	(3)	(3)	(20)	(20)	(20)	(17)	(1)	(1)
Adhesion	%	100	100	100	100	100	100	100	100	100	100	100	100
Opacity	%	Clr	Clr	82	Clr	100	100	100	100	100	76	Clr	Clr
Water Absorption	%	10.5	11.0	4.1	5.5	5.3	3.8	3.8	0.6	2.5	2.7	8.9	2.8
Water Resistance	Hrs	500	500	500	500	500	24	500	500	500	500	500	500
Blistering	Score	10	10	10	10	10		10	10	10	10	10	10
Color change	"	10	10	9	6	10		8	8	10	10	10	9
Gloss change	"	10	10	10	6	10		8	8	10	10	10	10
Hardness	"	10	10	10	4	0		0	0	0	6	10	10
Recovery	"	10	10	10	10	4		0	0	0	10	10	10
Acc. Weathering - 500 hrs													
Color change	Score	10	9	8	10	9	10	10	6	8	8	8	10
Gloss change	"	10	10	10	10	9	4	10	4	6	10	10	9
Chalking	"	10	2	8	10	10	10	10	10	9	6	9	10
Check. & Crack.	"	10	10	10	10	10	10	10	10	10	10	10	10

a - Gardner Holdt

b - Gel particles

c - Solidified

d - Two component

Clr - Clear

Wht - White

Gry - Gray

Blk - Black

Appendix II R

TEST DATA — Light Duty

Class 9A — MAINTENANCE TOPCOATS — Low VOC

		1	2	3	4	15	27	28
	Color ---->	Red	Blue	Wht	Wht	Wht	Wht	Red
	From ---->	(23)	(23)	(23)	(31)	(36)	(21)	(21)
Viscosity	KU							
Initial		82	70	97	86	64	86	64
4 wks/120°F		150	83	Gel	97	61	98	Gel
Storage - 4 wk/120°F	Score							
Separation	"	10	9	-	10	4	10	-
Skinning	"	10	10	-	10	10	10	-
Settling	"	9	10	-	10	6	10	-
Redispersion	"	9	10	-	10	8	10	-
Drying Time	Hrs							
Set to touch		0.3	0.3	0.3	0.3	0.2	0.2	0.2
Tack free		16	4	3.5	3.0	2.5	0.4	1.0
Dry hard		24	4	3.5	3.0	5.0	3.0	3.5
Dry thru		32	4	3.5	3.0	5.0	3.0	3.5
Application Ease	Score	10	10	8	10	9	10	10
Opacity	%	93	81	97	99	94	97	80
Gloss - 60°		46	67	31	38	74	75	64
Adhesion	%	80	100	100	100	100	100	80
Flexibility-Pass	Inch	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Acc. Weathering - 500 hrs								
Color change	Score	10	10	10	10	10	9	9
Gloss change	"	9	8	9	9	10	9	9
Chalking	ASTM	10	8	9	9	8	10	10
Check. & Crack.	"	10	10	10	10	10	10	10
Wrinkling	Score	10	10	10	10	10	10	6

Appendix IIS

TEST DATA — Light Duty

Class 9A — MAINTENANCE TOPCOATS — Conventional

		6	7	8	9	16	29	30
Color ----→		Red	Blu	Wht	Wht	Wht	Wht	Red
From ----→		(23)	(23)	(23)	(31)	(15)	(21)	(21)
Viscosity	KU							
Initial		77	71	76	70	78	79	79
4 wks/120°F		89	87	80	74	Gel	112	104
Storage - 4wks/120°F	Score							
Separation		6	8	4	4	-	10	10
Skinning		10	10	10	10	-	0	0
Settling		10	10	10	10	-	10	10
Redispersion		9	10	9	9	-	10	10
Drying Time	Hrs							
Set to touch		0.6	0.7	0.7	0.9	0.6	0.6	0.6
Tack free		16	16	16	4.0	1.8	16	16
Dry hard		16	16	16	4.0	2.0	16	16
Dry thru		16	16	16	4.0	2.0	16	16
Application Ease	Score	10	10	10	10	10	10	10
Opacity	%	100	100	98	99	100	95	77
Gloss - 60°		85	79	87	77	79	75	63
Adhesion	%	100	100	100	100	100	100	100
Flexibility - Pass	Inch	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Acc. Weathering - 500	hrs							
Color change	Score	8	8	8	8	9	9	6
Gloss change	"	6	6	6	6	6	9	4
Chalking	ASTM	6	6	6	6	8	9	9
Check. & Crack.	"	10	10	10	10	10	10	10

Appendix IIT

TEST DATA

Class 9B

MAINTENANCE TOPCOATS

		Low VOC						One Package Conventional			
	Color ------>	5 Wht	11 Wht	13 Gry	17 Wht	25 Gry	26 Wht	10 Wht	12 Wht	14 Gry	18 Wht
	From ------>	(36)	(33)	(33)	(11)	(34)	(30)	(36)	(33)	(33)	(11)
Viscosity	KU										
Initial		82	76	71	79	94	83	70	78	71	102
4 wks/120°F		93	72	60	150	95	89	108	76	77	120
Storage - 4 wks/120°F	Score										
Separation		6	6	6	8	6	8	4	8	9	9
Skinning		10	10	10	10	10	10	10	10	10	10
Settling		9	6	2	10	8	10	6	9	10	10
Redispersion		10	8	2	9	8	10	6	9	10	9
Drying Time	Hrs										
Set to touch		0.4	0.5	0.4	16	16	0.1	0.9	0.4	0.2	0.9
Tack free		2	15	0.6	16	168	0.3	6.0	4.0	0.2	6.0
Dry hard		2	24	0.8	16	216	0.4	6.5	7.0	0.8	16
Dry thru		2	24	0.8	16	216	0.4	16	7.0	0.8	16
Application Ease	Score	10	10	10	10	10	10	10	10	10	10
Opacity	%	100	97	100	98	100	97	86	98	100	98
Gloss - 60°		53	87	88	75	7	45	89	92	86	89
Adhesion	%	100	100	100	100	80	100	95	100	100	80
Flexibility - Pass	Inch	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Taber Abrasion	mgm	15	57	51	83	35	29	36	38	70	64

Appendix IIT

TEST DATA

Class 9B

MAINTENANCE TOPCOATS (cont)

		Low VOC						One Package Conventional			
	Color ------>	5 Wht	11 Wht	13 Gry	17 Wht	25 Gry	26 Wht	10 Wht	12 Wht	14 Gry	18 Wht
	From ------>	(36)	(33)	(33)	(11)	(34)	(30)	(36)	(33)	(33)	(11)
RESISTANCE TO -											
Water	Hrs	168	72	288	120	24	500 (b)	144	168	288	24
Xylol	Hrs	168	3	24	1	1	1	1	3	24	1
Mineral Spirits	Hrs	500	500	500	500	72	500	500	500	500	500
Color change	Score	8	0	6	10		9	0	0	8	6
Gloss change	"	8	8	6	6		10	0	9	8	8
Hardness	"	6	4	2	8		8	6	2	8	10
Recovery	"	8	8	6	10		10	8	6	8	10
Alcohol (95%)	Hrs	2	24	24	1	72	500	1	2	24	1
HCl (5%)	Hrs	5	24	24	500	500	1	500	48	48	120
Salt Fog (a)	Hrs	64	136	500	400	500	300	64	136	(c)	500
Blisters - Body	ASTM			10		10					10
" at X	"			10		10					2MD
Corrosion	Score			6		8					9
Creep at X	Creep			2		2					3
Acc. Weathering (a) - 500 hrs											
Color change	Score	10	10	8	9	6	9	8	10	(c)	9
Gloss change	"	10	6	4	8	10	10	8	6		6
Chalking	ASTM	9	10	8	8	9	10	6	9		8
Check. & Crack.	"	10	10	10	10	10	10	10	10		10

a - Primed
b - Slight rusting
c - Not tested. Topcoat lifted the primer

Appendix IIU

TEST DATA

Class 9C — MAINTENANCE TOPCOATS — 2 Component

		Low VOC				Conventional	
		19	20	22	24	21	23
Color ⟶		Wht	Bge	Wht	Wht	Bge	Wht
From ⟶		(22)	(22)	(28)	(18)	(22)	(28)
Viscosity	KU						
Parts A & B		(a)	(a)	(a)			
Initial		125/C	116/Z4	108/N	112/89	127/92	72/72
4 wks/120°F		150/D	140/Z5	126/N	120/116	150/104	104/72
Mixed Paint		90	150	88	93	100	72
Storage - 4 wks/120°F,	Score						
Separation		8/10	8/10	6/10	10/6	8/9	4/6
Skinning		10/10	10/10	10/10	10/10	10/10	10/10
Settling		10/10	10/10	6/10	10/6	6/10	6/10
Redispersion		9/10	9/10	6/10	10/6	6/10	6/8
Pot Life	Hrs	24	3.5	24	30+	24	30
Drying Time	Hrs						
Set to touch		2.5	0.2	0.6	0.1	0.2	0.3
Tack free		16	5.0	7.0	16	0.5	0.6
Dry hard		16	5.5	16	24	2.5	1.5
Dry thru		16	5.5	16	24	2.5	1.5
Application Ease	Score	10	10	10	10	10	10
Opacity	%	95	99	94	86	95	88
Gloss - 60°		63	6	20	55	7	4
Adhesion	%	100	100	100	100	100	100
Flexibility - Pass	Inch	1/8	1/8	3/4	1/8	1/8	1/8
Taber Abrasion	mgm	102	105	38	73	108	85

Appendix II U

TEST DATA

Class 9C

MAINTENANCE TOPCOATS (cont)

		Low VOC				2 Component Conventional	
		19	20	22	24	21	23
Color ------>		Wht	Bge	Wht	Wht	Bge	Wht
From ------>		(22)	(22)	(28)	(18)	(22)	(28)
RESISTANCE TO -							
Water	Hrs	500 (b)	48	500 (b)	24	500 (b)	432
Xylol	Hrs	1	500	500	500	500	500
Mineral Spirits - 500 hrs							
Blistering	ASTM	10	10	10	10	10	10
Color change	Score	10	10	8	10	10	10
Gloss change	"	10	10	10	10	10	10
Hardness	"	10	10	10	10	10	10
Alcohol (95%)	Hrs	1	500	5	1	500	500
HCL (5%)	Hrs	500	1	96	1	72	5
Salt Fog (c)	Hrs	500	18	500	24	500	500
Blisters - Body	ASTM	10		10		10	10
" at X	"	10		10		10	10
Corrosion	Score	6		6		6	6
Creep at X	mm	2		2		2	2
Acc. Weathering (c) - 500 hrs							
Color change	Score	8	8	9	8	6	8
Gloss change	"	6	9	10	6	10	10
Chalking	ASTM	4	4	4	4	4	4
Check. & Crack.	"	10	10	10	10	10	10

a - Gardner Holdt

b - No significant effect

c - Primed

Bge - Beige

Appendix IIV

TEST DATA

Class 10 METALLIC FINISHES

		Low VOC		Conventional		
		1	2	3	4	5
Color ----------→		All are aluminum		----------→		
From ----------→		(20)	(20)	(9)	(39)	(41)
Viscosity	KU	(a)	(a)			
Initial		54	54	51	47	56
4 wks at 120°F		54	54	42	38	54
Mixed		57	55			
Storage - 4 wks at 120°F						
Liquid separation	Score	10	10	6	9	6
Skinning	"	6	6	10	10	10
Settling	"	10	10	10	10	9
Redispersion	"	10	10	8	9	8
Drying Time	Hrs					
Set to touch		0.4	0.4	2.8	2.3	1.6
Tack free		0.8	0.7	7.0	7.0	5.0
Dry hard		0.8	0.8	16	16	48
Dry thru		0.8	0.8	16	16	48
Ease of Application	Score	10	10	10	10	10
Opacity	%	100	100	100	100	93.5
Metallic Leafing	%	100	**	5	100	10
Adhesion	%	100	100	100	100	100
Flexibility - Pass	Inch	1/8	1/8	1/8	1/8	1/8
Accelerated Weathering = 500 hrs						
Color change		4	4	8	8	8
Gloss change		4	4	8	8	4
Chalking		10	10	10	10	10
Checking		10	10	10	10	10
Cracking		10	10	10	10	10
Rusting		4	4	10	10	10

(a) Vehicle only. Aluminum paste is packaged separately

(b) Not applicable - Non leafing type

Note: Nos 1 and 2 are water-based

Appendix IIW

TEST DATA

Class 11 SWIMMING POOL PAINTS

		Low VOC						Conv.
		1	3	4	5	6	7	2
Color ------>		All	are white	------>				
From ------>		(20)	(27)	(10)	(10)	(10)	(10)	(20)
Viscosity	KU							
Initial		93	80	63	63	63	63	72
4 wks/120°F		140	85	**	**	**	**	74
Storage - 4 wks/120°F	Score			10	10	10	10	
Separation		8	6					6
Skinning		4	8					10
Settling		10	10					10
Redispersion		9	9					8
Drying Time	Hrs							
Set to touch		0.3	0.3	0.2	0.2	0.2	0.2	0.2
Tack free		0.4	0.4	0.2	0.2	0.2	0.3	0.3
Dry hard		0.4	0.4					0.3
Dry thru		0.6	0.6	Powdery surface				0.3
Application Ease	Score	10	10	2	2	2	2	10
Opacity	%	96	94	96	96	92	94	94
Adhesion	%	100	100	0	0	100	100	90
Resistance to Sodium Hypochlorite Solution (0.1%) - 700 hrs								
Blistering	Score	10	10	10	10	10	10	10
Color change	"	10	10	6	6	6	6	10
Gloss change	"	10	10	6	6	6	6	10
Hardness	"	10	10	10	10	10	10	10
Water Resistance - 1000 hrs	Score	10	10	10	10	10	10	10
Accelerated Weathering - 500 hrs								
Color change	Score	10	8	10	10	10	10	10
Gloss change	"	10	6	6	6	10	10	10
Chalking	ASTM	10	10	2	4	4	8	10
Checking	"	10	10	10	10	10	10	10
Cracking	"	10	10	10	10	10	10	10

** - powder paints - mixed with water

Appendix IIX

TEST DATA

Class 13A

MASTIC COATINGS - WATERPROOFING

		Low VOC						Conv	
		3 Wht (6)	4 Wht (6)	6 Wht (22)	10 Wht (12)	12 Blk (12)	13 Blk (12)	8 Blk (20)	9 Wht (12)
Viscosity	KU			(a)					
Initial		138	114	150	102	104	135	150	135
4 wks/120°F		140	123	150/150	(b)	134	150	150	(b)
Storage - 4 wks/120°F	Score								
Separation		9	9	10/8	-	8	10	10	-
Skinning		10	8	10/10	-	10	10	10	-
Settling		10	10	10/10	-	9	10	10	-
Redispersion		9	9	10/9	-	9	10	10	-
Drying Time	Hrs								
Set to touch		2.0	2.0	3.0	0.2	0.2	0.2	3.0	0.3
Tack free		500	500	16	0.2	16	16	500	0.5
Dry hard		500	500	16	0.4	16	16	500	0.5
Dry thru		500	500	16	0.4	16	16	500	0.5
Application Ease	Score	8	8	4	10	10	10	6	10
Adhesion	%	100	100	100	100	100	100	100	100
Opacity	%	100	100	100	100	100	100	100	100
Water Absorption	%	3.3	1.9	0.1	4.3	6.3	6.8	0.6	1.0
Water Resistance	Hrs	24	24	500	500	500	500	500	500
Color change	Score			8	10	10	10	8	10
Gloss change	"			8	10	10	10	8	10
Hardness	"			0	6	4	4	0	4
Recovery	"			0	8	9	9	0	8
Acc. Weathering - 500 hrs									
Color change	Score	10	10	8	10	10	10	6	10
Gloss change	"	10	10	6	10	10	10	4	10
Chalking	ASTM	9	9	4	10	10	9	10	10
Check. & Crack.	"	10	10	10	10	10	10	10	10

a - Two Component

b - Solidified

Appendix IIY

TEST DATA

Class 13B MASTIC COATINGS - TEXTURE PAINTS

		Low VOC				Conv.
		14	15	17	18	16
	Color ----	White	Green	White	White	White
	From -----	(21)	(9)	(42)	(42)	(42)
Viscosity	KU					
Initial		121	141+	141+	89	141+
4 wks at 120 F		121	141+	141+	83	141+
Storage - 4 wks at 120 F						
Liquid separation	Score	9	10	10	6	10
Skinning	"	8	10	2	10	2
Settling	"	10	10	10	6	10
Redispersion	"	9	8	10	6	10
Drying Time	Hrs					
Set to touch		1.0	0.2	0.2	0.3	1.0
Tack free		1.0	0.4	0.3	46	16
Dry hard		2.0	0.5	2.0	46	16
Dry thru		3.0	0.5	3.0	46	16
Application Ease	Score	10	10	4 (a)	10	4
Opacity	%	100	100	100	100	100
Adhesion	%	80	100	100	100	100
Flexibility - Pass	Inch	1/8	1+	1+	1/8	1+
Mud Cracking	Score	10	10	10	10	10

(a) Had to be trowelled

Appendix IIZ

TEST DATA

Class 14 MULTICOLOR PAINTS

		LOW VOC 1 (2)	Conv. 2 (37)
Viscosity	KU		
Initial		77	75
4 wks/120°F		83	Gel
Storage - 4 wk/120°F,	Score		
Separation		10	-
Skinning		10	-
Settling		10	-
Redispersion		10	-
Drying Time	Hrs		
Set to touch		1.2	1.2
Tack free		1.2	1.2
Dry hard		1.2	1.2
Dry thru		1.2	1.8
Application Ease	Score	10	10
Appearance	Score	2	8
Opacity	%	77	99
Gloss - 60°		5	6
Adhesion	%	100	90
Flexibility - Pass	Inch	1/8	1/8

Appendix III

TEST PROCEDURE

The following test methods were used, except as noted in the test conducted:

ASTM D ---- refers to methods described in Part 27 "Paint - Tests for Formulated Products and Applied Coatings" issued by the American Society for Testing and Materials, Philadelphia, PA.

Method ---- refers to tests described in Federal Standard No. 141A "Methods for Testing of Paint, Varnish, Lacquer and Related Materials" issued by the General Services Administration, Washington, DC.

Other tests are described.

1. Viscosity

   a) Pigmented Paints: - Unit - KU

      ASTM D-562 "Consistency of Paints Using the Stormer Viscometer"

   b) Clear Liquids: - Unit - G/H

      Method 4271 "Viscosity of Transparent Liquids (Gardner Tubes)"

2. Viscosity Stability — Unit - KU or G/H

   ASTM D-1849 "Package Stability of Paint". Viscosity was redetermined after storage.

3. Storage Stability — Unit - Score

   ASTM D-1849 "Package Stability of Paint"

4. Drying Time — Unit - Hours

   ASTM D-1640 "Drying, Curing or Film Formation of Organic Coatings at Room Temperature"

5. Ease of Application — Unit - Score

   The coating was brush-applied to an appropriate substrate and scored for relative ease of application.

   Note: Some products had to be sprayed as noted in the Test Data.

6. Pot Life — Unit - Hours

Eight ounces (8 oz) of the multi-component products were mixed in accordance with the supplier's instructions. They were periodically checked for workability. The same test was conducted with the powder paints after mixing with water.

7. Enamel Holdout — Unit - %

The test primer was dried for 24 hours. An enamel was then applied on the primer and allowed to dry for 24 hours. The gloss of the enamel was then determined in accordance with ASTM D-523 (see below).

$$\text{Enamel Holdout (\%)} = \frac{\text{Gloss on Primer}}{\text{Gloss on Sealed Surface}} \times 100$$

8. Bleeding — Unit - Score

The test primers were applied on red cedar and dried for one week. The relative degree of staining caused by bleeding from the cedar was observed and scored.

9. Appearance — Unit - Score

The multicolor paints (Class 14) were compared for relative appearance and definition of the multicolor pattern.

10. Gloss — Units

ASTM D-523 "Specular Gloss"

11. Opacity — Unit - %

Apply a 3 mil wet film of the test paint to a Leneta 5C panel. Allow to dry for 7 days at 77°F and 50% R.H. Take reflectance of coating over white and black areas of panel.

$$\text{Opacity} = \frac{\text{Reflectance over black}}{\text{Reflectance over white}} \times 100$$

12. Metallic Leafing — Unit - %

ASTM D-480 "Sampling and Testing Aluminum Powder & Paste"

13. Mud Cracking — Unit - Score

The dry coating was examined for any fine cracks

14. Adhesion — Unit - %

ASTM D-3359 "Measuring Adhesion by Tape Test"

15. Flexibility — Unit - Inch

ASTM D-1737 "Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus"

16. Taber Abrasion — Unit - mgm

Federal Method 6192 "Abrasion Resistance (Taber Abraser)"

17. Water Absorption — Unit - %

Preweighed concrete specimens were coated with the test paint and dried for one week. They were then immersed in water for 72 hours. The panels were then wiped to remove excess water and reweighed.

$$\text{Water Absorption (\%)} = \frac{\text{Gain in Weight}}{\text{Weight before Immersion}} \times 100$$

18. Immersion Resistance Tests

The following tests were conducted with completely coated substrate specimens partially immersed:

Cold water

Alcohol - 95%

Sodium hypochlorite - 0.1%

Xylol (Xylene)

Mineral Spirits

Coatings which withstood the maximum period of exposure were evaluated for -

Blistering - ASTM D-714 "Evaluating Degree of Blistering of Paints"

Color change - Score

Gloss change - Score

Hardness - Initial and after recovery for 24 hours - Score

Coatings which failed prematurely were removed and the time until failure was recorded.

19. Spot Resistance Tests

The following tests were conducted by placing 1 mm of reagent on the test coating and keeping it covered to prevent evaporation.

Hot water

Hydrochloric acid (HCl) - 50%

Alcohol - 50%

Butyl acetate

Where possible, the coatings were evaluated as described in No. 16 above. If not, the time until failure was recorded.

20. Fire Retardancy

One coat of paint was applied to red oak panels at a spreading rate of 200 square feet per gallon. The coated panels were dried for two weeks.

Fire retardancy was determined using the two foot flame tunnel developed by Monsanto Chemical Company. In the test, the panel is mounted in the tunnel with the coated side face down. A gas flame is directed onto the panel surface at the lower end. Observation of the flame spread across the surface of the panel is made from a side window. The coating is subjected to the flame for five minutes. During this time, the length of the flame front as it spreads up the inclined surface is recorded every 15 seconds for four minutes. The flame is allowed to burn for an additional one minute, during which time no recordings are made, and then extinguished.

The Flamability Rating is calculated from the maximum flame front advance on the panel surface as compared to that with preconditioned one-inch red oak and asbestos mill board, which arbitrarily are assigned values of 100 and 0, respectively.

21. UV Resistance Unit - Score

The coatings were exposed to ultraviolet light for two weeks and then compared with the unexposed coatings for -

Gloss Retention (change in gloss) Unit - Score

Color Retention (change in color) Unit - Score

22. Salt Fog (Corrosion) Resistance

ASTM B-117 "Salt Spray (Fog) Testing"

Duplicate coated panels were exposed. Before exposure, the panels were scored with an "X" to expose the steel. Panels which withstood a minimum of 500 hours of exposure were evaluated as follows:

Blistering - overall and along the "X"

ASTM D-714 "Evaluating Degree of Blistering of Paints"

Corrosion after stripping the paint - Score

Creep of corrosion from the "X" - mm

Panels which failed before the maximum period were removed and the time of exposure recorded.

23. Accelerated Weathering

ASTM G-53 "Recommended Practice for Operating Light and Water Apparatus for Exposure of Non-metallic Coatings". Duplicate panels were exposed. Panels which were exposed for at least 500 hours were evaluated for the following changes -

Color change - Score

Gloss change - Score

Chalking - ASTM D-659 "Chalking of Exterior Paints"

Checking - ASTM D-660 "Checking of Exterior Paints"

Cracking - ASTM D-661 "Cracking of Exterior Paints"

Panels which failed prematurely were removed and the time of exposure recorded.

Score: -

The scoring system used was that developed by ASTM:

Score	Performance	or	Effect
10	Perfect		None
9	Excellent		Trace
8	Very good		Very slight
6	Good		Slight
4	Fair		Moderate
2	Poor		Severe
0	No value		Failed

Appendix IV

RATING SCHEME

The following ratings or designations are used to evaluate or describe the results of the tests obtained. They are numbered in accordance with the tests described in Appendix III Test Procedure.

1a. Viscosity (KU)

VL	-	47	to	51
L	-	53	to	58
LM	-	60	to	66
M	-	68	to	83
MH	-	85	to	100
H	-	102	to	114
VH	-	116	to	126
XH	-	134+		

V - Very
L - Low
H - High
X - Extra

1b. Viscosity (G-H)

XL - A- to B

2. Viscosity Stability (Change)

Rating	KU	Gardner Holdt
10	0 to 4	
9	5 to 10	1 letter
8	11 to 18	
6	22 to 27	
4	30 to 39	B to K
2	42 to 59	
1	63 to 81	
0	Solid or Gel	

3. Storage Stability

Total Score	Lowest Score → 9	8	6	4	2	1	0
40 - 38	10	9					
37 - 31	9	9	8	6	4		
30 - 20			6	4	2		1
17 - 14					1	1	1
Gel or Solid							0

4. Drying Time - Tack Free + Dry Hard + Dry Thru (Hrs)

10	-	Below 10
9	-	11 to 19
8	-	24 to 39
6	-	44 to 81
4	-	101 to 168
2	-	264 to 384
1	-	600
0	-	1000

5. Ease of Application (Score)

Rating = Score

6. Pot Life (Hrs)

10	-	30+
9	-	24
8	-	16 or O/N
6	-	7 to 6
4	-	4 to 3.5
2	-	2 to 1.5
0	-	0.4

7. Enamel Holdout (%)

10	-	100
9	-	98 to 94
8	-	91 to 81
6	-	79 to 70
4	-	67 to 60
2	-	55 to 42
1	-	30

8. Bleeding (Score)

Rating = Score

9. Appearance (Score)

Rating = Score

10. Gloss (Units)

VH	-	91+
H	-	89 to 85
HM	-	80 to 74
M	-	67 to 53
ML	-	46 to 20
L	-	15 to 10
VL	-	7-

11. Opacity (%)

10	-	100		
9	-	99		
8	-	98	to	95
6	-	94	to	91
4	-	90	to	86
2	-	82	to	80
1	-	77	to	76
0	-	50-		

Transparency (Opacity - %)

8	-	50		
2	-	90	to	94

12. Metallic Leafing (%)

10	-	100		
0	-	10-		

13. Mud Cracking (Score)

Rating = Score

14. Adhesion (%)

10	-	100		
9	-	98	to	97
8	-	95	to	90
6	-	85	to	80
4	-	50		
0	-	0		

15. Flexibility (Inch)

10	-	1/8
6	-	1/4
2	-	3/4
1	-	1
0	-	1+

16. Abrasion Resistance - Taber Abrasion (mgm)

10	-	7	to	13
9	-	15	to	30
8	-	32	to	38
6	-	40	to	58
4	-	64	to	73
2	-	83	to	85
0	-	102+		

17. Water Absorption (%)

10	-	0.1		
9	-	0.3		
8	-	0.5	to	1.0
6	-	1.2	to	1.9
4	-	2.1	to	2.8
2	-	3.3	to	4.3
1	-	5.3	to	6.8
0	-	8.9+		

18. Immersion Resistance Tests (Score)

		Cold Water			Sodium	Mineral Spirits	
Max. Total→		50	40	30	Hypochl	Hvy Duty	Lt. Duty
Rating	Hours						
10	1000	X	X	X			
10	700-672		40-39		40		
8	"				32		
10	500	50-59		30-28		40-37	
9	"	46					
8	"	36-26	34-16	21		34-30	
6	"			2		20-14	
4	432-288	X	X	X		X	
2	192-120	X	X	X			
1	72-48	X	X	X		X	
0	24-	X	X	X			
10	1						50
8	1						47-46
6	1						40

Max - Maximum
Hypochl - Hypochlorite
Hvy - Heavy
Lt - Light

See blistering below for scores assigned to ASTM values obtained.

19. Spot Resistance Tests

Rating	Hours	Total Scores: Hot Water	Total Scores: Alcohol (50%)
10	500	X	
4	192	X	
2	120-72	X	
1	48	X	
0	24-	X	
8			
6			
2			
0			
8	1	50-47	50-44
6	1		41-40
2	1		19

20. Fire Retardancy (Total Value)

8 - 84
6 - 93 to 94
4 - 134
2 - 254 to 258

Total Value = Flame spread + After flame + Substrate consumed

21. UV Resistance

a. Gloss Retention

Rating = Score

b. Color Retention

Rating = Score

22. Salt Fog (Corrosion) Resistance

Rating	Hours	Total Score
10	1000	40
9	"	37-35
8	500	33-19
6	400-300	
4	285-210	
2	136-80	
1	64-45	
0	36-	

Blistering (ASTM)

Size	Score			
	F	M	MD	D
8	9	8	6	4
6	8	6	4	2
4	6	4	2	1
2	4	2	1	0

Creep at X

mm	Score
0	10
1	9
2	8
3,4	6
5	4

23. Accelerated Weathering

Total Score - 500 Hours			Rating				
Max.	Actual	Lowest Score -->	9	8	6	4	2
60	60-58		10				
	56			9			
	52					6	
	48						2
	42					4	
50	50-48		10	10			
	46			8	8		
	44-41				8	6	
	38						2
40	40-38		10	10			
	37-36		9	9	8		
	35-30			8	8	6	4
	29-28					4	
30	29		10				
	24					6	
	20						4
20	20-18		10	9			
	16				8		
	14					6	
	12						4

310 hours — Rating = 1

240 hours — Rating = 0

Max - Maximum