Report
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E. I. du Pont de Nemours & Co.
Fabrics and Finishes Department
Chemical Division

Philadelphia Laboratory

Competitive Products Report

EVALUATION OF COMPETITIVE WHITE HOUSE PAINTS

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EVALUATION OF COMPETITIVE WHITE HOUSE PAINTS

Introduction:

Eighteen competitive white house paints have been compared with #40 White under Investigation WT-71. The samples were obtained for the most part in the Fall of 1949, a few in 1950. During the course of the investigation, #40 White was revised to eliminate soya oil and to reinstate leaded zinc oxide in the South. The revised products 301-885 and 301-887 are included in this report as well as the products 301-875 and 301-880 that were current when the investigation was begun.

The paints have been examined for composition, brushing, hiding, drying, gloss, color and settling.

Similar comparisons were made in 1947 and 1948. Exposure studies begun at that time now yield information on the cleanliness of #40 White against competitive samples of the same date. There are no significant results yet on durability.

Summary & Conclusions:

Competitive Situation of #40 White

Brushing - The outstanding advantage of #40 White over most competitive paints is ease of brushing. However, two premium paints and one non-premium paint (Glidden #1867, National Lead and Montgomery-Ward) also have excellent brushing properties.

Hiding - When #40 White was reintroduced in 1947, the hiding was equal to the best premium paint at that time, National Lead. However, it appears that there has been a general increase in hiding, so that now the hiding of #40 White is no better than the average non-premium competitive paint. At its present hiding level, #40 White will hide a black and white contrast in two coats when applied at the spreading rate specified for a two coat system. Any large increase in hiding would bring the risk of poorer durability because the paint might be spread too thin. There has been no complaint on the hiding of #40 White.

Cleanliness - The results from exposure series with paints current in 1947 and 1948 show that #40 White is equal to average in cleanliness on weathering. All important competitive paints are of the self-cleaning type, although a few of them have sufficient chalk resistance to be definitely below average in cleanliness. The 1949-50 paints are being put on exposure.

Drying - The results on drying are not yet complete enough to permit comparison with individual competitive paints. #40 White is about average in drying time under normal temperature and humidity

conditions. When paints are compared at equal spreading rates, #40 White is equal to average in tack-free time and somewhat slower in through drying. This is because the high solids of #40 White give a thicker film at equal spreading rate. When compared at equal film thickness, #40 White dries tack-free faster than the average competitive paint and dries through at the same rate. A supplementary report will be issued when the drying tests are complete.

Gloss and Color - The outstanding deficiencies of #40 White are low gloss and poor initial color. Both these properties are of importance from the standpoint of sales, but do not affect the service to the customer. In both these properties, #40 White is below the average. In gloss it is the lowest of all paints examined.

Trends in Composition:

Among the three largest competitors, both Devoe & Raynolds and Pittsburgh now have no lead pigment, and Sherwin-Williams has dropped basic carbonate white lead. Two of these competitors and several others now contain a proportion of modified soya oil. In Devoe & Raynolds the soya oil is probably the pentaerythritol ester Sherwin-Williams at one time contained bodied soya and tung oil, but has now gone back to all linseed.

Many paints contain calcium sulfate extender and rutile titanium dioxide; the calcium sulfate extender gives them an advantage in gloss and possibly in color, whereas the rutile titanium dioxide represents more economical hiding. We have not used rutile titanium oxide because it turns yellow under some rare conditions; apparently some competitors are willing to take this risk.

Ten paints still keep the oil saving vehicle with less than 4 lb. of oil per gallon. Four paints have an intermediate oil content, about 4 lb. per gallon, and four others have an oil content, about 4.4 lb. per gallon, equal to #40 White.

Cost:

The content of lead pigment is more important in regard to raw material cost than the oil content. The lead free modificatio of #40 White, 301-885, is only 2¢ per gallon higher than the average raw material cost of the non-premium competitive paints. However, it is 15¢ per gallon higher than the average cost of the three leading competitors, Sherwin-Williams, Pittsburgh and Devoe & Raynolds. The cost of the leaded modification, 301-887, is about 18¢ per gallon higher than the average of competitive paints, although there are some non-premium competitive paints that cost more.

Trends in Properties:

There is a decided trend toward high gloss, evidently following the lead of the Devoe & Raynolds One-Coat House Paint

which has an enamel gloss. Both Sherwin-Williams and the National Lead Company may have revised their products in the past year to improve gloss.

There appears to be a general improvement in the initial color of the competitive paints taken as a whole. The tendency toward higher hiding has been mentioned earlier in this report.

Action Proposed:

The Laboratory will review the possibilities for a quick step to improve the balance of properties in #40 White. This means an improvement in one or more of the properties drying, gloss or initial color, with minimum risk to the essential properties brushing, cleanliness and durability. The review will be made under the house paint project P-1047. No goal date has been set.

As regards hiding: The Laboratory has a study underway (inactive at present but will be reactivated during the summer), of the desirability of a one-coat house paint, by questionnaire to painters and house owners. The results of the questionnaire will give information on the relative importance of hiding as compared with durability. Depending on the results, the Laboratory may propose an increase in hiding of #40 White for Management decision.

Experimental:

Table I is a summary of the properties of the competitive paints and modifications of #40 White. The properties are discussed individually in later sections of this report. Table II is a summary of composition and cost. The composition has been calculated from the label analysis. The raw material cost has been calculated as of February, 1950.

Changes in Composition:

Of the paints examined both in 1948 and 1949, two show no change in label analysis. These are Pittsburgh and Kyanize. The Pittsburgh paint had already been changed to a lead-free paint with a proportion of modified soya oil in the beginning of 1948.

Two paints had no label analysis in 1948 or 1949:- Bruder and Fuller. Bruder has been much improved in color and other properties. It is suspected that the vehicle in this paint contains maleic treated soya oil (Ardol); a chemical analysis is being made to confirm this opinion.

Cook: The titanium oxide has been increased, lead-free zinc oxide has replaced leaded zinc, and a portion of the magnesium silicate extender has been replaced by calcium carbonate.

Devoe & Raynolds #547 White (regular): This paint carried an incorrect label in 1948. A new sample with revised label and composition has just been obtained. It contains lead-free zinc oxide, and the extender is entirely calcium sulfate and calcium carbonate. The vehicle contains 10% of dehydrated castor oil and approximately 60% of "esterified soya acids". We expect that the soya acids are esterified with pentaerythritol; chemical analysis is in process to confirm this opinion.

Glidden #1800 (regular): Anatase titanium oxide has been replaced by a lower amount of rutile titanium oxide at equal hiding. A small proportion of basic carbonate white lead has been introduced into the pigment. This is the only paint in which the trend toward lower lead content is reversed.

National Lead: Lead-free zinc oxide with an equivalent volume of Pigment 45-X (lead silicate - silica pigment) has replaced leaded zinc. This has been done to lower cost without change in other properties.

Sears-Roebuck: This paint had a large amount of basic lead sulfate in the 1948 formula. The amount has now been reduced. Titanium oxide has been increased to keep the hiding the same. The amount of oil has been increased to 4 lb. per gallon in order to obtain a slight improvement in brushing.

Sherwin-Williams: The lead pigment has been reduced by using 25% leaded zinc oxide in place of 35%, and by omitting basic carbonate white lead entirely. A small proportion of calcium sulfate extender has been introduced. The oil is now entirely linseed. It had previously been a blend of raw linseed with bodied soya and tung oil. The hiding and gloss have been increased, but the brushing is poor - worse than before.

Montgomery-Ward: The titanium oxide has been increased and there has been a slight reduction in the content of lead sulfate. There is an increase in hiding corresponding to the increase of titanium oxide.

Wilbur & Williams: The label reads "Rubberized Wood Bond White House Paint". Part of the vehicle is described as "Synthetic Copolymerized Oil", and part of the thinner is aromatic. Among vehicles that have been promoted for house paint, this label would fit a styrene copolymer oil. The application properties are very bad because the paint sets up too quickly. Therefore it has not seemed worthwhile to determine the composition by chemical analysis.

Hiding:

The determination of hiding is experimentally difficult, and the results are not precise. The determined hiding is taken as the spreading rate where the contrast ratio over black and white is 0.98. This is based on a straight line established in most cases

by six individual determinations. Statistical analysis shows that the least significant difference between paints is 57 square feet per gallon in this determination. The difference that can be recognized in practice is probably of the same order.

The paints are listed in order of the experimentally determined hiding power in Table III. Owing to the large variation in the method, only three paints are significantly better in hiding than #40 White, although #40 White is below the middle of the list.

The hiding for each paint has also been calculated by factors for the prime pigment taken from H. A. Gardner's "Chemical and Physical Examination of Paints". These factors are:

Anatase Titanium Oxide	-	115 sq. ft. per lb.
Rutile Titanium Oxide	-	144 " " " "
Zinc Oxide	-	20 " " " "
Basic Carbonate White Lead	-	15 " " " "
Basic Sulfate White Lead	-	13 " " " "
Basic Silicate White Lead	-	15 " " " "

The calculated values are shown in Table I. They agree fairly well with the determined values.

Brushing:

Brushing was determined by actual trial on a clapboard panel with a five minute lapping time. The visual gloss and flashing at the lap were determined on the same panel.

A measure of brushing by determining the change in consistency as measured at 50 and 200 RPM on the modified Stormer Viscometer has been proposed and used in several laboratories. Similar determinations were made on this set of paints, but the results do not correlate with practice. The qualitative results presented here are believed to be more significant.

Drying:

One drying test has been made on the competitive samples and a number of batches of the various modifications of #40 White under the normal condition of 77°F. and 50% relative humidity. Results of this test are shown in Table IV in the form of averages. Additional tests will be made at low and high temperature. The results of the tests will then be combined to show individual values for the separate paints. These results will be issued as a supplementary report.

Dust-free time has been determined by sifting a black pigment onto the surface of the film and blowing it off. The dust-free time is the point at which the black pigment no longer adheres to the surface.

Tack-free time is determined by the Atlas Tack Tester. The firm dry time is the time at which the film can be drawn under a rubber finger pressed down with a load of 2,000 grams without rupturing the film. This corresponds roughly to a breaking strength of 400 lb. per square inch.

Gloss:

Instrumental gloss measurements are influenced by the presence of brush marks. In order to minimize the effect of brush marks, gloss measurements have been made at an 85° angle (glancing angle). This does not entirely eliminate the effect of brush marks, as shown by comparison with the visual gloss ratings. The instrumental measurements for all modifications of #40 White are lower than for any other house paint, although there are two other paints which have no higher gloss when rated visually.

Color:

The paints have been rated visually for the order of wet color and the color of a freshly dried film. These visual ratings are shown in Table I.

As a more permanent record of color, Spectrophotometric curves have been determined on the Beckman instrument. These results have been combined into a single value showing the departure of the paint from whiteness of magnesium oxide. This term is called the "color difference", and the smaller the difference the whiter the paint. The values for color difference are shown in Table V with the paints ranked in order of excellence.

The calculations are made according to a method of Scofield, Scientific Section Circular #664, July, 1943. Complete description of color would include two other constants, the hue angle, and the saturation index. All paints were either yellow or red in tone toward magnesium oxide.

The original spectrophotometric curve was made against White Vitrolite as 100%. Magnesium oxide averages about 116% as compared with Vitrolite. Therefore, the color differences are calculated against magnesium oxide at approximately 116%. For details of calculation, the notebook reference should be consulted.

It should be understood that the determination of the color of a freshly dried film is an arbitrary method. As soon as the paint is brushed out, two competing processes of yellowing and bleaching go on at rates depending on the drying conditions, particularly the illumination. For this investigation, films were measured after drying overnight in the laboratory. In practice, house paints are always exposed to the bleaching action of sunlight. The whitest paint in this study, Devoe & Raynolds One-Coat White, has been painted out side by side with #40 White on a house; there is no perceptible difference in color after several days drying. As exposure continues, the whiteness of the paint depends prin-

cipally on cleanliness and has little relation to the initial color.

Table V shows all determinations made on various batches of the modifications of #40 White. Statistical analysis shows no significant difference between the various batches; therefore all the values of 301-885, 887, 875, and 880 have been averaged to obtain a composite value for #40 White. Examination of a larger number of batches would probably show small differences between the various codes lumped together here.

The color difference corresponds fairly well with the visual rating for the dry color of the fresh film. One exception is the soya PE paint, 301-882; this has a high visual rating but a large color difference. This paint has a definite red tone, and the calculation of the color difference is biased against the red end of the spectrum.

Similar color measurements were made in 1948 on a number of competitive white paints and on the then current modifications of #40 White, 301-864 and 301-863. These have been recalculated to a comparable basis and are shown in Table VI. There has been an improvement in whiteness in #40 White between 1948 and 1949; most of this improvement is accounted for by elimination of leaded zinc oxide and by improvement in the extender. There has also been a large improvement in the color of competitive paints.

Weathering Properties:

Competitive paints were exposed in Series #9511 in 1947, Series #10562 in 1948. Series 9511 is now 30 months old and Series #10562 is now 12 months old.

There are no significant results in durability from these exposures to date. The results of Series #9511 will be somewhat erratic at best, since exposures in Delaware and Florida were made on a grade of white pine that shows wide panel variation, and there was no control of spreading rate or film thickness.

A significant comparison can be made between the cleanliness of a limited number of competitive paints and 301-863, the modification of #40 White first introduced in 1947. The data are shown in Table VII. The ratings are based on a scale where 10 is perfect and 0 is practically black. One paint, Sherwin-Williams, is definitely cleaner than 301-863 and one paint, Sears-Roebuck, is definitely dirtier. All other paints are within the range of chance variation.

A larger number of competitive paints and several modifications of #40mWhite containing soya oil are included in Series #10562. This series does not contain the 20% soya lead-free paint 301-875, nor the all linseed paints 301-885 and 301-887. The data for the exposure North vertical in Delaware are shown in Table VIII.

Since there is only one panel and one exposure, no definite conclusions are drawn. There is indication that the lead-free paint collects more dirt than the leaded zinc modifications during the first year of exposure; when other series with similar comparisons are taken into consideration, the difference is not as large as it appears in Series #10562. This is being given further study by accelerated laboratory tests and more complete exposure study.

Settling and Color of Supernatant Liquid:

Early in 1949, it was observed that some samples of #40 White showed a deeper layer of supernatant liquid and had a darker color than a number of competitive paints. It was felt that this would be a drawback to sales. The rate of subsidence of the pigment layer has been followed for the competitive paints and a number of batches of various modifications of #40 White. The results are presented in Table IX. A number of competitive paints subside at about the same rate as #40 White, although there are many that subside much more slowly. The oil saving modification of #40 White also subsides more slowly.

There have been no further comments on this particular property of the paint, and no action seems necessary.

Exposure Studies:

Paints in this report are exposed in Series #11379. Previous exposure studies on competitive white house paints are #9511, 9666 (two-coat house paint systems) and Series #10562.

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TABLE I

SUMMARY - PROPERTIES OF WHITE HOUSE PAINT - 1949-50

Product	Stormer Viscosity	Brushing		Gloss		Flashing	Hiding Sq.ft.per gal		Visu
		Initial	5 min.lap	Visual	85°	at lap	Calculated (See Discussion)	Determined	Wet I =
#40 White									
301-885 - lead free	92	Excellent	Excellent	Medium+	41	None	271	265	8 to 9
301-887 - leaded	92	"	"	Medium+	44	"	279	275	8 to 10
Obsolete and Experimental									
301-882 - Soya PE	92	Excellent	Excellent	Medium	29	Slight	262	-	9
301-875 - lead-free, 20% Soya	92	"	"	Medium+	35	None	271	267	8 to 9
301-880 - " " ,35% "	92	"	"	Medium+	41	"	271	-	7 to 8
301-864 - Leaded, 20% soya	92	"	"	Medium+	34	"	275	-	11
301-863 - " , 35% "	92	"	"	Medium+	50	"	275	-	10
301-756 - Prewar	100	"	"	Medium+	45	"	260	-	5
301-756 - Oil Saving	88	"	Poor	High-	56	Slight	260	-	4
Competitive									
SR-43103 Bruder	90	Fair	Fair	High	61	None	-	300	5
SR-43113 Cook	79	Excellent	Fair	High-	54	Slight	267	280	1
SR-43255 Davis	100	V. Good	Fair	High+	67	None	264	275	4
SR-43381 Devoe #547	107	Fair	Poor	High	77	None	281	-	2
SR-43165 Devoe One-Coat	92	Poor	Poor	High+	70	None	465	405	3
SR-43166 Fuller	86	Fair	Poor	High	61	None	-	230	4
SR-43094 Glidden #1800	93	Excellent	Fair	Medium+	50	definite	235	285	9
SR-42914 Glidden #1867	90	Excellent	Excellent	High+	71	None	331	315	4
SR-43143 Kyanize	94	Good	Fair	High	51	Slight	183	230	4
SR-43144 Moore	92	Fair	Fair	High+	60	None	281	285	2
SR-43117 National Lead	80	Excellent	Excellent	Medium+	50	None	286	310	3
SR-43115 Pittsburgh	81	V. Good	Poor	High	61	None	302	330	7
SR-43142 Pratt & Lambert	80	Fair	Poor	High	53	None	250	270	4
SR-43118 Sears	88	V. Good	Poor	High	59	None	273	270	5
SR-43116 Sherwin Williams	79	Fair	Poor	High+	71	None	247	340	6
SR-43141 Valspar	80	Excellent	Poor	High-	47	Slight	244	225	9
SR-43114 Ward	107	Excellent	Excellent	High	68	Slight	275	310	5
*SR-43275 Wilbur & Williams	89	Poor	*	High+	83	*	348	-	1

* SR-43275 will not lap after 5 minutes. It piles up.

[illegible]

COMPOSITION OF WHITE HOUSE PAINTS - 1949-50 IN LB. PER GALLON

Product	Titanium Oxide	Zinc Oxide	White-lead Sulfate	White-lead Carbonate	White-lead Silicate	Magnesium Silicate	Barium Sulfate	Calcium Sulfate	Calcium Carbonate	Linseed Oil	Soya Oil	Modified Soya Oil	Dehydrated Castor Oil	Other	Drier and Thinner	Gallon Weight Calculated	Gallon Weight Determined	Pigment Volume	Solids By Volume	Material (February, [illegible]
240 White																				
301-886 lead-free	1.86	2.86				4.25				4.43					1.00	14.[illegible]	-	[illegible]	88.3%	$1.65
301-887 leaded	1.75	2.90	1.56			3.95				4.26					0.96	15.38	-	[illegible]	88.0	1.81
Obsolete and Experimental																				
301-882 - Soya - PK	1.79	2.79				3.81						4.38(a)			1.26	14.03	-	[illegible]	85.8	-
301-825 - lead-free, 20% Soya	1.86	2.86				4.25				3.54	0.89				1.00	[illegible]	-	[illegible]	88.[illegible]	-
301-880 - " " , 35% "	1.86	2.86				4.25				2.88	1.55				1.00	[illegible]	-	[illegible]	88.[illegible]	-
301-864 - leaded, 20% Soya	1.72	2.90	1.56			1.96	3.02			3.45	0.85				0.99	16.45	-	[illegible]	[illegible]	-
301-862 - " , 35% "	1.72	2.90	1.56			1.96	3.02			2.77	1.48				[illegible]	[illegible]	-	[illegible]	[illegible]	-
301-756 - prewar	1.39	2.90	1.55	1.63		2.21				5.09					[illegible]	[illegible]	-	[illegible]	[illegible]	-
301-756 - Oil Saving	1.39	2.90	1.55	1.63		2.21				3.66					1.82	15.16	-	[illegible]	[illegible]	-
Competitive																				
SR-43103 Bruder	No label analysis																16.[illegible]			
SR-[illegible] Cook	1.92	2.32				2.68		[illegible]	0.77	3.90					1.65	13.26	13.27	[illegible]	[illegible]	1.56
SR-[illegible] Davis	1.44(b)	2.57	1.37			1.27		[illegible]57		3.85					1.64	14.11	14.13	[illegible]	[illegible]	1.55
SR-[illegible] Devoe #[illegible]	1.58(b)	2.47						[illegible]71	0.81	1.34		2.00(a)	0.38		1.59	13.88	13.59	[illegible]	[illegible]	[illegible]
SR-[illegible] Devoe One-Coat	2.86(b)	2.39						[illegible]70		3.86(c)					1.25	15.06	15.06	[illegible]	82.0	1.89
SR-43106 Fuller	No label analysis																15.[illegible]			
SR-430[illegible] Glidden #1800	1.05(b)	2.72	1.47	0.88		2.27	1.3[illegible]			3.68					1.69	14.86	14.75	[illegible]	76.2	1.71
SR-429[illegible] Glidden #1867	2.25	2.70	1.46			0.76	1.86			3.80	0.38			0.68(f)	0.97	14.89	14.85	[illegible]	85.5	1.81
SR-431[illegible] Kyanize	0.76(b)	2.62	1.44			1.86		[illegible]78		3.68					1.73	13.87	14.05	35.1	74.5	1.51
SR-431[illegible] Moore	1.72	3.07	1.66			3.16				4.00					1.45	15.06	14.77	35.2	80.4	1.83
SR-431[illegible] National Lead	1.79	2.14		1.64	1.00	2.20				4.41					1.16	14.34	14.56	29.7	81.0	1.90
SR-431[illegible] Pittsburgh	1.77(b)	1.98				2.82				2.98		0.99(d)			[illegible]	12.60	12.89	29.[illegible]	74.0	1.49
SR-431[illegible] Pratt & Lambert	1.48	2.93	1.57			2.63(e)				4.21					[illegible]	[illegible]	[illegible]	[illegible]	80.0	1.90
SR-[illegible] Sears	[illegible]	2.79	2.21			2.97				4.05					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.84
SR-[illegible] Sherwin Williams	1.51(b)	3.00	1.00			2.87		[illegible]30		3.77					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.60
SR-[illegible] Valspar	1.25(b)	2.72	1.46			0.97		[illegible]		3.79					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.57
SR-[illegible] [illegible]	1.71	2.58	1.36			3.06				4.38					[illegible]	[illegible]	14.76	[illegible]	85.0	1.81
SR-[illegible] Wilson & Williams	2.29(b)	1.91						[illegible]		1.57				2.44(g)	[illegible]	[illegible]	15.90	[illegible]	[illegible]	-

Notes:
(a) Soya pentaerythritol ester.
(b) Includes rutile titanium oxide.
(c) "Processed vegetable oils". Analysis indicates all linseed.
(d) Solvent fractionated soya oil.
(e) Includes 0.71 # Silica
(f) Alkyd resin solids.
(g) "Synthetic Co-polymerized oil"; possibly styrenated oil.

TABLE III

ORDER OF HIDING: SPREADING RATE AT CONTRAST RATIO 0.98

(Difference must be greater than 57 sq.ft./gal. to be statistically significant. Each value taken from at least 6 observations. Standard deviation of a single observation 43 sq.ft./gal.).

Product		Square feet per gal.
SR-43165	Devoe & Raynolds One Coat	405
SR-43116	Sherwin Williams	340
SR-43115	Pittsburgh	330
SR-42914	Glidden #1867	315
SR-43117	National Lead	313
SR-43114	Ward	310
SR-43103	Bruder	300
SR-43094	Glidden #1800	285
SR-43144	Moore	285
SR-43113	Cook	280
SR-43255	Davis	275
301-877	Batch 815112 - #40 White, linseed, leaded zinc	275
SR-43118	Sears	270
SR-43142	Pratt & Lambert	267
301-875	Batch 836929 - #40 White, 20% soya, lead-free	267
301-885	" 815191 - " " ,linseed, " "	265
SR-43143	Kyanize	230
SR-43166	Fuller	230
SR-43141	Valspar	225

TABLE IV

AVERAGE DRYING TIME UNDER NORMAL CONDITIONS (77°F, 50% Rela

Product	No. of Specimens	Dust Free hr.	Corrected to 2.0 Tack Free hr.	Firm hr.
301-885 - All linseed, lead-free	3	6.3	11.3	25.0
301-887 - All linseed, leaded zinc	2	9.0	10.5	22.0
301-875 - 20% soya, lead-free (obsolete)	3	8.0	14.0	22.7
301-880 - 35% " " " (obsolete)	3	8.7	14.7	24.3
Average - #40 White		7.9	12.8	23.6
All Competitive	17	9.5	20.5	21.7
Standard Deviation		3.0	3.1	3.9
Difference - #40 White vs. Competitive - hours		1.6	7.7	1.9
Probability of chance variation		20%	less than 1%	20%
Significance		not significant	#40 White better	not s nific

TABLE V

ORDER OF INITIAL WHITENESS

Color Difference of Fresh Dry Films vs. Magnesium Oxide
Statistically significant difference: Versus #40 White average-0.69
Between individual values-1.0

Standard Deviation: 0.31

Product	Color Difference
SR-43165 - Devoe & Raynolds One-Coat	2.32
SR-43275 - Wilbur & Williams	2.42
SR-43381 - Devoe & Raynolds #547	2.49
SR-43113 - Cook	2.80
SR-43166 - Fuller	2.89
SR-43144 - Moore	2.94
SR-42914 - Glidden #1867	3.00
SR-43255 - Davis	3.15
SR-43117 - National Lead	3.22
SR-43103 - Bruder	3.29
301-875 Batch 846647 - #40 White - 20% Soya, lead-free	3.38
P-301-R-53835 - Oil Saving 301-756 #40 White	3.42
SR-43114 - Ward	3.42
SR-43116 - Sherwin-Williams-high polymer oil	3.51
SR-43226 - Sherwin-Williams-soya/tung oil	3.53
SR-43143 - Kyanize	3.54
301-875 Batch 836929 - #40 White - 20% soya, lead-free	3.57
301-875 Batch 865717 - #40 White - 20% soya, lead-free	3.58
SR-43142 - Pratt & Lambert	3.61
301-875 Batch 926440 - (P-301-R-33985) #40 White - 20% soya, lead-free	3.63
301-880 Batch 855681 - #40 White - 35% soya, lead-free	3.66
301-885 Batch 815162 - (P-301-R-62912) #40 White - linseed, lead-free	3.68
301-880 Batch 916754 - #40 White - 35% soya, lead-free	3.69
301-880 Batch 836739 - #40 White - 35% soya, lead-free	3.69
SR-43118 - Sears	3.73
SR-43115 - Pittsburgh	3.74
301-885 Batch 815269 - (P-301-R-62912) #40 White, linseed, lead-free	3.77
Average - Current #40 White (301-885, 887, 875, 880)	3.78
301-887 Batch 801569 - #40 White - linseed, leaded	3.84
301-863 Batch 964609 - #40 White - 35% soya, leaded	3.87
SR-43094 - Glidden #1800	4.01
301-885 Batch 815191 (P-301-R-62912) #40 White, linseed lead-free	4.08
SR-43141 - Valspar	4.11
301-882 Batch 884811 - Soya PE	4.13
P-301-R-53837 - Prewar 301-756 #40 White	4.21
301-864 Batch 945523 - #40 White - 20% soya, leaded	4.23
301-887 Batch 865717 - #40 White - linseed, leaded	4.30
301-875 Batch 836929 - #40 White - 20% soya, lead-free	4.31

TABLE VI

CHANGE IN COLOR OF WHITE HOUSE PAINT SINCE 1948
COLOR DIFFERENCE VS. MAGNESIUM OXIDE

Product	1949-50	1948
#40 White		
301-885 - average of 3	3.84	
301-887 - average of 2	4.07	
301-875 - average of 5	3.69	
301-880 - average of 3	3.68	
301-864 - (average of 2 in 1948)	4.23	4.88
301-863	3.87	4.24
Bruder	3.29	4.18
Davis	3.15	4.89
Devoe & Raynolds #547	2.49	4.05
Devoe & Raynolds One-Coat	2.32	2.62
Glidden #1800	4.01	5.12
Moore	2.94	4.53
National Lead	3.22	4.11
Sears	3.73	4.17
Ward	3.42	4.55

TABLE VII

CLEANLINESS OF WHITE HOUSE PAINTS - PAINTS EXPOSED BOTH IN 1947 AND 1

S-9511 - 30 Mo.

Product	Panel # S-9511	Panel # S-10562	45°S. Fla.	45°S. Del.	SV-Del.
301-863 #40 White - 35% soya, leaded-zinc	19	2	6.0	7.7	8.9
301-756 Prewar #40 White	1	20	6.8*	7.7	8.8
Bruder	13	3	6.7	7.2	9.1
Devoe & Raynolds #547	9	7	6.0	7.3	8.5
Moore	8	12	7.0	6.8	8.8
National Lead	11	13	7.5	7.5	8.9
Pittsburgh	6	14	6.8*	6.9	8.9
Sears	7	15	6.2	6.6	8.5
Sherwin-Williams	10	17	7.6	8.7	8.7

* Panels damaged during flood; 6.8 is average all other panels of th

Standard Deviation = 0.37
Significant difference between averages = 0.5

TABLE VIII

CLEANLINESS OF WHITE HOUSE PAINTS IN SERIES #10562

Delaware North Vertical - 12 Months

Product	Panel	Mini Clean
301-864 Batch 955090 - #40 White - 20% soya, leaded zinc	1	6.
301-863 Batch 995615 - #40 White - 35% " " "	2	6.
P-301-R-29147 Similar to 301-880 - 35% soya, lead-free	23	6.
P-301-R-24100 " " " - 35% " " "	22	6.
P-301-R-14755 Similar to 301-882 - Soya, PE	25	7.
301-756 Prewar #40 White	20	6.
SR-42334 - Bruder	3	6.
SR-42368 - Cook	4	6.
SR-42338 - Cutler	5	6.
SR-42364 - Davis	6	6.
SR-42363 - Devoe & Raynolds #547	7	6.
SR-42308 - Devoe & Raynolds One-Coat	8	6.
SR-42333 - Felton Sibley	9	6.
SR-42365 - Glidden #1800	10	6.
SR-42546 - Glidden #1867	19	6.
SR-42337 - Kyanize	11	6.
SR-42362 - Moore	12	6.
SR-42352 - National Lead	13	6.
SR-42335 - Pittsburgh Plate Glass	14	7.
SR-42553 - Rockcote	27	7.
SR-42366 - Sears Roebuck	15	6.
SR-42339 - Sherwin-Williams 40% Soya/tung	16	6.
SR-42336 - Sherwin-Williams (old all linseed)	17	6.
SR-42358 - Montgomery Ward	18	6.

Standard Deviation (from Table VI) 0.37
Significant difference between averages : 1.0

TABLE IX

RATE OF SUBSIDENCE OF WHITE HOUSE PAINT

Code	Description	% Depth 12/13/49-11 days	% Depth 1/3/50-1 Mo.	% Dept 4/3/5
301-875-BC-836929	#40 Lead-free 20% soya	3%	10%	20%
301-875 BC-846647	" " " "	3%	8%	20%
301-875 BC-865717	" " " "	1.5%	2%	6%
301-875 BC-875566	" " " "	1%	2%	8%
P-301-R-33985 BC-926440	" " " "	2%	3%	8%
301-880 BC-836739	" " 35% "	2%	9%	21%
301-880 BC-855681	" " " "	2%	8%	21%
301-880 BC-916754	" " " "	0.5%	3%	10%
P-301-R-53835 (301-756)	Oil Saving #40	0.5%	2%	4%
P-301-R-53837 (301-756)	Prewar #40	2%	4%	14%
SR-42914	Glidden #1800	2%	3%	12%
SR-43094	Glidden #1867	1%	6%	18%
SR-43103	Bruder	0.5%	3%	10%
SR-43113	Cook	0.5%	4%	18%
SR-43114	Ward	0.5%	2%	8%
SR-43115	Pittsburgh	0.5%	2%	15%
SR-43116	Sherwin-Williams	0.5%	3%	16%
SR-43117	National Lead	3%	8%	25%
SR-43118	Sears	0.5%	5%	20%
SR-43141	Valspar	2%	4%	10%
SR-43142	Pratt & Lambert	3%	10%	15%
SR-43143	Kyanize	2%	8%	24%
SR-43144	Moore	0%	2%	10%
SR-43165	Devoe & Raynolds One-Coat	0.5%	2%	7%
SR-43166	Fuller	0%	3%	16%