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The low viscosities obtained on the Premier mill are due in part to the fact that the bodied oil GV 49 was low in body. Production rates on SWP for the past six months have averaged 259 gallons per hour for the 3-roll mill and 284 gallons per hour on the Premier mill.

Exposure series 9958-10023, representing cooperative exposures with the du Pont Company, was examined during the month and a progress report was written. The conclusions are based mainly on Florida and Chicago tests, vertical south on cedar beveled siding (also north at Chicago), exposure time three years. Routine readings on the Coffeyville panels, south only, at 38 months were considered, but no conclusions were drawn from them since we had not inspected the panels personally. It appears that one of the most interesting aspects of the series as a whole, in future final analysis, will be the variation due to geographic location (du Pont has parallel exposures at Wilmington, Delaware, but their readings are not on hand at present).

Space does not permit a detailed account of the paints involved, much less a comprehensive story on the variations in behavior, as covered in the forthcoming report. The general purpose is to test variations in BCWL and BSWL in white house paints, but anatase versus rutile titanium is also a major factor. The formulas submitted by us are quite orthodox, testing 14% BCWL (as supplementary lead), 14% BSWL, 7% of each and none (Ti-Sil type), with some using all anatase and some 50/50 rutile/anatase. All our pigmentations are used both with bodied oil and pre-war vehicles. du Pont submitted three similar orthodox formulas using anatase and testing the omission of BCWL, plus two others similar but high in rutile and two high-rutile formulas with only zinc oxide and extender in the pigmentation. All paints exposed by us were applied (a) over regular Rex 450 Undercoater shaded gray, (b) over Rex 450 White and (c) self-primed.

Our bodied oil formulas seem definitely ahead of the pre-war type in durability and somewhat better in appearance, Chicago north and south and Florida exposures being considered. The du Pont formulas using rutile TiO_2 seem somewhat more durable than our anatase and 50/50 formulas, but are definitely more dirty and have a yellow cast ranging from slight to very bad. Due to the above mentioned effect of vehicle type, plus that of the titanium, it is difficult to single out effects due strictly to the BCWL and BSWL variations. It seems quite probable that low lead content contributes to the rutile yellowing effect. In a very general way, the durability results so far favor the all-BCWL formulations slightly, but the BSWL, 50/50 and even lead-less samples are also performing satisfactorily in most cases. The du Pont samples, roughly, show a definite advantage for 17% supplementary BCWL as against none. du Pont's "extreme" formulas (high rutile) show remarkably good films in spite of the lack of leaded zinc.

A limited number of copies of this progress report will be available for distribution.

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Acetone Extraction Data

Paint No.	Exposed to Ultraviolet 1 Week	3 Weeks	Exposed at 50° F. Behind Glass 3 Weeks
534 M	25.45% oil extracted	19.74%	62.08%
580 M	19.47% " "	13.92	44.74
581 M	19.76% " "	11.11	46.27
582 M	18.12 " "	13.90	43.75

It is interesting to note the high percentage of binder which remains extractable when such paints dry at relatively low temperatures with little ultraviolet. The P.E. soya paints show a greater conversion than the linseed control.

In order to study the dirt collection as against erosion tendencies of Rex 471, card 50, a series of exposures have been prepared in which the only variable is the type of TiO_2 used. All rutiles are excluded due to the yellow chalk face which is associated with this type of pigment. 1403 dry and 2030 T are studied in blends: 100/0, 75/25, 50/50, 25/75 and 0/100. South exposures are applied over gray primers to emphasize erosion tendencies, while north exposures are over white primer to emphasize dirt collection tendencies.

The shipment of Nytal 300 referred to in the November report has been compared with 20 dry for general performance in SWP. Factory batches were made on the Premier and roller mill to check the general performance of these inerts.

Nytal 300 appears to be slightly lower than 20 dry in gloss, flow and consistency characteristics. The differences are not large, but a small amount of some higher consistency inert such as 1989 may be required to increase viscosity.

Rex 471, Card #50	Plant Batches 3 Roll Mill 1800 Gals.	1500 Gals.	Plant Batches Premier Mill 1800 Gals.	1800 Gals.
Inert used	20 dry	Nytal 300	20 dry	Nytal 300
Viscosity #3	30"	29"	20"	20"
Brushing	Good	Good	Good	Good
Flow	Good	Slightly short	Good	Slightly short
Gloss	Good	Slightly low	Good	Slightly low
Grinding Rate	114 gals./hr.	176 gals./hr.	257 gals./hr.	288 gals./hr.
Grind	2 H -	2 H	2 H -	2 H -

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Batch	Oil Combination	Drier Combination	Viscosity #5 Fresh	Viscosity #5 O'Nite	Drying Set-to-touch	Drying O'Nite
584 M	19 gals. (48) 29-3/8 gals. (2)	Regular Rex 471 Pb. 0.546% Mn. 0.014%	18.8"	26"	7 hr. 15 min.	Good
585 M	50% P.E. Soya Esters	Pb. 0.546# Mn. 0.014%	19.4"	22.6"	8 hr. 30 min.	Good
582 M	" "	Pb. 0.546% Co. 0.036%	25.2"	51.6"	6 hr. 13 min.	Good
580 M	" "	Pb. 0.692% Mn. 0.014% Co. 0.018%	28.4"	35"	5 hr. 53 min.	Good
603 M	" "	Pb. 0.394% Mn. 0.016% Co. 0.018%	22"	25"	4 hr. 50 min.	Good
583 M + 1/2 gal. (4232)	" "	Pb. 0.546% Mn. 0.014. Co. 0.018%	-	-	4 hr. 10 min.	Good
596 M	61-1/2 gals. (2) 3-1/4 " (310)	Pre-war formula Pb. 0.557 % Mn. 0.054%	29.2"	11 days 26"	8 hr. 30 min.	Fair

Verification of initial drying rates was made by acetone extraction of films exposed to the ultraviolet arc and a set exposed at approximately 50° F. behind glass in a south window.

Paint No.	Oil Used	Driers Pb %	Driers Mn %	Driers Co %	Drying Recorder Tear Point Minimum	Drying Recorder Break Point Minimum
534 M	Linseed	0.346	0.014	-	485	610
580 M	50% P.E. Soya	0.692	0.014	0.018	240	305
581 M	"	0.346	0.014	-	445	525
582 M	"	0.346	-	0.036	-	-

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Drying Properties of SWP (Card #50)
Vehicle and Drier Variations
Using AV 1101 P. E. Soya Ester

Batch	Oils Under Test			24-Hour Tack	Gloss	Paint Viscosity Fresh	Paint Viscosity O'Nite
518 M	29-3/8 gals.		(2)				
	19	"	(510)	Definite	Good	19.2"	29"
519	29-3/8	"	(2)	Definite -	Fair	15.8"	16"
	19	"	AV 1101				
520	"	"	"	Definite	Fair	15.6"	16"
521	"	"	"	Definite -	Fair	15.6"	15.8"
522	"	"	"	Definite -	Fair	15.4"	15.8"
523	"	"	"	Slight	Fair	15.6"	16.2"
524	"	"	"	Slight	Fair	15.4"	15.8"

Work has been under way to establish a formulation for SWP using 50% of the oil as P.E. soya esters, particularly to obtain proper brushing, flow, gloss and drying characteristics. It appears that the following combination of oils would be suitable for SWP Gloss White and 450 Undercoater.

	Rex 471	Rex 450
(2)	9-1/4 gallons	6-1/2 gallons
(798)	15 "	15 "
AV 1100	5 "	14-1/2 "
AV 1101	19 "	7 "

Work has also been under way to determine the optimum drier combination to use in SWP made with AV 1100 and AV 1101. This work has not been completed to date, but the following drier combinations compared for set-to-touch and over night dry as indicated.

#97 - SWP 471

Three drums of P.E. soya esters were received from Cleveland for evaluation in SWP. This shipment consisted of two drums of AV 1100 and one drum of AV 1101.

	AV 1100	AV 1101
Color	11	11 - 12
Acid Value	2.3	2.2
Viscosity	13 sec.	46 sec.
Acetyl No.	8	0

The higher bodied sample was checked initially for drying properties when used in conjunction with (2) in the proportion of 40% AV 1101 and 60% (2). In the initial tests an effort was made to determine the optimum drier combination to be used in order to obtain the same drying properties as a blend of 40% (310) and 60% (2). The drying properties of the various vehicle and drier variations are as follows:

Drying Properties of SWP (Card #50)
Vehicle and Drier Variations
Using AV 1101 P. E. Soya Ester

Batch	Oils Under Test	Driers (% Metal) Pb	Mn	Co	Drying Time Set-to-touch	O'Nite
518 M	29-3/8 gals. (2) 19 " (310)	0.346	0.014	-	7 hr. 30 min.	V. good
519	29-3/8 " (2) 19 " AV 1101	0.346	0.014	-	9 " -	" "
520	" " "	0.346	-	0.018	9 " 45 "	" "
521	" " "	0.346	-	0.054	7 " 8 "	" "
522	" " "	0.346	0.014	0.018	6 " 28 "	" "
523	" " "	0.692	0.014	0.018	5 " 23 "	" "
524	" " "	0.692	0.014	0.036	4 " 18 "	" "

(Cont.)

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The lead substitute driers have a rather sweet smell, even at low concentrations, which would be objectionable, particularly in interior formulations.

The following series of exposure tests were examined during the month:

1. Panels 8318-51 F, C were discontinued after four years' exposure at Chicago and Florida. The paints include pre-war and bodied oil SWP Gloss White using half, regular and twice the regular amounts of lead and manganese driers, also plus cobalt, individually and in combination. Failure at Chicago is principally by erosion, while in Florida there is considerable variation in checking and cracking. Results are somewhat erratic, making conclusions difficult. Cobalt seems to improve durability, with slight improvement due to doubling lead, but also rather surprisingly due to doubled manganese. No sample performed better than that with the regular Pb-Mn-Co ratio. More study is indicated.

2. Exposures 10618-26 F were examined after 24 months at Florida. The main part of the series tests several hempseed oils in Rex 471 - SWP Gloss White of 1-19-45 (rutile-anatase TiO_2) as follows: (2) and CVR-126 bodied hempseed; AV-1001 alkali refined hempseed and CVR-126; AV-1001 and (48), AV-1000 raw hempseed and (48). All looked good, slightly more white than the regular guides, but tending to be a little more "thin." This is more noticeable on the Chicago panels, where the "show-through" indicates possibly a little more tendency to erode. There is no real film failure in any case. The minor part of the series tests the same Rex 471 formula using Kelvitol, a catalyzed linseed from Spencer-Kellogg, with (2), plus the same combination in Rex 462 SWP Cream of 4-16-45. The Kelvitol in white looks almost exactly the same as the hempseed oils, clean and durable up to two years. The only departure from normal in the series is the slightly better color in Rex 462 with Kelvitol at Florida as against slightly more fading at Chicago.

3. Panels 10764-71 F were given a final examination after two years of exposure at Chicago. Both the S-W and Martin-Senour two coat systems were employed and applied both by brush and spray on new cedar and yellow pine siding. The Chicago panels were also examined after 29 months' exposure, and included brush and spray application on badly weathered lumber. In Florida the Martin-Senour system is less durable, with the heavy spray coats having the best appearance, normal spray coats slightly inferior to brush coats. In Chicago the failure of spray application to fill in deep cracks has resulted in more serious failure than where the undercoater was applied by brush.

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The following paints were made up in preparation for subsequent exposure:

1. SWP White made with raw and bodied Neutral Conophor oil obtained from Lewis Berger and Sons. Conophor oil has an iodine value of 200 or better (sample 209.8 per Resin Research). Comparison with all linseed SWP follows:

SWP Using	Viscosity #3 Fresh	Viscosity #3 O'Nite	Drying Set-to-touch	Drying O'Nite	Brushing	Flow	Gloss
(2) and (310)	20"	27"	6 hr. 45 min.	Good	Good	Good	Good
Conophor Oil	19"	20"	4 " 25 "	Good; not tough.	Good	Good	Good -

2. SWP Whites and Colonial Yellow tints on straight linseed (2) plus (310) binder and also plus 6 gallons blown (798) replacing an equal volume of (2); also with vehicle consisting of 16 gallons (2) plus 52-3/8 gallons (503), and the same replacement with 6 gallons (798). This is a supplement to Series 8669-80 covering the general performance of transparent litho oils of the 300 and 500 series. The new tests were suggested on the basis that all the tints in the original series made with the 500 series oils were very heavy in body after four years' storage whereas the whites made with the 300 series all maintained satisfactory viscosities.

Two lead substitute drier mixes, RC 1038 and RC 1039, were submitted by the Resin Research Department for evaluation in SWP. The substitute driers were compared for drying properties against (4230) lead naphthenate drier and also in conjunction with the regular amount of (543) manganese drier used in SWP. The driers were introduced to the extent of 7/8, 1-3/4 and 3-1/2 gallons per 100 gallons of paint.

The lead substitute driers were not equivalent in drying to (4230) regardless of concentration if manganese is not added. If manganese drier is used RC 1038 and RC 1039 are approximately equivalent in drying to the regular amount of (4230) and (543) used in Rex 471.

Batch	Drier Under Test	Set-to-touch Time With (543)	Set-to-touch Time Without (543)
385 M	3-1/2 gal. RC 1038	5 hr. 15 min.	19 hr. 45 min.
386 M	1-3/4 " "	5 " 30 "	17 " 15 "
387 M	7/8 " "	5 " 45 "	16 " 25 "
388 M	3-1/2 " RC 1039	5 " 30 "	16 " 25 "
389 M	1-3/4 " "	5 " 45 "	18 " 5 "
390 M	7/8 " "	6 " -	19 " 15 "
391 M	1-3/4 " (4230)	5 " 45 "	15 " 45 "

Over night dry: With Mn drier - good, without Mn drier - slightly soft.

#97 - Cont.

The Vegetable Products Research Laboratory submitted two P. E. soya esters, AVM 16 heavy body (45 seconds) and AVM 16 light viscosity (14 seconds). The samples were checked for drying in clear films and in SWP. The samples were rather small so we were unable to complete the various tests.

Drying Tests (On Clear Oils)

Batch	Oil Under Test (Plus Driers*)	Drying Time Set-to-touch	O'Nite	Tack - 24 Hours
415 M	AVM 16 (Light Body)	5 hr. 40 min.	V. good	Slight tack
418 M-A	AVM 16 (Heavy Body)	5 " 40 "	" "	" "
418 M-B	(310)	5 " 10 "	" "	Definite +
416 M	40% AVM 16 Heavy 60% (2)	5 " 40 "	Good	Slight +
417 M	40% (310) 60% (2)	6 " 25 "	"	Definite

*Same percentage of driers used as in Rex 471: 48-3/8 gals. Oil
5/8 " (543)
1-3/4 " (4230)

SWP Gloss White Tests

Batch	Oil Under Test	Viscosity #3 Orifice Fresh	5 Days	Drying Set-to-touch	O'Nite	Gloss	Color
415 M	All oil as AVM 16 (Light)	35.4"	36.4"	7 hr. 10 min.	Good	Lower than 417 M	V. sl. yellow
416 M	19 gal. AVM 16 Hvy 29-3/8 gals. (2)	18"	19"	7 " 55 "	"	"	"
417 M	19 gals. (310) 28-2/8 gals. (2)	26"	32.2"	7 " 25 "	"	Good	OK

#97 - Cont.

Prices used in this pigment cost comparison (as of November 15):

Dry No.	$/Cwt.	Dry No.	$/Cwt.
9	$21.50	1895	$25.00* (Estimated)
18	22.40	1897	7.75
20	2.00	2030	18.25
412	15.10	2132	7.25
414	12.25	2188	5.00
511	16.10	2296	14.00
1403	18.25	2307	2.00

*1895 dry cost estimated on basis of September, 1948 cost at $11.50 by comparison with 1128 at $9.25 and 1403 at $14.75. Prices of 11/15/48: 1128 dry - $25.00, 1403 - $18.25.

A shipment of Nytal 300 was received during October from R. T. Vanderbilt Company for a trial run in SWP. Laboratory batches of Gloss White were made with this inert and 20 dry and the paints were compared for general characteristics. Factory batches have not been made to date.

The laboratory batch of SWP made with Nytal 300 was slightly lower in viscosity and gloss than the batch made with 20 dry. However, the batch made with Nytal 300 ground out in much less time with equal texture of the finished paint (2 H).

SWP Made With Nytal 300 and 20 Dry

Batch	Inert Used	Viscosity #5 Orifice Fresh	O'Nite	4 Days	Brushing	Flow	Gloss	Grinding Time
400 M	20 dry	22.6"	28.8"	28"	Good	Good	Good	7' 57"
401 M	Nytal 300	24"	27"	28.1"	Good	Fair	Fair	4' 23"
397 M	250# Nytal 300 50# 1989	26.4"	30.6"	29.4"	Good	Fair-	Fair	4' 46"

	Residue (325 Mesh)	Oil Absorption	Bulking Value
20 Dry	2.4%	31	4.21
Nytal 300	0.52%	36.8	4.16

#97 - SWP 471

Due to the increased cost of lead and zinc pigments, serious consideration has been given to the problem of reformulating SWP Undercoater and Gloss White. The exposure history has been reviewed and it was concluded that to modify Rex 471 by eliminating the B.C.W.L. would result in only a minor increase in erosion. In order to maintain the reactive pigment quotient in the formula it was decided that to offset the elimination of B.C.W.L. the leaded zinc should be increased by 25 pounds. There is extensive exposure experience supporting this new formula and no apprehension is felt regarding its durability beyond the increase in erosion tendencies mentioned.

A pigment cost comparison has been made between SWP and various paints being sold competitively in the field. Composition was estimated on the basis of label analysis and weight per gallon of the paints. In addition to the cost analysis a quality evaluation was made comparing these paints for color, opacity and gloss. Results of these tests are tabulated below:

Summary of House Paint Characteristics

Competitive	Pigment Cost	Photo-volt Gloss	% Bright-ness	A-B / G Color Index	0.008" Gauge Contrast Ratio
Devoe - 547 House Paint	$126.90	33	85.4	6.3	96.9
du Pont - 40 Outside White	116.81	51	80.3	7.3	97.3
Montgomery Ward - 751 TiO_2 White	104.42	79	81.7	8.5	97.6
National - Dutch Boy 110	159.50	58	79.5	9.4	97.8
Pittsburgh - 1-54 V	81.53	34	83.8	7.5	98.4
Sears 143 White	125.09	65	82.0	6.2	97.3
SWP Gloss White					
Rex 471 - Card #49	114.77	60	81.5	8.0	96.9
Rex 471 - no B.C.W.L.	106.89	61	81.6	7.8	97.2
Rex 471 - no B.C.W.L. 414/511	100.48	63	84.5	5.9	97.9
Rex 471 - 414/18	106.04	67	79.5	9.3	97.9
SWP Fume Resisting Type					
Rex 436 - Card #13	82.86	73	82.3	3.0	98.6
Rex 436 - 414-ZnO (50 color)	80.87	72	79.4	7.8	98.5
Rex 436 - 414-ZnO (65 color)	80.87	68	80.3	7.0	98.4
One Coat House Paint					
Devoe	99.03	78	87.2	6.0	99.1
SWP- CH 4697	160.30	81	83.5	8.1	98.8

(d) Rex 450 - 471 vs. One Coat House Paint White.

(e) Rex 450 - 471 vs. SWP with 4.25 pounds oil per gallon.

(f) One Coat House Paint with basic lead silicate.

With reference to (1) above, panels 11116 - 11122 F, C were examined after 18 months vertical south at Florida, and 19 months south and north at Chicago, all on cedar beveled siding with Rex 450 Undercoater. The basic formula is Rex 471 of 6-13-46, using all linseed oil and all 1403 anatase TiO_2. The three special formulas use raw and bodied soya oils as detailed below:

(a) All oil as (1273) and bis-bodied soya CV 7027. Seems inferior in durability at Florida, some checking and cracking. No failure at Chicago. No real dirt differences at present but was dirtier than regular during first year.

(b) All oil as S. O. #500, raw and bodied. Seems equal to regular in durability. Same dirt history as (a).

(c) Same as (b), but increased drier content. As (b), but shows a very slight tendency toward checking.

(d) Regulars of 4-8-42 (all 1403, pre-war type) and 10-13-42 (similar but 2173 dry) performed about as the 6-13-46 formula, but collected more dirt, especially with 2173 dry.

In the Monthly Report for May, 1948 reference is made to a sample of lead glyceroxide of cottonseed oil monoglyceride submitted by Dr. Grummitt for evaluation as a drier. SWP made with this material and regular lead naphthenate drier (4230) were compared for granulation, package condition and drying characteristics after approximately 17 months' storage.

As indicated below, the paint containing the lead glyceroxide is slightly better than the regular for package condition and granulation and appears to be equivalent in drying properties to the regular formula. However, in our previous report we found the lead glyceroxide to be dark in color and bad in staining. We also stated the lead glyceroxide produced a rather heavy precipitate that settled out after standing for a few days if dissolved in mineral spirits to the extent of 10% metal.

Experimental Batch No.	Formula	Drier	Drying Set-to-touch	Drying O'Nite	Package Condition	Granulation
835 K	Rex 471 Formula 6-13-46	(543) (4230)	5 hr. 40 min.	Good	Good	Very slight
837 K	" Lead Glyceroxide	(543)	5 hr. 55 min.	Good	Good	None

#97 - Cont.

Exposures will be made south and north vertical in Chicago and Florida. The panels will be painted both this fall and next summer to check the effects of drying conditions on dirt collection and durability. The paints will also be checked for viscosity changes over a period of six months.

Experimental paints were made on the SWP formulation with: (a) 60 pounds 16 dry, (b) 60 pounds lead linoleate, and (c) without any lead introduced as the carbonate or linoleate. We have always favored the use of some carbonate in SWP to decrease erosion and it may be that similar results can be obtained with equivalent or lower percentages of lead linoleate.

Panels prepared for exposure during the month include:

1. 13223-38 CS, CN and F. This series is a repeat of an earlier series 10945-63 covering the use of various soybean oils in SWP. The original paints exposed in the late fall of 1946 showed early dirt collection which was retained, also bad and spotty fading. The oils used included (310) linseed, RB 8474 (CV 7027) Bis Soya, RB 8471 (CV 7028) SO_2 treated soya, RB 8472 (CV 7029) Catalyst bodied soya, RB 8473 (CVR 584) 80/20 soya/tung, and RB 8477 (CVR 570) P.P.G. #500 bodied soya. Because of the poor appearance of the first series it was decided to repeat it, using the regular shading colors specified for Rex 478, BY 10 and BY 40. The series also includes whites using 1403 TiO_2. The temperatures during the painting period ranged from 47° to 62° F.

2. 13239-46 CS, CN and F. This is a repeat of series 13162-69 which was painted in August with temperatures ranging from 57° to 85° F. and low humidity, after which there was a period of very hot weather (up to 100° F.). This new group was painted at temperatures ranging from 57° to 69° F., and high morning and evening humidities. The paints include SWP Whites and Colonial Yellows, using (310), CV-49 and (3316) as the bodied oils.

3. 13252-61 CS and CN. This series covers panel exposures of the paints used on test houses during this past summer. Briefly, the tests are:

   (a) Rex 450 - 471 and Rex 70110 primer on aluminum siding.

   (b) Reproduction of National's Dutch Boy White vs. actual sample National's #110 Bright White vs. Rex 450 - 471.

   (c) Rex 450 - 471 vs. Rex 450 - RB 2349 SWP with basic lead silicate.

Study of Rex 471 and Rex 465 in Various Oils
Cont.

Batch No.		Viscosity Fresh	Viscosity O'Nite	Set-to-Touch	Thru Dry	Brushing	Flow	Gloss	Wrinkling at 140° F. under U. V. Light
315 M 19 gals.	Rex 465 RB 9650	22.4"	23"	7 hr.	Good	Good	Good	Good -	No wrinkling. Fair gloss.
316 M 19 gals.	Rex 465 RC 0733	20.4	20	6 hr. 50 min.	"	"	"	"	"
317 M 19 gals.	Rex 465 RC 0734	20	21	7 " 5 "	"	"	"	"	"
318 M 19 gals.	Rex 465 RC 0735	23	24.8	6 " 25 "	"	"	"	"	-
319 M 19 gals.	Rex 465 RC 0736	26.2	27.8	6 " 25 "	"	"	"	"	No wrinkling. Fair + gloss.
351 M 19 gals.	Rex 465 RC 0739	18.8	22	7 " 30 "	"	"	"	"	"
352 M 19 gals.	Rex 465 RC 0740	15	16.8	Over 8 hours	"	"	"	Fair	"
353 M 19 gals.	Rex 465 RC 0741	22	27	7 hr. 45 min.	"	"	"	Good -	"
354 M 19 gals.	Rex 465 (3316)	23.4	26	?	"	"	"	"	"
355 M 14-1/2 gals. 5 "	Rex 465 (3316) (4106)	18.2	21	?	Good. Less tack than 354 M	"	"	"	"

Study of Rex 471 and Rex 465 in Various Oils
Cont.

Batch No.	Viscosity Fresh	Viscosity O'Nite	Set-to-Touch	Thru Dry	Brushing	Flow	Gloss	Wrinkling at 140° F. under U. V. Light
330 M Rex 471 19 gals. RC 0739	19.2"	22.8"	6 hr. 20 min.	Good	Good	Good	Good -	No wrinkling. Fair gloss.
331 M Rex 471 19 gals. RC 0740	17	20	6 " 50 "	"	"	"	"	"
350 M Rex 471 19 gals. RC 0741	20	27	Over 8 hours	"	"	"	Good +	No wrinkling. Good gloss.
232 M Rex 471 Formula of 4-19-48 19 gals. (3316)	26	29	7 hr. 45 min.	"	"	"	Good	"
233 M Rex 471 14-1/2 gals. (3316) 5 gals. (4106)	24	26	6 " 25 "	"	"	"	Good -	"
311 M Rex 465 Formula of 4-21-48 19 gals. (310)	46	49	7 " 15 "	"	"	"	Good	No wrinkling. Fair-good gloss
312 M Rex 465 15-1/2 gals. (3316) 3-1/2 " (2325)	30	31	6 " 45 "	"	"	"	Good -	"
313 M Rex 465 19 gals. RB 9646	29	30	7 " 25 "	"	"	"	"	"
314 M Rex 465 19 gals. RB 9647	25.2	25.6	7 " 25 "	"	"	"	"	"

Cont.

Study of Rex 471 and Rex 465 in Various Oils

Batch No.	Viscosity Fresh	Viscosity O'Nite	Set-to-Touch	Thru Dry	Brushing	Flow	Gloss	Wrinkling at 140° F. under U. V. Light
302 M Rex 471 Formula of 4-19-48 (310)	27"	30.2"	6 hr. 45 min.	Good	Good	Good	Good	.008" film. No wrinkling. Good gloss.
303 M Rex 471 15-1/2 gals. (3316) 3-1/2 " (2325)	23	23.2	6 " 37 "	"	"	"	Good -	"
304 M Rex 471 19 gals. RB 9646	23	23.4	6 " 42 "	"	"	"	"	No wrinkling. Fair gloss.
305 M Rex 471 19 gals. RB 9647	19	21	4 " 35 "	"	"	"	"	"
306 M Rex 471 19 gals. RB 9650	20	21.6	5 " 35 "	"	"	"	"	"
307 M Rex 471 19 gals. RC 0733	17	19	5 " 35 "	"	"	"	"	"
308 M Rex 471 19 gals. RC 0734	19	22	4 " 35 "	"	"	"	"	"
309 M Rex 471 19 gals. RC 0735	20	21.4	4 " 35 "	"	"	"	"	"
310 M Rex 471 19 gals. RC 0736	21	24	4 " 35 "	"	"	"	"	"

Cont.

#97 - Cont.

Drying Tests (Clear Films)

Batch	Oil	Set-to-touch	Over Night Drying
200 M	(1273)	12 hr. 55 min.	Fair
201 M	P.P.G. 500 Soya	9 " 37 "	Very good
202 M	AVM 42	9 " 40 "	Good

(3316), the 80% soybean/20% tung bodied oil which was used in SWP has been criticized for dirt collection tendencies, particularly when dried under unfavorable conditions. The tung oil makes the film vulnerable to surface wrinkling and dulling. The Resin Research Department submitted a number of oils largely of a composition 65% soybean/35% tung for evaluation in SWP to observe whether any improvements could be made. The oils include:

Sample	Composition	Additive	Body	Acid Value
RB 9646	65% (1273) 35% (140)	None	Z_1	2.9
RB 9647	"	0.1% Zn	Z_1	3.1
RB 9650	"	0.05% Zn	Z_1	4.6
RB 0733	"	0.1% Vultac #2	Z_2	4.6
RB 0734	"	0.05% Vultac #2	Z_2	4.3
RB 0735	"	0.05% Thiofide	Z_2	4.6
RB 0736	"	0.025% Thiofide	Z_3	4.8
RB 0739	80% (1273) 20% (140)	None - Regular (3316)	Z_2	2.9
RB 0740	"	As RC 0739 but 0.03% 1128 dry in cook. Color dark.	$Z_1 - Z_2$	2.6
RB 0741	"	As RC 0740 but CO_2 blow, no SO_2.	$Z_1 - Z_2$	4.0

The paints made with these oils were checked for viscosity, brushing, flow, gloss and wrinkling tendencies, with the following results.

#97 - SWP 471

Page 21 of the Paint Research Report for August, 1948, outlined a series of tests being made to study the moisture resistance of several paint systems. The comparative moisture permeabilities on these paint systems are reported below:

	Permeability Grams per 22 Hours
Rex 16 Lead-in-Oil - 3 coats	.0527
Rex 450 - Rex 471 system	.0546
Rex 471 - Rex 471 self-prime	.0735*
Rex 436 - Rex 436 self-prime	.0589
RB 2376-RB 2376 du Pont Moisture Resistant Paint self-prime	.0584
Rex 45000 - Rex 45000 Kem Bulletin White self-prime	.1005*
Rex 471 - Rex 471 36% PVC self-prime	.0592
" " 45% " "	.0537
" " 50% " "	.0573
" " 55% " "	.0502
" " 60% " "	.0772
" " 65% " "	.1156

*These values appear to be in error and are being repeated.

The Vegetable Products Research Laboratory submitted a quart sample of AVM 42 prepared by the "Directed Ester Inter-Change" process referred to in patents recently granted to Proctor and Gamble for the treatment of oils. The oil was compared with Pittsburgh's #500 selected soya and (1273) in the clear for set-to-touch and over night drying characteristics. (543) and (4230) were used as driers at the same metal content as Rex 471.

#97 - Cont.

SWP Gloss White

Batch	Drier	Set-to-touch	Over Night	Color
OJ 234 M	(4230) (543)	6 hr. 25 min.	Good	Good
OJ 235 M	RC 0258	4 " 10 "	Very good	Poor
OJ 236 M	RC 0259	3 " 55 "	Very good	Poor

Kem Namel Snow White

OJ 237 M	(4230) (4231) (4232)	3 hr. 50 min.	Good	Good
OJ 238 M	RC 0255	1 " 30 "	Very good	Poor
OJ 239 M	RC 0256	1 " 30 "	Very good	Poor

Enameloid White

OJ 240 M	(4230) (4231) (4232)	1 hr. 50 min.	Very good	Good
OJ 241 M	RC 0253	1 " 35 "	Very good	Poor
OJ 242 M	RC 0254	1 " 45 "	Very good	Poor

#97 - SWP 471

Panels prepared for exposure included the following groups:

1. 13162-9 CS, CN and F. SWP Gloss White and Colonial Yellow tint, using as the bodied oil portion of the binder (310) all linseed, (48), 50/30/20 linseed/soya/chinawood oil, and (3316) 80/20 soya/chinawood. Exposures south and north vertical at Chicago and south vertical Florida. These panels were painted over a temperature range from 70° to 87° F., with relative humidities from 37% to 45%. The same paints will be applied under less favorable conditions and exposed late this fall to observe effects of variations in drying conditions.

2. 13150-2 CS, CN and F. SWP Gloss White regular and a special using hexane extracted linseed oil to replace the regular (2) raw linseed oil. The usual 19 gallons of bodied oil was used, in this case as (310). Exposures south and north vertical at Chicago and south vertical Florida.

3. 13146-13149 CS, CN and F. SWP tint base versus a duplication of Dutch Boy 124 Buff pigmentation, tinted with identical tinting colors. In the 1947 series National's 124 Buff was definitely superior to the SWP tint base shaded to the 124 Buff shade. This new set was prepared to determine whether this superiority was due to the tint base pigmentation or to the use of better tinting colors. Exposures south and north vertical at Chicago and south vertical Florida.

4. 13183-96 CS, CN and F. SWP Gloss White and Berkely Yellow comparing regular receipts of International's 3 X Asbestine with their micronized talc CW 2679, using laboratory batches of paint. Also a supplementary group which includes both White and Colonial Yellow using factory pastes reduced in the laboratory, in which 20 F, the combination of 2203 and 2201, and Nytal 300 were used, respectively, as the extenders. Exposures south and north vertical at Chicago and south vertical Florida.

Special driers RC 0253, RC 0254, RC 0255, RC 0256, RC 0258, and RC 0259 were submitted by the Resin Research Department for evaluation against the regular metallic driers in SWP, Enameloid and Kem Namel Snow White Gloss. The special driers gave faster drying than the regular metallic driers in SWP and Kem Namel Snow White Gloss and equivalent drying in Enameloid White. They produced considerable staining and discoloration in all the formulations. An improvement should be made in the color and odor of these driers.

#178 - Studies of Dark Colored House Paints

National Paint, Varnish and Lacquer Association Scientific Section Circular 720 describes work on metal phenolates as anti-oxidants in dried films. This followed a study by Dr. L. L. Carrick and associates of confiscated patent 1,842,207. A sample of clear vehicle of 100% solids as used in Rex 493 Woodland Brown was treated with 1% copper phenolate. The treated and untreated binders were drawn down on glass, air dried for one week, and placed in the arc cabinet. After 2689 hours, the untreated vehicle has very dull gloss and considerable disintegration of the film has occurred. The treated vehicle still has good gloss and no film failure visible to the eye.

Panels 12984 - 90 CS, CN and F were prepared for exposure south and north vertical at Chicago and south vertical in Florida using SWP Woodland Brown regular, also specials using 1 and 2% copper phenolate based on the vehicle solids. In addition paints were formulated with copper hydroxynaphthenate with a copper content equivalent to 25 pounds of cuprous oxide and also with half that copper content. The regular formula carries 25 pounds of 89 dry. A special was included omitting the copper oxide. (See Monthly Report February, 1948, page 19.)

#97 - Cont.

The following series of paints were prepared for subsequent exposure:

1. In the 1947 series Dutch Boy 124 Buff was definitely better in tint retention than the corresponding SWP tint. Paints were prepared comparing the Dutch Boy and the S-W pigmentation, using lead-free zinc oxide as well as co-fumed leaded zinc. The paints were all shaded with BY 10, HY 20 and BO 30. Exposures will be at Chicago south and north vertical and south vertical at Miami.

2. Due to potentially lower prices for soybean oil it was decided to repeat comparisons of SWP made with all linseed versus linseed-CWO-soybean combinations such as (3316) and (48). (310), (3316) and (48) were used in the regular amounts in both Rex 471 White and Rex 465 Colonial Yellow. The exposure panels will be prepared both during favorable summer drying conditions and late in the fall at lower temperatures.

3. The Northern Regional Research Laboratory has suggested the use of dry calcium oxide ground into paints to accelerate drying. SWP Gloss White batches were prepared based on the following binders: (a) all linseed, (b) 60% linseed, 32% soybean, 8% chinawood, and (c) 92% soybean and 8% chinawood. The paints were formulated with 4% CaO on the vehicle solids and 4% on the pigment by weight. There was no improvement in set-to-touch time and somewhat slower through drying except in the case of the 92% soybean-8% chinawood paint where set-to-touch was accelerated slightly. The paints will be exposed at Chicago.

Panels 15003-19 CS, CN and F were prepared for exposure south and north vertical at Chicago and south vertical at Miami. The paints include both Rex 471 SWP Gloss White and Rex 493 Woodland Brown using polyallyl esters of soybean and linseed oils. The Monthly Report for November, 1947 discussed the initial tests with experimental data. The polyallyl ester paints dried well with little after-tack but the Woodland Brown 100% polyallyl ester paints showed tendencies to wrinkle. In the current tests the polyallyl ester contents have been reduced to 10 to 15 gallons per 100 gallons of paint.

#97 - Cont.

	Iodine No.	Acid Value
Extracted Linseed	176.7	3.8
Stock Sample (2)	179.1	3.22

The two paints were similar in brushing, flow, drying and gloss. The solvent extracted oil produced a somewhat thinner paint. Exposures will be made at Chicago north and south and Florida south only.

Batch	Raw Oil Used	Viscosity #3 Fresh	Viscosity #3 O'Nite	Drying Set-to-touch	Drying O'Nite	Brush	Flow	Gloss
102 M	(2)	26"	32"	7 hr. 43 min.	Good	Good	Good	Good
103 M	Extracted Linseed	20"	21"	7 hr. 53 min.	Good	Good	Good	Good

The permeabilities of draw-down films of pre-war SWP Gloss White and current Rex 471 were determined by the electrical resistance method. Both films were found to be substantially equal in permeability, having a resistance of 1200 ohms each. Another test on these samples will be run by the moisture-permeability method.

A series of tests was started to explore the problem of formulating house paints which will tolerate some moisture within the surface on which they are applied without showing blistering and peeling. The east-west exposure fence at the Chicago farm has been remodeled to carry moisture within the wall. The following exposure comparisons are being made.

West Face of Fence

1. Lead-in-Oil - 3 coats.
2. Rex 450 - Rex 471 system.
3. Rex 471 - Rex 471 self-primed.
4. Rex 436 - Rex 436 " " .
5. RB 2376 - RB 2376 du Pont Moisture Resistant Paint self-primed.
6. Rex 45000 - Rex 45000 Kem Bulletin White self-primed.
7. Rex 471 - Rex 471 36% PVC self-primed.
8. Ditto 45% "
9. " 50% "
10. " 55% "
11. " 60% "
12. " 65% "

#97 - Cont.

As indicated by these data, we were unable to obtain the standard viscosity or weight per gallon with raw materials sent from Gibbsboro. In our laboratory work we could not detect any manganese float on any of the tests made with Gibbsboro or Chicago raw materials. The quart sample of Gibbsboro Rex 450 production dated F 2168, in which the manganese was replaced with calcium, was found to be more tacky after drying over night than the laboratory batch made with the regular amount of manganese.

The initial results indicate that further work must be done on this problem. A new supply of Gibbsboro raw materials has been requested together with a copy of the formulation and a break-down of liquids such as FV 74 which are being used in their production. Samples of our raw materials have also been sent to Gibbsboro for their inspection.

In further work along similar lines an effort was made to associate drier composition, drier source, and oil composition with manganese float and drying efficiency. House paints were made using lead, manganese, cobalt and calcium driers from regular suppliers. Tests were made both with single driers and combinations of driers. A total of eight manganese compounds were tested, consisting of naphthenates, Octoates and Hexoates. The bodied oils used were (310), (48) and (3316).

None of the paints prepared exhibited manganese float. Between the three oils tested the mass of evidence shows (3316) to dry to touch most readily with the (310) averaging 5% slower and (48) about 15% slower. All of these materials dried well over night and there is little difference after one week.

It has been suggested that lead pigments and possibly leaded zincs promote the drying of house paints even when lead driers are used. To investigate this possibility paints were made based on Rex 436 - SWP Fume Resisting White. Zinc oxide substitutions were made in the above using 414 and 412 dry leaded zincs as well as a secondary series which was made including 50 pounds of basic carbonate white lead in each pigmentation. Two drier combinations were used: (a) the conventional Rex 436 drier blend and (b) the Rex 471 drier combination.

Set-to-touch and over night dry indicate that 414 does not promote drying but that 412 does. The Rex 436 drier combination generally is faster than the Rex 471 in set-to-touch tests but all were very close over night. Active lead pigment such as basic carbonate white lead promotes the drying of paint even in the presence of lead driers. Storage tests will be made and the drying checked after six months.

The Linseed Oil Mill has submitted a sample of solvent extracted linseed oil for evaluation in SWP. The extracted oil was compared with regular raw linseed oil in SWP Gloss White, formula of 4-19-48.

#97 - Cont.

The tendency towards settling observed in the institutional house paints has prompted a study of the manner in which this characteristic might be affected by the addition of suspension or wetting agents. Test batches of Rex 471 SWP Gloss White were prepared using the formula of Card #49 and adding 6 pounds CW (2343) Acto 450, 6 pounds 2270 dry lecithin, and 5 pounds 1826 dry calcium stearate per 100 gallons, respectively. The samples were packaged in one gallon containers and placed in storage.

The cans were examined after 30 days using the spatula method. The control or agent-free material showed considerably more settling than any of the agent fortified samples. There were no observable differences in the extent of settling between the various agent treated batches, but the degree of thixotropy near the surface of the pigment pack was greatest with calcium stearate in the batch. This should translate itself into relatively better suspension for this sample with continued ageing. Its effect upon the viscosity was not determined in this observation as the inspections were made carefully so as not to disturb the package at this time.

A second settling test series was set up for Porch and Floor Enamel - Rex 155. In this the effect of Acto 450 CW (2343) is being checked against the control material as formulated on Card #2, 3-5-47. The 30-day inspection of these materials showed considerable soft settled material with a slight advantage gained through the use of CW (2343). The extent of settling was not objectionable in either case.

Work is under way to determine the reason for the"manganese float" on Gibbsboro production of SWP and 450 Undercoater. Two sets of experimental paints were prepared, one based on Gibbsboro raw materials and the other on Chicago raw materials. In each case three variations were made in each basic formula as follows:

Rex 450 - Card No. 26				Manganese Drier		Wt./Gal.	Viscosity #3 Fresh	Viscosity #3 3 Days	Color
124 M	Laboratory	Raw	Mat'ls	(543)	Chicago	14.38	15"	21.4"	Std.
125 M	"	"	"	(543)	Gibbsboro	14.40	15"	21.4"	"
126 M	"	"	"	(4231)	Chicago	14.39	15"	21.4"	"
127 M	Gibbsboro	"	"	(543)	Gibbsboro	14.60	42" +	35"	"
128 M	"	"	"	(543)	Chicago	14.62	42" +	35"	"
129 M	"	"	"	(4231)	Chicago	14.62	40" +	35"	"

SWP House Paint White - Rex 471
(Cont.)

Material	Brushing	Hiding*	Flow	Gloss	Drying 75° F. - 46% R. H. Set-to-touch	Through Dry	Color
Rex 471 - O 1338 B	Good	2nd	Good -	Very good	6 hr. 20 min.	Good	Good
Rex 471 - C 1398	Very good	3rd	Very good	Very good	7 hr. -	Good	Good
Rex 471 - T 1598	Good	3rd	Very short	Fair -	6 hr. -	Good	Good
Rex 471 - P 1408	Good	2nd	Good -	Very good	5 hr. 35 min.	Good	Good
Rex 471 - N 1598	Good	4th	Very good	Very good	8 hr. 30 min.	Good	Good
Rex 471 - E - A 1428	Very good	2nd	Very good	Very good	6 hr. 35 min.	Good	Good
Acme - 122 O. S. White 1 A 122 - C 858 A	Good	2nd	Short	Fair	6 hr. 10 min.	Good	Good
Lowe Bros. 328 O.S.White 3 B 868 - 328	Good	2nd	Good	Good -	5 hr. 10 min.	Good	Good
Martin-Senour 100 O. S. White - 100 M 1488	Easy	2nd	Very good	Good	5 hr. 45 min.	Good	Good
Lawrence - 35 O. S. White - 32937 - 35	Easy	1st	Good	Good -	Over 8 hrs.	Good	Very good
Lucas - TG - O. S. White TG 260 - 5 F 1618	Easy	4th	Very good	Very good	6 hr. 55 min.	Good	Very good

*All were close in hiding.

SWP House Paint White - Rex 471

Material		Package Cond.	Settling	Stirring	Odor	Consistency	Grind	Wt./Gal.	Viscosity #3 Orif. S-W Cup
Rex 471 - O 1338 B	5-12-48	Good	Slight +	Easy**	Normal	Normal	3 H	14.7	31.2"
Rex 471 - C 1398	5-18-48	Good	Slight +	Easy**	Normal	Normal	2 H	14.6	55.5"
Rex 471 - T 1598	6-7-48	Good	Slight +	Easy**	Normal	Normal	2 H	14.57	58.2"
Rex 471 - P 1408	5-19-48	Good -	Slight* + Rather firm	Easy**	Normal	Normal	2 H	14.90	55.0"
Rex 471 - N 1598	6-7-48	Good	Slight +	Easy	Normal	Normal	2 H	14.65	42.0"
Rex 471 - E - A 1428	5-21-48	Good	Slight +	Easy	Normal	Normal	2 H	14.80	48.0"
Acme - 122 Outside White 1 A 122 - C 858 A	3-25-48	Good	Very slight	Easy	Normal	Normal	2 H	14.78	31.4"
Lowe Bros. 328 O.S.White 3 B 868 - 328	3-26-48	Good -	Slight* + Rather firm	Easy**	Normal	Normal	1-1/2 H	14.92	33.2"
Martin-Senour 100 O. S. White - 100 M 1488	5-27-48	Good	Very	Easy	Normal	Normal	2-1/2 H	14.75	32.6"
Lawrence - 35 O. S. White 32937 - 35		Good	Trace	Very easy	Perilla Oil Odor	Slightly thin	2-1/2 H	15.05	22.0"
Lucas - TG - O. S. White TG 260 - 5 F 1618		Good	Slight	Easy	Normal	Normal	2 H	14.86	33.6"

*Small amount of hard settling.

**Broke up slightly lumpy

#97 - SWP 471

Institutional House Paint Survey

Samples of SWP Gloss White were obtained from our various plants for evaluation for general performance. The paints were checked for such properties as package condition, degree of settling, ease of stirring, odor, consistency, grind, weight per gallon, etc. The brushing tests were run on beveled siding panels that had been primed previously with SWP 450 Undercoater. After application of the various house paints, the panels were inspected immediately for flow and sagging tendencies. All hiding determinations were made on contrast sheets. The white house paints were spread at 500 square feet to the gallon.

As indicated in the chart, all samples were found to be quite satisfactory in general and representative of standard production. However, there was a noticeable tendency to develop a small amount of firm to hard settling that broke up slightly lumpy. The Lawrence #35 Outside White was slightly slow in set-to-touch time, but was superior in brightness to the other production samples. The Chicago, Cleveland and Newark samples were somewhat high in viscosity.

Chart follows.

Group 3. Unsatisfactory

306 Barytes (but dirt and fade not bad).
566 Mineral Whiting (ditto; also fair at 50%). (13)
Aluminum Flake #5.
1246 Soapstone. (Very dirty color, actual performance fair to goody.
1822 Talc Dust (ditto)

(1) 2203 definitely poorer in durability at Coffeyville. Might consider for Group 2 (a).

(2) Metronite BXXXX should be noted as showing up especially well at Florida, two years white only.

(3) 2500 definitely poor at Coffeyville, both color and durability.

(4) Atomite reversed, Coffeyville as against Chicago. Durability OK, but color poor.

(5) Silica smoke definitely OK in all respects at Coffeyville. Might consider for Group 1.

(6) "B" York Limestone definitely better than Lesamite at Coffeyville. Tends to be dirty.

(7) "A" York Limestone, ditto, but slightly less dirt tendency.

(8) 2077 entirely OK at Coffeyville, both appearance and durability.

(9) 213 definitely poor at Coffeyville in all respects, might consider for Group 3.

(10) 599 reversed at Coffeyville as against Chicago, appearance (including tints) not bad, but durability definitely poor.

(11) 1989 tint-retention and clean-up OK at Coffeyville, might consider for Group 1.

(12) 1194 definitely poor at Coffeyville, check and crack. Tint retention OK.

(13) 566 definitely better rating than "Group 3" at Coffeyville. Average or slightly better.

JWC:MBH

J. W. Chapin

Paint Research Dept.

Special Report on Extenders in House Paints
Various Exposures from 7775 QS to 10818 CS
July 8, 1948

JCWeaver JUL 16 1948

Introduction

In the Report of Investigations for December, 1946, Mr. Jagd presented a listing of all inerts which we have tested in SWP formulas on outdoor exposure, classifying them as satisfactory, partially satisfactory and unsatisfactory for SWP use. This account was the result of a study undertaken because of the shortage of extender pigments in view of the 1946 emphasis on SWP production.

It was decided that this method of presentation of results would, in general, serve very well for the present report on these extender tests at approximately one additional year of exposure. However, certain details will have to be added in order to make this report serve the purpose of the usual progress reports on individual series of panels.

Rather than considering all extenders which we have ever tested, this report goes back to about March, 1944; when a comprehensive test series set the pattern for many subsequent tests. In general, these series are tested on beveled cedar siding, 2-coat work, with Rx 460 Undercoater tinted gray under the whites and white under the tints, to emphasize erosion. The panels are exposed at Chicago, north and south vertical. Practically all series consist of two parallel sets of paints, one on the prewar vehicle basis and the other bodied oil. Most series contain SWP Gloss White, Colonial Yellow and Slate formulas, with the various extenders substituted for the usual magnesium silicate on a volume basis unless otherwise specified. It is now recognized that this is not as reliable as substitution on equal binder requirements. 17 months is the minimum exposure time (two summers); 45 months the maximum to date. All panels continue on exposure.

Most of the tests are exposed also at Coffeyville, vertical south, and some at Florida. Whenever the results agree with those at Chicago, no particular comment is made. Thus, two assumptions may be made by those who scan the classification lists below:

1. The Chicago tests are considered basic (because both north and south exposures are available, and because we have actually watched the progress of these panels).

2. All items listed without footnote or special comment are "doubly sure", because they are based on concurring results from two locations.

It should be emphasized that erosion is the type of failure usually predominant at Chicago, while checking and cracking are much more characteristic of Coffeyville and Florida.

We regret having to complicate the listing by adding footnotes and comments, but this is made imperative by the wide variety in exposure conditions, etc. This also helps greatly in making this serve the purpose of the usual progress report for our laboratory use.

H. J. L. C. JUL 16 1948

Paint Research Project
SWP

JCWeaver JUL 2 1948

Inspection Trip
Exposures - National Lead Company
Titanium Pigment Corporation
du Pont Pigment Division
June 7, 8, 9, 1948

General Statement

On June 7, 8 and 9 Mr. E. W. Fasig and the writer again reviewed the various panel and/or house tests of the National Lead Company (basic silicate white lead exposures only) and the Titanium Pigment Corporation at Sayville, Long Island, and the du Pont Pigment Division at Wilmington, Delaware. In general, no outstanding new developments were observed. A considerable portion of the inspections consisted of review of progress of exposures which had been checked over previous years. For this reason, details will be omitted in some cases where reference to earlier reports will give necessary background data.

Certain general statements may be made:

1. There still are no indications of any new white pigments in the paint field or of any unusual methods of formulation not already under observation in our own exposures.

2. Each year the preference for the bodied oil type of house paint formulation becomes established more definitely, although some differences in opinion may appear as to the proportion and degree of polymerization of the bodied oil content. General better clean-up and greater mildew resistance of bodied oil formulas are definitely established.

   Current moves by some manufacturers from 3.75 to 4.25 pounds of oil per gallon seem to arise from a desire to meet our gloss rather than any deficiencies in durability.

3. The tendency of rutile titanium pigments, especially the most free chalking types such as R-200 or RA-10 MO, to show a yellowish discoloration in a white chalking paint is now recognized generally, and their use in white house paints is not recommended. The yellowing is more evident on paints with calcium carbonate extenders than with magnesium silicate, and is aggravated on 45° south exposures. It is claimed that rutile calcium pigments such as RC HT do not show this yellow discoloration.

4. Rutile titanium calcium pigments of the more free chalking type such as Titanox RC HT still show more dirt collection than would be desirable for a white house paint. The use of some anatase pigment improves the situation but does not entirely correct it.

5. Titanium Pigment Corporation has withdrawn any previous recommendations for low p.v.c. house paints which contain no extender, and in which the vehicle is neutralized with sodium hydroxide. Such paints eventually show slit cracking and tendencies to peel. They still are considering low p.v.c. paints which contain some extender, with at least a portion of the vehicle MgO - CaO neutralized bodied oil.

6. Robertson, of Titanium Pigment Corporation, favors higher titanium oxide contents, up to 20%, and prefers slower chalking Titanox AA or minimum blends of Titanox A with AA commensurate with ideas of clean-up required. Low basic carbonate white lead contents should be used, as high carbonate contents tend to keep the paint plastic and increase dirt collection. One objection which may be raised against high TiO_2 paints is that high opacity may encourage the painter to brush out the paint too far and reduce the durability through application of too thin films.

7. du Pont still does not recommend calcium carbonate extenders for white paints. For tints the dry ground R. E. Carroll York White is preferred, and usually replaces other extenders at equal oil demands, although alternate approaches are under test.

8. du Pont's tests on the use of chalk resisting titanium oxides in priming coats are very interesting and should be watched carefully. A move towards more chalk resistant TiO_2, specifically R-610 or RA NC, would seem indicated when the supply situation permits.

National Lead Company - Sayville, Long Island, New York

Only the exposures involving basic silicate white lead were examined on this trip. Panels exposed south vertical for five years, three coats self-primed on cedar show 100% basic silicate white lead in oil as having a trifle less checking than the conventional basic carbonate white lead in oil. Both are gray in cast and have not cleaned up. In mixed pigment paints exposed for the same period, a 55% basic carbonate white lead, 15% Titanox A, 20% zinc oxide and 10% magnesium silicate paint is clean but checked. When basic silicate replaces basic carbonate at equal volume, leaving the other poundages the same, the silicate paint shows a trifle less checking, but both are checked.

In the 100% straight pigment paints exposed north the basic silicate paint (at equal pigment volume) is grayer than the carbonate, showing slightly slower chalking tendencies. This is also evident on similar paints exposed for 1-1/2 years. There is considerable cracking and peeling of the mixed pigment paints on the north side of the fence after five years' exposure, definitely less with the basic silicate paint. However, the basic silicate paint looks deficient in hiding power and has more mildew than the carbonate paint. National now rates basic silicate white lead approximately equal in opacity to Old Dutch white lead, so that equal volume replacement results in some drop in hiding for the paints with basic silicate. Straight pigment paints after 2-1/2 years' exposure comparing basic carbonate white lead with lead sulfate (10 and 20% PbO) and with basic silicate white lead favor the silicate. The sulfate paint shows more peeling and the 10% PbO sample looks thin.

Replacing basic carbonate white lead with basic silicate in T.P.C.'s MW-401 exterior primer showed substantially equal performance after 2-1/2 years. Note these panels were painted around November and therefore have actually had two summers of weathering.

In TT-P-25 Paint: Exterior-Primer using 25% basic carbonate and 25% basic sulfate white lead, the replacement by volume with basic silicate of (a) the sulfate or (2) all the white lead did not affect the performance up to 2-1/2 years.

In another series out 2-1/2 years self-primed, a paint with 45% leaded zinc, 20% basic carbonate, 15% Titanox A and 20% magnesium silicate, basic silicate replacing the basic sulfate white lead and part of the zinc oxide and using XX 50 zinc oxide at 29.5% p.v.c., is in good condition after 2-1/2 years. The same is true when additional silicate replaces the BCWL. If more basic silicate is added up to equal cost there is a trifle more checking and peeling as if too much active pigment were present. This is more apparent on the north than on the south. National rates basic silicate approximately equal to basic carbonate in reactivity, and feels that at high lead contents the zinc oxide should be reduced to keep the film from becoming too hard. National thinks the order would be something like 1% zinc oxide for 2% or 3% basic carbonate or silicate white lead.

Basic silicate was used in a gray house paint with a control pigmentation of 45% leaded zinc, 20% basic carbonate white lead, 10% Titanox RA NC, 25% magnesium silicate. Exposures have run 2-1/2 years to date. Replacements were (1) 45 X basic silicate for lead sulfate at equal volume, (2) for sulfate plus some zinc oxide, (3) for carbonate and sulfate plus some zinc oxide, and (4) additional 45 X to equal the original cost, displacing magnesium silicate. Tint retention drops off slightly where basic silicate is used and some cracking has developed on Group 2 and 4 woods. Other exposures after 1-1/2 years using replacement methods (2) and (3) indicate that the total activity should be raised in the interests of tint retention, but this might also increase tendencies towards film failures due to excessive hardness.

In general, the National Lead exposures are not well executed and frequently show rather unusual failures which detracts from confidence in their results. The scope of tests covering use of basic silicate in conventionally formulated house paints is too limited to permit acceptance of their recommendations for its use in large volume sales of house paints, without prolonged testing of our own.

Titanium Pigment Corporation - Sayville, Long Island, New York

(a) Basic Silicate White Lead Series

Titanium Pigment's exposures of basic silicate white lead include Series 7953-60, exposed for almost three years. A typical 15% TiO_2 (Titanox A or RA-10 MO)/46% 35/65 leaded zinc/19% BCWL/20% magnesium silicate formulation was revised to include replacements by basic silicate for (1) basic sulfate white lead only, (2) basic carbonate only, (3) both sulfate and carbonate. The paints have the pre-war type binder with 29% p.v.c. There is less cracking when basic silicate replaces the sulfate, still better when the carbonate or both the carbonate and sulfate are replaced. When the control paint is used over MW-401 primer in which basic silicate replaces BCWL, the paint does not seem to wear away quite as fast as over the regular MW-401.

(b) Decreasing Active Pigment Series

The composition of this series has been briefed in previous reports but is repeated here because again there are definite developments. This series was started at Dr. Holley's suggestion that tests be made to see how much extender could be introduced before durability is affected seriously. The paints were first applied in 1941 and each year since, three coats self-primed on cedar and white pine. The compositions of the paints are as follows:

Pigmentation

15% Titanox AA - 46.0% leaded zinc - 19.0% BCWL - 20% Asbestine (30% ZnO)
15% Titanox AA - 42.0% leaded zinc - 17.5% BCWL - 25.5% Asbestine (27.5% ZnO)
15% Titanox AA - 38.5% leaded zinc - 15.7% BCWL - 30.8% Asbestine (25% ZnO)
15% Titanox AA - 34.6% leaded zinc - 14.7% BCWL - 35.7% Asbestine (22.5% ZnO)
15% Titanox AA - 30.8% leaded zinc - 12.6% BCWL - 41.6% Asbestine (20% ZnO)
10% Titanox AA - 30.8% leaded zinc - 12.6% BCWL - 46.6% Asbestine (20% ZnO)

Vehicle

94% Refined linseed oil - 6% Z_2 Bodied linseed oil. 85% NVM PVC - 29%

This series, still in good condition after seven years, again shows an advantage for lower zinc oxide content at high extender levels. (Note conflict with National Lead theories.) The 25% zinc oxide paint is in the best condition, followed closely by that containing 22.5% zinc oxide. All show some cracking, starting with slight at 30% zinc oxide, going through a minimum at 25%, increasing again and accompanied by erosion and checking at the highest extender levels. The last two paints become almost transparent in wet weather.

The same paints tinted show about the same sequence after seven years' exposure, with the last two at 20% zinc oxide content being inferior.

Proprietary paints exposed for the same period include SWP and Lowe Brothers High Standard, both in good condition. Montgomery Ward's paint, which evidently had very good flow, is perhaps best. du Pont's "Ti-Sil" paint is eroded, checked and cracked.

The same series exposed in 1944 and now four years old, compares 15% Titanox A with AA, and always favor AA. This is consistent with all experience showing durability improving as the chalking of the TiO_2 is retarded. All the paints except the 15% Titanox AA paints at 22.5% and 20% zinc oxide show some cracking, with erosion developing at the high extender levels. There is as much erosion on the north vertical exposures as on the south.

A similar series, exposed in 1946, repeats the same compositions but varies the titanium oxide as follows: (1) 20% Titanox A 168, (2) 15% Titanox A, (3) 15% Titanox RA 10, and (4) 10% Titanox RA 10 and 5% Titanox A. 15% Titanox RA 10 develops some yellow cast and collects some dirt, both of which are reduced by the use of 5% Titanox A. The last combination used in a paint of 33% p.v.c. with 4.25 pounds oil of which 25% is bodied oil produces a smoother film and is a trifle cleaner than the high oil formula.

(c) Grades of "Titanox" Pigments

This is a new series put out in 1947, three coats self-primed on cedar and white pine. The fundamental pigmentation is 15% TiO_2 - 46% leaded zinc - 19% BCWL - 20% magnesium silicate at 29% p.v.c. in the full oil vehicle. The titanium oxides are respectively (1) A 24, (2) AA, (3) A 168, (4) A regular, (5) RA NC, (6) RA 25, (7) RA and (8) RA 10. Titanox A is cleanest both south and north. Of the remaining anatase oxides, the order of increasing grayness is A 168, AA and A 24. RA 10 is the cleanest of the rutile oxides, not equal to A regular, followed by RA, RA 25, with RA NC showing most dirt collection.

(d) Rutile Calcium Paints

This group of exposures, also described previously, includes a series put out in June, 1943, 3 coats self-primed on cedar and white pine. The pigmentations include:

(1) 50% leaded zinc - 50% Titanox RC
(2) " " " - 25% " - 25% Titanox RC HT
(3) " " " - 12.5% " - 37.5% "
(4) " " " - 50% Titanox RC HT
(5) " " " - 35% Titanox RC - 5% Titanox A 168 - 10% magnesium silicate

(5) cleans up to some extent and has less yellow cast than (1), while (4) with 50% RC HT does not clean up, although it is better than the others in the group. All show some erosion and (2) and (3) some cracking. These are all high oil formulas at 29% p.v.c.

In 1946, a series was exposed using the following pigmentation patterns:

(1) 50% leaded zinc - 50% titanium calcium
(2) 40% leaded zinc - 50% titanium calcium - 10% magnesium silicate
(3) 40% leaded zinc - 40% titanium calcium - 20% magnesium silicate
(4) 25% zinc oxide - 50% titanium calcium - 25% magnesium silicate

The titanium calcium pigment was varied as follows:

A. 50/50 Titanox RC/ RC HT
B. 100% Titanox RC HT
C. 50/50 Titanox RC HT/Anatase Titanium Calcium

The "C" paints are always cleanest. All are quite good south vertical, but the "A" and "B" types show spotty clean-up on north exposure. Pigmentations (1)C and (2)C are preferred.

(e) Tint Base Paints

A series of gray tints put out in 1947, three coats self-primed, on cedar and white pine, is reported for future reference. The pigmentations are:

(1) 40% Titanox RC - 30% leaded zinc - 30% magnesium silicate
(2) 50% " - 35% zinc oxide - 15% " "
(3) 40% " - 30% " " - 30% " "
(4) 40% " - 35% " " - 25% " "
(5) 50% " - 40% leaded zinc - 10% calcium carbonate
(6) 50% " - 40% " " - 10% calcium sulfate
(7) 40% " - 30% zinc oxide - 30% calcium carbonate
(8) 40% " - 30% " " - 30% calcium sulfate

The paints are ground with the full oil vehicle, 85% N.V.M. and 29% p.v.c.

After one year's exposure the magnesium silicate paints show slight streaking, the calcium sulfate and carbonate paints having slightly better tint retention, with the sulfate paints showing slightly more streaking.

(f) High Pigment Volume Paints

This series, also put out in June, 1947, is also described in detail for future reference. The paints were formulated as follows:

(1) 35% leaded zinc - 35% Titanox RC HT - 30% magnesium silicate

Vehicle: 75% refined linseed oil - 25% Z_2 bodied linseed oil

77% N.V.M. 33% P.V.C.

(2) 35% leaded zinc - 35% Titanox RC HT - 30% Natural Whiting 40% p.v.c.

(3) 33% " " - 12% Titanox A - 55% " " 40% p.v.c.

(4) 35% " " - 35% Titanox RC HT - 30% " " 45% p.v.c.

(5) 33% " " - 12% Titanox A - 55% " " 45% p.v.c.

Vehicle: 50% refined linseed oil - 30% Z_4 bodied linseed oil

20% Magnesia oil. 65% N.V.M.

On south exposure, (1) shows some dirt, (2) is smoother but shows dirt collection, (3) is cleaner, (4) shows a trifle less dirt collection than (2), and (5) is the cleanest of the carbonate paints. On the north (2) is definitely dirty, (3) is cleaner and brighter, (4) shows streaky dirt collection, and (5) is cleaner with slight streaking.

(g) Low Pigment Volume Paints

A new series of low p.v.c. paints was put out in 1947, one finish coat over MW-401 primer, on cedar and yellow pine. The pigmentations are:

(1) EX-5121. 30% Titanox A - 20% zinc oxide - 30% BCWL - 20% Titanox RC HT

(2) EX-5051. 35% " - 20% " " - 35% " - 10% magnesium sil.

(3) EX-5052. 40% " - 20% " " - 30% " - 10% " "

(4) EX-5053. 50% " - 20% " " - 20% " - 10% " "

The vehicle is:

45% Alkali Refined Linseed Oil

30% Calcicoater Vehicle

25% Magnesia Oil

55% N.V.M. 21% P.V.C.

The use of inert is a change from earlier formulations. It retards the slightly excessive flow of previous low p.v.c. paints and is intended to reduce tendencies towards slit cracking. On 45° exposure low p.v.c. paints with no inerts, such as EX-4208 and 4508, described in previous reports, show severe cracking, much worse in the former.

It is obvious that low p.v.c. paints have not shown up well so far. However, at one year, the above paints are very smooth and clean both south and north, and will be watched closely.

(h) Lead Free Paints

This series was put out in 1943, three coats self-primed, on cedar and white pine. The pigmentations include:

(1) 37.5% Titanox RC HT - 37.5% Titanox RC - 25% ZZZ-33 zinc oxide.

(2) 75% Titanox RC HT - 25% ZZZ-33 zinc oxide.

(3) 25% Titanox RC HT - 25% Titanox RC - 25% ZZZ-33 zinc oxide - 25% magnesium silicate.

(4) 50% Titanox RC HT - 25% ZZZ-33 - 25% magnesium silicate

The paints are all formulated at 29% p.v.c. with the full oil vehicle. (1) shows some slit cracking and some mildew, (2) some mildew and erosion, with (3) and (4) similar to (2). (2) is interesting, as the pigmentation is similar to Devoe's new one coat house paint.

Robertson warns that lead-free paints are vulnerable in atmospheres containing SO_2, where dampness will leach out the paints, cause bad washing and transparency.

In a series put out in 1946 some 4.25 pounds of oil per gallon paints at 33% p.v.c. are compared with full oil lead-free paints at 29% p.v.c. The paints are applied one coat over MW-401 primer. The pigmentations are:

(1) 15% Titanox A - 30% zinc oxide - 55% magnesium silicate. 29% p.v.c.

(2) 15% " - 30% " - 55% " " 33% "

(3) 50% Titanox RC HT - 5% Titanox A - 30% zinc oxide - 15% magnesium silicate. 29% "

(4) 50% Titanox RC HT - 5% Titanox A - 30% zinc oxide - 15% magnesium silicate. 33% "

All are in good condition at this point, except for cracking of paint (1) on one bad board.

(i) Washing Tests

This series was started in June, 1947, three coats self-primed on cedar, to check the washing tendencies of various white house paints. This characteristic is checked by running a beveled siding painted black under each white paint. The formulation of each paint and its current washing status is as follows:

(1) 100% Basic Carbonate White Lead, in regular vehicle. Very slight washing.

(2) "Ti-Sil," 50% leaded zinc - 50% Ti-Sil, in regular vehicle. Definite washing.

(3) 15% Titanox A - 38.5% leaded zinc - 15.7% BCWL - 30.8% magnesium silicate, in regular vehicle. Definite washing.

(4) Pigment as (3) but 33% p.v.c. Definite washing.

(5) 20% Titanox AA - 38.5% leaded zinc - 15.7% BCWL - 25.8% magnesium silicate, in regular vehicle. Very little washing.

(6) 30% Titanox A - 30% zinc oxide - 40% BCWL at 21% p.v.c. Definite washing.

(7) 15% Titanox A - 35% zinc oxide - 50% magnesium silicate, in regular vehicle. Slightly less washing than (6).

(8) 15% Titanox AA - 35% zinc oxide - 50% magnesium silicate, at 33% p.v.c. Very slight washing.

(9) 50% Titanox RC HT - 40% leaded zinc - 10% magnesium silicate, in regular vehicle. Very slight washing, - has adherent chalk.

(10) 25% Titanox RC HT - 25% anatase titanium calcium - 40% leaded zinc - 10% magnesium silicate, in regular vehicle. Slight washing.

(11) 50% Titanox RC HT - 25% zinc oxide - 25% magnesium silicate, in regular vehicle. Very slight washing.

(12) SWP Gloss White - oil conservation vehicle. Definite washing.

(j) Sherwin-Williams Cooperative Tests

This series has now been on exposure for two years, and represents both S-W and T.P.C. paints which were exchanged for cooperative exposure at Sayville and Chicago. This is a very complicated series and will be handled in a separate report at such time as worth while results develop.

At the present time the paints at Sayville with regular percentages of Titanox A are the cleanest and brightest, both south and north. The rutile titanium oxide paints show their characteristic yellow cast, but this is reduced although not eliminated when a 50/50 blend of RA 10 and Titanox A is used. When titanium calcium pigments are used, the paints become whiter and cleaner as they progress from Titanox RC HT through blends to anatase titanium calcium.

In the tints, the S-W tints are cleaner than the T.P.C. tints. Micro Velva substituted for magnesium silicate shows little difference except for less mildew.

du Pont Pigment Division - Wilmington, Delaware

Before the actual inspection of panels, a discussion was held on du Pont's proposed house paint exposure program. The original "Ti-Sil" formula will be exposed at 4.89, 3.75 and 4.25 pounds of oil per gallon. The 4.25 pound formula is added to anticipate interest in such paints in the future, and not because of any lack of quality in the 3.75 pound "bodied oil" paints. The formulas are repeated using both Krebs' Drier "P" and naphthenate driers. The latter usually require the addition of a puffing agent such as Syntex RL-80.

These paints are then repeated using York Whiting at equal oil demands. Another group involves similar treatment of a lead-free pigmentation, 19.5% Ti-Pure FF - 42.3% acicular zinc oxide (ZZZ-33 or XX-601) - 38.2% magnesium silicate. Lead-free paints are more susceptible to drying troubles. Another formula, 10.4% Ti-Pure FF - 10.4% Ti-Pure Y-CR - 49.2% leaded zinc - 30% magnesium silicate, shows an attempt to control chalking at high TiO_2 levels by using some of the slower chalking Y-CR. The basic tint formula is 12.5% Ti-Pure R-610 - 45% leaded zinc - 42.5% magnesium silicate, to which is added a lead-free tint base, 11.2% Ti-Pure R-610 - 26.4% acicular zinc oxide - 62.4% calcium carbonate. Most of these involve the drier variations and extender replacements described in the first set. We propose to cover these and additional ideas during this summer's exposure work.

(a) Ti-Pure FF in White House Paints - Cleaning

The basic pigmentations in this series compare 10% TiO_2/45% leaded zinc/22.5% BCWL/22.5% magnesium silicate with the typical "Ti-Sil" formula, 15% TiO_2/50% leaded zinc/35% magnesium silicate. In each group the TiO_2 used is successively FF, R-200, Y-CR and R-110. The exposures were made in both the pre-war vehicle, 92%/8% alkali refined linseed/Q bodied linseed, and the bodied oil type. Those put out in 1943 carried 50% of Z_4 bodied linseed but those put out in '44 and '45 and '46 carry 50% of X bodied linseed to improve brushing. Exposures are both south and north vertical.

The groups put out in 1943, 1945 and 1947 were inspected to get the picture after 1, 3 and 5 years' exposure. Ti-Pure FF showed better self-cleaning properties than R-200, Y-CR or R-110, the differences being more definite in the 22.5% BCWL than in the "Ti-Sil" formulas. The latter were always cleaner, showing the greatest advantage during exposures from 7 to 15 months. The current bodied oil formulas showed a definite advantage in clean-up. Ti-Pure Y-CR or Titanox AA show maximum dirt retention at two years. Ti-Pure Y-CR and R-110 show more mildew, especially where no BCWL is used, and the bodied oil paints show much greater mildew resistance than the pre-war full oil paints. Calcium carbonate accentuates yellowing of rutile TiO_2 paints but reduces mildew compared with magnesium silicate. This is further emphasized in another series out four years. In this group Titanox RC HT and RC show bad dirt collection and mildew.

In a series exposed in 1945, R-200 and RA-10 MO are compared at 12.5% versus Ti-Pure FF and Y-CR at 15% in the "Ti-Sil" paint. In the oil rich paints, FF makes the only really white paint at two years' exposure, RA-10 MO, R-200 and Y-CR show bad dirt on north exposures, with the last named worst. Again the bodied oil paints are much cleaner. du Pont now do not recommend the use of any rutile titanium oxides in white finish coat house paints.

(b) Lead Free House Paints - Whites - Cleaning

The first of two groups examined was put out in 1945, and include the following pigmentations exposed in the full oil vehicle at 28.5% p.v.c.:

15%	Ti-Pure FF	- 50%	leaded zinc		- 35%	magnesium silicate	
16.5%	"	- 35.7%	acicular zinc oxide		- 47.8%	"	"
18.1%	"	- 39.4%	"	"	"	- 42.5%	"	"
18%	"	- 36%	"	"	"	- 46%	"	"

The second group was put out in August, 1947 and therefore now represents almost one year of exposure. The pigmentations and vehicles include:

	% P.V.C.	
	Oil Rich	Oil Restricted
15% Ti-Pure FF - 50% leaded zinc - 35% magnesium silicate	28.5	34.9
17.2% " - 37.3% acicular zinc oxide - 45.5% magnesium silicate	27.4	33.5

The lead-free zinc oxide formulations are superior to the leaded zinc oxide paints in cleaning characteristics. The one year old exposures actually look good both south and north. It should be noted that lead-free zinc oxides of the acicular type have higher oil demands than co-fumed leaded zinc oxides. Therefore, the lead-free paints were formulated at slightly lower p.v.c. to maintain approximately equivalent free binder relationships.

(c) Calcium Carbonate Extenders in House Paints

This series has been covered in detail in previous reports (see page 5, 1946 report and page 6, 1947 report), and the fundamental conclusions remain the same now after six years' exposure.

1. Ground limestone (York White) gives the best durability of the calcium carbonate samples tested, but is inferior to magnesium silicate.

2. Calcium soaps lead to poor durability and should be eliminated as far as possible. Low oil absorption, low reactivity, natural calcium carbonates are preferred. Precipitated carbonates are inferior in durability.

3. Mica (10%) can be used to correct checking and cracking tendencies introduced by calcium carbonate.

4. Durability differences are much wider in whites than in tints.

5. Calcium carbonate is more resistant to mildew than magnesium silicate.

As incidental remarks it may be added that diatomaceous silica looks very good among the other extenders tested, also Eastern Magnesia's 500 Talc. It should be recalled that this series, started in 1942, covered a replacement of magnesium silicate at equal volume in the pre-war vehicle, at 28.5% p.v.c.

Substitution of calcium carbonate for magnesium silicate at equal oil demands is preferred. Special methods of substitution discussed on page 14 of the 1945 report and page 6 of the 1946 report show no mildew on calcium carbonate at equal oil demands for magnesium silicate, but mildew at equal volume replacement. In general, extenders should be compared with equal free binder. The preferred method is to control consistency by adjusting extender against total vehicle.

Calcium carbonate paints with high zinc oxide contents show dirt collection on whites. Tint retention in grays is definitely better with carbonate extenders, but should be watched as dirt retention also increases. Terra Alba is slightly superior to magnesium silicate in tint retention but shows tendencies to collect dirt and mildew.

(d) Two Coat Systems - Durability

This series is becoming more interesting as time progresses and some details from earlier reports are repeated here for clarity. The paints were exposed in August, 1945, using the "Ti-Sil" 15% Ti-Pure FF - 50% leaded zinc - 35% magnesium silicate pigmentation as the basic pattern. The paints were applied as three and two coat self-primed systems and over four commercial primers as well as a tint base paint, 12.5% Ti-Pure R-610 - 45% leaded zinc - 42.5% magnesium silicate.

The two coat systems in general are not as durable as the three coat systems. When the "Ti-Sil" top coat is used over the special R-610 primer, this two coat system almost equals three coats of "Ti-Sil" self-primed. Again this is interesting and is being covered in our own set of exposures. It is claimed that when the primer coat carrying R-610 is exposed due to erosion of the top coat, there is no tendency for the chalk to take on the rutile yellow cast. R-200 should be avoided in undercoats for this reason. (Note: Rex 450 should be revised to eliminate 2173 or 2269 and to use 2229 or 2174 when stocks permit.)

(e) One Coat House Paints

du Pont feel that the exposures since 1945 of a 25% Ti-Pure FF - 50% leaded zinc - 25% magnesium silicate paint offer considerable promise as a one coat house paint. The preferred formula is that in the bodied oil vehicle at 35% p.v.c. This paint carries 2.22 pounds TiO_2 per gallon and was spread at 450 square feet per gallon. The principal trouble in one coat application is flashing and the problem of applying uniform film thickness in one coat. Durability, of course, is controlled to a large extent by film thickness.

If such a one coat paint were used as a primer on new wood, it was suggested that oil be added rather than thinner, as the lower p.v.c.'s look better on bare wood.

(f) Special Oils

This heading includes a number of different series in which special oils were used, and which were placed on exposure from 1944 through 1947. Without going into detail, in "Ti-Sil" or similar paints Drisoy A, ASV #4 and Ardol show up well for the two years the tests have run so far. A dehydrated castor oil paint at 35% p.v.c. is showing objectionable cracking failure. We found that using Dehydrol as the bodied oil portion of the SWP vehicle, or 40% of the binder, durability was satisfactory but there is a tendency towards loss of gloss due to surface wrinkling if too much conjugated oil is used.

Low p.v.c. paints following Titanium Pigment's pattern show early film failure where sodium hydroxide and lime neutralized oils were used.

Some special comments should be added. The Department of Agriculture's conjugated soybean oil used 100% as the paint binder was very poor. The Conjulin oils were not too good. Zinc-free paints with conjugated oils show erosion. Special lead and zinc-free paints look good with some conjugated oils. For example, 100% ADM copolymer oils show checking failure with conventional pigmentations but none in the lead and zinc-free types. Such a pigmentation would be 1.8 pounds Ti-Pure FF to 35% p.v.c. with magnesium silicate or 50/50 magnesium silicate/Mineralite.

Unbodied Kelvitol gives a thin film, Kelvitol bodied to Z and to Z_5 gives much more durable paints. Linogel gives thin films on exposure. In general bodied oils out-perform parallel unbodied oils. P.E. soya oils look promising.

(g) Porch Paints

du Pont put out an extensive new series of porch paints in February of this year, on the 45° fence and also on a board walk at the Newport laboratory. Ti-Pure R-610 is used alone and with various extenders in a very wide variety of vehicles, and these are compared with a number of commercial porch paints.

The tests will be watched carefully and details discussed when significant results appear. At the moment it appears that best gloss is obtained when all extender is omitted. Surfex is helpful in giving uniform gloss in one coat. Vinyl coatings are already cracking on the wood.

Soya lecithin used as 1% by weight of the pigment and included in the grind gave marked improvement in suspension characteristics as tested in several vehicles. In several instances the soya lecithin was effective as an anti-flooding agent. Alkyd vehicles are generally superior in gloss and tint retention.

(h) House Tests

Some of the house tests examined have been described in previous reports which may be consulted for further detail.

1. du Pont House. Wilmington, Delaware.

The test paints on this house were discussed in detail in the 1946 report. The conventional "Ti-Sil" pigmentation is the cleanest and brightest, better in the bodied oil vehicle than in the pre-war high oil binder. When calcium carbonate replaces the magnesium silicate and total vehicle to equal consistency, there is more dirt collection. When terra alba is used in the same manner, the paint shows the least chalking of the group and shows bad streaking under the windows. A paint pigmented with 17.5% Ti-Pure FF - 44% acicular ZZZ - #33 zinc oxide - 38.5% calcium carbonate in OKO M 2-1/2 linseed oil at 40% p.v.c. shows streaked dirt collection not as bad as the terra alba paint.

When R-200 TiO_2 is used instead of FF there is a distinct yellow discoloration but this is not as definite as during our 1947 inspection.

2. Tarring House. Newark, Delaware.

This house compares the conventional "Ti-Sil" pre-war paint with a special, 40% Ti-Cal R 25 - 50% leaded zinc - 10% magnesium silicate. The house was painted in June, 1946. There is a definite difference in dirt collection, the FF paint being superior to the R 25 paint, and the latter is more yellow in cast.

3. Wood House. Newark, Delaware.

This house, painted in August, 1946, compares the "Ti-Sil" pigmentation in a 3.75 pound oil vehicle (50% alkali refined linseed, 50% X viscosity bodied linseed), with a lead-free 18.1% Ti-Pure FF - 39.4% ZZZ-33 zinc oxide - 42.5% magnesium silicate pigmentation in the full oil formula at 28.5% p.v.c., and the conventional "Ti-Sil" formula (full oil vehicle). The "Ti-Sil" bodied oil formula is the cleanest, not equalled by the "Ti-Sil" conventional formula or the lead-free paint with full oil.

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As usual, the National Lead Company, the Titanium Pigment Corporation and the du Pont Pigment Division extended us every courtesy and assistance to make our inspection trip enjoyable and instructive.

MVL:AR

M. VAN LOO

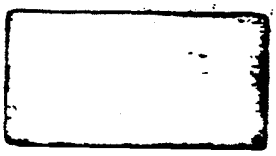
Director of Paint Research

To the Technical Information Mailing List:

July 8, 1948

Mr. Chapin's special report of the current status of exposures of various extenders in house paints is being distributed to the Technical Information Mailing List because of potential general interest. Many of the exposures have attained sufficient length of exposure so that replacements can be made, when necessary, with a considerable degree of reliability. Further reports will follow as other extenders show final results.

M. VAN LOO



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study of Chicago ratings discloses no trends from the normal in dirt. Only one paint is in any way unusual: (1273) - "bis" bodied (1273) shows a peculiar checking at Florida and rather heavy dirt at Chicago up to one year, but cleaning up rather suddenly to as good a rating as the others.

A test was completed at 12427 S. Stewart Avenue, Chicago, on a house which had been painted as a test job in July, 1944. The house was in good condition, except for areas on the front and rear porches where trouble with blistering had always been encountered. These areas were burned off, and the rest of the house thoroughly scraped, cleaned with steel wool and spot-primed where necessary. Regular Rex 450 Undercoater, C 1488 B, was used as primer over all. Areas on the east, south and north sides were top-coated with RB-2350, testing 4.25 pounds of oil per gallon as against the regular Rex 471, C 1668 (supervised factory batch), using 3.75 pounds of oil, which was applied on the balance of the house. The painters, both semi-skilled, favored the RB-2350 as slightly easier brushing. There is no difference in whiteness, and general appearance is good throughout, but the special does show a slightly higher gloss.

Spreading rates were estimated on the basis of entire amounts of each paint used, and ran rather low, but uniform: 463 sq. ft. per gallon for Rex 450, 470 for Rex 471 and 479 for RB-2350.

Porch and Floor Paints

Panels 12792 - 801 C and F and were prepared for exposure during the month. These compare various Porch and Floor enamels based on the regular vehicles, (6173) and (4950)G, AV 170 and (2841)G, and specials including an alkyd combination of (4100) and (4103), also 15 and 18 gallon length "A resin" varnishes based on various oils. They will be exposed 45° south at Chicago and Miami .

#97 - Cont.

Exposures 9246-75 C, F were examined after approximately three years' vertical south exposure at Chicago and Florida. The tests cover Pittsburgh's Selected Soya Oil CW (2035) in both Rex 471 SWP Gloss White and Rex 375 Colonial Yellow. The coverage is very complete, as both pre-war and bodied oil type formulas are used, and the soybean oil is substituted for linseed (2), for (48) and for all the oil, the CW (2035) having been kettle-bodied for this purpose. Further, the same sort of substitutions are tested in Rex 450 Undercoater, so that some soybean oil appears in both coats. The variations are all minor, and general performance of the soybean oil is good. One consistent trend, though slight, is that of greater dirt due to the soya; this shows up more in the cases where both coats contain the CW (2035). Erosion at Chicago is quite noticeable but there seems to be no trend due to the special oil. In some cases, there may be slightly greater fading due to the soya.

Exposures 10416-35 F, C were examined after approximately two years at Florida, vertical south, and Chicago, north and south. All are cedar beveled siding, primed with Rex 450 Undercoater tinted gray to emphasize erosion. Details of oil replacements are too complex to present here. Basically, both (48) and all oil are replaced in Rex 471 SWP Gloss White of 10-4-43 (bodied oil type, 50/50 rutile/anatase TiO_2). The oils involved are:

Pittsburgh's #200 linseed, as is, regular bodied and "bis" bodied.*

Pittsburgh's CW (2035) linseed, as is, regular bodied and "bis" bodied.**

Linseed, S-W batches, linseed, as is, regular bodied and "bis" bodied.

(1273) soya, regular and "bis" bodied.

Cook's raw and bodied soya (separately and together, but not with other special oils).

(3017) light Dehydrol, part and full replacement.

(2325) heavy Dehydrol, for (48).

*Selected Linseed **Selected Soya

There is very little choice as to durability and not much more as to general appearance at any of the three locations, and the general acceptability of treated and selected soybean oils is indicated throughout. A study of all available past readings shows that all Florida panels rating appreciable dirt in early stages contained soybean oils, but also other soybean oils were clean, and not all non-soya types were clean. A similar

#97 - SWP 471

Paints were prepared for exposure to study the behavior of Myvoil 2, soybean oil molecularly distilled and stripped of its sterols, carotenoids and other non-glycerides by Distillation Products Company. The Myvoil was used to prepare (3316) and (48) (50/30/20 version). The paints are regular SWP Gloss White formulations except that the (48) portion is successively all linseed, RB 8557 50/30/20 linseed/(1273)/CWO, RB 8558 50/30/20 linseed/Myvoil/CWO, (3316) regular and CTV 5007 80/20 (1273)/CWO, CTV 5008 80/20 Myvoil/CWO. Two additional bodied oils were included; RB 8936 90/10 (1273)/CWO and RB 8937 75/25 (1273)/(2325).

Panels 12914-29 CS, CN and F were prepared for exposure during the month. The paints are a repeat of an earlier study of the use of bodied soybean oils in SWP. The oils are used for the bodied oil portion of the binder and were supplied at Z_2-Z_3 bodies by Resin Research under the following designations:

New No.	Old No.	Description
RB 8474	CV 7027	"Bis" bodied soybean oil
8471	7028	SO_2 bodied soybean oil
8472	7029	Catalyst bodied soybean oil
8473	CTV 584	80/20 (1273)/(140) bodied oils
8477	570	PPG SP 500 soybean bodied

Earlier tests along this line were painted out during winter months at relatively low temperatures, and especially in tints showed a tendency to hold dirt compared to all linseed paints. The new paints, whites and Geneva Cream tints and including linseed paints, were applied under favorable drying conditions at this time, and will be repeated in the fall at temperatures in the vicinity of 50° F. Exposures will be south and north vertical at Chicago and south vertical in Florida.

Panels 12802-35 CS, CN and F were prepared for exposure during the month. The paints represent alkyd type house paints made from vehicles submitted by Resin Research. They were applied self-primed, over Rex 450 SWP Undercoater and as repaints over weathered SWP. (4106) gave a paint which had slightly sticky brushing while the other experimental alkyds all produced definitely sticky brushing. The repaint panels will be exposed south vertical in Chicago only, the others south and north vertical at Chicago and south vertical in Florida.

#97 - Cont.

A house test was completed at 10508 S. Christiana Street using basic silicate (National's 45 X) plus 414 leaded zinc for the lead and zinc content of Rex 471. The zinc oxide was replaced on an equal weight basis while the lead substitutions were on a volume basis. The finished job looks excellent although the silicate-414 paint has a yellowish cast compared to regular Rex 471.

Warm storage tests have been in progress for approximately one year to check the granulation tendencies of Octoate, Hexogen, Naphthenate, X-507 and D-121 lead driers in pre-war and bodied oil SWP formulations. The driers as listed were introduced on an equal metal basis, equivalent to the lead content of each formulation.

1. Lead Octoate (24% metal)
   Frederick A. Stresen-Reuter, Inc.

2. Lead Compound X-570 (28% metal)
   (Non-naphthenic; made with vegetable oil acids)
   Nuodex Products Co.

3. Lead Hexogen (24% metal)
   Advance Solvent and Chemical Co.

4. Lead Naphthenate (10% metal)
   Stock sample (4230)

5. Nuodex Compound D-121 (24% metal)

Condition of SWP Samples

Batch	Formula	Lead Drier Used	Granulation at 5 Months	Granulation at 10-1/2 Months
OJ 137 L	4-8-42	Lead Naphthenate (4230)	OK	OK
OJ 133 L	"	Octoate (24% Pb)	OK	Very slight
OJ 134 L	"	Hexogen (24% Pb)	OK	Slight
OJ 135 L	"	Compound X-507	OK	OK
OJ 182 L	"	Compound D-121	-	Slight (9-1/2 Mo.)
OJ 136 L	6-15-48	(4230)	OK	Very slight
OJ 100 L	"	Octoate (24% Pb)	OK	Considerable
OJ 102 L	"	Hexogen (24% Pb)	OK	Considerable
OJ 101 L	"	Compound X-507	OK	OK
OJ 183 L	"	Compound D-121	-	OK (9-1/2 Mo.)

#97 - SWP 471

Mr. E. W. Fasig and Mr. Van Loo inspected the panel and/or house tests of the National Lead Company (basic silicate white lead house paints only) and the Titanium Pigment Corporation at Sayville, N. Y. and of the du Pont Pigment Division at Wilmington, Delaware. A report was prepared and distributed.

Exposures 10518-39 CS, CN and F were examined after two years' exposure south and north vertical at Chicago and south vertical in Florida. The paints involve studies of basic silicate white lead (both National and Eagle-Picher) where basic silicate replaces (1) lead sulfate at equal volume, using XX 503 zinc oxide for 412 dry, (2) replacing basic carbonate white lead in a conventional 30% lead - 30% zinc oxide - 15% TiO_2 - 25% extender top coat pigmentation. Basic silicate was also substituted for equal volume of lead carbonate in Rex 450 and in MW-401 zincless primer.

The Chicago panels are difficult to evaluate because of the general cleanness even on the north. The principal failure is erosion. The SWP top coats made with basic sulfate white lead are the most pronounced in this respect. In general the MW 401 primer is inferior to Rex 450. National's 45-X basic silicate white lead gives poor results in MW 401. In the straight top coat comparisons, there is very little choice as to the special materials.

The Florida panels are much more varied in results and the major conclusions must be based on them; this applied to dirt as well as film integrity. Rex 471 with Rex 450 normally looks bad in this series because of a spotty surface flaking (poor clean-up). Eagle-Picher's material almost invariably cleans up without this prolonged spottiness, but while National's is just as clean in some cases, it is no better than the regular in other cases. Both show a "yellow" film, however, and are not satisfactorily white. The only cases of serious failure (more than a very slight microscopic cracking) are found on paints which contain Eagle-Picher and National basic silicate substituted for the basic sulfate content of the leaded zinc oxide normally contained.

Here again basic sulfate white lead shows up poorly when substituted for the BCWL normally contained. Paints in which the basic silicates have been used to replace the BCWL continue to perform equally well with the standard SWP. This difference in performance may possibly be ascribed to the use of a pure zinc (XX 503) in the first case and a co-fumed leaded zinc in the second.

In the Florida exposures MW 401 is only very slightly inferior to Rex 450 and the silicates in MW 401 are equivalent at this inspection to BCWL.

#97 - Cont.

RB 8557 - Regular (48) based on 100% (44).

Body - 50"
A.V. - 6
Color- 8

RB 8558 - Special bodied Myvoil #2

Body - 51"
A.V. - 7
Color- 8-9

The paints made with the Myvoil liquids were similar in brushing, flow and drying properties to the regular SWP batches made with standard oils CTV 5007, regular (3316), and RB 8557, regular (48). Additional paints are to be made on a tint base formulation to be exposed along with the whites at Chicago and Florida.

SWP Gloss White (Bodied Oil Tests)

Batch	Bodied Oil Under Test	Viscosity #3 Fresh	Viscosity #3 O'Nite	Drying Time Set-to-touch	Drying Time O'Nite	Brushing	Flow	Gloss
983 L	Std. (48) (all linseed)	20"	20"	5 hr. 40 min.	Good	Good; slightly free.	Good	Good
980 L	RB 8558	19.2"	27.4"	4 hr. 18 min.	"	"	"	Good -
979 L	RB 8557	18"	21"	4 hr. 15 min.	"	"	"	"
984 L	(3316)	21.2"	28"	4 hr. 13 min.	"	Good	"	Fair
981 L	CTV 5007	18"	21.8"	4 hr. 15 min.	"	Good; slightly free.	Good -	Fair
982 L	CTV 5008	19"	22.6"	4 hr. 35 min.	"	"	"	"

#97 - SWP 471

Plant grinding trials have been made to evaluate R. T. Vanderbilt's Nytal #300. This material was substituted for the extender portion in SWP White and tint base formulas. Reference tests were made using 20 F and the 2201/2203 Metronite/Carbola Talc combination.

One mixer was made using each extender and an aliquot part of the paste was reduced in the laboratory to check the characteristics. Results are tabulated below:

Rex	Date	Inert Pigment	Mill	Rate	Paint Characteristics Grind	Visc.	Gloss
496	5-21-48	2201/2203	3-roll	257 GPH	OH	45" +	Low
"	"	20 F	"	240	OH	51" +	"
"	"	Nytal 300 - CW 2748	"	240	1-1/2 H	37"	Good
465	5-26-48	2201/2203	3-roll	257 GHP	1-1/2 H	28"	Good
"	"	20 F	"	257	1 H	38.8"	Fair
"	"	Nytal 300 - CW 2748	"	280	2 H	22"	VG
471	5-24-48	2201/2203	Premier	330 GHP	1 H	24.6"	Fair
"	"	20 F	"	330	1/2 H	25.8"	Low
"	"	Nytal 300 - CW 2747	"	300	1-3/4 H	20.4"	Good

Summarizing the above tests, it may be concluded that Nytal 300 is easier to grind than either of the reference materials. The Paint Research Report for April, 1948 reported results of similar tests made in the laboratory. The low consistency characteristics of Nytal 300 would exclude an acceptance of this material as a direct alternate for 20 F or 20 L. It could be used with a small portion of high consistency extender. Microscopic examination shows Nytal 300 to have a crystal structure similar to 20 F except that it is more uniform for size. The coarse particles are not as coarse, while the fines seem to be almost completely absent.

The Resin Research Department has submitted the following bodied oils for evaluation in SWP Gloss White.

CTV 5007 - 1 part (140), 4 parts (1273)

Body - 50" G-H
A.V. - 5.5
Color 6.7

CTV 5008 - 1 part (140), 4 parts Myvoil #2

Body - 50" G-H
A.V. - 4.4
Color 5.6

(Cont.)

#97 - Cont.

A final report was written on exposures 6241-4 C, Cof., exposed 53 months at Chicago and at Coffeyville, vertical south. The panels test W 2068 safflower seed oil in paint S-71-B-25 sent us from Cleveland Technical Service. The control paint (not applied in the usual 1/3 guide manner) is regular Rex 471 of 10-27-41, while S-71-B-25 is the same with all the (5091) replaced by W 2068. The paints are tested both as 2 coats self-primed (first coat reduced) and over Rex 450 Undercoater. The group represents a very unusual example of variation in performance between Coffeyville and Chicago exposures, showing a complete reversal of durability. The safflower tests are relatively very poor at Chicago due to erosion and subsequent cracking, while at Coffeyville the safflower shows up much better than the regular, which shows very bad checking and cracking. Rex 450 priming gives considerable improvement. Since the poorest showing of the safflower paint is at least as good as the poorest showing of the regular paint, we must consider it to have possibilities.

Some time was spent in preparation for a talk by M. Van Loo before the 25th anniversary meeting of the Division of Paint, Varnish and Plastics Chemistry of the American Chemical Society, on the subject, "Twenty Five Years of Paint Testing."

#97 - Cont.

Group 2 (a). Not satisfactory, primarily because of low durability.

8 dry China Clay	Southwark Gilder's Whiting
2500 Suspenso Whiting	"R" York Ground Limestone
2247 Atomite	"A" York Ground Limestone
1817 Surfex	A.S.P. Clay #1
3 dry Silica Smoke	A.S.P. Clay #11
10 dry Lesamite	A.S.P. Clay #4

Group 2 (b). Not satisfactory, primarily because of fading or dirt.

2077 Celite	1989 Microne Talc (O.K. in later stages)
213 Blanc Fixe	2198 Georgia Clay
CW 1875 Micronized H.O.A. Asbestine	"E" Grade Ground Limestone
599 Barium Carbonate	1194 Ground Limestone

Group 3. Unsatisfactory

306 Barytes	Aluminum Flake #5	1246 Soapstone (Color very bad, but performance fair.)
566 Mineral Whiting		1822 Talc Dust (Ditto)

Panels 6136-49 C, Cof. were examined after approximately 4-1/2 years at Coffeyville and at Chicago, vertical south, cedar beveled siding. The main interest was in zincless primers and top coats. Titanium Pigment Corporation's MW-401 zincless primer used with two special zincless top coats shows good durability under Chicago conditions (erosion the main failure pattern) but poor durability at Coffeyville and serious dirt collection. When tinted, these zincless top coats are definitely inferior to orthodox white formulas tinted (disregarding regular tint bases) in both durability and appearance. These specials consist of BCWL, magnesium silicate and Ti-Pure 51 in a resin-modified vehicle, with one of the two carrying about 8% mica, which gives little if any advantage.

#97 - Cont.

A comprehensive report was finished during the month covering all exposures on house paint extenders. Only the highlights can be presented here. Most of these tests are at two locations, on the usual cedar siding, and represent 100% substitutions by volume of nearly all recognized extenders in both pre-war and bodied oil type formulas. Undercoaters, all Rex 450, are tinted gray under the whites and white under the Slate and Colonial Yellow tints, to emphasize erosion. Exposure times range from 17 months (2 summers) to nearly 4 years, practically all the more commonly known materials being in the longer exposure category. Following a classification used in the Report of Investigations for December, 1946, which was based on much less conclusive data, the extenders are rated as shown below. We are necessarily omitting some special notes having to do mainly with more or less conflicting results at the two locations involved.

Group 1 (a). Satisfactory in all respects.

20 L, 20 F, 20 MSX	Pyrax B (poor grinder)
2203 Carbola Talc	Pyrax HP (poor grinder)
2201 Metrolite BXXXX (if used with 2203 dry)	1179 Water Ground Mica (7 to 10%)

Group 1 (b). Satisfactory, but short exposure, durability not fully established.

Asbestol Filler*	Oolitic Calcium Carbonate*
Fibrene C*	Cook's Sno-Float Whiting*
Warm Springs Talc*	Talc #41
Velvatone*	Talc #42
Royal Talc*	Talc #49
Micro-Nite*	Talc RC-500

*These items might be considered for Group 1 (a), as recently reported. Florida results at 2 years show all of them in good condition.

#97 - Cont.

The R. T. Vanderbilt Company submitted a sample of Nytal #300 magnesium silicate to be evaluated for general performance in SWP. This inert was compared with regular 20 F on an equal weight basis and the paints checked for grinding time, viscosity, flow, brushing, etc.

As indicated below, two runs were made. In each run Nytal #300 was found to be easier to grind than 20 F. The Nytal #300 batches were somewhat low in body, but the paints had good brushing, flow and gloss characteristics. Based on these initial tests, it appears that a small amount of a high consistency extender may be required to equal the body obtained with 20 F dry in SWP. R. T. Vanderbilt are now planning to supply the Chicago plant with 900 pounds of standard good color Nytal #300 for a plant batch of Rex 471 and 2700 pounds of Nytal #300 which is slightly off color, to be used in SWP tints.

Nytal #300 in SWP

Batch	Inert	Grinding Time	Grind	Viscosity #5 Fresh	Viscosity #5 O'Nite	Brushing	Flow	Gloss
OJ 830 L	20 F	7' 20"	2 H	24"	34"	Good	Good	Good
OJ 831 L	Nytal #300	6' 10"	3 H	17"	21"	Slightly free	Very good	Very good
OJ 830 L Repeat	20 F	9' 35"	2-1/2 H	30"	31.6"	Good	Good	Good
OJ 831 L Repeat	Nytal #300	6' 10"	2-3/4 H	20"	20.2"	Slightly free	Good	Very good

The Chicago Varnish Department submitted a sample of Dorwart and Sons' 80/20 Soya/CWO bodied oil for comparison with a sample of (3316) in SWP. The paints were checked for brushing, flow, drying and gloss characteristics. The sample made with Dorwart and Sons' oil was high in body, short in flow and somewhat slower in drying.

	Bodied Oil	Paint Viscosity Fresh	Paint Viscosity O'Nite	Brushing	Flow	Gloss	Drying Set-to-touch	Drying O'Nite
OJ 828 L	(3316)	25.4"	30.4"	Good	Good	OK	6 hr. 55 min.	Good
OJ 829 L	Dorwart and Sons' 80/20 Heat Bodied Oil.	47"	54" + 1/8 cup	Sticky	Short	Low	7 hr. 5 min.	Good

#97 - SWP 471

Comparative label analyses plus weight per gallon measurements on samples of competitive house paint, undercoater and top coats, reveal that wide differences exist between the products being offered by the various manufacturers. du Pont, Devoe, Pittsburgh, National Lead, and Sherwin-Williams are compared.

Undercoaters

Lead contents range from 3-1/4 to 4-3/4 pounds per gallon, with the exception of Pittsburgh undercoater, which carries no basic carbonate white lead, and only 1.20 pounds basic sulfate white lead. Zinc oxide is present as 10% of the Sherwin-Williams pigmentation and as 30% of Pittsburgh's pigment. National and Devoe use resin in the vehicle but no zinc oxide. du Pont use neither resin nor zinc oxide. TiO_2 ranges between 1.0 and 1.5 pounds per gallon in all paints. Magnesium silicate plus other extenders range between 2-3/4 to 4 pounds per gallon of paint.

Finish Coats

Finish coats present a somewhat more uniform picture than do the undercoaters. The lead contents vary from 1-1/2 to 4 pounds per gallon, with the average about 2-1/4 pounds. Zinc oxide varies from 2 to 5 pounds, and titanium oxide varies from 1 to 1-7/8 pounds per gallon. Magnesium silicate contents range from 2 to 3-1/2 pounds per gallon.

Vehicles with controlled penetration properties are used by Pittsburgh, du Pont and Sherwin-Williams. Devoe's paint is intermediate and National's Dutch Boy House Paint performs as though it were an all raw oil vehicle.

Comparing the paints for opacity it was found that du Pont and Devoe are substantially low, with National, Pittsburgh, and Sherwin-Williams all about equal. Draw-downs of each of the products show all the competitive materials to be low in gloss. This was probably due to poor dispersion since all rated 0 Hegman as compared to 2-1/2 H on SWP. Brush-outs on wood confirmed gloss observations on the draw-downs.

Comparative compositions of both undercoaters and top coats based on label analyses are shown below:

#97 - Cont.

Comparative Analysis of House Paint Undercoaters
Expressed as Pounds of Each Material per Gallon

	du Pont	National	Devoe	Pittsburgh	SWP Rex 450 Card 24	SWP Proposed Revision RB 2277
Weight per Gallon	13.47	14.83	13.16	12.74	14.60	14.26
Pigment						
BCWL	3.58	4.75	3.26		3.74	2.37
BSWL				1.20	.50	1.20
Zinc Oxide				2.26	.90	1.23
TiO_2	.96	1.42	.95	1.20	1.17	1.17
$BaSO_4$			2.23			
Mg. Silicate	3.42	3.32	2.14	2.86	2.7	2.81
Total pigment	7.96	9.49	8.58	7.52	9.01	8.78
Vehicle						
Linseed Oil	2.78	1.82	2.17	3.46	2.02	2.02
Soya					1.09	1.09
Tung	___	___	.32	___	.22	.22
Total Oil	2.76	1.82	2.49	3.46	3.33	3.33
Resin		.99*	.19			
Varnish		.99*				
Drier and Thinner	2.76	1.55	1.94	1.76	2.15	2.13

*Varnish is shown on label. 50% solids is assumed.

#97 - Cont.

Comparative Analysis of House Paints
Expressed as Pounds of Each Material per Gallon

	du Pont	National	Devoe	Pittsburgh	Rex 471 Card #48
Weight per Gallon	14.37	15.20	14.33	14.00	14.80
Pigment					
BCWL		2.17	1.22		.59
BSWL	1.61	1.92	1.44	1.54	1.55
Zinc Oxide	2.94	1.95	2.66	2.85	2.86
TiO_2	1.04	1.75	1.28	1.85	1.47
Mg. Silicate	3.35	1.95	2.11	2.16	2.94
Lead Titanate	____	____	.46	____	____
Total pigment	8.94	9.74	9.18	8.40	9.41
Vehicle					
Linseed Oil	1.58	4.37	4.54	3.72	2.22
Soya	2.06				1.18
Tung	____	____	____	____	.29
Total oil	3.64	4.37	4.54	3.72	3.89
Drier and Thinner	1.80	1.09	.62	1.89	1.70
	82¢	$1.15	$1.12	92¢	98¢

In the December report we reported on a fundamental investigation that was started to determine what properties of heat bodied oils affect the flow and consistency of paints. In connection with this problem, samples of (48) prepared by the methods as listed in the December report were made into paints. These paints were initially checked for brushing, flow, drying and viscosity, and were then placed in storage for a future check on after-bodying tendencies. These paints have now been checked after storage for a period of 105 days.

SWP Rex 471 Using Various (48)'s
Extender: 4 Parts 20 F - 1 Part 2201 Dry

	Viscosity - #3 Orifice								
Batch	Fresh	1 Day	4 Days	7 Days	28 Days	105 Days	Set-to-touch	Brushing	Flow
464 L (48) #1	21.4"	22"	26.4"	29.6"	34"	40"	6 hr. 15 min.	Good	Good
465 L (48) #2	29	36	36.8	36.6	43	56 +	5 " 45 "	Good -	Good -
466 L (48) #3	29	37	42.4	50	55 +	Too hvy	5 " 15 "	Fair	Fair
467 L (48) #4	43.4	54.4	61.4	60 +	Too hvy	"	5 " 10 "	Sticky; poor.	Fair +
468 L (48) #5	35	43.8	45.8	44	54.4	"	5 " 35 "	Fair +	Fair +
469 L (48) #6	29	36.8	41.2	43.8	51.4	"	5 " 35 "	Good	Good -
470 L (48) #7	38	47.2	50.8	53.4	51.8	"	5 " 35 "	Fair +	Fair +
471 L (48) #8	42.8	52	62	58.6	68 +	"	5 " 45 "	Fair	Fair +
472 L (48) #9	27	31.8	33.4	33.6	46.2	55 +	5 " 45 "	Good	Good -
473 L (48) #10	35	44.6	48	48.8	55.4	Too hvy	5 " 45 "	Fair +	Fair +
474 L (48) #11	27	30	36.2	43	54	57 +	5 " 45 "	Good	Good -
475 L (48) Old drum	27	29.4	33	34.6	40	43	6 " 05 "	Good	Good
476 L (48) New drum	20.6	21.6	23	24	28.2	30.3	6 " 30 "	Very good	Good

All batches had good through dry, with slight tack.
All batches had good house paint gloss.

#97 - Cont.

The Resin Research Department has submitted a number of alkyd varnishes during the past few months for evaluation in house paint formulations. This investigation was held up from time to time due to pressure of other work, but we have now completed the initial tests. A number of paints made from these liquids will be exposed this spring. Due to the wide range in body between the various alkyds, a considerable number of the experimental paints were too high or too low in body and had to be eliminated. In several cases the paints were short in flow, while others were high. Paints using the following alkyds were selected as being fairly satisfactory for body, brushing, flow, etc.

Characteristics on Alkyd Vehicles

		Resin	Oil	Body	A. V.	Color
RB 4259	(V 15012)	Alkyd	(44) and (1273)	Z	4.5	9 +
RB 4828	(V 15777)	"	(2182)	E	5.2	6
RB 5135	-	P.E. Phthalate	(1273)	V	4.0	6
RB 4825	-	Dipentek	(2182)	Y -	5.0	12
RB 4824	-	"	(2245)	Y	4.0	12
RB 4257	(2159) Type	Alkyd	(2182) and (44)	R-S	4.2	-
RB 4679-80	-	P.E. Phthalate	(4015)	V	6.2	9-10
RB 4826	CV 5057	Alkyd	(1273)	T	4.4	7
RB 4256	(4106)	"	(1273) and (44)	U	5.6	10
RB 7424	-	"	CW (1999)	Z_2	7.9	11
RB 7429	-	"	75% CW (1999) 25% Soya F.A.	X	10	-
RB 7430	-	"	50% CW (1999) 50% Soya F.A.	V	9.5	-

Up to the present time we have not developed an alkyd or semi-alkyd paint that has optimum brushing, flow, and drying characteristics for a paint of this type.

#97 - Cont.

100% Alkyd House Paints

Batch	Alkyd	Pigmentation	P.V.C.	Viscosity Fresh	Viscosity 3 Mo.	Brushing	Flow	Gloss
408 K	RB 4257	1403, 412, 18 dry	21%	26"	26.2"	Sl. sticky	Good	Very good
409 K	V 15731	" " "	"	27"	48"	"	"	"
410 K	RB 4258	" " "	"	24.8"	32.5"	"	Fair	"
414 K	RB 4259	" " "	"	29.8"	37.4"	Good	Fair +	"
415 K	RB 4824	" " "	"	25"	40.4"	"	"	"
416 K	RB 4825	" " "	"	27.2"	39.8"	Sticky	Good	"
452 K	RB 4257	" " "	36%	16.2"	5 Mo. 27.8"	Fair	Fair	Good
453 K	V 15731	" " "	"	14"	5 Mo. 21.2"	Good	"	Fair
454 K	RB 4258	" " "	"	14.8"	5 Mo. 23"	Fair	"	Good

Semi-Alkyd House Paints

Batch	Alkyd	Pigmentation	P.V.C.	Viscosity Fresh	Viscosity 24 Hr.	Brushing	Flow	Gloss
601 L	RB 7424	412, 1403, 2307, 2188, 18 dry	-	29.8"	34"	Sticky	Good	Very good
602 L	RB 7429	"	-	29"	34"	"	"	"
603 L	RB 7430	"	-	29"	33.4"	"	Sl. short	Good
608 L	(4106)	"	-	25.4"	29"	Sl. sticky	"	Very good
607 L	100% RB 7424	412, 1403, 18, 1895, 20 MSK, 2307	-	29"	33.8"	Sticky	Very good	Good
158 L	(2) - (48)	20 F, 1403, 412, 18 dry.	-	32"	-	Good	Good	Good

#97 - Cont.

In cooperation with the Cleveland Technical Service Department, samples of various magnesium silicate pigments were examined under the microscope to correlate plant experience in usage of these materials with their particle size and shape. The samples in question were as follows, with the Cleveland plant experience noted:

(1) 20 L of 7-17-46 — Plant experience good.

(2) AW 82 of 8-26-47 — Plant experience very bad; hard to grind.

(3) AW 82 " 2-16-48 —

(4) AW 82 " 2-16-48 — Better than (2); not as good as (1).

(5) Special 20 F superfine — No tests completed.

Photomicrographs show sample (2) to contain a high percentage of large groupings, many as large as 200 microns. Sample (1) is uniformly fine, with no acicular particles longer than approximately 50 microns. Samples (3) and (4) above are intermediate between (1) and (4) with a tendency to be more similar to (2) which has caused trouble in production. Sample (5), the superfine 20 F special, is similar but inferior to sample (1) 20 L of 7-17-46. Further improvement is required before either AW 82 or 20 F special will be equal to the old 20 L.

In view of the difficulty in grinding AW 82 magnesium silicate for house paints, the exposure tests on extenders have been reviewed once more. So far as durability is concerned there seems to be no reason to rate 20 F or AW82 above the 2203/2201 blend. These exposures are 3 years and 9 months old. Within the limits of availability it is recommended that the order of preference for these materials be based on their comparative ease of grinding, namely 2201/2203, 20 F Superfine, and AW 82 in that order.

In the interest of improved performance it has been recommended that the zinc oxide content of SWP tint base be returned to the 33% level which it occupied prior to the severe pigment shortage period. As long as a dollar pigment cost is imposed as the limiting factor which would stand in the way of the return to 35% zinc oxide it is proposed that this move be made at the expense of the basic sulfate white lead by shifting from 35/65 leaded zinc oxide to an appropriate blend of 414 and 511 dry.

Panels 6812-5 C, Cof. were examined after 44 months, vertical south, at Chicago and Coffeyville respectively. The paints are Rex 317 Family Paint Cream, regular of 11-7-41, versus a special using 1/3 each of Cryptone MS-130/leaded zinc/extender. Better tint retention was sought, based on previous good results with MS-130. Though the group of panels was small, it is an intensive test, and several valuable indications resulted:

#97 - Cont.

1. Chicago versus Coffeyville exposure. MS-130 looks comparatively better at Coffeyville, because Chicago exposure emphasizes its erosive tendencies. Any tendency to hold better color was completely counteracted at Chicago by a deep erosion which left a "streaky" appearance; even at Coffeyville, MS-130 was superior in color only in the earlier stages. Both places seem to show, however, that MS-130 resists checking and cracking better than the low-cost lead-zinc-extender formula, and is at least as good in clean-up.

2. Self-primed versus Rex 450 Undercoater. A tremendous improvement results with the latter. There is some indication that the MS-130 type does better than the regular when the switch to self-priming is made.

The exposure series 9632-7, 9647-8 and 9861-2, testing various pigment and vehicle changes in Rex 69 Porch and Deck Gray under several conditions, was given a complete final evaluation. Since this series consists of three parts, of two to six panels each, exposed at Chicago and at Florida for different times, complete data on the exposure conditions would be too long to include here. Roughly, the conditions consisted of (a) 2-coat self-primed work on 8" x 24" yellow pine panels exposed 45° south at Chicago for approximately 2-1/2 years, (b) the same paints on steel, 45° at Florida for 7 months, and (c) the same paints tested in the Weather-Ometer for 3000 hours. The most outstanding general results were: (1) great improvement due to the use of titanium-calcium as against leaded zinc-extender in resistance to cracking and peeling on yellow pine, and (2) the very poor showing of CRB-0292 "coal resin" vehicle, which chalked extremely and flaked away, in spite of some promise in the early months due to unusually good gloss. Minor differences and equivalent performances may be listed as follows (thus mentioning all tests involved):

(a) CVR-139 and CVR-157 tall oil linseed variations are tested against (4880)E ester gum-Dehydrol varnish, both with the leaded zinc and titanium pigmentations, and there is a slight but consistent trend in favor of (4880)E.

(b) The titanium type formulas tested included:

Titanox RC - Atomite - mineral whiting.

Ti-Pure R-610 - Atomite - mineral whiting.

Ti-Pure R-610 - Atomite - Multifex MM.

Ti-Pure R-610 - Micro Velva.

There are some differences in parts of the test set-up, but no clear indications. The last named is slightly best on wood (Chicago), while RC seems somewhat inferior in several cases.

#97 - Cont.

(c) Florida tests, being on steel only, are of secondary interest, but there is (a) a very definite superiority of the lead-zinc type in resisting rust, and (b) at least one clear-cut case of (4880)E surpassing the tall oil vehicles in rust resistance.

#97 - SWP 471

Two factory batches of SWP were made on the proposed formula OJ 573 L (see January report, page 13) using 20 F as the inert in the first batch and 2201 dry and 2203 dry in the later batch.

Formula OJ 573 L	Inert Used	Size	T. Wt.	A. Wt.	Viscosity - #3
Rex 471, C 278 B	20 F dry	900 gals.	14.80	14.97	30 seconds
Rex 471, C 298 B	2201 dry 2203 "	1800 gals.	14.80	14.82	30 "

A gallon sample of Rex 471, C 298 B was sent to Cleveland for their inspection. The two production batches compared quite favorably for brushing, flow and drying characteristics with our present SWP.

Panels 12472-87 CS, CN, Cof. and F were prepared for exposure south and north vertical in Chicago, and south vertical in Coffeyville and Miami. The paints include SWP White and Colonial Yellow paints carrying a percentage of soybean oil in the vehicle. Rex 471 and Rex 465 are exposed with all linseed binder, with 19 gallons (40%) of (3318), and with the whole binder replaced with AVM 14 and 15, P.E. soybean esters. To check dirt collection properties the paints were dried at temperatures between 45 and 50° F.

Panels 8430-6 F were examined at 3 years' Florida exposure, vertical south. These are on cedar beveled siding, primed with Rex 450 Undercoater tinted gray. The Chicago tests, at 42 months were given a supplementary examination. The paints tested are New Jersey Zinc Company's "proposed post-war house paints" and were supplied by them. The p.v.c. is approximately 35%, with weight per gallon 14.5 pounds, and oil content 3.6 pounds per gallon. With one exception, the vehicles are alike, with 16.5% by weight of Alinco 2-5 bodied oil, 49.5% raw linseed, and 31.7% mineral spirits. The exception uses "Bodied Varnex" for the Alinco oil. The pigmentations are:

Paint No.	Ti-Pure R-200	Lehigh 6 Leaded Zinc	Mica	Asbestine	Albalith 11
1	15.0%	47.0%	10.0%	28.0%	-
2	"	55.0%	-	30.0%	-
3	"	"	10.0%	20.0%	-
4	"	62.5%	"	12.5%	-
5	-	35.0%	15.0%	-	50.0%
6 (As #3 except "Bodied Varnex")	15.0%	55.0%	10.0%	20.0%	-

#97 - Cont.

Both locations, especially Chicago, show poor appearance due to "show-through" of the gray primer. The erosion of the lithopone sample makes it outstandingly poor. Shallow "surface flaking" is a bad feature on the Florida test; it seems to be considerably alleviated by the use of mica. The SWP guide, with 12% basic carbonate white lead, did not show this failure. It is difficult to show a trend, because both the high and low leaded zinc samples are among the poorer in durability. The "Bodied Varnex" sample is definitely good at Florida, but poorest (except lithopone) at Chicago, perhaps due to cracks in the "valleys," as brush-marks are heavy. The Chicago location might promote this failure because of the eroding tendency. Paint #1 seems slightly below average in durability, both locations considered.

Exposures 8714-32 C, F were retired and reported after 3 years' exposure, vertical south, at Chicago and Florida. All panels are cedar beveled siding, primed with Rex 450 Undercoater tinted gray. The purpose of the main part of the series was to determine the optimum lead concentration for a modified oil conservation type of formula as expected to be used in "Post-War" SWP Gloss White. The results, in general, were unsatisfactory, probably due to three factors: (a) unsuitable p.v.c. for the formula type, (b) poor drying conditions when painted, and (c) poor control of film thickness. The information obtained, obviously not as expected of a "ladder" type test, may be given briefly:

Group I. Lead content varied 0 to 35% in 5% steps, zinc oxide held at 30%. Erosion very bad at Chicago, Florida failure light. Practically identical performance of all paints, except 0% lead shows definitely more failure at both locations than 5%.

Group II. Lead content 0 to 20% in 5% steps, zinc oxide varied 33 to 36%. (In both I and II, Titanium content varies to give constant opacity.) Almost exactly same performance as Group I, but in this case it is only the Florida tests which show the peculiar inferiority at 0% lead.

Group III Loosely related series testing Titanox RC against RC-HT and C (1271 dry) in the same type of formula. 1271 stands out for clean appearance at Florida, but is obviously subject to erosion. Both RC and RC-HT show much more durable films, but especially earlier in the test tend to collect dirt.

Further work has been carried out to establish a house paint formulation based on the use of polyallyl esters of linseed and soya that would be less subject to wrinkling than the formulations reported in the Monthly Report for November, 1947, page 17. The polyallyl esters of linseed, RB 6034 and RB 7686, and the polyallyl esters of soya, RB 6035 and RB 7687, were used only to the extent of 10 gallons per 100 gallons of paint in Rex 471 and 15 gallons per 100 gallons in SWP Woodland Brown.

#97 - Cont.

The lower gallonage of polyallyl esters reduced the wrinkling as compared with the earlier tests. However, we have not been able to eliminate this wrinkling condition even with the lower gallonage and any further reduction would not warrant its use. An effort will be made to reduce the wrinkling further by the use of Drisoy B in place of linseed. The paints are to be exposed at Chicago and Florida in the near future.

VARNISH PROCESS REPORT

Exp. No. (3316) Rev. Mat'l Class [redacted] Date [redacted]

Formulator ____ Std. Cook Time ____ Hrs. Filtered Centrifuged ____ Minimum Age Limit ____ Months, Storage Loss ____ Per Cent ____ Lab

Prev. Batch (2851)R Batch Size ____ x Std. Batch # ____ Kettle # B Batch Started by Ludwig

Standard Formula Pounds	Standard Formula Gallons	Raw Material	Used Formula	Time	Batch Temp °F	Flow Meter C. F. M.	Visc.	Cure	Acid Value	Manufacturing Instructions and Remarks
		(1273)	4022	10:20	-	5				Heat (1273)&(140) to 560°F.
				1:00	560	2.5				Start SO_2 blow
		(140)	1023	3:00	560		W-X			Stop SO_2 blow @ W-X
				3:00	560	5				Start CO_2 blow
		2207	60	4:00	560		31"		7.2	Hold for body
				5:00	560		49"			Watch A.V.
				5:15	560			COOL		Get 60" Body
				6:00	485			DROP		Water spray

Drop by ____ Special Instructions ____

		Thinning Wt. %	FILTERING: Yes No Thinning Tank No.				
Base Input	5045						
Base Yield	4975		Time O.K'd	A.M. P.M.			
Base Loss			Thinning tank needed by	A.M. P.M.			
Thinners Driers, Etc.			Start Filtering	A.M. P.M.	Charac-teristics	Std.	Plant / Lab.
			Finish Filtering	A.M. P.M.	Lbs. / Gal.	7.93	
			Prev. Batch Filtered		Sp. Gr.	0.952	0.952
			System Washed Yes No with		Cure (Seconds)		
			Press No.		Visc.	55"	56"
			Pumped to Tank No. T408-409		Color	9	7-8
Total Input			Tank Read. After		A. V.	8-10	9.6
Output Pounds	4975		Before		N.V.M., %	100	100
Output Gallons	627		Output		Clarity		Sl. Cloud
Loss							
			Filtered by		Tester's Initials		Approved By

0007-SWP-044558

[illegible] Server

Pt Research project S.F.B. (SWP)

Chicago JAN 12 1948 Paint Research

Lowe Bros. Co.
Dayton, Ohio

January 8, 1948

E. W. Fasig

X (3316)

Late summer you will recall that we started work with a series of [illegible] containing a variety of oils substituted for the usual linseed oil. These paints were painted out on glass and exposed vertically at our Chicago farm. Since that time, August 6, we have [illegible] of the films and determined the soluble/insoluble [illegible] using a 16 hour Soxhlet extraction with acetone.

Results of these extractions are tabulated below. It is interesting & [illegible] to note the relative position of paint [illegible] and (3316), especially at the 12-week exposure period.

Paint (S.I.D.) Vehicle	Vehicle Composition					% Soluble Oil			
	Linseed Raw	Linseed Bod.	De-hyd.	[illegible]	[illegible]	1 Wk	4 Wks	8 Wks	12 Wks
7871 [illegible] (3316)	6[illegible]		39			35.5	30.5	21.9	20.57
[illegible] (40), (3316)	61	29	10			39.7	34.6	27.3	20.54
[illegible] (700), [illegible] 40	73.4	3	16.5	5	5.5	45.5	36.2	29.9	20.30
[illegible] (40)	62	39				45.5	38.3	28.1	20.67
[illegible] (3316)	61			31	8	46.2	35.4	31.6	24.22
[illegible]	60			32	8	44.4	36.7	29.3	21.60
[illegible]	60		3	24	8	48.3	33.3	27.8	21.88
[illegible]	60			32	8	39.6	34.6	27.3	23.30

Comments would be appreciated.

H. VAN LOO

Director of Paint Research

HVL:AH
cc [illegible]

0007-SWP-044559

#97 - SWP 471

On request from Cleveland a revision was made of the SWP Gloss White formula to use a higher poundage of titanium dioxide with a minimum amount of leaded zinc and lead. Four formulations, including the Ti-Sil pigmentation, were proposed:

Paint	TiO_2	Zinc Oxide	Basic Sulphate White Lead	Inert	Added Lead Pigment
OJ 529 L	15%	32.5%	17.5%	35%	None
OJ 530 L	15%	30%	16.2%	36.3%	2.5% Tribase
OJ 531 L	15%	32.5%	17.5%	32.5%	2.5% BCWL
OJ 532 L	15%	32.5%	17.5%	32.5%	2.5% Tribase

The four formulations compare in cost with current and earlier SWP formulas as follows:

	Costs of 1-9-48				Costs of 1-9-48
Formula OJ 529 L	$216.89	Formula	1-19-45	Card #41	$236.28
" OJ 530 L	217.70	"	8-16-43	" #37	243.82
" OJ 531 L	221.84	"	7-19-40	" #26	291.45
" OJ 532 L	223.70	"	9-5-35	" #17	337.34
" 7-29-47 Card #47	229.47	"	12-5-27	- -	339.18

The four formulations will be exposed at Chicago and Florida this spring. Our experience with Tribase is very limited, and it was used only in the hope that the reactivity introduced by 7% of basic carbonate white lead would be matched by 2-1/2% Tribase, with a saving of 5-1/2¢ per gallon. It was decided that for the immediate future a formula based on the following pigmentation should be approved for SWP.

	Pigmentation
Proposed SWP Gloss White - OJ 573 L	20 F dry - 300# 1403 " - 150# 412 " - 450# 18 " - 60#
Present SWP Gloss White, 7-29-47	20 F dry - 290# 1403 " - 136# 412 " - 480# 18 " - 70#

The proposed formula, OJ 573 L, is approximately 2-1/2¢ lower in cost than the present.

#97 - Cont.

A rather extensive investigation has been made of the possibilities of using dehydrated castor for a portion of the oil in SWP. Various tests have been made by introducing the conjugated oil as (2325) and (3316) and checking the films for frosting and wrinkling tendencies when exposed to heat and ultraviolet light.

	Frosting and Wrinkling on .008 inch film in arc
1. Rex 471 (all linseed formula)	Trace
2. " " (5 gal. (2325)/100 gals.)	Definite to slight
3. " " (10 " " " ")	Bad
4. " " (15 " " " ")	Very bad
5. " " (19 " " " ")	Very bad

Other tests were also run on paints made by introducing the conjugated oil as part (3316) and part (2325).

Batch	Bodied Oil	Conjugated Oil	Gloss on .008" film in arc
OJ 560 L	19 gals. linseed (48)	None	Good
OJ 561 L	19 gals. (3316)	3.8 gals.	Good -
OJ 562 L	(17-1/2 gals. (3316) (1-1/2 " (2325)	5.0 "	Fair
OJ 563 L	(16 gals. (3316) (3 " (2325)	6.2 "	Fair -
OJ 564 L	(14 gals. (3316) (5 " (2325)	7.8 "	Poor

These tests indicate that more than 5 gallons of dehydrated castor or combinations of conjugated oils would be a potential source of trouble in SWP if applied at low spreading rates during the summer or under weather conditions which would aggravate surface drying and wrinkling.

A series of bodied oils based on various combinations of linseed, soya, Dehydrol and kettle dehydrated (113) were submitted by the Resin Research Department to consider possibilities of increased usage of castor oil in SWP.

#97 - Cont.

CVR	993	994	996	997	998	999
% (2525)	-	67	-	-	-	40
% (44)	33	33	20	40	67	20
% (1273)	-	-	40	40	-	40
% Kettle Dehydrated (113)	67	-	40	20	33	-
Body (G.H.V.)	61"	53"	63"	55"	63"	53"
A. V.	13	10	10	10	11.5	10
Color	9	7	8	8	8	7

The various oils were used as a replacement for (3316) in SWP and the paints checked for general performance. The only bodied oil that compared favorably with (3316) or linseed (48) is CVR 997. The laboratory batch of SWP made with CVR 997 is similar to the regular SWP using (3316) in body, brushing, flow, drying and gloss characteristics. This series of tests also indicates that 4 to 5 gallons of dehydrated castor is the maximum amount that can be used in SWP without noticeable drop in gloss.

Evaluation of Bodied Oils in SWP

Batch	19 Gals. Bodied Oil Used	Viscosity - #3 Fresh	24 Hrs.	2 Days	Drying Set-to-touch	O'Nite
OJ 541 L	(48) linseed	27"	31"	30"	6 hr. 10 min.	Good
OJ 542 L	(3316)	38.2"	43"	43.4"	6 " 15 "	"
OJ 535 L	CVR 993	58"	67"	3 days 70"	6 " -	"
OJ 536 L	CVR 994	45"	52"	3 days 56"	6 " -	"
OJ 537 L	CVR 996	48.8"	56.2"	3 days 62"	6 " 15 min.	"
OJ 538 L	CVR 997	27"	31"	3 days 36.8"	6 " 15 "	"
OJ 539 L	CVR 998	40.2"	45"	3 days 46.8"	5 " 30 "	"
OJ 540 L	CVR 999	44"	48.2"	3 days 50"	5 " 30 "	"

(Cont.)

#97 - Cont.

Evaluation of Bodied Oils in SWP
Cont.

Batch	Brushing	Flow	Gloss on .008 inch film placed in arc
OJ 541 L	Good	Fair	Good
OJ 542 L	Slightly sticky	Short	Good -
OJ 535 L	Sticky	Short	Poor
OJ 536 L	Sticky	Short	Poor
OJ 537 L	Sticky	Short	Fair
OJ 538 L	Good	Slightly short	Good -
OJ 539 L	Slightly sticky	Fair -	Fair +
OJ 540 L	Slightly sticky	Short	Fair +

Experimental house paints were made with all oil introduced as Myvoil 2, soybean oil stripped by molecular distillation by Distillation Products, as well as with all (1273) alkali refined soybean oil to compare the drying properties when pigmented in a manner similar to SWP (pre-war formula dated 4-8-42). The paint made with Myvoil 2 was much superior in drying to the paint made with (1273).

Paint	Oil Content	Set-to-touch Time
OJ 579 L	65 gals. AV 94 (Myvoil-2)	Approx. 15 Hr.
OJ 578 L	65 gals. (1273)	23-1/2 hours

The Resin Research Department has agreed to prepare samples of a 55 second heat bodied oil and a (3316) type from Myvoil and (1273) for additional tests.

Paints have been prepared for exposure covering an evaluation of various samples of (3316) including one made by Dr. Coffey using the solvent process, also both raw and bodied safflower seed oil in SWP, as well as ADM 65-1 chinawood-soya oil, using all linseed SWP as the control. A special addition to the series will be Sicca Soya Paint Company's Sta-Par One Coat Exterior Finish White (see the November, 1947 Report of Investigations, page 19), with the "Catalyzed Soya Bean Oil" vehicle.

#97 - Cont.

Two tons of CW 2679 micronized 20 F were ordered from International Talc Company for use in SWP. Laboratory batches of SWP made with this inert appear to be satisfactory for brushing, flow, gloss and texture. The paint was finer in texture and slightly higher in gloss than the regular SWP made with 20 F dry. The micronized asbestine appears to be slightly lower in oil absorption than 20 F but produces a satisfactory consistency in the active Rex 471 formula based on (3316). If linseed (48) is used it is necessary to use part 1989 dry. A factory batch of SWP will be made with CW 2679 to check production rates and ease of grinding compared with 20 F.

Laboratory Batches Rex 471

Batch	Inert Used	Bodied Oil	Grind	Viscosities - #3 Fresh	O'Nite	4 Days
OJ 558 L	290# CW 2679	(3316)	4 H	25.2"	28"	32"
OJ 555 L	" "	Linseed (48)	5 H	18	18.8	18.8
OJ 542 L	" 20 F	(3316)	2 H	38.4	43	43.4
OJ 551 L	" "	Linseed (48)	2 H	27	29	29.2
OJ 557 L	240# CW 2679 48# 1989	(3316)	5 H	28.4	-	3 days 46"

Panels 12366-89 CS, CN and Cof. were prepared for exposure south and north vertical Chicago and south vertical Coffeyville, with Fibrous Calcium Silicate from Thompson Weinman and Company in SWP pre-war and current formulas, White, Colonial Yellow and Slate. (See Report of Investigations, December, 1947, page 15.)

Panels 12390-1 C and F were prepared for exposure comparing 2188 Micro Velva A versus Vanderbilt's Veecote in Porch and Floor Enamel Gray - Rex 153. The extenders were introduced at equal oil demands, resulting in somewhat lower gloss where the higher poundage of Veecote was used.

Exposure panels were examined and reported as follows:

1. Panels 5092-5107 C, Cof. were examined after approximately 6 years' exposure at Chicago and Coffeyville, vertical south. All are on cedar beveled siding, with Rex 450 Undercoater. The purpose when exposed was to study the effects of lowering titanium and co-fumed leaded zinc contents in SWP tints as required by shortages in 1941. Ivory, Cream and Golden Yellow tints are used, the main part of the series testing four formulas:

#97 - Cont.

(a) 5-7-41 2031-1895 Titanox A-NC/lead titanate/co-fumed leaded zinc.

(b) 7-24-41 A 24 - 1895 TiO_2/lead titanate/co-fumed leaded zinc.

(c) Only 40 pounds of A 24, no 1895, high BCWL plus co-fumed leaded zinc.

(d) Similar, but mechanical mix with XX-50 zinc oxide and BCWL.

Chicago gives the better basis for appearance judgments. Here the mechanical mix is definitely ahead in color retention, but obviously more dirty than the others. In general, no formula looked better than that of 5-7-41. At Coffeyville, appearance is good on all. The inferiority of both the high BCWL formulas (c and d) in regard to checking and cracking is outstanding. Thus lowering of titanium, elimination of lead titanate and lowering of co-fumed leaded zinc seems definitely undesirable.

2. A final report was prepared on exposures 7033-40 F, C, tint bases which had reached a static condition as regards appearance, though still satisfactory in film integrity. The panels are cedar and yellow pine exposed 4-1/2 years south vertical at Chicago; cedar at Florida, 4 years; yellow pine at Florida, 3 years. Both Slate and Colonial Yellow shades are involved. The guides, of early 1942, one using Ti-Pure R-610, the other Titanox A-24, are slightly better in all respects than any of the tests, which are:

(a) Oil Conservation, Lowe Brothers' suggested pigmentation using 414, R-610, no lead titanate.

(b) Same, but also using Lowe Brothers' vehicle, 2-1/4 gallons less oil, more thinner.

(c) New SWP Tint Base as of early 1943. 414, R-610/lead titanate at 1/2 ratio.

3. Panels 8121-32 F were examined after 36 months' exposure in Miami, checking the performance of high acid oils in SWP white and cream. This series uses the same paints as 7021-32 F, painted a year earlier, to observe whether storage of paints containing high acid oils and zinc oxide would reduce durability due to excessive zinc soap formation. du Pont Pigment Division in 1943 recommended that acid values for the composite vehicle above 15 should be avoided. While the bodied oils in this series had individual acid values approaching 22, they could be used only as a portion of the binder, so that the acid value of the composite vehicle never exceeded 9.

#97 - Cont.

The tests indicate that package stability is excellent. In both the white and cream paints, there are no differences in performance except for the minor variations noted:

Bodied Oil Used	Acid Value Bodied Oil	Composite Acid Value	Remarks
(48)	11.2	5.5	Normal failure.
(506)	21.7	9.0	Slightly greater failure.
(213)	6.3	4.0	Normal failure.
S 70 - OKO	2.0	2.7	Slightly low in tint retention.
50/50 (48)/S 70-OKO	6.6	4.1	Normal failure.

4. Exposures 10630-5 F, C were examined after 1-1/2 years (two summers) at Chicago and Florida, vertical south. All are 2-coat work on cedar beveled siding with Rex 450 Undercoater. The basic formula is Rex 471 SWP Gloss White of 9-14-45, a 50/50% R-200/FF titanium type. The test involves substitution of certain special oils, with results as follows:

   (a) SN-1172, Dow Resin X-480, a 15% styrene modified linseed used for all oil. Good durability. Although most chalky, it is rather dirty at Chicago.

   (b) ADM 75-5 oil, containing cyclopentadiene, Y and Z-4 viscosities, all except 12 gallons of (2) being replaced. Least satisfactory of group. Clean, but serious checking and cracking.

   (c) Wolin IS oil, presumably a polyallyl ester of dehydrated castor fatty acids. Used for all oil and for (2) only. Good durability. Slightly dirty at Florida. Brush marks too prominent when used 100%.

5. A progress report was written on two series of exposures, 10927-32 F, C and 10945-63 F, C, covering several tests of soya oils in Rex 471 SWP Gloss White, related closely enough in all respects to be summarized together. All tests are on cedar beveled siding, primed with Rex 450 Undercoater tinted gray to emphasize erosion, and have been exposed 12 to 14 months at Florida and Chicago, vertical south. Some tint tests are included, but with no significant results to date. The two reports dated December 18, 1947, contain many details too numerous to include here. In general, however, there are remarkably few differences in performance among these paints, including the regular guides. The materials tested are listed below, with notations where there are any significant variations from normal.

#97 - Cont.

P.P.G. Soya (Selected) #500, normal body, replacing (2) only. Possible tendency to check, quite noticeable brush marks.

CVR-569 Linseed (44) brought to (48) body. This and all following are substituted for the usual 19 gallons of (48). Brush marks slightly more than average.

CVR-570 P.P.G. SO-500 soya brought to (48) body.

CVR-571 Soya (1273) plus catalyst, at (48) body.

CV-7027 Bis soya, air-blown to (48) body. Probably least free chalking.

CV-7028 SO_2-treated soya, at (48) body.

CV-7029 Catalyst-bodied soya, at (48) body.

CVR-584 80/20% (1273)/tung oil, blended at (48) body. Least checking tendency (microscopic so far) of the last four items.

While differences in dirt collection are small, in the earlier stages CVR-571 shows the greatest dirt collection, and linseed (48) the least. The Bis soya usually is the best of the soya oils in clean-up, with the soya-tung combination oil close.